

# BSI UNIVERSITY



**ARMOR**



**DISCORD**

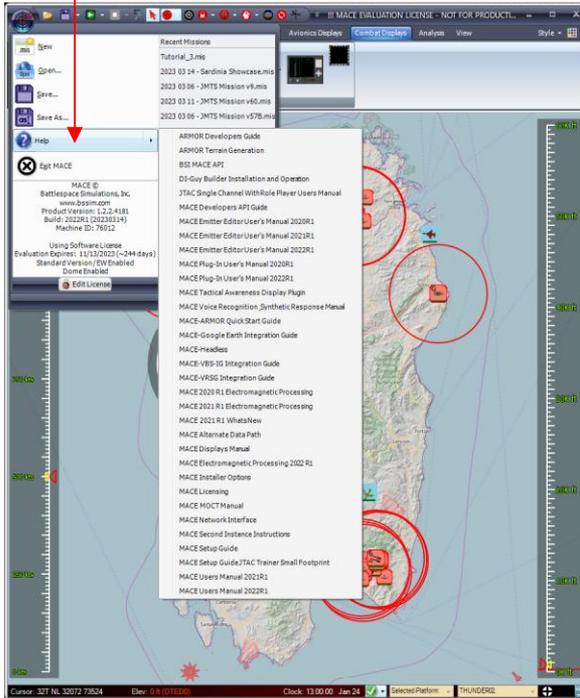


# SOURCES OF HELP

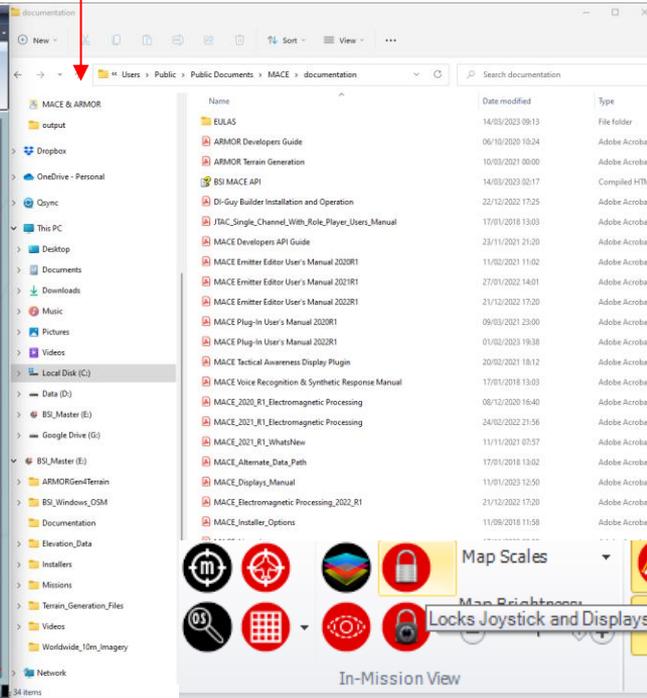
<https://www.youtube.com/@BattlespaceSims/>



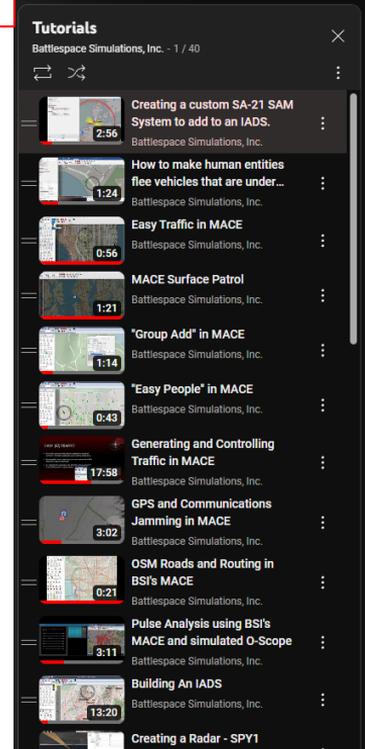
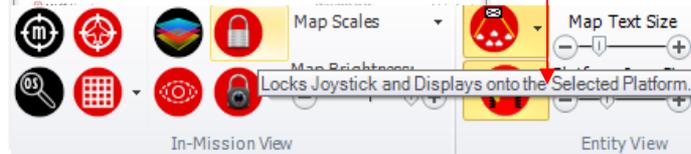
BSI-Quick Menu → Help



C:\Users\Public\Public Documents\MACE\Documentation



Tool Tips



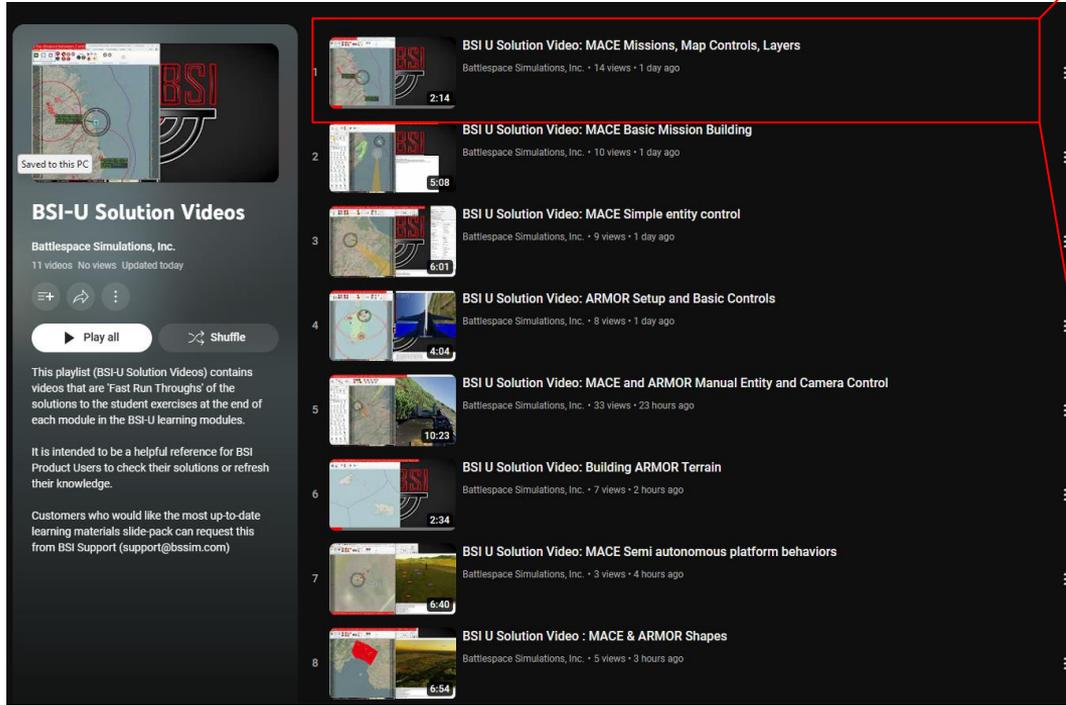
Exercise Solutions:  
Email Support:

[Student Exercises Solutions Videos](https://www.youtube.com/@BattlespaceSims/)  
[support@bssim.com](mailto:support@bssim.com)



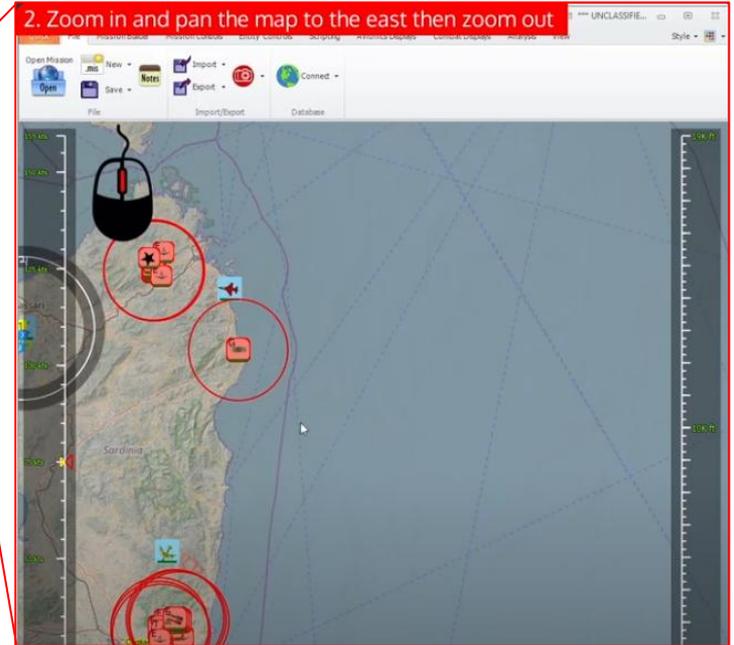
# SOURCES OF HELP

- 'Fast Run Throughs' of the solutions to the student exercises at the end of each



The image shows a YouTube playlist page for 'BSI-U Solution Videos' by Battlespace Simulations, Inc. The playlist contains 11 videos. The first video, 'BSI U Solution Video: MACE Missions, Map Controls, Layers', is highlighted with a red box. The video thumbnails show various map and mission control screens. The playlist description states: 'This playlist (BSI-U Solution Videos) contains videos that are 'Fast Run Throughs' of the solutions to the student exercises at the end of each module in the BSI-U learning modules. It is intended to be a helpful reference for BSI Product Users to check their solutions or refresh their knowledge. Customers who would like the most up-to-date learning materials slide-pack can request this from BSI Support (support@bssim.com)'

Video Title	Duration	Views	Time Ago
BSI U Solution Video: MACE Missions, Map Controls, Layers	2:14	14 views	1 day ago
BSI U Solution Video: MACE Basic Mission Building	5:08	10 views	1 day ago
BSI U Solution Video: MACE Simple entity control	5:01	9 views	1 day ago
BSI U Solution Video: ARMOR Setup and Basic Controls	4:04	8 views	1 day ago
BSI U Solution Video: MACE and ARMOR Manual Entity and Camera Control	10:23	33 views	23 hours ago
BSI U Solution Video: Building ARMOR Terrain	2:34	7 views	2 hours ago
BSI U Solution Video: MACE Semi autonomous platform behaviors	6:40	3 views	4 hours ago
BSI U Solution Video : MACE & ARMOR Shapes	6:54	5 views	3 hours ago



## Student Exercises Solutions Videos

# MACE INITIAL SETUP

## Learning objective:

- Understand how to setup MACE with the required data to start mission build

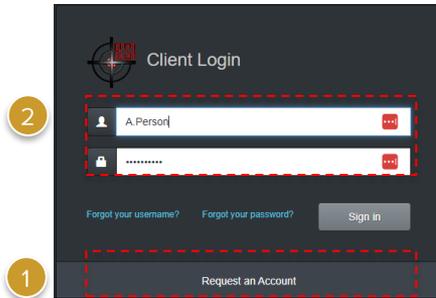
## Enabling objectives

- Know what files to download and install
- Understand what different types of data MACE needs / can use
- Understand how to access the data settings in system settings
- Understand how to assign data paths for Elevation, Vectors, CADRG (if applicable)
- Understand how to access the OSM and imagery settings in system settings
- Understand how to assign paths for OSM and imagery
- Understand how to connect to OSM data and imagery

# MACE INITIAL SETUP

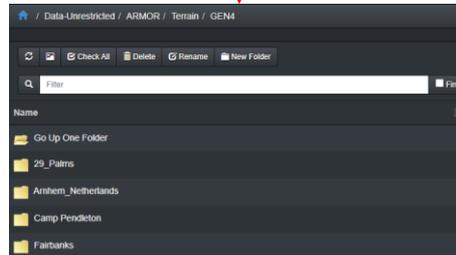
## Download and Install

- (1) Get an FTP Account <https://downloads.bssim.com/>
- (2) Login
- (3) Download all ARMOR installer files
- (4) Download MACE installer file
- (5) Download some ARMOR Terrain (If you don't have a GIS drive)

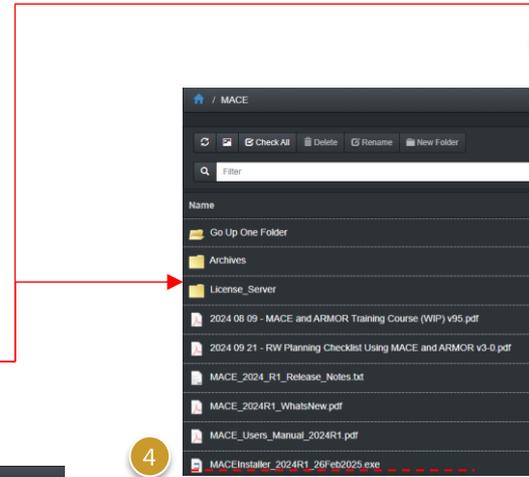


2

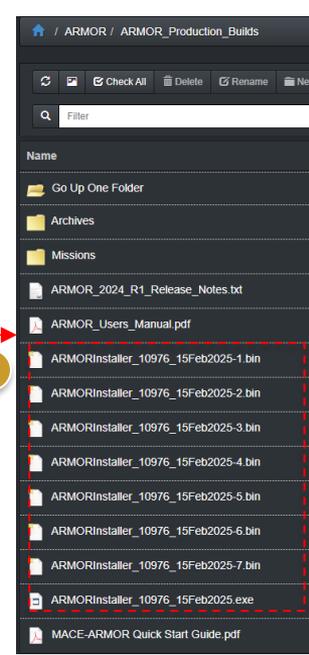
1



5



4



3

### NOTE - UPDATE REGULARLY

If you are paying for maintenance, you are entitled to support and updates. MACE and ARMOR update regularly for new features and bug fixes



# MACE INITIAL SETUP

## Install – Min / Recommended Requirements

### MACE (MINIMUM)

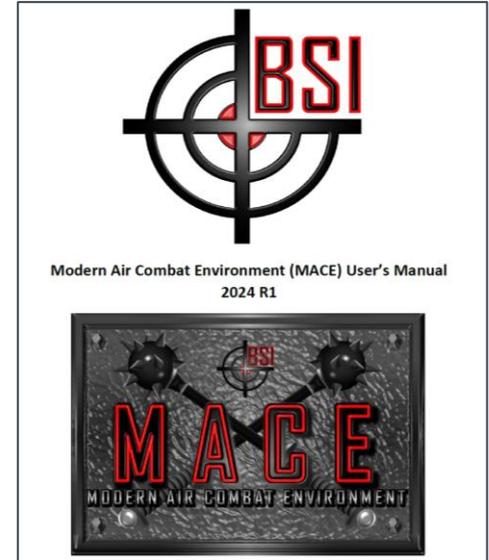
- 3.5 GHz / 8 Thread CPU or faster
- Windows 10 (64 bit) or Windows 11 (64-bit)
- 16 GB RAM (32 GB for large battlespaces)
- 1 GB free hard drive space (not including map, imagery, and elevation data) \*
- NVidia 2060 or better graphics card

### MACE (RECOMMENDED)

- 4.0+ GHz / 16+ Thread CPU \*\*
- Windows 10 (64 bit) or Windows 11 (64-bit)
- 32 GB RAM \*\*\*
- 1 GB free SSD space (not including map, imagery, and elevation data) \*
- NVidia 3070 or better graphics card

### Additional minimum requirements if running ARMOR with MACE are:

- 64GB RAM
- NVidia 4080 or better graphics card (4070 minimum if only running in screen mode)



# MACE INITIAL SETUP

## License

### Software License (per machine)

- Start MACE for the first time
- Select 'Software Key'
- Send the 'Machine ID' to [support@bssim.com](mailto:support@bssim.com)
- (When Received) Enter the License Code – Press 'Submit'

### USB Dongle

- Ensure USB Dongle is in machine (USB port accessible)
- MACE Checks automatically – but can be verified from **Quick>Update License**

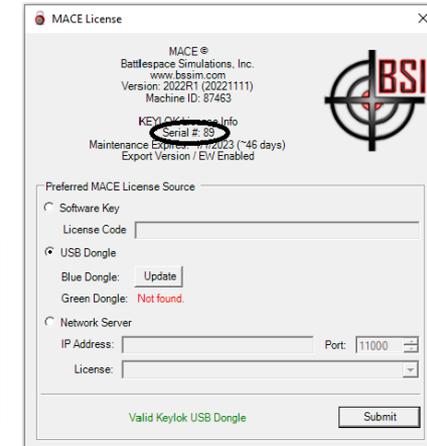
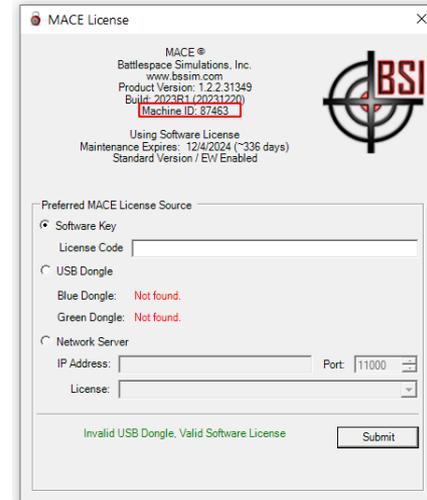
### Updating a USB dongle

- Select the USB Dongle in license manager
- Select update – navigate to a provided .dat file, select and open
- Submit to verify

### NOTE – KEYLOCK USB LICENSE FILES

License files are tied to KEYLOK USB Key serial numbers and are not interchangeable between dongles. You will need to enter a unique update file for each dongle. The naming convention used by BSI will be to add the serial number to the file name.

*E.g. USB Key serial number is #5 and the update file is called "BSI\_5.DAT".*



# MACE INITIAL SETUP

## Getting Required Data in MACE – Static Data

1 VIEW → System Settings



### Data Paths: HI Res Imagery & Vector Data (Optional)

MACE Data Type	Dir Num	Directory Name	Items Found
CADRG Map Data			
Hi-Res Imagery Data	1	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\zne_50m_populated_places_simple.shp	1
	2	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\physical\zne_10m_coastline.shp	1
Vector Map Data	3	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\zne_10m_admin_0_countries.shp	1
	4	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\zne_10m_admin_0_boundary_lines_land.shp	1
Elevation Data			

### Data Paths: Elevation Data (Required)

MACE Data Type	Priority	Type	Status	Configure	Clear Cache	Reload
CADRG Map Data	1	ARMOR	Found 0 terrain tiles.	Configure	Clear Cache	Reload
Hi-Res Imagery Data	2	CDB	No tiles loaded.	Configure	Clear Cache	Reload
Vector Map Data	3	VRSG	No paths configured.	Configure	Clear Cache	Reload
	4	DTED	No elevation found.	Configure	Clear Cache	Reload
Elevation Data	5	SRTM	No elevation found.	Configure	Clear Cache	Reload

- (1) System Settings – Endure between MACE sessions (mission settings are saved with the mission)
- (2) Worldwide Vectors – Countries, Boundaries, Populated Places (Optional but useful)
- (2) Hi Res Imagery Data – Usually customer's geo-referenced own data (GeoTif etc)
- (3) Elevation – A prioritized list of what MACE uses first for ground position
  - ARMOR Data is highest fidelity and should be top if using ARMOR as your IG
  - A secondary source (CDB or DTED) is required where there is no IG Terrain

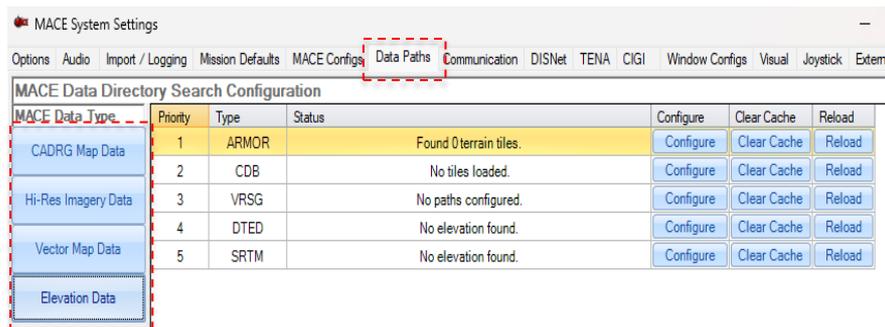
### NOTE – STATIC GIS DATA

Customers who have purchased MACE will be given a 4TB GIS Terrain Drive which contains Elevation Data and ARMOR Terrain. If you are evaluating, you do not have this so:

- MACE can read ARMOR terrain elevation – download ARMOR terrain and configure the data path in System Settings>Data Paths to point at the terrain folder
- You can also download Elevation data (DTED and 90m CDB) from the BSI FTP site – this will be required for mission rehearsal tool functions

# MACE INITIAL SETUP

## Getting Required Data in MACE – Static Data vs Streaming (Data Drive)

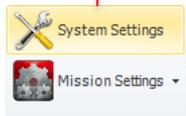


MACE System Settings - Data Paths

MACE Data Directory Search Configuration

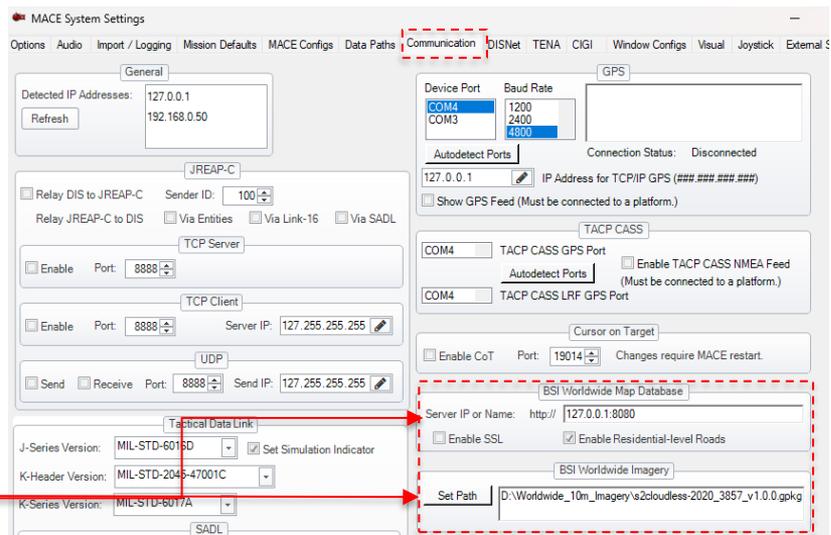
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Vector Map Data	3	VRSO	No paths configured.	Configure	Clear Cache	Reload
	4	DTED	No elevation found.	Configure	Clear Cache	Reload
Elevation Data	5	SRTM	No elevation found.	Configure	Clear Cache	Reload

Static Data  
<Data Paths>



System Settings  
Mission Settings

Streaming Data  
<Communication>



MACE System Settings - Communication

General

Detected IP Addresses: 127.0.0.1, 192.168.0.50

JREAP-C

Relay DIS to JREAP-C Sender ID: 100

Relay JREAP-C to DIS Via Entities, Via Link-16, Via SADL

TCP Server

Enable Port: 8888

TCP Client

Enable Port: 8888 Server IP: 127.255.255.255

UDP

Send Receive Port: 8888 Send IP: 127.255.255.255

Tactical Data Link

J-Series Version: MIL-STD-6016D Set Simulation Indicator

K-Header Version: MIL-STD-2045-47001C

K-Series Version: MIL-STD-6017A

SADL

GPS

Device Port: COM4, COM3 Baud Rate: 1200, 2400, 4800

Autodetect Ports Connection Status: Disconnected

127.0.0.1 IP Address for TCP/IP GPS (####.###.###)

Show GPS Feed (Must be connected to a platform.)

TACP CASS

COM4 TACP CASS GPS Port Enable TACP CASS NMEA Feed (Must be connected to a platform.)

COM4 TACP CASS LRF GPS Port

Cursor on Target

Enable CoT Port: 19014 Changes require MACE restart.

BSI Worldwide Map Database

Server IP or Name: http:// 127.0.0.1:8080

Enable SSL Enable Residential-level Roads

BSI Worldwide Imagery

Set Path D:\Worldwide\_10m\_imagery\s2cloudless-2020\_3857\_v1.0.0.gpkg

### NOTE – STATIC GIS DATA

Customers who have purchased MACE will be given a 4TB GIS Terrain Drive which contains Elevation Data and ARMOR Terrain. If you are evaluating, you do not have this

MACE can read ARMOR terrain elevation – download ARMOR terrain and configure the data path in System Settings>Data Paths to point at the terrain folder

You can also download Elevation data (DTED and 90m CDB) from the BSI FTP site – this will be required for mission rehearsal tool functions

# MACE INITIAL SETUP

## Getting Required Data in MACE – Steaming Data



### 2 Communication: BSI Worldwide Map Database / Imagery

The screenshot shows the 'Communication' tab in the MACE System Settings. The 'General' section shows detected IP addresses (127.0.0.1 and 192.168.0.50) and a 'Refresh' button. The 'GPS' section shows device ports (COM4, COM3) and baud rates (1200, 2400, 4800). The 'TACP CASS' section shows ports for GPS, NMEA Feed, and LRF. The 'BSI Worldwide Map Database' section is highlighted with a red dashed box and contains the following information:

- Server IP or Name: http:// 127.0.0.1:8080
- Enable SSL:
- Enable Residential-level Roads:
- BSI Worldwide Imagery: Set Path: D:\Worldwide\_10m\_Imagery\s2cloudless-2020\_3857\_v1.0.0.gpkg

The screenshot shows the MACE main interface with the 'System Settings' window open. The 'System Settings' window has a 'Projection' dropdown menu set to 'Spherical Mercator' and 'EPSG: 3857'. A red dashed box highlights the 'Projection' dropdown and the 'EPSG: 3857' text.

### 3 BSI Open Street Maps Server

The screenshot shows the 'BSI OSM - OSM Server Control Panel'. It displays a table of running services:

Component	Status	Process ID	Start time	File path	IPv4 address
PostGIS Database	Running	15400	21/03/2023 11:30:08	E:\osm\pgsql	127.0.0.1
Apache HTTP Server	Running	7308	21/03/2023 11:30:05	E:\osm\apache	192.168.0.50
RenderLoop Tile Server	Running	29816	21/03/2023 11:30:06	E:\osm\apache	172.20.166.1

### 4 FILE → Connect: BSI Sources

The screenshot shows the 'Connect' dropdown menu in the MACE main interface. The menu is open, showing the following options:

- BSI Worldwide Map Tiles
- BSI Worldwide Road Vectors
- BSI Worldwide Imagery
- More Connections (Internet)

### NOTE – GIS DATA

Customers who have purchased MACE will be given a 4TB GIS Terrain Drive which contains an offline Open Street Map server, Worldwide GeoTif Imagery. If you are **evaluating**, you do not have this – you will not be able to fill in the ‘communications tab’ paths but you can use OSM online tiles (no road vectors or building footprints) by selecting from the ‘More Connections’ Option on the Connect dropdown menu (4)

# MACE INITIAL SETUP

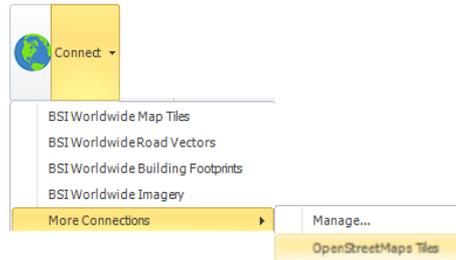
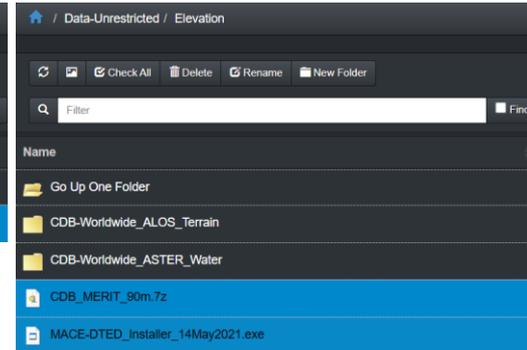
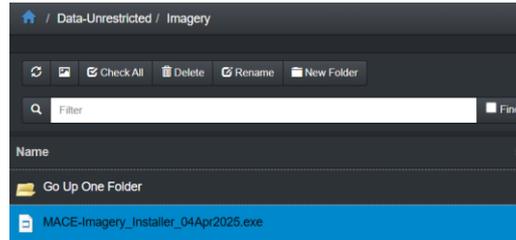
## No GIS Drive – Sample and Online Data Only

### Terrain – Imagery – Elevation Data

- Downloads.bssim.com / Data-Unrestricted
  - Imagery – MACE Imagery Installer (Sardinia and Pacific Northwest)
  - Elevation – CDB MERIT and DTED0 Installer
  - ARMOR/Terrain – Sardinia Corsica

### Online Data

- Connect to Online Open Street Maps Tiles
  - FILE → Connect → More Connections → Open StreetMaps Tiles



### NOTE – SAMPLE DATA LIMITATIONS

If using only sample data users will not be able to use Road Vectors, Building Footprints, or make ARMOR terrain from the data

# MACE INITIAL SETUP

## Student Exercise

1. Open System Settings
2. Set Elevation data paths
3. Start OSM and set the OSM path
4. Set the worldwide imagery path
5. Set vector paths for country outlines and major populated areas

# MACE OVERVIEW

## Learning objective:

- Understand how to navigate through the MACE GUI, and the types of inputs and information that are available.

## Enabling objectives

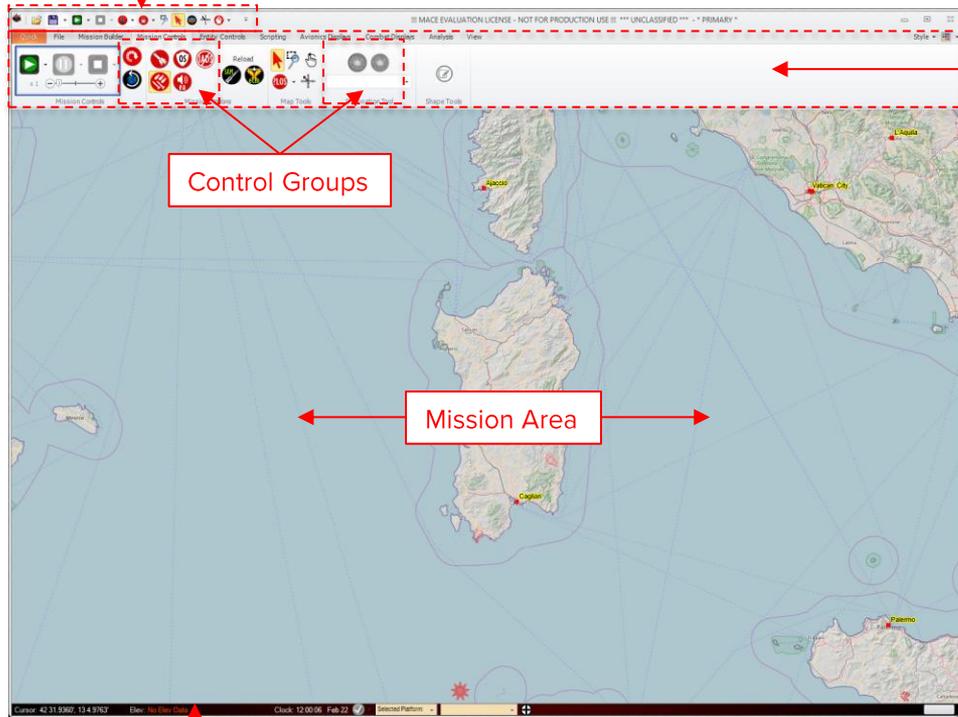
- Understand the components of the MACE GUI
- Understand how to use and customise the Quick Access Toolbar
- Overview of the different grouped functions of the Top Ribbon Navigation Bar
- Understand the appearance and function relationship of the different types of buttons
- Understand the purpose of the mission area
- Understand the information and functions available on the status bar

# MACE OVERVIEW

## MACE Workflow



Quick Access Tool Bar



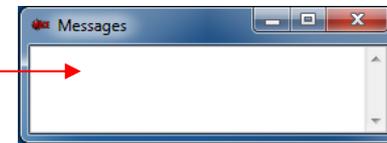
Main Tool Bar

Control Groups

Mission Area

Status Bar

Message Window



### TIP - DO NOT MAXIMISE MACE

Since MACE uses several separate windows for the user interface, it is generally NOT a good idea to keep the main MACE window maximized (taking up the whole screen) because it makes it harder to quickly find and use these other windows.

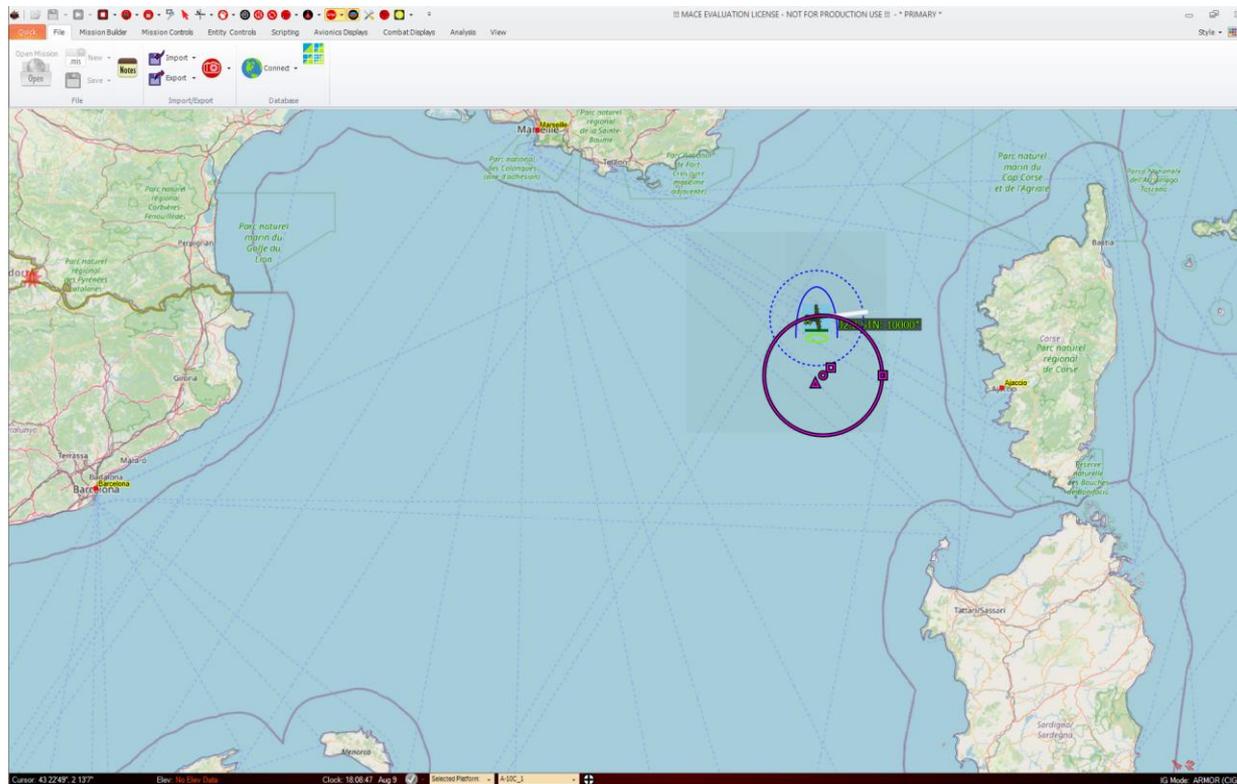
### TIP - TOOLTIPS

Most MACE controls have 'tool tips' if you hover your mouse over them some text will appear explaining their function



# MACE OVERVIEW

## MACE Workflow – File Tab



Sets the canvas for the scenario

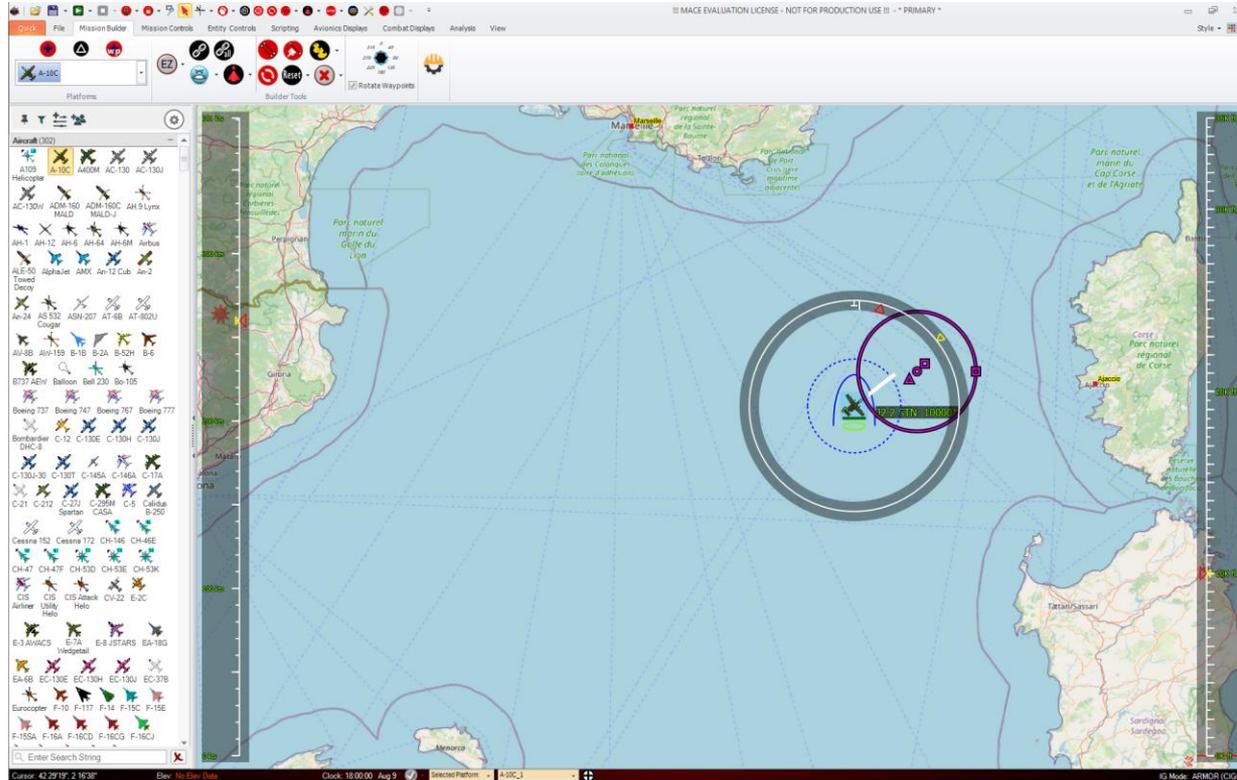
- Open previous missions
- Clear scenario for new mission
- Save missions
- Import Mil Data – ACO/ATO, Shapes, Routes etc
- Import MACE specific – Partial Missions, Scripts etc
- Connect to Streaming Data – OSM, Imagery
- Export data for use in other scenarios
- Export data for use in Mil Systems



# MACE OVERVIEW

## MACE Workflow – Mission Builder Tab

File **Mission Builder** Mission Controls Entity Controls Scripting Avionics Displays Combat Displays Analysis View



### Add and config scenario entities

- Drag and drop platforms
- Swap out platforms
- Add waypoints
- Duplicate, copy properties
- EZ – Traffic, People
- IADS Tools – linking, snap to high point etc

# MACE OVERVIEW

## MACE Workflow – Mission Controls Tab

Data

Build

Execute & Control

Analysis

File

Mission Builder

Mission Controls

Entity Controls

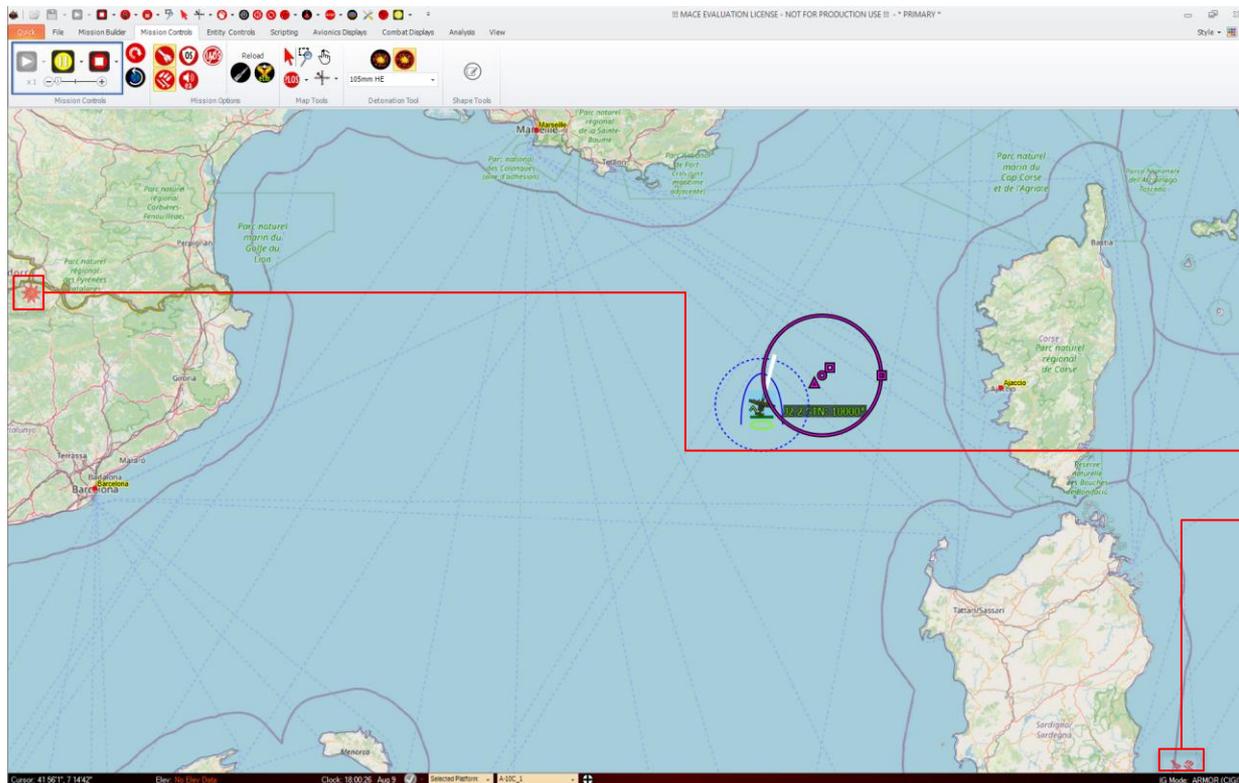
Scripting

Avionics Displays

Combat Displays

Analysis

View



### Whole mission actions

- Start/Stop Pause
- Clock multiplier
- Foam weapons, infinite ammo, invulnerability
- Reload all weapons and expendables
- Map tools – map measure, LOS
- Detonation tool
- Shape drawing tools



Sun Position



Unlimited Ammo

Foam Weapons

Ownership  
Invulnerable

# MACE OVERVIEW

## MACE Workflow – Entity Controls Tab

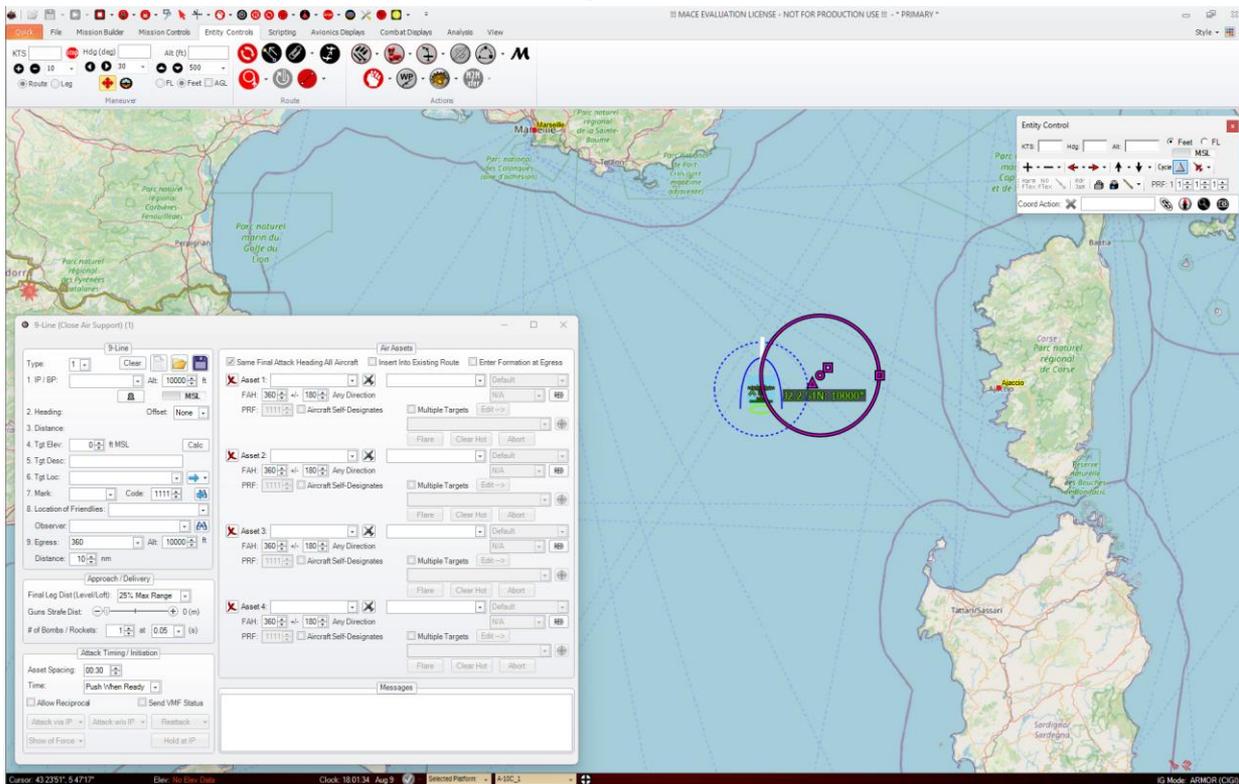
Data

Build

Execute & Control

Analysis

File Mission Builder Mission Controls Entity Controls Scripting Avionics Displays Combat Displays Analysis View



### Entity specific control

- Navigational control
- Formation and attachments
- Manoeuvre modes
- Combat – Targeting, Attack, Weapon Release
- Form based control – 9/5-Lines, Call for fire
- Tactics/Actions
- UAV View control
- Manual Emitter control
- Transfer entities between MACEs on network

# MACE OVERVIEW

## MACE Workflow – Scripting Tab

Data

Build

Execute & Control

Analysis

File

Mission Builder

Mission Controls

Entity Controls

Scripting

Avionics Displays

Combat Displays

Analysis

View

The screenshot displays the MACE Script Editor interface. The top menu bar includes 'File', 'Mission Builder', 'Mission Controls', 'Entity Controls', 'Scripting', 'Avionics Displays', 'Combat Displays', 'Analysis', and 'View'. The 'Scripting' tab is active. The main window is divided into several sections: 'SCRIPTS' (a table listing scripts like 'My Script'), 'SELECTED SCRIPT' (configuration for the chosen script), 'TRIGGERS' (a list of trigger events), 'ACTIONS' (a list of actions to be performed), and 'SCRIPT COMPLETION' (options for script execution). The background shows a 3D map of a coastal region with a mission vehicle and its path overlaid.

Conditional, autonomous / semi-autonomous actions

- Customize behaviours of platforms and environment for manual or triggered execution
- Script Editor - Write scripts with triggers and actions
- Buttonized scripts – independent of mission

# MACE OVERVIEW

## MACE Workflow – Avionic Displays Tab

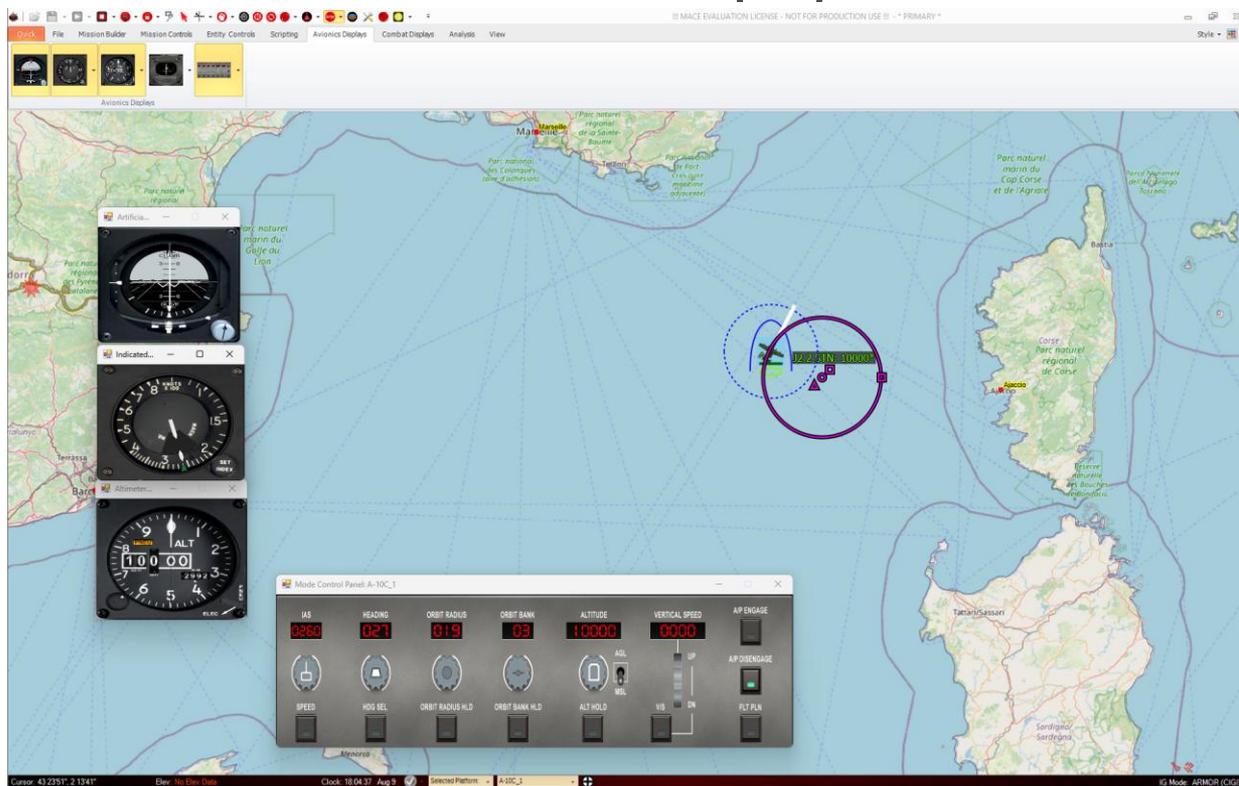
Data

Build

Execute & Control

Analysis

File Mission Builder Mission Controls Entity Controls Scripting **Avionics Displays** Combat Displays Analysis View

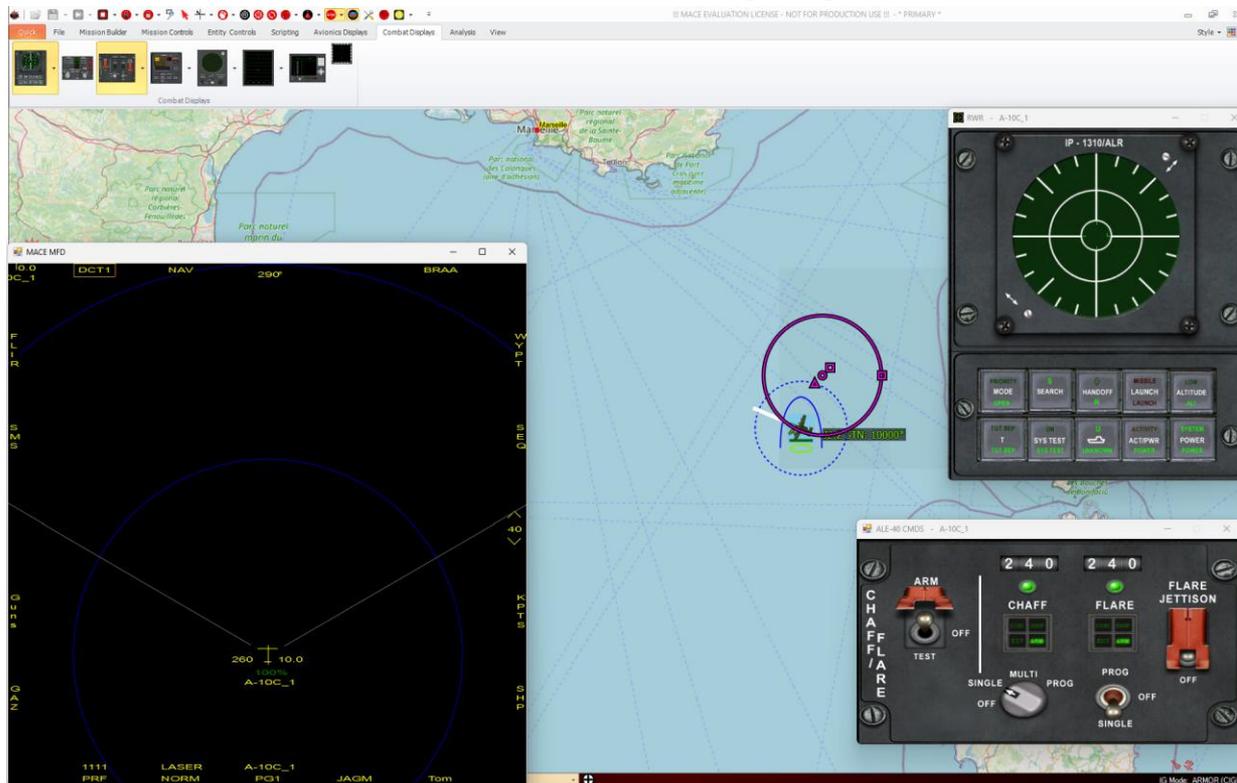


### Cockpit avionic instruments

- Standard flight instruments
- Role player setup
- Use with MACE – Window Configs to create cockpits

# MACE OVERVIEW

## MACE Workflow – Combat Displays Tab



### Cockpit combat displays

- Role player setup
- Use with MACE – Window Configs to create cockpits
- RWR, IRWR, CMDS
- DF and other EW displays
- Cockpit Multifunction Display (MFD)



# MACE OVERVIEW

## MACE Workflow – Analysis Tab



Time	Type	Entity	Event
18:08:34	Weapon Launch	A-10C_1	A-10C_1 (42.1417P, 7.1129S) shot AGM-882(L, MAVERICK, (No target))
18:07:11	Weapon Detect	AGM-882(L, MAVE	AGM-882(L, MAVERICK from A-10C, detected at 42.143P, 7.20S

### In/After Scenario Analysis

- Message Window
- Event Log
- EW Analysis Plugins
- Mask Analysis



# MACE OVERVIEW

## MACE Workflow – View Tab

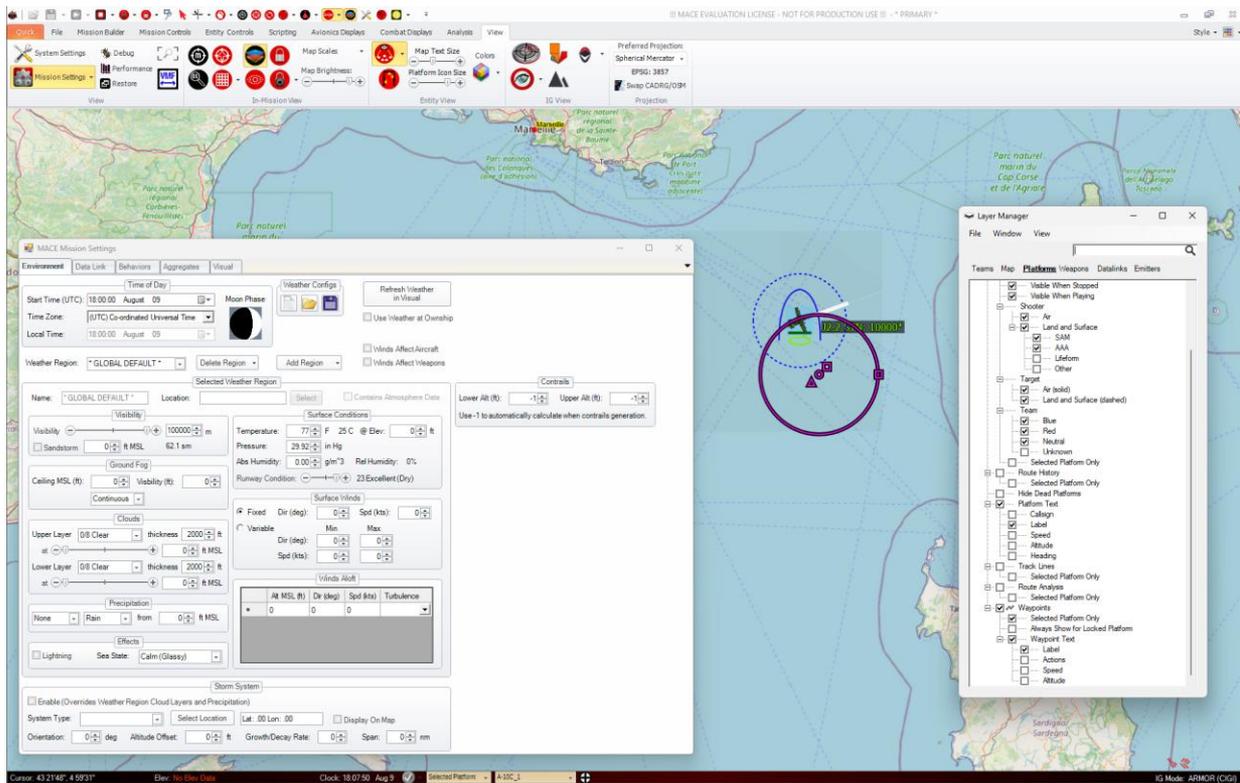
Data

Build

Execute & Control

Analysis

File Mission Builder Mission Controls Entity Controls Scripting Avionics Displays Combat Displays Analysis **View**



### Settings, Map Controls, IG

- System Settings
- Mission Settings
- Map Controls – layer manager, grids, scales
- Ownship display and camera locks
- IG Launch and IG Plugins
- Map datum



# MACE OVERVIEW

## Button types

Action buttons are black (for example, the 'Cycle to Next Waypoint' button)  and are momentary; they cause the associated action to occur once when pressed.

Toggle buttons are red  and will be highlighted  when selected and are in effect until deselected. Note that the highlight color will vary, depending on the Style you have selected for your MACE.

Response buttons are gold  and, like toggle buttons, remain in effect until deselected. However, unlike Toggle buttons, they do not take effect until triggered.

Drop-down buttons are silver  and will open when clicked to show additional buttons.

Status buttons are typically square  and will often open external status windows.

# MACE OVERVIEW

## Student Exercise

1. Open MACE and navigate through each of the tool bars
2. Select the View toolbar and size the MACE window so that all the controls on this bar are visible
3. Hover the mouse over buttons to see the tool tips
4. Click on some of the dropdown menus to see options available

# MACE MISSIONS, MAP CONTROLS, LAYERS

## Learning objective:

- Understand how to setup and navigate around the mission area, and use map tools

## Enabling objectives

- Know how to load a mission
- Know the methods for zooming in an out and using pre-set zoom levels
- Know the methods for panning the map
- Understand the various map options for scaling and panning
- Know that the default map tool is selection including the “return to select tool” function
- Know how to change coordinate type in use on the map
- Understand the information on the bottom status bar
- Understand the entity mouseover information
- Understand how to use the bottom status bar in the selection and finding of entities
- Know how to use and cancel the range and bearing tool
- Know how to add a button to the shortcut bar
- Know how to switch on and off map layers and to change layer transparency

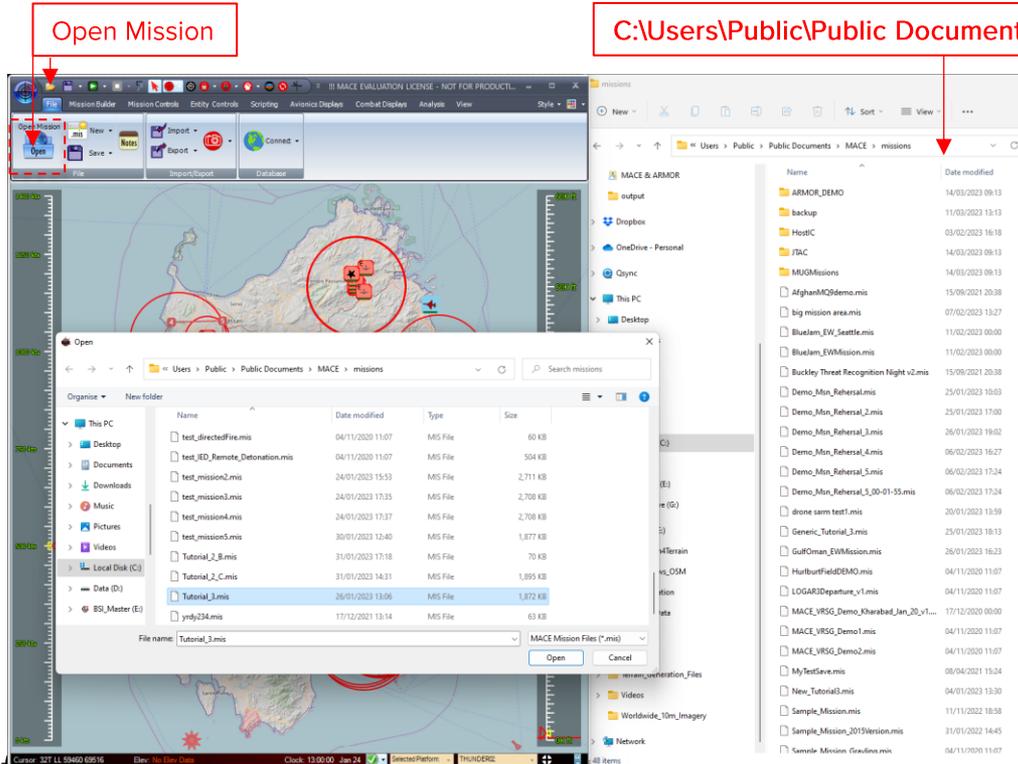
# MACE MISSIONS, MAP CONTROLS, LAYERS

## Load A Mission

FILE → File → Open Mission “Tutorial\_3.mis”

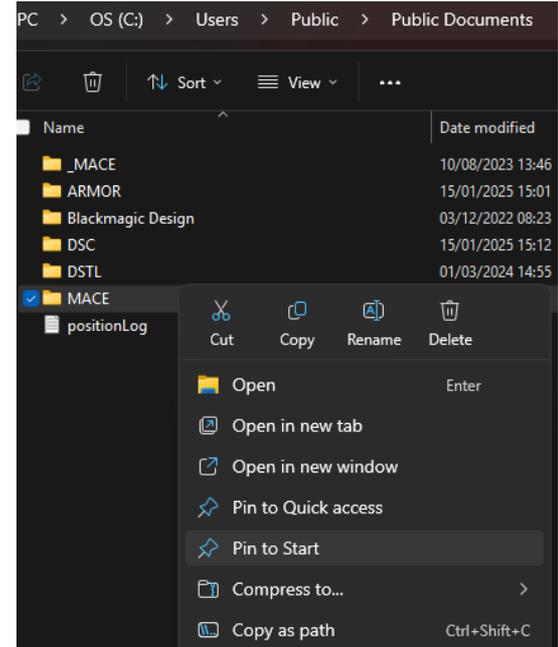
Open Mission

C:\Users\Public\Public Documents\MACE\Missions



TIP – PIN THE MACE DIRECTORY

‘Pin to Quick Access’ the MACE folder



# MACE MISSIONS, MAP CONTROLS, LAYERS

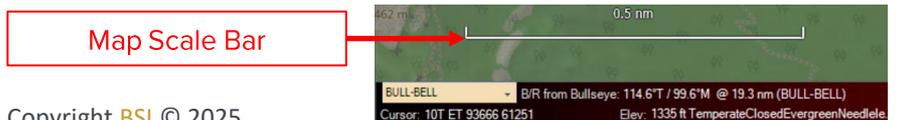
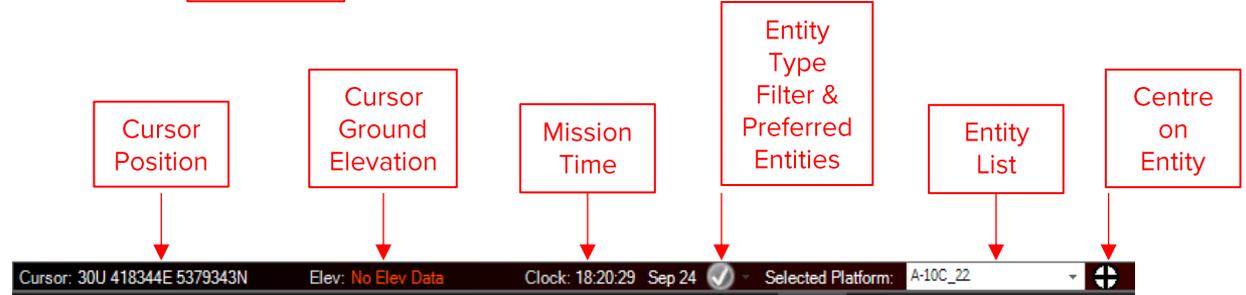
- PAN
  - LMB on Mission Area and move
- Zoom
  - Scroll Wheel or 
  - Top Left to Bottom Right = Zoom In
  - Bottom Right to Top Left = Zoom Out
- RMB Reset
  - RMB any blank part of mission area
  - Returns to select 
- RMB on control
  - Add to quick access tool bar
- Select Entity and Press ALT
  - Shows range and bearing from entity in status bar
- CTRL + LMB hover over entity
  - Shows entity information



LMB = Left Mouse Button  
RMB = Right Mouse Button

**SHORTCUTS**

- CTRL + F Change coordinate type
- CTRL + F5 to F8 Save a zoom level
- ALT + F5 to F8 Zoom to saved zoom level





# MACE MISSIONS, MAP CONTROLS, LAYERS

## The Overlay Manager

Layer Manager

File Window View

Teams Map Platforms Weapons Datalinks Emitters

Teams

- Blue Team
- Only if Detected
- Red Team
- Only if Detected
- Neutral Team
- Unknown Team
- Only Draw Detected Entities

Map

- BSI Map Data
- Sentinel2 Worldwide Imagery
- Open Street Maps
- Map Tiles
- Road Vectors
- Full Planet Building Vectors
- Raster Images
- MACE CADRG
- Full Earth
- Hi-Res Imagery
- 10m or Better Only
- Vector Images
- WMS
- IADS Layer
- Navigation Points
- NAVAIDS
- Obstructions
- Masks
- EW Radar
- Acq Radar
- TTR
- Selected Platform Only

Platforms

- Camera Line
- Latched Platform Only
- Priority Target Line
- Assigned Target Line
- Laser Line
- Engagement Range
- Visible When Stopped
- Visible When Playing
- Shooter
- Air
- Land and Surface
- SAM
- AAA
- Lifform
- Other
- Target
- Air (solid)
- Land and Surface (dashed)
- Team
- Blue
- Red
- Neutral
- Unknown
- Selected Platform Only
- Route History
- Selected Platform Only
- Hide Dead Platforms
- Platform Text
- Label
- Speed
- Altitude
- Heading
- Callsign
- Track Lines
- Selected Platform Only
- Route Analysis
- Selected Platform Only
- Waypoints
- Selected Platform Only
- Always Show for Locked Platforms
- Waypoint Text
- Label
- Actions
- Speed
- Altitude

Weapons

- Weapon Text
- Type
- Speed
- Altitude
- Guidance
- Time of Flight
- Engagement Zones
- Assigned Target Only
- Target Line

Datalinks

- J2 Tracks
- Blue J2 Tracks
- Red J2 Tracks
- Neutral J2 Tracks
- Unknown J2 Tracks
- J3 Track Originator
- Blue Team J3s
- Red Team J3s
- Neutral Team J3s
- Unknown J3 Tracks
- J2 Labels
- J2 STNs
- J2 Heading Tick
- J3 Labels
- J3 Track #s
- J3 Heading Tick
- J3 Type
- J3 Trespass Ring
- Mode 1 Squawk
- Mode 3 Squawk
- J3 Track Identifies
- J3 Pending Identity Tracks
- J3 Unknown Identity Tracks
- J3 Assumed Friend Identity Tracks
- J3 Friendly Identity Tracks
- J3 Neutral Identity Tracks
- J3 Suspect Identity Tracks
- J3 Hostile Identity Tracks
- Networks
- Selected Platform Only
- Link 16
- SADL
- SAM TDL
- IADS TDL
- Adversary TDL
- J12.6 Target Sort
- K5.1 URNs

Emitters

- Emissions
- Detection Rings
- EW
- ACQ
- Domain
- Air
- Land
- Surface
- Weapons
- Datalink
- Jammer
- Jammer Corridor
- Infrared
- Radar Receiver Beam
- EO/IR Receiver Beam
- Selected Platform Only
- Radio
- Search
- Acquisition
- Target Tracking
- Missile Guidance

Tracks

- J2.2 STN: 10360\*
- J2.2 STN: 10370\*

Jammer Corridor

Detection Rings

Laser Line

Camera Line

Target Line

Engagement Range

Weapon Text

Platform Text

Engagement Zones

Waypoints

Networks

Radio/IR/Receiver

Radar

Imagery

Open Street Maps

Vector Images

Masks

**TIP - USE THE LAYER MANAGER**

- Add it to the QAT!
- Filter your map based on use case
- Save configs based on use case
- Look here first if things aren't displaying

# MACE MISSIONS, MAP CONTROLS, LAYERS

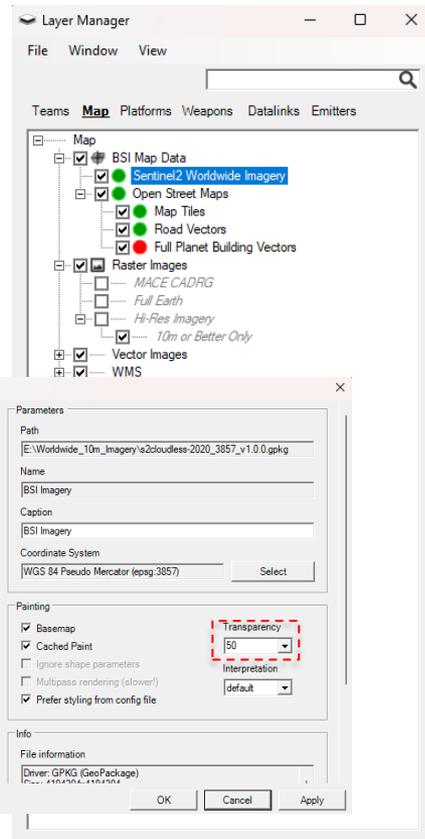
## Layer Manager Intro

### MAP

VIEW → In-Mission View → Layer Manager



- ☑ Switch on and off map layers / vectors etc.
- RMB → Appearance
  - Set transparency



- Add a quick access button



# MACE MISSIONS, MAP CONTROLS, LAYERS

Student Exercise - [Link to Online Solution Video](#)

1. (00:13) Open Tutorial\_3.mis in MACE
2. (00:22) Zoom in and pan the map to the east then zoom out
3. (00:28) Centre on the mission area
4. (00:33) Pick an Entity from the status bar and center on it.
5. (00:40) Measure the distance between 2 entities
6. (00:52) Remove measurement lines
7. (01:04) Use the Mouse + Control button to show an entity name
8. (01:14) Use the cursor to determine ground elevation and coordinate at a point
9. (01:18) Cycle through coordinate systems. Finish with MGRS
10. (01:22) Add the map measurement tool as a quick access toolbar button
11. (01:32) Use the layer manager to hide OSM and imagery leaving only the vectors
12. (01:53) Switch OSM and imagery back on and adjust transparency of the imagery layer to 40%

# MACE ADDING MOVING REMOVING MISSION ITEMS

## Learning objective:

- Understand how to choose, place, move and delete entities, and how to see the properties of entities in MACE

## Enabling objectives

- Know how to Save, Run, Clear, and Load missions
- Know how to add platforms
- Know how to filter and search the mission builder list
- Know how to change platforms
- Know how to add platform waypoints
- Know how to Move Platforms and Waypoints
- Understand Intent
- Know how to select and move multiple platforms
- Know how to group and recall platform groups
- Know how to Delete platforms, and waypoints
- Understand the uses of known points
- Know where to select and see bullseye information

# MACE ADDING MOVING REMOVING MISSION ITEMS

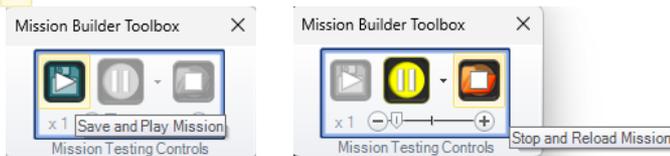
- New vs Global New – Mission Clear-out
- Save
  - Clean – Mission not started
  - Dirty – Mission in progress (includes time stamp)
- Quick Open from BSI/Quick Menu
- Scenario Editing Workflow:
  - OPEN → EDIT → SAVE → PLAY → STOP → RELOAD (BEFORE EDITING)
- Use 'Recent Missions'
- Or use mission builder toolbox



## BSI / QUICK MENU



## MISSION BUILDER → Mission Builder Toolbox



SHORTCUTS	
CTRL + S	Save (Overwrites)
F5	Start Mission
F6	Stop Mission

# MACE ADDING MOVING REMOVING MISSION ITEMS

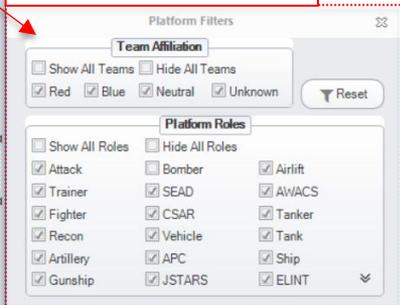
## Add/Move/Select/Change

Search By Category  
RMB Minimise All

Filter By Type

Filter By Team / Role

Search By Name



Select and click

[ALT] + Drag and drop to add a group

Click to swap existing for selected

Drag and drop

### ADD:

- Drag and Drop
- OR
- Select and Click 
- RMB after finished adding

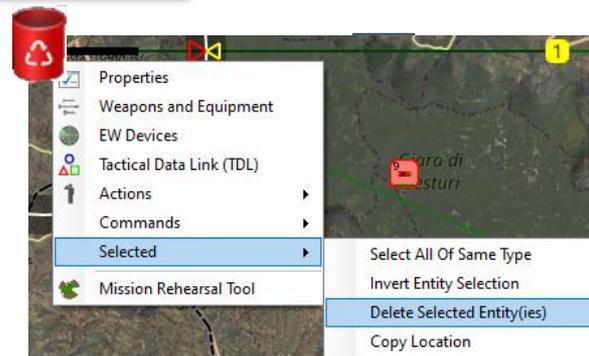


### TIP - CLEAR FILTERS

Clear filters and search windows or else you won't see all available when selecting platforms in future

### DELETE:

- CTRL + DEL – Selected
- ALT + DEL – Non-Selected
- OR
- Drag and drop to bin
- OR
- Via Context Menu (RMB)



# MACE ADDING MOVING REMOVING MISSION ITEMS

## Selecting Platforms

### SINGLE PLATFORM SELECTION

- Bottom Status Bar
  - SELECT FROM LIST
- OR
- LMB on Single Platform



### MULTIPLE PLATFORM SELECT

- SHIFT + LMB – on individual platforms
- SHIFT + LMB & DRAG – over multiple platforms
- SHIFT + LMB Dbl Click – on platform selects all of that type

### MOVE MULTIPLE PLATFORMS

- CTRL + LMB on the map area (not platform)

### GROUP AND RECALL

- CTRL + (0 to 9) to assign group
- ALT + (0 to 9) to recall group

### SHORTCUTS

LMB = Left Mouse Button  
RMB = Right Mouse Button

CTRL + LMB	Move the <u>single</u> clicked-on <u>Item</u> OR move <u>group</u> selected to LMB clicked Point
SHIFT + LMB	Multi Select (Drag or Click)
CTRL + DELETE	Delete Selected
ALT + DELETE	Delete ALL BUT Selected
CTRL + 1 to 9	Create a Group
ALT + 1 to 9	Recall a Group
CTRL + W	Reverse Selected Platform Waypoints
CTRL + R	Resurrect ALL
ALT + A	Select ALL AIR
ALT + G	Select ALL GROUND

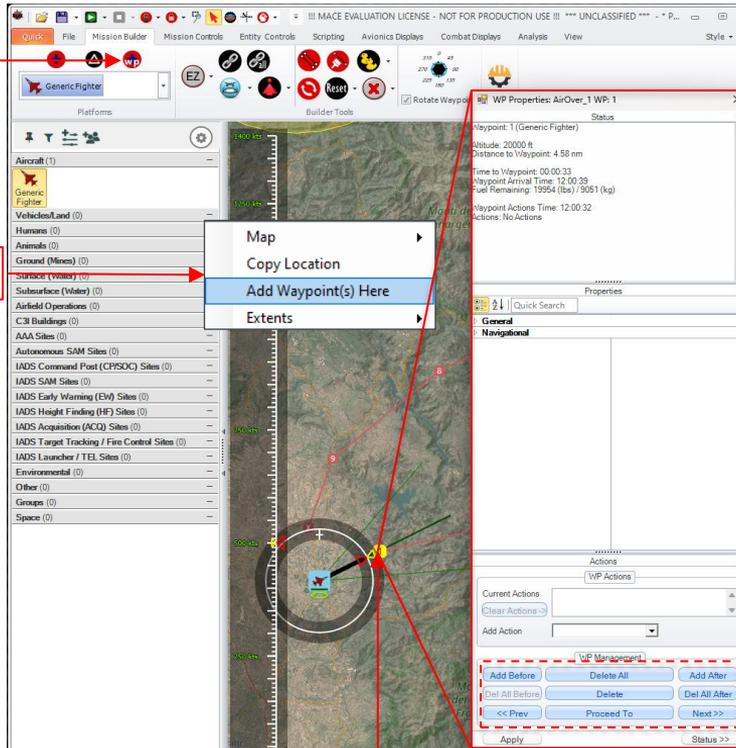
# MACE ADDING MOVING REMOVING MISSION ITEMS

## Add/Move/Select/Change Waypoints

Waypoint Add  
(Stateful)

Context Menu Add

Waypoint Properties Window



- RMB on waypoint for properties
- CTRL + LMB on waypoint to move
- Use stateful button to add multiple
- Orbit waypoint tool
- Context Menu Add (Later MACE Versions)
- RMB on Map – ‘Add waypoint here’



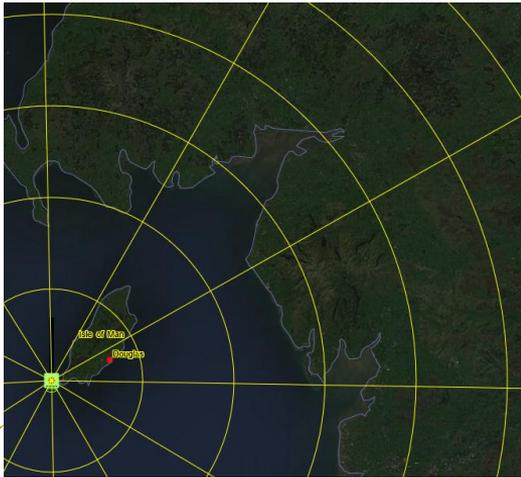
Waypoint Add/Delete Buttons

RMB on waypoint  
To open properties

# MACE ADDING MOVING REMOVING MISSION ITEMS

## Known Points and Bullseye

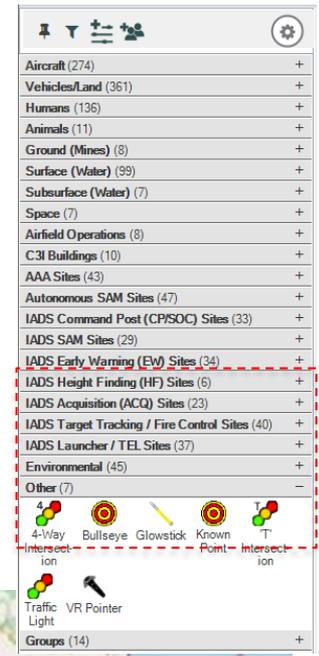
- Known Point – An invisible platform, useful for:
  - Reference points for attacks (9-Lines, Call for Fire)
  - Landing zones
  - Bullseyes
  - Trigger points in scripts e.g. proximity triggers



Select Any Known Point in the List



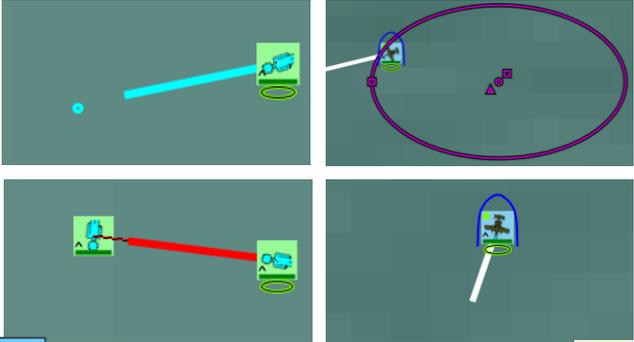
Bullseye information from selected known point



# MACE ADDING MOVING REMOVING MISSION ITEMS

## Introduction to Intent and delta

- Intent – Black Vector Line
  - Platform follows waypoints
  - Return to intent
    - Button on ENTITY CONTROLS Tab 
    - RMB on platform vector line 
    - Button on ENTITY CONTROL FORM 
- Delta (Not Black)
  - Platform does not follow waypoints
  - Tell by vector color **OR** intent state drop down (entity controls)



		In Intent (follows Waypoints)	
		Delta (not following waypoints)	
		Rallying	
		Moving to Target	
		Running Away	
		Taking Cover	
		Random Walk	
		Joystick Controlled	
		In formation	

# MACE ADDING MOVING REMOVING

## Student Exercise - [Link to Online Solution Video](#)

1. (00:13) Clear out any existing mission - New
2. (00:18) Add: 2 x Attack Aircraft Platforms, a Blue Soldier platform, 20 Human platforms
3. (01:06) Filter your platforms to help you add a AAA Site and a building then clear the filters
4. (01:33) Change one of the Attack aircraft to a different type of attack aircraft
5. (01:50) Put an attack aircraft in an orbit around the Blue Soldier by using the existing waypoints (orbit tool)
6. (02:00) Make the Soldier a 5-waypoint path
7. (02:18) Move some of the soldiers waypoints to make a zig zag pattern
8. (02:26) Move the one Air platform from south of the other to north of it
9. (02:34) Save your mission, then run the mission
10. (02:50) Give an air platform direction manually [by clicking the black line] and let it fly for a while and then use intent button
11. (03:07) Stop the mission and save. Go and check your saved files - dirty mission
12. (03:27) Add 4 more soldiers
13. (03:45) Select them all and save as a group
14. (04:02) Select ALL AIR and save as a group
15. (04:11) Select ALL Ground but remove 3 from the selection then save as a group
16. (04:22) Recall Groups – Move the whole group
17. (04:35) Delete the group
18. (04:49) Recall another group and delete ALL BUT the Group



# ARMOR SETUP AND BASIC CONTROLS

## Learning objective:

- Understand how to setup ARMOR with and use the basic controls to visualise MACE Missions

## Enabling objectives

- Understand the how to set MACE to use ARMOR Supplemental Configs
- Know how to access the ARMOR plugin from MACE
- Understand how to correctly set the data paths in the MACE-ARMOR plugin
- Know how to launch and connect to ARMOR
- Know how to attach to a MACE platform in ARMOR
- Understand the different attached views available within ARMOR
- Introduction to ownership – top lock / bottom lock
- Know how to access the on-screen interface
- Know how to detach and move the camera around in ARMOR
- Understand the functions of the on-screen interface items
- Know how to save and restore a viewpoint
- MACE environment settings

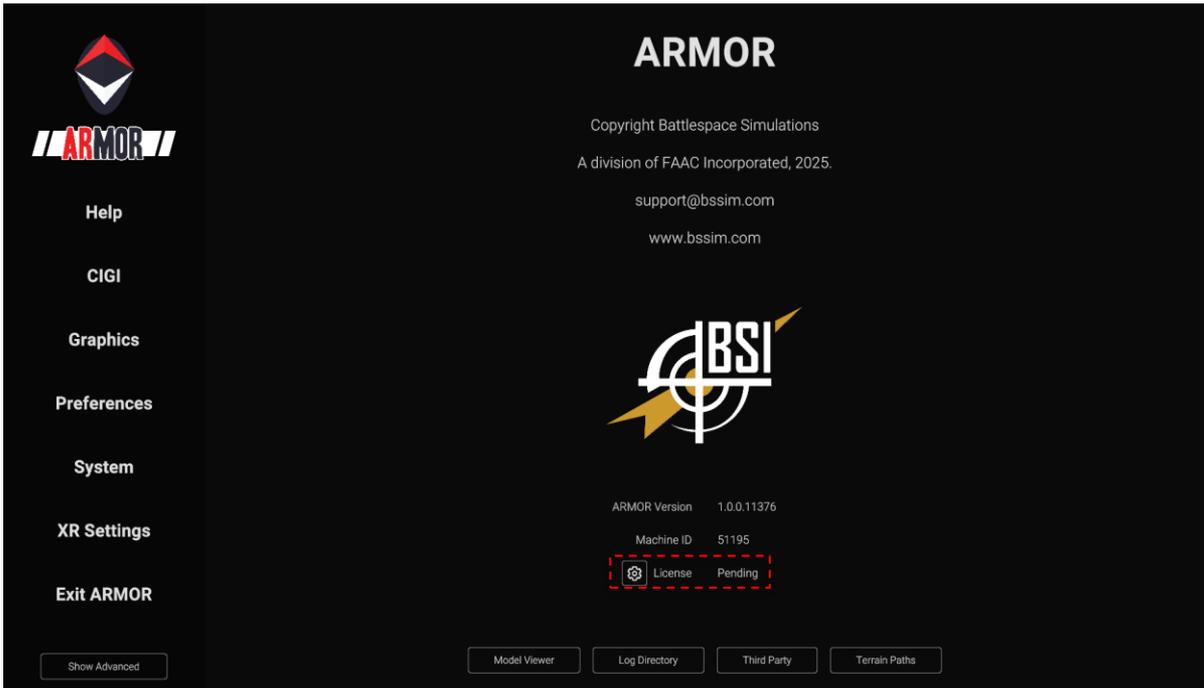
# ARMOR LICENSING

## Checking for License

Configure

Exit

Launch MACE or configure ARMOR with a stand-alone license.  
Machine ID: 51195



The screenshot shows the ARMOR main menu. On the left is a vertical navigation menu with options: Help, CIGI, Graphics, Preferences, System, XR Settings, and Exit ARMOR. At the bottom left is a 'Show Advanced' button. The main area features the ARMOR logo at the top, followed by the text 'ARMOR', 'Copyright Battlespace Simulations', 'A division of FAAC Incorporated, 2025.', 'support@bssim.com', and 'www.bssim.com'. Below this is the BSI logo. At the bottom of the main area are buttons for 'Model Viewer', 'Log Directory', 'Third Party', and 'Terrain Paths'. In the center, the 'License' status is shown as 'Pending' with a gear icon, and this entire status area is highlighted with a red dashed box.

**ARMOR**

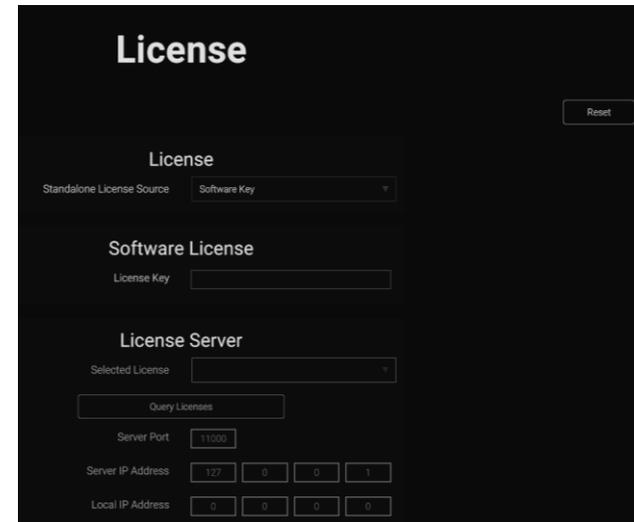
Copyright Battlespace Simulations  
A division of FAAC Incorporated, 2025.  
support@bssim.com  
www.bssim.com

BSI

ARMOR Version 1.0.0.11376  
Machine ID 51195  
License Pending

Show Advanced

Model Viewer Log Directory Third Party Terrain Paths



The screenshot shows the 'License' configuration window. It has a 'Reset' button in the top right. The 'Standalone License Source' is set to 'Software Key'. Under 'Software License', there is a 'License Key' input field. Under 'License Server', there is a 'Selected License' dropdown menu and a 'Query Licenses' button. At the bottom, there are input fields for 'Server Port' (11009), 'Server IP Address' (127.0.0.1), and 'Local IP Address' (0.0.0.0).

## License

Reset

License

Standalone License Source Software Key

Software License

License Key

License Server

Selected License

Query Licenses

Server Port 11009

Server IP Address 127 0 0 1

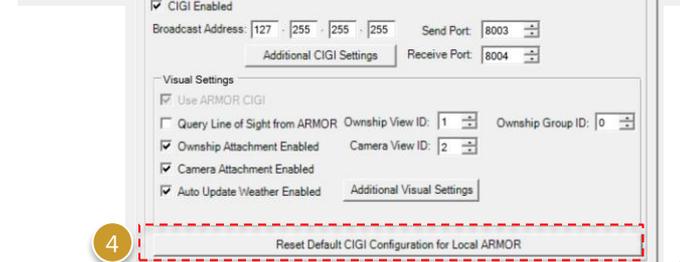
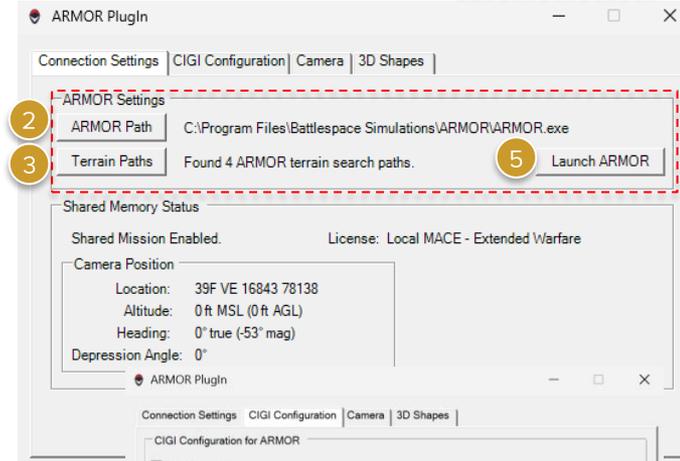
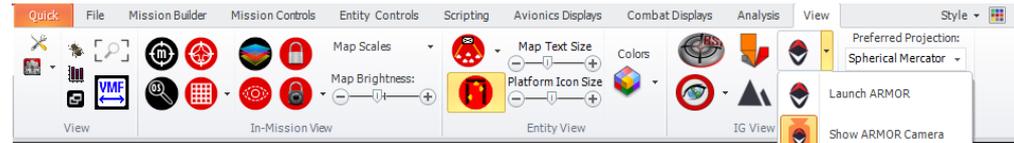
Local IP Address 0 0 0 0



# ARMOR SETUP AND BASIC CONTROLS

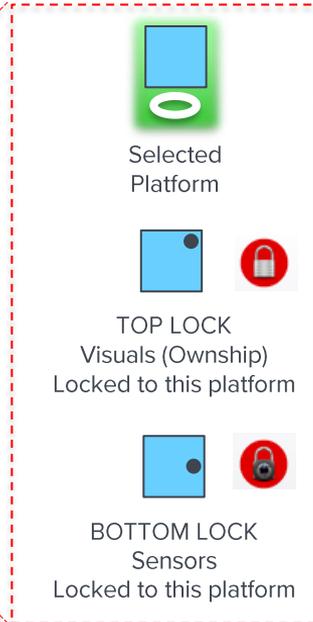
## 1<sup>st</sup> TIME SETUP

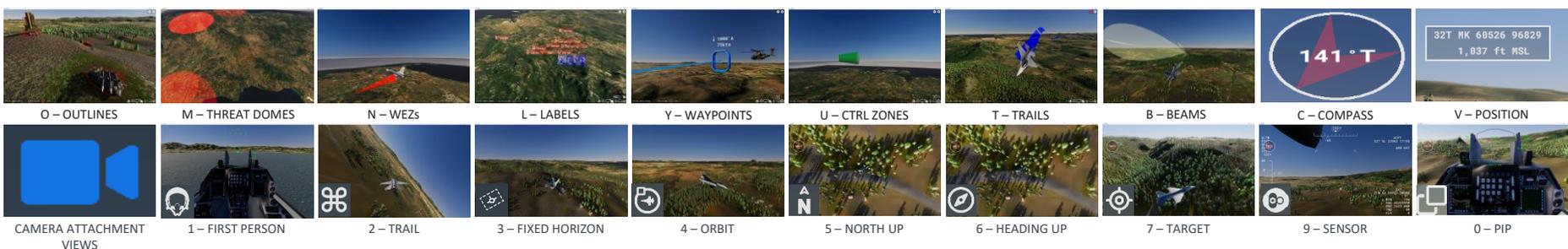
- ARMOR Plugin
  - (1) View Tab > IG View
- ARMOR Data Paths
  - (2) Application Path
  - (3) Terrain Data Path - Recursive search
- CIGI Settings – (4) If running AMOR locally use reset button
- (5) Launching ARMOR



## OWN-SHIP – WHAT IS IT?

- What is selected in MACE ...
- ... until we 'LOCK' an entity as own-ship
- Joysticks and displays control/view THAT entity
- ARMOR Views (See Next Slide)
  - [SPACE BAR] – attach to own-ship
  - 1 to 9 (+0) attached views
  - Z – Change spectrum
  - WASDRF – Keys / 3D Mouse
  - [TAB] to on screen interface (OSI)





**CAMERA ATTACHMENT VIEWS**

- O - OUTLINES
- M - THREAT DOMES
- N - WEZs
- L - LABELS
- Y - WAYPOINTS
- U - CTRL ZONES
- T - TRAILS
- B - BEAMS
- C - COMPASS
- V - POSITION
- 1 - FIRST PERSON
- 2 - TRAIL
- 3 - FIXED HORIZON
- 4 - ORBIT
- 5 - NORTH UP
- 6 - HEADING UP
- 7 - TARGET
- 9 - SENSOR
- 0 - PIP

**Function Key Bindings:**

- ctrl F1: Screen / XR Toggle
- ctrl F2: XR 1:1 / Tabletop PoV
- ctrl F3: MR Pass-through mode
- shift T: Trail Team Filter
- ctrl T: Trail Type Filter
- shift Y: Waypoint Label Mode
- ctrl Y: Cycle Waypoint Entity
- ctrl - =: HUD Scale
- alt - =: Waypoint Scale
- ctrl pause: Freeze Entity Motion
- shift home: Video Capture
- ctrl home: Screen Capture

**Keyboard Key Bindings:**

- shift C: Magnetic / True Heading
- ctrl C: Mils / Degrees Heading
- alt C: Mission Clock Display
- shift V: Altitude units m/ft
- ctrl V: Cycle Coordinate Format
- alt V: Altitude amsl/agl
- 1: 1st PERS
- 2: TRAIL
- 3: F-HORIZ
- 4: ORBIT
- 5: NTH UP
- 6: HDGUP
- 7: TARGET
- 9: SENSOR
- 0: PIP
- MODEL SCALE -
- MODEL SCALE +
- tab: ON SCREEN UI
- XR Q: LEFT
- W: FWD
- XR E: RIGHT
- R: UP
- T: TRAILS
- Y: WPTS
- CRTL U: ZONES
- WPN I: CAM
- O: OUTLINES
- P: [ ]
- caps lock
- PAN A: LEFT
- S: BACK
- PAN D: RIGHT
- F: DOWN
- DESIG G: BEAMS
- H: HUD
- JUMP J: VIEWPT
- K: AIRSPACE
- L: LABELS
- FAST shift MOVE
- CYCLE Z: SPEC
- CYCLE X: POLARITY
- C: COMPASS
- V: POSITION
- MACE B: BEAMS
- N: WEZ
- THREAT M: DOMES
- ATTACH / DETACH spacebar: CAMERA
- slow ctrl MOVE
- start
- alt
- alt gr
- ctrl

**Navigation and Sensor Key Bindings:**

- Z: Main Spectrum
- shift Z: Sensor Spectrum
- X: Main Polarity
- shift X: Sensor Polarity
- FWD
- PAN LEFT
- BACK
- PAN RIGHT
- ctrl L: Label Team Filter
- ctrl L: Label Type Filter
- alt L: Label Compact / Large
- ctrl page up: IR Manual Temp Lower limit up/down
- alt page up: IR Manual Temp Upper limit up/down
- ctrl end: IR Auto temperature range

# ARMOR SETUP AND BASIC CONTROLS

## On-Screen-Interface [TAB]

**Viewpoints <J>**

**Attach <Spacebar>**

**Camera Modes <1 to 9>**

**Main Spectrums <Z>**

**Sensor Spectrums <X>**

**Screen Capture <CTRL + HOME>**

**Video Capture / Stream**

**Pause <CTRL + PAUSE>**

**Visualization Overlays**

- Trails <T>
- Waypoints <Y>
- Waypoint Scale <ALT +/->
- Beams
- WEX
- Control Zones
- Threat Domes

**Entity Overlays**

- Labels <L>
- Outlines <O>
- Model Scale <+/->

**Display Overlays**

- Compass <C>
- Position <V>
- Primary Spectrum Camera Spectrum NVG Noise / Exposure

**HUD on/off <H>**

**Camera Location**

**Camera Elevation**

**Camera Direction**

**Mission Date**

**Mission Time**

38U 510632.03 6099517.61 170 ft AGL 91°M 04 Nov 2024 17:12:43 Display

# ARMOR SETUP AND BASIC CONTROLS

## Labels

Shift L LABELS Label Team Filter  
Ctrl L LABELS Label Type Filter  
Alt L LABELS Compact / Detailed

**Labels:**

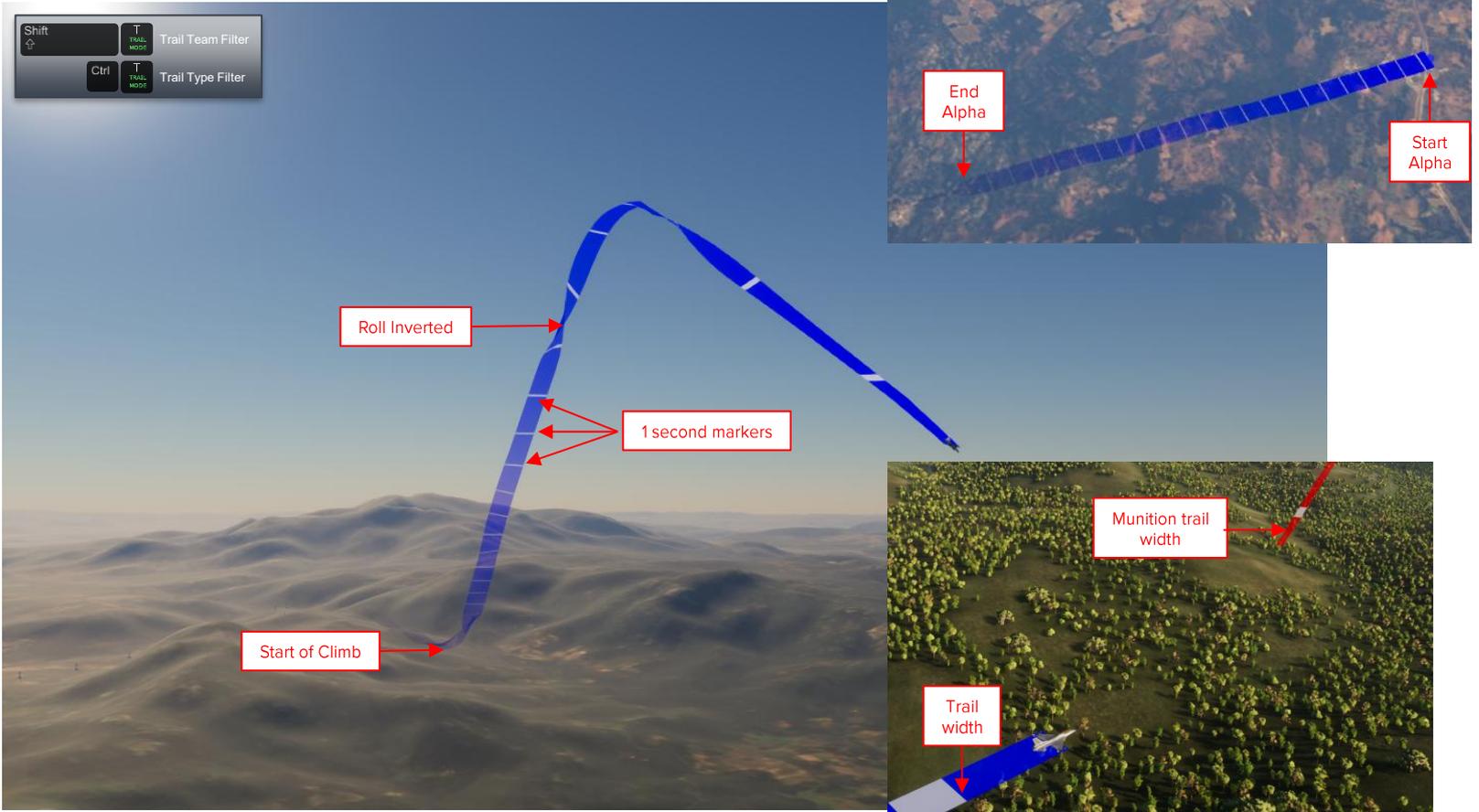
- SAM\_2** 133 km  
Generic SAM  
HDG 087M 090T S 0 mph
- NW\_Auto\_AA** 18 km  
Generic AAA  
HDG 357M 000T S 0 mph
- THUNDER02** 26 km  
Generic Fighter  
HDG 175M 178T IAS 500 kts  
AGL 483 ft
- NW\_Auto\_SA** 4.6 km  
Generic SAM  
HDG 006M 009T S 0 mph
- TEL\_43** 177 km  
Generic\_TEL  
HDG 043M 046T S 0 mph
- TEL\_44** 177 km  
Generic\_TEL  
HDG 271M 274T S 0 mph
- TEL\_45** 178 km  
Generic\_TEL  
HDG 054M 058T S 0 mph
- TEL\_42** 176 km  
Generic\_TEL  
HDG 296M 299T S 0 mph
- TT\_41** 177 km  
Generic TT Radar  
HDG 357M 000T
- BOGART01** 160 km  
Generic Bomber  
HDG 265M 268T IAS 392 kts  
MSL 8403 ft
- BMP-3\_2** 2.7 km  
BMP-3  
HDG 357M 000T S 0 mph  
+4 ATTACHED

**Callouts:**

- Callsign**: Points to the top line of the label.
- Distance From Camera**: Points to the distance value.
- Type**: Points to the second line of the label.
- Jammed (by Blue)**: Points to the label background color.
- Heading Mag / True**: Points to the HDG field.
- Altitude / Height**: Points to the MSL field.
- Speed**: Points to the IAS field.
- Entity Position**: Points to the entity on the map.
- Dead Entity**: Points to the HDG field of a destroyed entity.
- # Of Attached Entities**: Points to the +4 ATTACHED field.

# ARMOR SETUP AND BASIC CONTROLS

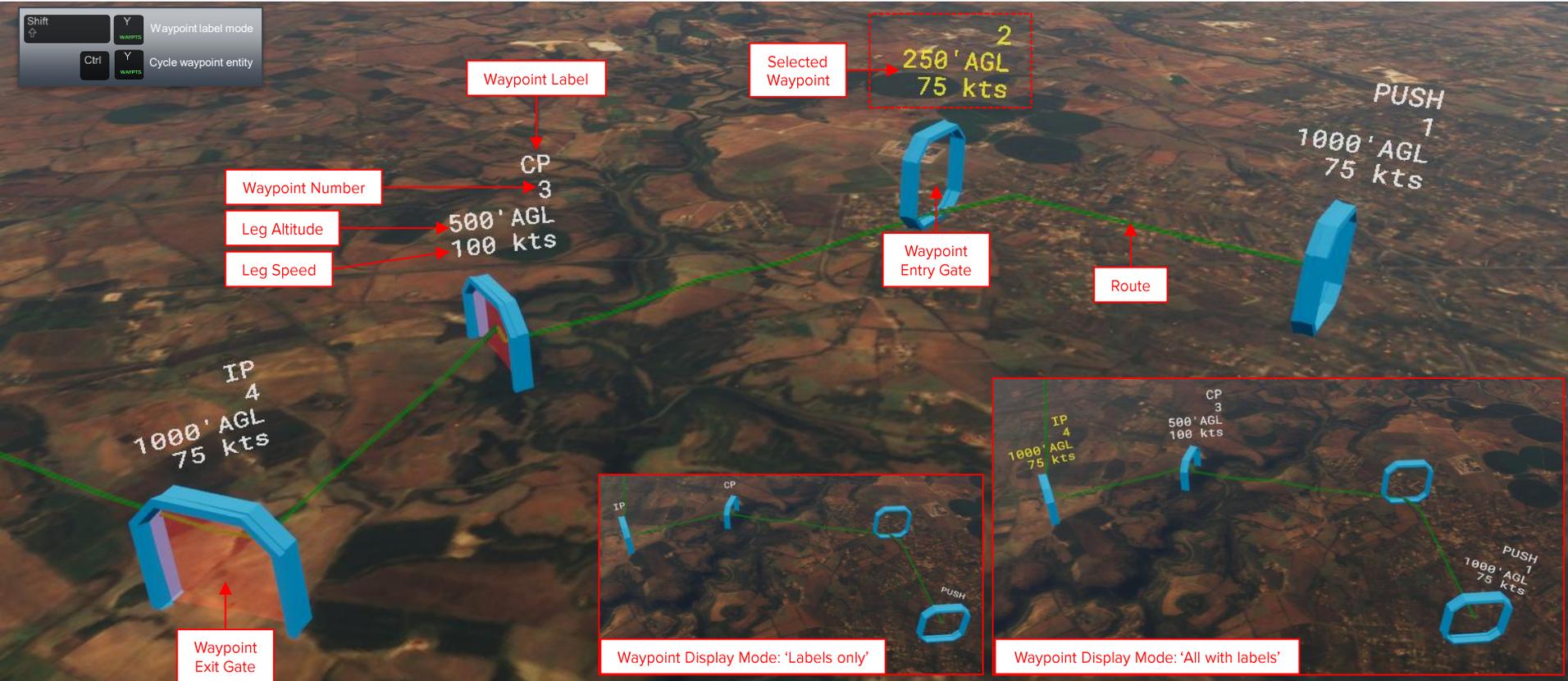
## Trails



# ARMOR SETUP AND BASIC CONTROLS

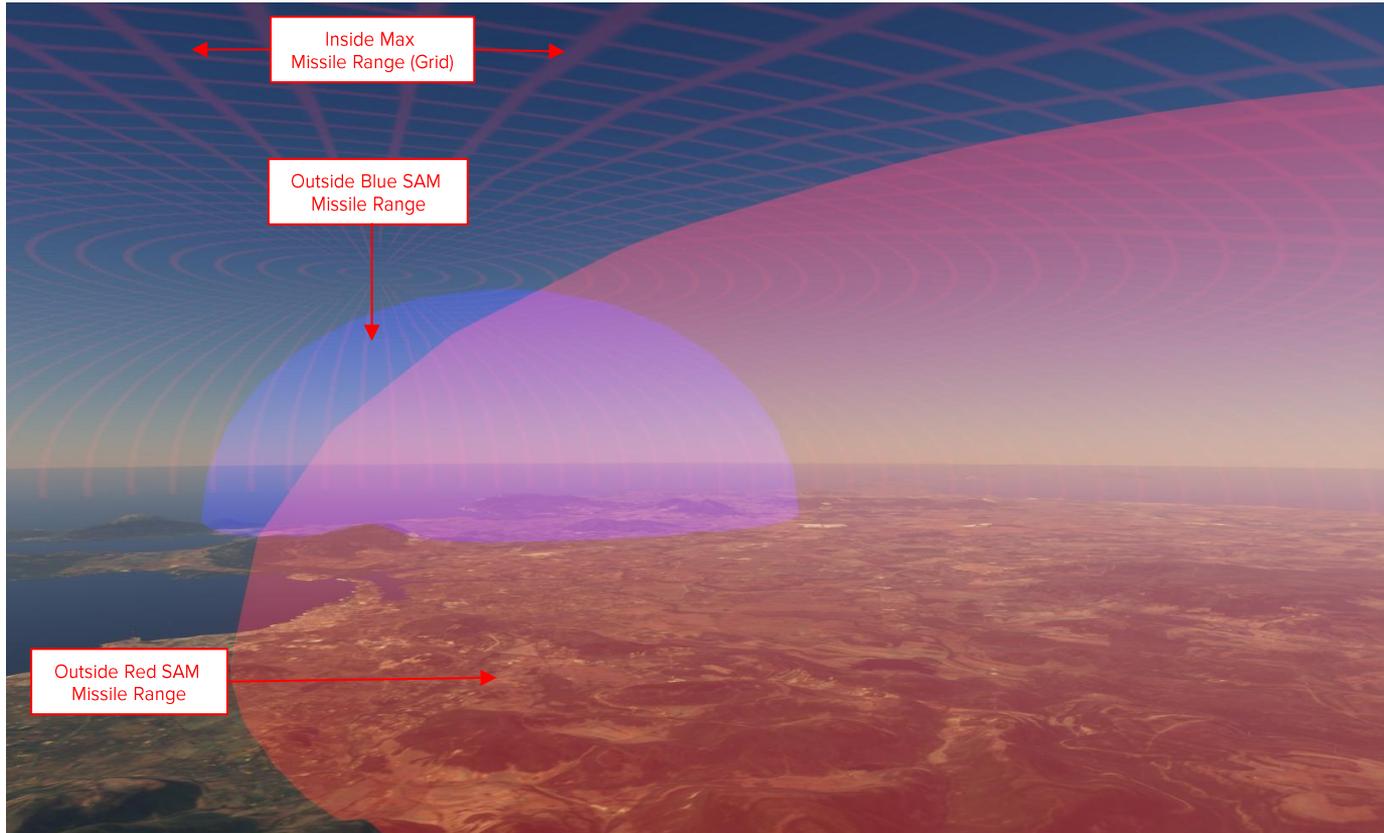
## Waypoints

Shift + Y Waypoint label mode  
Ctrl + Y Cycle waypoint entity



# ARMOR SETUP AND BASIC CONTROLS

## Missile Max Range Domes



# ARMOR SETUP AND BASIC CONTROLS

## Display – Compass, position, time

32T ML 37327 02899  
194 m MSL

16:00:46

313°M

Clock <ALT+C>

Compass <C>

Position <V>

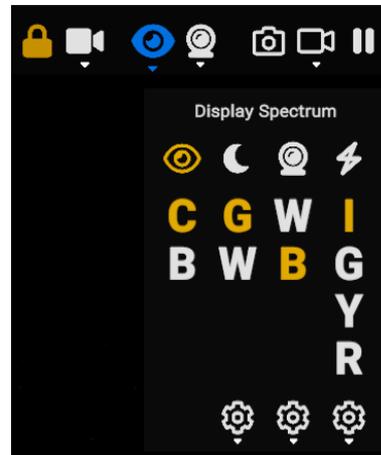
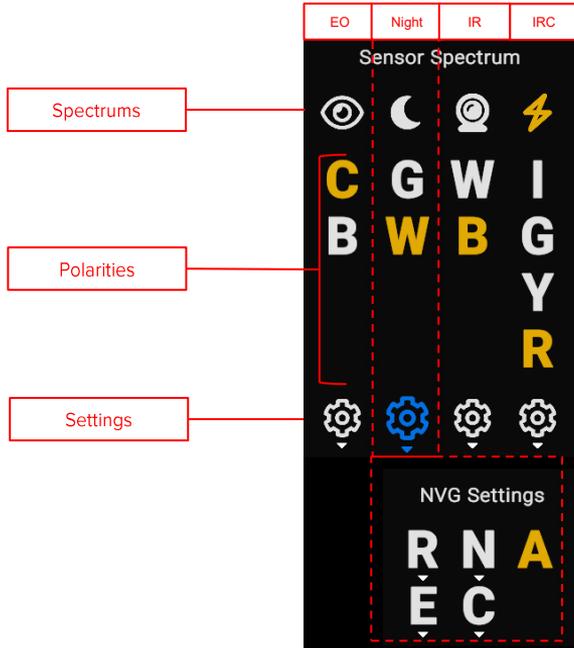
32T ML 37327 02899 194 m MSL 313°M 24 Jan 2023 16:00:46

Display



# ARMOR SETUP AND BASIC CONTROLS

## Spectrums & Polarities



- 4 Spectrums
- [Z] Main Camera / [SHIFT]+[Z] Secondary
- Polarities in columns under each spectrum
- [X] Main Camera / [Shift] + [X] Secondary
- Settings at the bottom of each column



# ARMOR SETUP AND BASIC CONTROLS

## Sensor Picture in Picture – View <O>



- 4 Spectrums
- [Z] Main Camera / [SHIFT]+[Z] Secondary
- Polarities in columns under each spectrum
- [X] Main Camera / [Shift] + [X] Secondary
- Settings at the bottom of each column

# ARMOR SETUP AND BASIC CONTROLS

## Viewpoints

The screenshot displays the ARMOR software interface. On the left, a 'Viewpoints' menu is open, listing various viewpoints such as Cyprus, Sardinia, Scotland, Seattle, vancouver, Portugal, YP1, IADS\_1, IADS\_2, Bright Convas1, Airport Gallari, sam site, WARTS Route Eval, Viewpoint, AAA, and north sardinia. Below the list is a 'Viewpoint Name Entry' field with the text 'Viewpoint 09'. At the bottom of the menu, there are icons for deleting, duplicating, editing, and adding viewpoints, along with a plus sign for adding a new viewpoint. The main 3D view shows a landscape with green hills, a river, and a town. The bottom status bar displays coordinates: 32T MK 57916 62175, 1,144 ft MSL, 2645 T 16 Feb 2023 15:48:08.

**Viewpoint Menu**

**Jump to Selected Viewpoint**

**Previous Viewpoint**

**Next Viewpoint**

**Cycle Viewpoints**

**Saved Viewpoints**

**Viewpoint Name Entry**

**Delete Selected Viewpoint**

**Duplicate Selected Viewpoint**

**Edit Selected Viewpoint**

**Add New Viewpoint**



# ARMOR SETUP AND BASIC CONTROLS

## MACE – Environment Settings



Date and Time  
Time Zone

Fog and Haze

Cloud Layers  
Thickness  
Coverage

Rain and Snow

Sea States

Clear / Open / Save  
Environment settings

Refresh (if not auto  
refreshing) in visual

Weapons and Aircraft  
drift with wind

Fixed or Variable winds  
with limits

Editable table of winds at  
different altitudes

Time of Day

Start Time (UTC): 13:00:00 January 24  
Time Zone: (UTC) Co-ordinated Universal Time  
Local Time: 13:00:00 January 24

Weather Region: \*GLOBAL DEFAULT\*  
Delete Region Add Region

Selected Weather Region

Name: \*GLOBAL DEFAULT\* Location: Select Contains Atmosphere Data

Visibility: 100000 m  
Sandstorm: 62.1 sm  
Ground Fog: Ceiling MSL (ft): 0 Visibility (ft): 0 Continuous

Clouds

Upper Layer: 0/8 Clear thickness 2000 ft  
at: 0 + 0 ft MSL  
Lower Layer: 0/8 Clear thickness 2000 ft  
at: 0 + 0 ft MSL

Precipitation: None Rain from 0 ft MSL  
Effects: Lightning Sea State: Calm (Glassy)

Surface Conditions

Temperature: 77 F 25 C @ Elev: 0 ft  
Pressure: 29.92 in Hg  
Abs Humidity: 0.00 g/m<sup>3</sup> Rel Humidity: 0%  
Runway Condition: 23 Excellent (Dry)

Surface Winds

Fixed Dir (deg): 0 Spd (kts): 0  
Variable Dir (deg): Min Max Spd (kts): 0 0

Alt MSL (ft)	Dir (deg)	Spd (kts)	Turbulence
0	0	0	

Winds Aloft

Storm System

Enable (Overrides Weather Region Cloud Layers and Precipitation)  
System Type: Select Location Lat: .00 Lon: .00 Display On Map  
Orientation: 0 deg Altitude Offset: 0 ft Growth/Decay Rate: 0 Span: 0 nm

Contrails

Lower Alt (ft): -1 Upper Alt (ft): -1  
Use -1 to automatically calculate when contrails generation.



# ARMOR SETUP AND BASIC CONTROLS

Student Exercise – [Link to Online Solution Video](#)

1. (00:13) Open the ARMOR plugin from the View tab
2. (00:18) Set the correct ARMOR application path in the MACE-ARMOR Plugin
3. (00:33) Set a valid terrain data path in the MACE-ARMOR plugin and verify on the MACE map
4. (00:52) Launch ARMOR from the MACE-ARMOR Plugin
5. (01:09) Open Tutorial\_3.mis in MACE – observe ARMOR connecting to the mission
6. (01:22) Start the mission in MACE
7. (01:25) Select an aircraft entity in MACE then select ARMOR and attach to an entity [Spacebar]
8. (01:55) Use the number keys to cycle through attached views 1 to 9
9. (02:27) Reselect view 1 and bring up the picture in picture camera view by pressing 0
10. (02:33) Detach from the platform [Spacebar]
11. (02:36) Maneuver the camera in 6 degrees of freedom
12. (02:49) Open the OSI [Tab]
13. (02:54) Use the OSI to select: Abbreviated labels, outlines, medium trails, and waypoints
14. (03:25) Open the viewpoints function on the OSI
15. (03:29) Maneuver the camera to a different position; name and save the viewpoint
16. (03:40) Maneuver the camera to a different position – restore the viewpoint
17. (03:50) Change the view spectrums until you get back to normal EO
18. (09:11) Open MACE Mission settings – change clout to 4/8 @5000ft Thickness 2000ft
19. (09:31) Make it snow moderately from 10,000ft



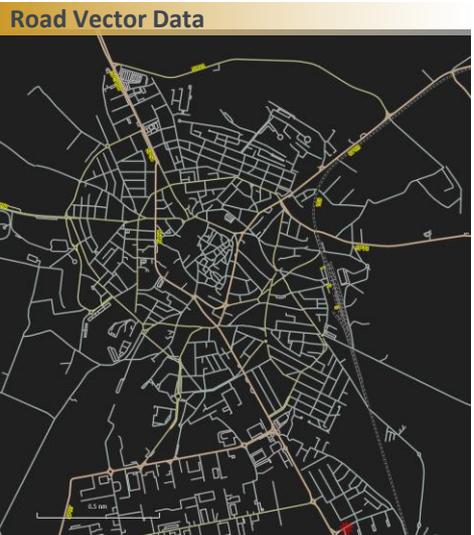
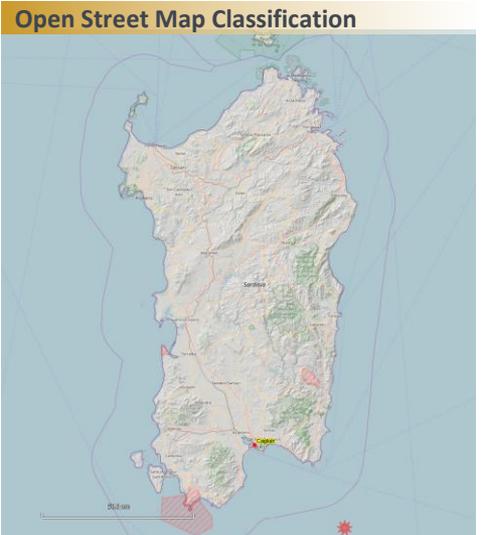
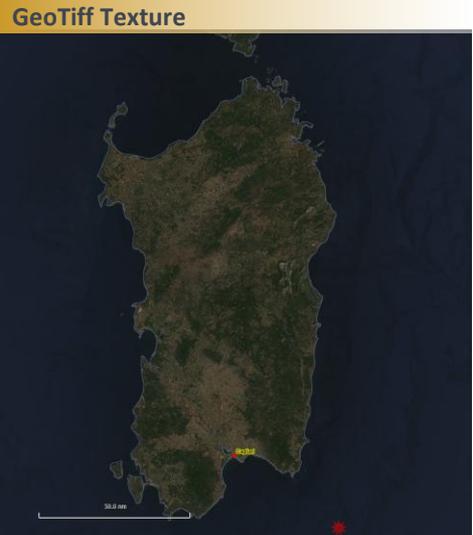
# BUILDING ARMOR TERRAIN

## Learning objective:

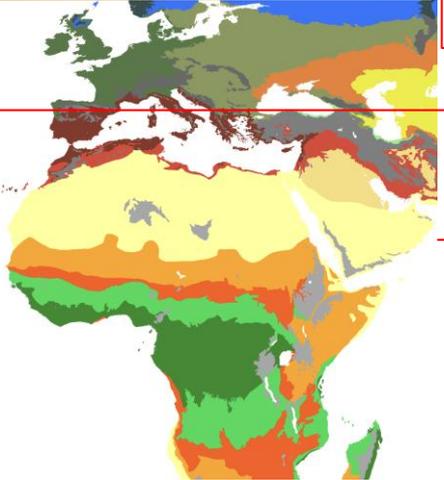
- Understand how build an ARMOR terrain using the MACE plugin from GIS data

## Enabling objectives

- Understand how to correctly set the data paths in the MACE-ARMOR Terrain building plugin
- Understand the functions of the different terrain data sources
- Know how to build a terrain in the correct directory
- Understand the ARMOR terrain caching process



### Climate Zone Data



### ARMOR Terrain Generator

ARMOR Terrain Generator

General | Data Paths | Regions

BSI worldwide map database (required for all DSM data)

Set Address

BSI worldwide imagery (used for low resolution imagery files)

Set Path

High resolution imagery data (used for high resolution imagery files)

Set Imagery Data

Show Coverage on MACE Map

Elevation data (used for height map generation)

Set Elevation Data

CDB: Elevation Tiles: 19007, Viter Tiles: 0  
 DTED: DTED0: 25584 files.  
 VRSO: No paths configured.  
 SRTM: No elevation found.

Supporting Terrain Generation Files

Select Root Folder / Assign All Path

Land use 10 meter data path (optional, for increasing land use info resolution)

Set Path

Land use 30 meter data path (required for embedding land use info in elevation files)

Set Path

Climate zones data path (optional, for creating much more detailed land use info)

Choose File

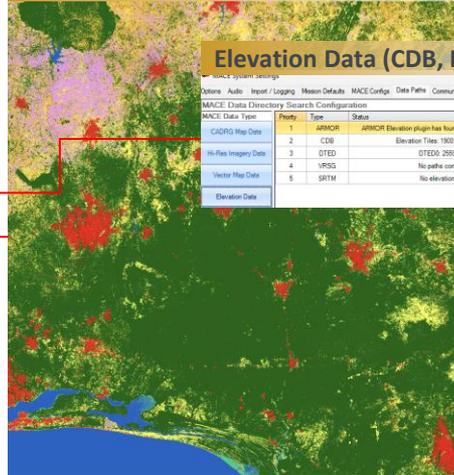
Land polygons data path (optional, for redundant files elimination)

Choose File

Water polygons data path (required for coastlines generation)

Choose File

### Landsat Land Usage Data



### Elevation Data (CDB, DTED, SRTM)

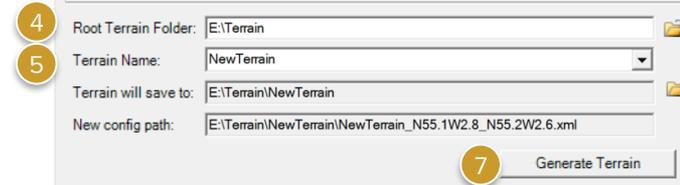
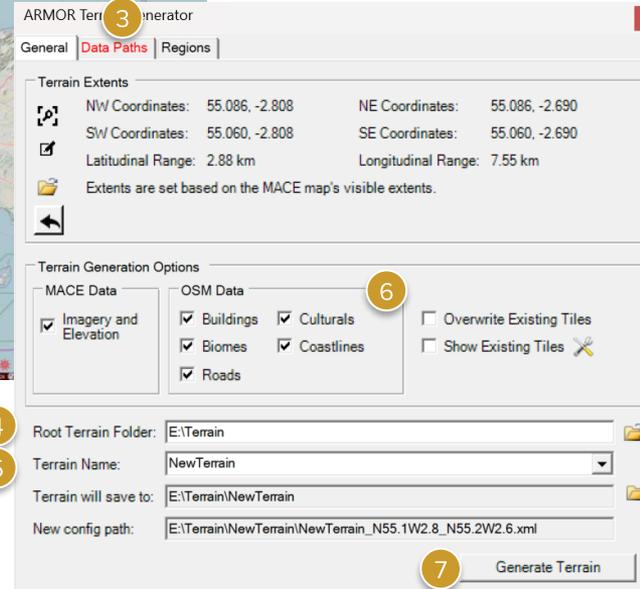
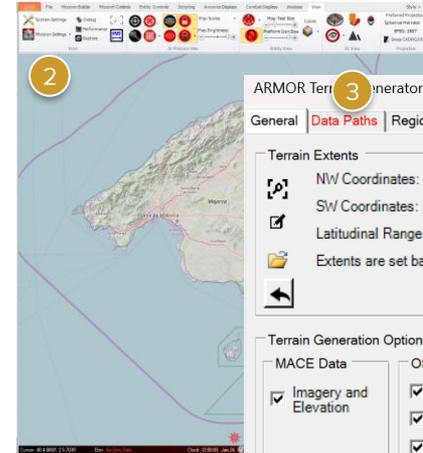
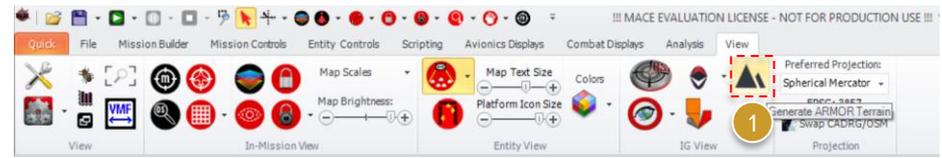
MACE Data Type	Priority	Type	Status	Configure	Clear Cache	Refresh	Ignore
CADRG Map Data	1	ARMOR	ARMOR Elevation plugin has found 10731 unique terrain files	<input type="button" value="Configure"/>	<input type="button" value="Clear Cache"/>	<input type="button" value="Refresh"/>	<input checked="" type="checkbox"/>
Hi-Res Imagery Data	2	CDB	Elevation Tiles: 19007, Viter Files: 0	<input type="button" value="Configure"/>	<input type="button" value="Clear Cache"/>	<input type="button" value="Refresh"/>	<input type="checkbox"/>
Hi-Res Imagery Data	3	DTED	DTED0: 25584 files.	<input type="button" value="Configure"/>	<input type="button" value="Clear Cache"/>	<input type="button" value="Refresh"/>	<input type="checkbox"/>
Vector Map Data	4	VRSO	No paths configured.	<input type="button" value="Configure"/>	<input type="button" value="Clear Cache"/>	<input type="button" value="Refresh"/>	<input type="checkbox"/>
Vector Map Data	5	SRTM	No elevation found.	<input type="button" value="Configure"/>	<input type="button" value="Clear Cache"/>	<input type="button" value="Refresh"/>	<input type="checkbox"/>

# BUILDING ARMOR TERRAIN

## High Level Process Description

### Detailed info on next slides

- (1) Open Terrain Builder Plugin
- (2) Pan/Zoom MACE Map to build area
- (3) Set correct data paths (from GIS Drive)
  - **OSM must be running and connected to MACE** (System Settings > Communications)
    - Check OSM is running from the MACE GIS Drive OSM Application
    - Tiles seen on MACE map when connecting from File>Connect> BSI Worldwide Map Tiles
  - Imagery path (System Settings → Communications)
  - Hi Res Imagery Data (Optional)
  - Elevation Data (System Settings → Data Paths)
  - Terrain Generation Data (Land Use / Water / Land Polygons) – set GIS drive directory
- (4) Select Correct Terrain Root Folder
- (5) Name Terrain
- (6) Select what is to be generated (usually All for a new terrain)
- (7) Generate Terrain
  - ⊕ Wait while terrain generates
- (8) First Load – Terrain Tiles Cache in ARMOR
  - ⊕ Must have an entity placed in MACE to start this process

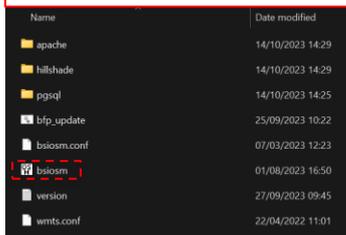


# BUILDING ARMOR TERRAIN

## Worldwide Mapping

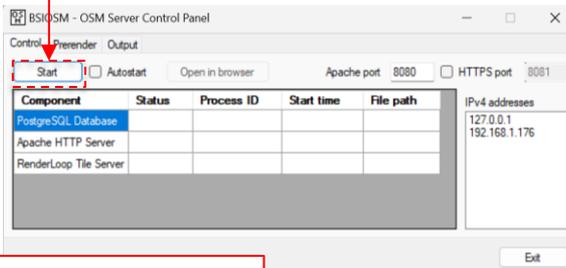
1

Double Click the BSIOSM icon in the OSM folder on the GIS Drive



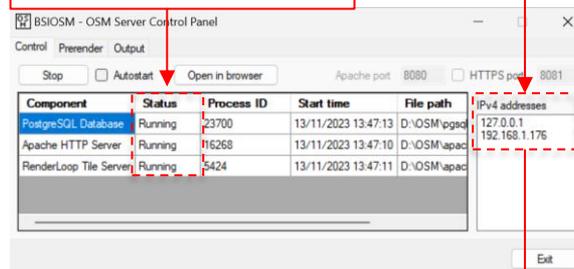
2

Start the OSM Applications



3

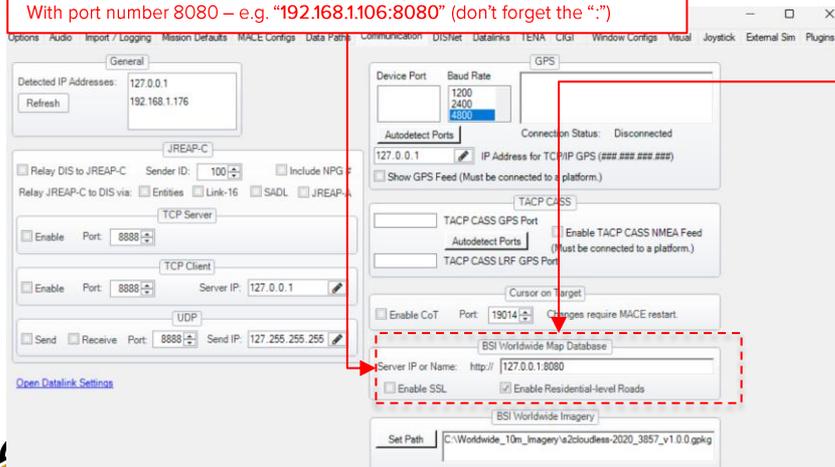
Verify the applications are running  
Note: the IPV4 Address



4

MACE>Visual>System Settings>Communication

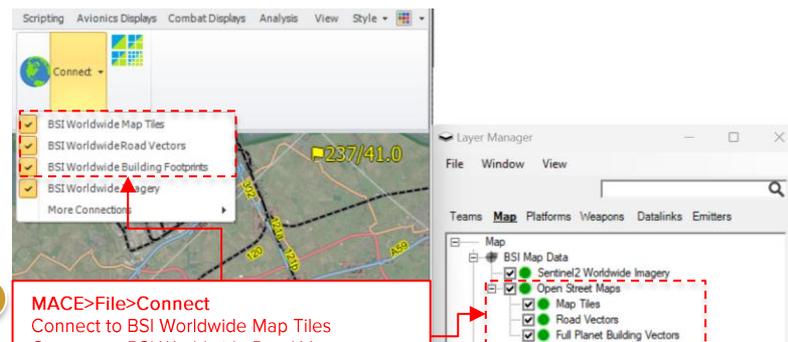
Put the IPV4 Address in the BSI Worldwide Map Database Field  
With port number 8080 – e.g. “192.168.1.106:8080” (don't forget the “:”)



5

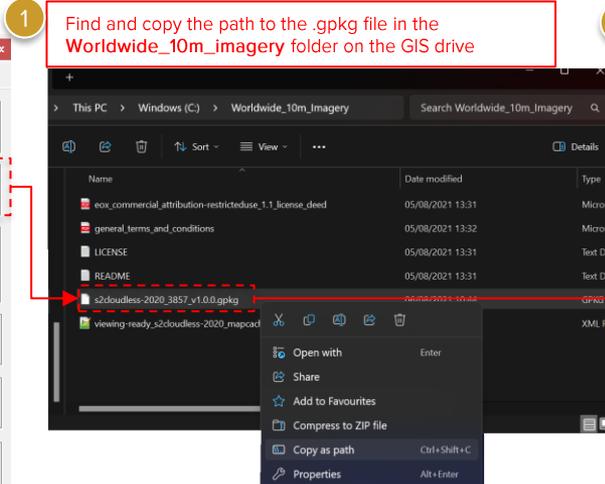
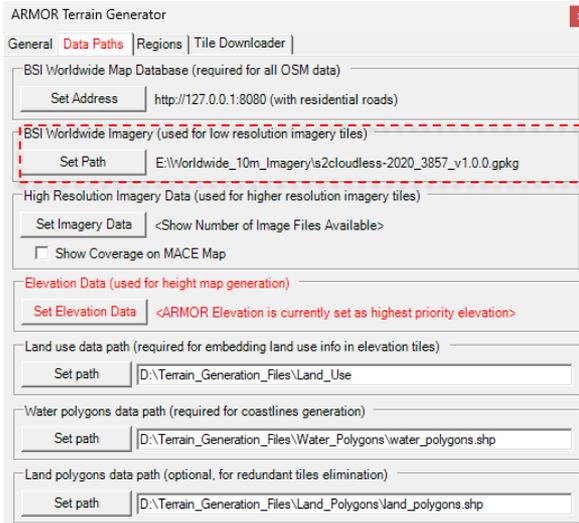
MACE>File>Connect

Connect to BSI Worldwide Map Tiles  
Connect to BSI Worldwide Road Vectors  
Connect to BSI Worldwide Building Footprints

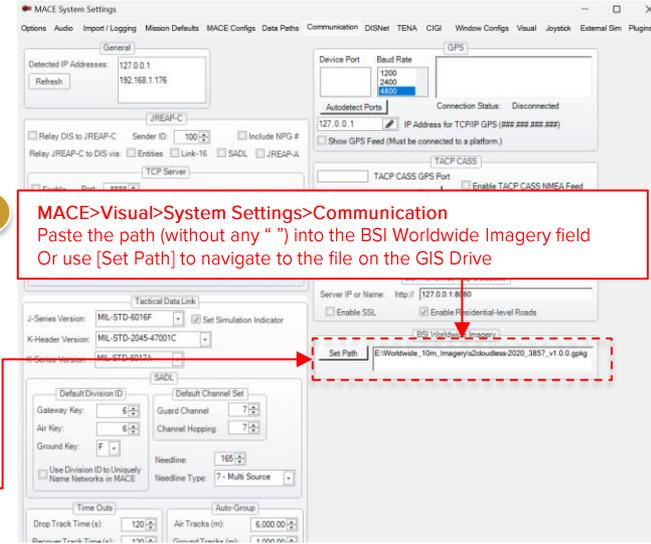


# BUILDING ARMOR TERRAIN

## Worldwide Imagery Data

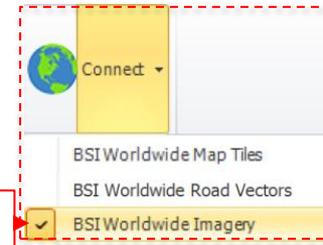


1 Find and copy the path to the .gpkg file in the **Worldwide\_10m\_imagery** folder on the GIS drive



2 MACE>Visual>System Settings>Communication  
Paste the path (without any " ") into the BSI Worldwide Imagery field  
Or use [Set Path] to navigate to the file on the GIS Drive

3 MACE>File>Connect  
Connect to BSI Worldwide Imagery



4 Confirm MACE is displaying Imagery



# BUILDING ARMOR TERRAIN

## Static Data – Hi-Res Imagery (Optional) & Elevation Data

ARMOR Terrain Generator

General Data Paths Regions

BSI worldwide map database (required for all OSM data)

Set Address

BSI worldwide imagery (used for low resolution imagery tiles)

Set Path

High resolution imagery data (used for higher resolution imagery tiles)

Set Imagery Data

Show Coverage on MACE Map

Elevation data (used for height map generation)

Set Elevation Data

Supporting Terrain Generation Files

Select Root Folder / Assign All Path

Land use 10 meter data path (optional, for increasing land use info resolution)

Set Path

Land use 30 meter data path (required for embedding land use info in elevation tiles)

Set Path

Climate zones data path (optional, for creating much more detailed land use info)

Choose File

Land polygons data path (optional, for redundant tiles elimination)

Choose File

Water polygons data path (required for coastlines generation)

Choose File

1

### MACE>Visual>System Settings>Data Paths

- Select [Hi-Res Imagery Data] blue button on the left-hand side
- Select [Add Dir] on the right-hand side and navigate to your high-resolution imagery files
- Repeat as required

MACE System Settings

Options Audio Import / Logging Mission Defaults MACE Configs Data Paths Communication DISNet TENA CIGI Window Configs Visual Joystick External Sim Plugins

MACE Data Directory Search Configuration

MACE Data Type	Dir Num	Directory Name	Items Found
CADRG Map Data			
Hi-Res Imagery Data	1	E:\CADRG\UK OS Sample	1
Vector Map Data			
Elevation Data			

Buttons: Add Dir..., Remove, Move Up, Move Down, Move Top, Move Bottom, Build Catalog

2

### MACE>Visual>System Settings>Data Paths

- Select [Elevation Data] blue button on the left-hand side
- Select [Configure] on the right-hand side and navigate to your elevation files for CDB and DTED
  - On the GIS Drive – the 'Elevation Data Folder' contains both [CDB] folder and [DTED] Folder
  - CDB is the highest resolution elevation data supplied with MACE
- Check that 'Tiles' are showing in the status column

MACE System Settings

Options Audio Import / Logging Mission Defaults MACE Configs Data Paths Communication DISNet TENA CIGI Window Configs Visual Joystick Ext

MACE Data Directory Search Configuration

MACE Data Type	Priority	Type	Status	Configure	Clear Cache	Reload
CADRG Map Data	1	ARMOR	Found 8135 unique terrain tiles.	Configure	Clear Cache	Reload
Hi-Res Imagery Data	2	CDB	Elevation Tiles: 23997, Water Tiles: 22912	Configure	Clear Cache	Reload
Vector Map Data	3	DTED	DTED0: 25594 tiles.	Configure	Clear Cache	Reload
Vector Map Data	4	VRSRG	No paths configured.	Configure	Clear Cache	Reload
Elevation Data	5	SRTM	No elevation found.	Configure	Clear Cache	Reload



# BUILDING ARMOR TERRAIN

## Terrain Generation Files

ARMOR Terrain Generator

General **Data Paths** Regions

BSI worldwide map database (required for all OSM data)  
Set Address http://127.0.0.1:8080 (with residential roads)

BSI worldwide imagery (used for low resolution imagery tiles)  
Set Path C:\Worldwide\_10m\_imagery\s2cloudless-2020\_3857\_v1.0.0.gpkg

High resolution imagery data (used for higher resolution imagery tiles)  
Set Imagery Data 39 high resolution image files available  
 Show Coverage on MACE Map

Elevation data (used for height map generation)  
Set Elevation Data <ARMOR Elevation is currently set as highest priority elevation>

Supporting Terrain Generation Files  
Select Root Folder / Assign All Path

Land use 10 meter data path (optional, for increasing land use info resolution)  
Set Path D:\Terrain\_Generation\_Files\Land\_Use

Land use 30 meter data path (required for embedding land use info in elevation tiles)  
Set Path E:\Terrain\_Generation\_Files\Land\_Use

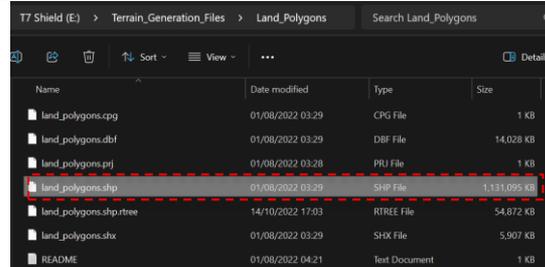
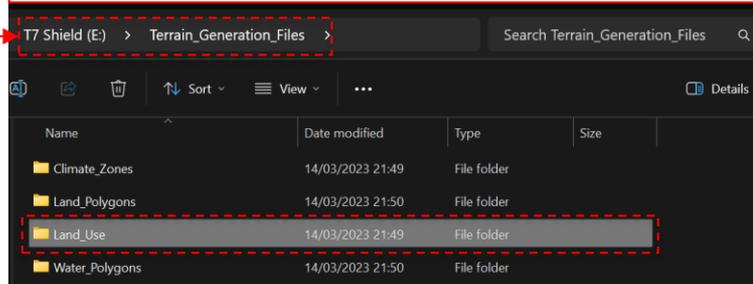
Climate zones data path (optional, for creating much more detailed land use info)  
Choose File E:\Terrain\_Generation\_Files\Climate\_Zones\WorldClimateZonesInflated.tif

Land polygons data path (optional, for redundant tiles elimination)  
Choose File E:\Terrain\_Generation\_Files\Land\_Polygons\land\_polygons.shp

Water polygons data path (required for coastlines generation)  
Choose File E:\Terrain\_Generation\_Files\Water\_Polygons\water\_polygons.shp

1

If the GIS drive data is in the correct hierarchy:  
- Select the root folder for the Supporting Terrain Generation Files



2

OR Select each directory individually

# BUILDING ARMOR TERRAIN

## Select Terrain Build Area

- ARMOR Terrain
- Sardinia
- Pacific Northwest
- A N Other Terrain
- A N Other Terrain 2

ARMOR Terrain Generator

General | Data Paths | Regions

Terrain Extents

SW Coordinates: 59.953, -11.540 NE Coordinates: 59.953, 42.975  
SE Coordinates: 38.169, -11.540 SE Coordinates: 38.169, 42.975  
Latitudinal Range: 2424.98 km Longitudinal Range: 3033.60 km  
Extents are set based on the MACE map's visible extents

Terrain Generation Options

MACE Data OSM Data  
Imagery and Elevation  Buildings  Culturals  Overwrite Existing Tiles  
 Biomes  Coastlines  Show Existing Tiles  
 Roads

Root Terrain Folder: D:\ARMOR Terrain  
Terrain Name: New Terrain  
Terrain will save to: D:\ARMOR Terrain\New Terrain  
New config path: D:\ARMOR Terrain\New Terrain\New Terrain\_N60.0W11.6\_N38.3E43.0.xml  
Mission area too large. Generate Terrain

Name

- Cache
- TerrainElevation
- TerrainImagery
- TerrainOSMCultural
- bsi-hm10-catalog.xml
- Version.txt
- Woensdrecht\_N52.1E2.8\_N51.2E5.4.xml

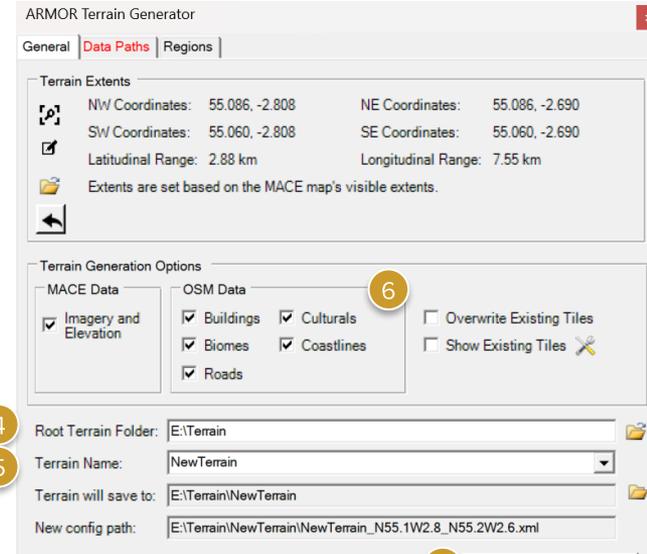
- See Existing Tiles
- Pick terrain area (3-ways)
- Zoom MACE Map
- Draw a rectangle
- Open a pervious area
- Type corner coordinates
- Check Root Level Folder – ARMOR Terrain
- Name new terrain



# BUILDING ARMOR TERRAIN

## High Level Process Description

- (1) Open Terrain Builder Plugin
- (2) Pan/Zoom MACE Map to build area
- (3) Set correct data paths (from GIS Drive)
  - OSM must be running and connected to MACE (System Settings > Communications)
    - Check OSM is running from the MACE GIS Drive OSM Application
    - Tiles seen on MACE map when connecting from File>Connect> BSI Worldwide Map Tiles
  - Imagery path (System Settings → Communications)
  - Hi Res Imagery Data (Optional)
  - Elevation Data (System Settings → Data Paths)
  - Terrain Generation Data (Land Use / Water / Land Polygons) – set GIS drive directory
- (4) Select Correct Terrain Root Folder
- (5) Name Terrain
- (6) Select what is to be generated (usually All for a new terrain)
- (7) Generate Terrain
  - ⊕ Wait while terrain generates
- ⊕ (8) First Load – Terrain Tiles Cache in ARMOR
  - ⊕ Must have an entity placed in MACE to start this process



# BUILDING ARMOR TERRAIN

## Student Exercise [Link to Online Solution Video](#)

1. [\(00:16\)](#) Open the MACE-ARMOR Plugin terrain paths to show existing terrain coverage
2. [\(00:49\)](#) Find a small (<50by50km) area of the world and frame it by zooming and panning the MACE map
3. [\(01:00\)](#) Open the ARMOR terrain building plugin and select the required GIS data paths as sources for the terrain
4. [\(01:11\)](#) Ensure ARMOR is NOT the primary terrain elevation data source in MACE System Settings
5. [\(01:28\)](#) Create a terrain configuration name and select a path folder for the terrain
6. [\(01:49\)](#) Ensure the correct options are ticked in MACE and OSM Data
7. [\(01:53\)](#) Build a terrain
8. [\(02:04\)](#) Test the terrain in ARMOR with a simple MACE mission using a FW aircraft to fly around it

# MACE SIMPLE ENTITY CONTROL

## Learning objective:

- Learn how to control platforms in MACE using Entity Control Window and Ribbons

## Enabling objectives

- Recap intent and delta states
- Know how to use the entity manoeuvre window to conduct delta state movement and return to intent
- Know how to copy location from the mission area to the entity manoeuvre window
- Know how to initiate actions on coordinate in the entity manoeuvre window (orbit, camera centre, zoom, attack)
- Know how to perform actions by copying coordinates into platform properties
- Know how to use the Ribbon Controls to control platforms
- Recap how to return a platform to intent
- Know how to rally ground platforms and helicopters
- Know how to put an aircraft in a delta state orbit and adjust its parameters
- Know how to add weapons to a platform
- Know how to get a platform to perform an instant attack on a selected entity
- Know how to use the detonation tool and platform properties to destroy entities
- Know how to resurrect entities
- Understand what is displayed on the MACE platform icons

# MACE SIMPLE ENTITY CONTROL

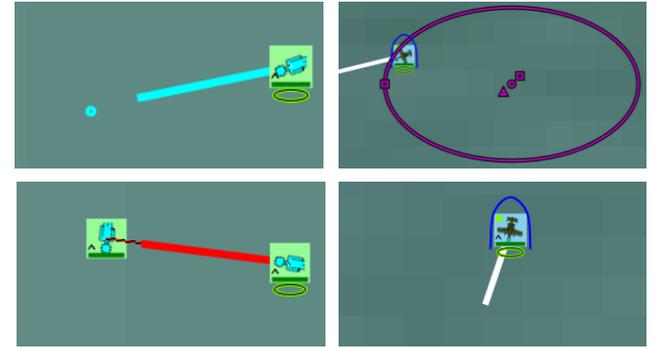
## Intent and delta

- Intent (Waypoint Following) – Black Vector Line

- Platform follows waypoints
- Return to intent
  - Button on ENTITY CONTROLS Tab 
  - RMB on platform vector line
  - Button on ENTITY CONTROL FORM 

- Delta (Not Black)

- Platform does not follow waypoints
- Tell by vector color OR intent state drop down



			Waypoint following (Intent)
			Delta (not following waypoints)
			Rallying
			Moving to target
			Running away
			Taking cover
			Random destination
			Joystick controlled
			In formation

# MACE SIMPLE ENTITY CONTROL



RETURN TO INTENT

## SHORTCUTS

- ALT + H Opens entity control window cursor in heading
- ALT + S Opens entity control window cursor in speed
- ALT + L Opens entity control window cursor in altitude
- ALT + C Dispense Chaff on selected platform
- ALT + F Dispense Flares on selected platform
- ALT + B Dispenses Chaff AND Flares on selected platform
- CTRL + T Entity Control Tapes

## ENTITY CONTROL WINDOW (Controls the Own-ship) ALT + H/S

The Entity Control window contains the following controls and callouts:

- SPEED CHANGE:** Type new speed
- HEADING CHANGE:** Type new Heading
- ALT CHANGE:** Type new Altitude
- Incremental Changes By Dropdown amount:** Points to the +/- speed control buttons.
- WP CYCLE:** Cycle button
- INTENT:** Intent button
- PRF:** PRF (Priority) buttons
- Orbit Location:** Orbit button
- Attack Location:** Attack button
- Centre Map:** Centre Map button
- Camera Slew to Location:** Camera Slew button

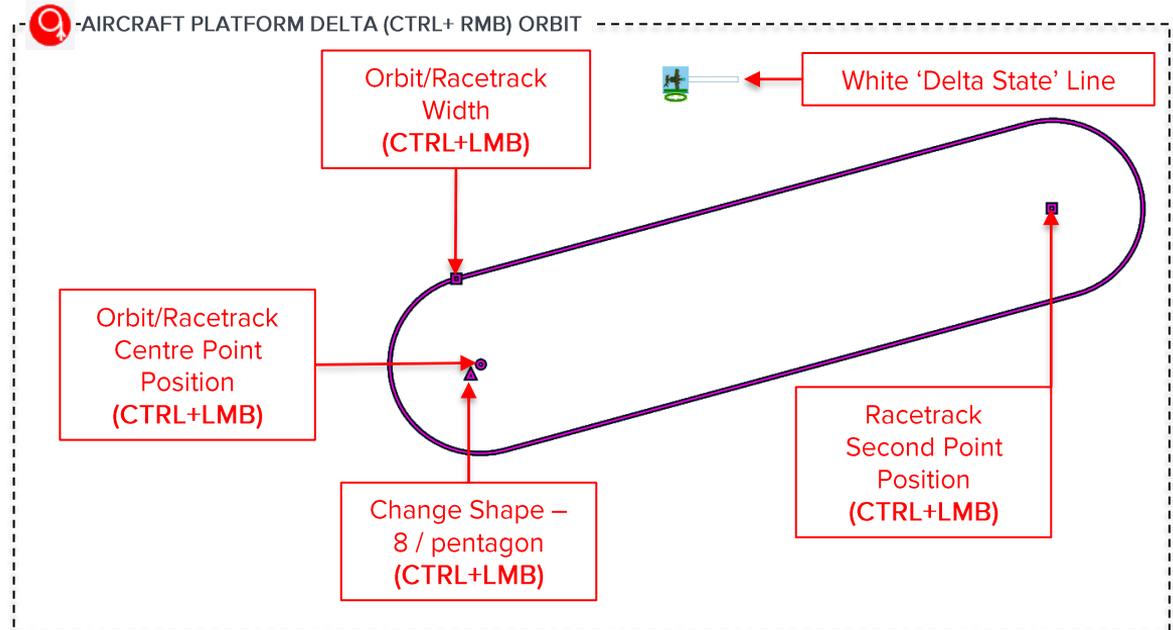
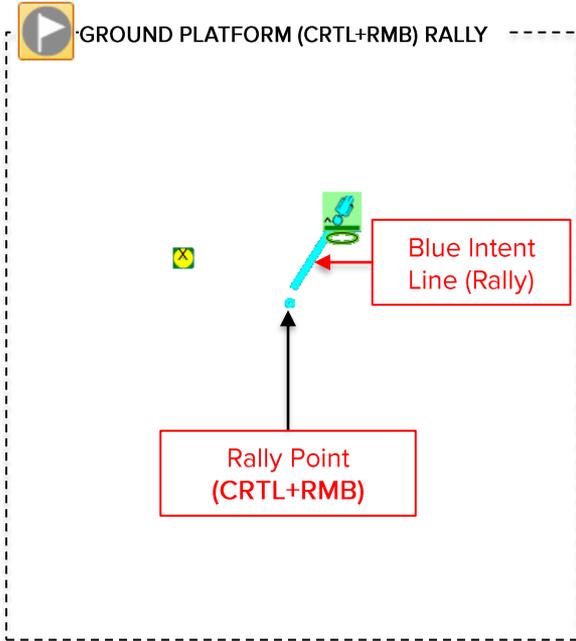
## ENTITY CONTROL TAPES (Controls the Own-ship) CTRL + T

The Entity Control Tapes interface includes the following callouts:

- SPEED CHANGE:** ALT+LMB ON Δ & DRAG
- HEADING CHANGE:** LMB on VECTOR Or ALT+LMB ON Δ & DRAG
- ALT CHANGE:** ALT+LMB ON Δ & DRAG
- COORD ACTION:** RMB - Copy Location >
- CTRL+V Paste < Location:** Paste location into the Coord Action field.
- YELLOW = INSTANT RED = TARGET VALUE:** Legend for the speed and altitude tapes.
- MSL:** Mean Sea Level indicator.



# MACE SIMPLE ENTITY CONTROL



## SHORTCUTS

- CTRL + RMB
- CTRL + RMB on entity
- CTRL + LMB
- CTRL + L

FW Aircraft Delta Orbit OR Ground Unit / Helicopter Rally Point

Move to Target (Opposite team)

Move Aircraft Orbit Points

Selected platform loiter at current position

LMB = Left Mouse Button  
RMB = Right Mouse Button

# MACE SIMPLE ENTITY CONTROL

## Adding Weapons + Instant Attack

- (1) Access Weapons and Equipment Form
  - Via the Context Menu
    - RMB on Platform > Weapons and Equipment
  - Via Platform Properties
    - Bottom of form – **Weapons >>**
- (2) Use the filters to find weapons
- (3) Use to add / Remove weapons
  - [-->]** Add 1 x Weapon
  - [<--]** Remove 1 x Weapon
  - [<<--]** Remove ALL weapons
- (4) Change Quantity of Weapons
- (5) Enable/Disable Auto
  - Allows constructive (semi automatic) use weapons/ equipment
- [SCL]**– save weapons load outs and restore them

**Weapons & Equipment (HG-02)**

Name	Auto / Enabled	Weapon	Location	Qty	Auto Enabled	Selected Weapon	Edit	Shoot
100mm AAA	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
100mm AAA Naval	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
100mm French Naval Gun	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
100mm Tank	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm DPICM	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm HE	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm HE Rodar	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm HE/DP Sidefire	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm HE/PROX Side-fire	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm Ibm	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm IR Ibm	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm Tank	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
105mm WP	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
90mm Motor	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
12mm	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm M200A1 HEAT-MP-T	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor DPICM	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor HE	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor Ibm	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor IR Ibm	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor Smoke	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Motor WP	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
120mm Tank	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
122mm Cheese Rocket (MLRS)	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
125mm Tank	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
130mm AAA	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot
14.5mm AAA	<input checked="" type="checkbox"/>	AGM-85E2/L MAVERICK (Entry 13)		20	<input checked="" type="checkbox"/>		Edit	Shoot

**Save SCL**

SCL: **CURRENT LOADOUT \*** [Load]

Name	Hardpoint	#
Laser Designator		1
Visual Detection Airborne (A/L/S)		1

**Platform Properties: US\_UAV\_3**

Status

US\_UAV\_3

Health: 100%

DIS Type: 1, 2, 225, 50, 0, 0, 0

DIS ID: Site: 1, App: 105, Entity: 1090

Location: 39 52 31420', 9 1.38861'

Speed: 90 kts

Indicated Airspeed: 90 kts

Alt: 15500 ft MSL / 14543 ft AGL

Heading: 270.1 (true) / 267.1 (mag)

Next Waypoint: 1

Time to Waypoint: 00:01:07

Waypoint Arrival Time: 14:31:55

Target: 39 52 31385', 9 1.57115'

Bearing (deg): 076.0 (true) / 073.0 (mag)

Range: 9.9 (nm) / 18297.2 (m)

Orders: MACE Generic Platform Engagement

Status: Executing

Target Tracks: None

**Properties**

Quick Search

Landing Zone Callsign

Leg Altitude: 15500 ft

Leg Altitude AGL or MSL

Leg Speed: 90

Location (Lat/Lon): 39 52 31385', 9 1.57115'

Location (MGRS): 32S NK 02239 13540

Loop Route

Maximum Attach/Rally Speed: 0

Movement Frozen

Next Waypoint: 1

On Ground

Parking Spot Callsign

Push Delay

Push Time: 13:00:00 01/24/2023

Formation: None

Attached Entities: No Attached Entities

Copy/Move: [Detach] [Delete] [MACE Xfer] [Weapons >>]

Apply [Apply To Group] [Configure Wep]

# MACE SIMPLE ENTITY CONTROL

## Simple Weapon Use

- Weapon Release Button 
  - Will release any weapon in the inventory
  - Regardless of range or guidance
    - In WEZ ✓
    - out of WEZ ⚠

- Entity Attack Button 

- Allocate and Move To Target Only

- CRTL + RMB on entity
- Allocates Target and Moves to Target only
- Go 'Weapons Tight' to engage  Wpns Tight

- Will attack target with the next suitable **AUTO ENABLED** weapon

- Select Entity → Allocate Target  → Move To Target  → Weapons Tight 

OR

- Select Entity → Attack  – Select Target

### Weapon Release



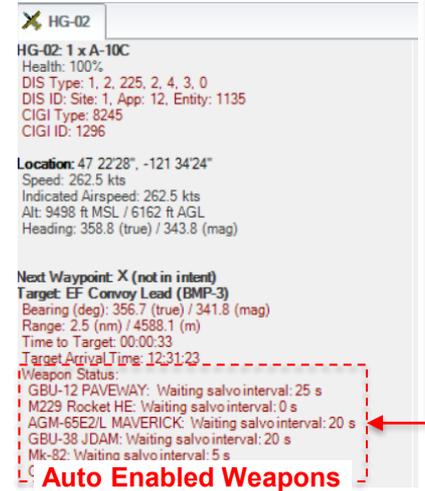
AGM-65E2/L MAVERICK  
 Air Illum Flare  
 Chaff (RR-180):Left Wing Dispenser  
 Chaff (RR-180):Left Wingtip Dispenser  
 Chaff (RR-180):Right Wing Dispenser  
 Chaff (RR-180):Right Wingtip Dispenser  
 Flare (M-206):Left Wing Dispenser  
 Flare (M-206):Left Wingtip Dispenser  
 Flare (M-206):Right Wing Dispenser  
 Flare (M-206):Right Wingtip Dispenser  
 GAU-8 30mm  
 GBU-12 PAVEWAY  
 GBU-38 JDAM  
 Laser Designator  
 M229 Rocket HE  
 Mk-82

### Target & Attack



Attack

Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
IR Signature		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Air RADAR		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Air to Air Missile		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Air to Air Missile		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Air to Ground Missile		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Air to Ground Missile		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Aircraft Bullet		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic Aircraft Visual Detection		400	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic ARM		1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Edit



**HG-02**  
**HG-02: 1 x A-10C**  
 Health: 100%  
 DIS Type: 1, 2, 225, 2, 4, 3, 0  
 DIS ID: Site: 1, App: 12, Entity: 1135  
 CIGI Type: 8245  
 CIGI ID: 1296  
**Location:** 47 22'28", -121 34'24"  
 Speed: 262.5 kts  
 Indicated Airspeed: 262.5 kts  
 Alt: 9498 ft MSL / 6162 ft AGL  
 Heading: 358.8 (true) / 343.8 (mag)  
**Next Waypoint: X (not in intent)**  
**Target: EF Convoy Lead (BMP-3)**  
 Bearing (deg): 356.7 (true) / 341.8 (mag)  
 Range: 2.5 (nm) / 4588.1 (m)  
 Time to Target: 00:00:33  
 Target Arrival Time: 12:31:23  
 Weapon Status:  
 GBU-12 PAVEWAY: Waiting salvo interval: 25 s  
 M229 Rocket HE: Waiting salvo interval: 0 s  
 AGM-65E2/L MAVERICK: Waiting salvo interval: 20 s  
 GBU-38 JDAM: Waiting salvo interval: 20 s  
 Mk-82: Waiting salvo interval: 5 s  
**Auto Enabled Weapons**



# MACE SIMPLE ENTITY CONTROL

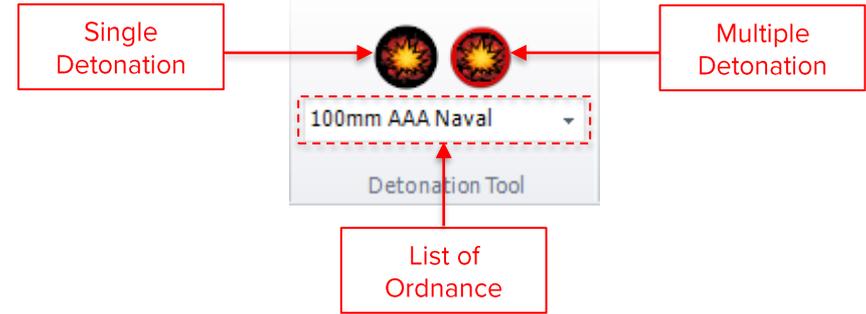
## Detonation Tool and Resurrection

- Detonation Tool
  - Pick from list any ordnance
- **Single** detonation
- **Multiple** detonation (live mouse)
- Resurrection
  - Individually from **Platform Properties**
  - Raise ALL the Dead: **CTRL+R**

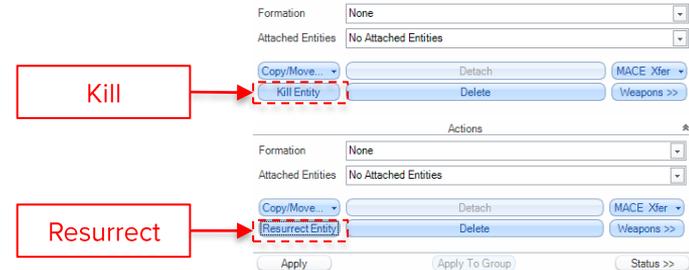
**SHORTCUTS**  
**CTRL + R**

Resurrect all dead entities

Mission Controls: Detonation Tool



Platform Properties



# MACE ENTITY ICONS 2024

**Entity Outline:**

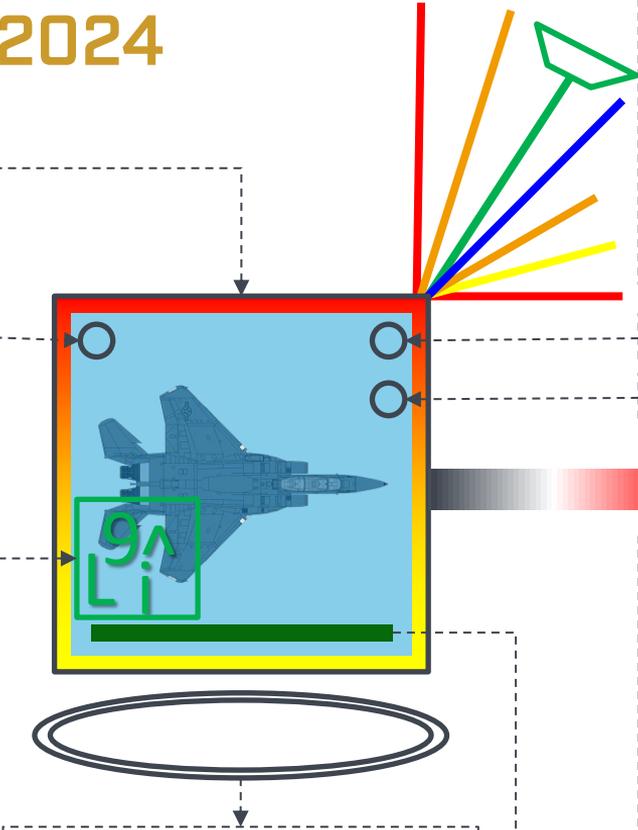
- Entity set to 'Weapons Free'
- Entity set to 'Weapons Tight'
- Entity set to suppression

**Top Left Dot:**

- Detected by early warning radar
- Detected by acquisition radar
- Platform is being engaged

**Green Symbols:**

- Entity in Delta mode
- Entity has attached entities
- Entity movement frozen
- Entity being navigation-jammed
- Entity invulnerable
- Entity being sensor-jammed
- Entity is landing
- Airborne entity is on the ground
- Entity is assigned to a 9-Line
- Entity is assigned to a 5-Line
- Entity has not 'pushed yet'
- External entity from DIS or HLA
- Entity has concealment



**Long Lines:**

- Sensor line and swathe
- Attached to entity (formation)
- Target line
- Track Line

**Short Lines:**

- Jamming Acquisition
- Jamming Search
- Jamming Tracker

- Visuals and displays locked to this entity
- Camera/sensor locked to this entity

**Vector Line:**

- Intent (following waypoints)
- Delta mode
- Moving to target
- Running Away
- Taking Cover
- Rallying to point
- Random walk
- Joystick Controlled

**Lower Ellipse:**

- Primary selected entity
- Other selected entities in a group

**Health Bar:**

- Full Health
- Damaged
- Severely damaged



# MACE ENTITY ICONS 2025

## Entity Outline:

-  Entity set to 'Weapons Free'
-  Entity set to 'Weapons Tight'
-  Entity set to suppression

## Top Left Dot:

-  Detected by early warning radar
-  Detected by acquisition radar
-  Platform is being engaged

## Green Symbols:

-  Entity in Delta mode
-  Entity has attached entities
-  Entity movement frozen
-  Entity being navigation-jammed
-  Entity invulnerable
-  Entity being sensor-jammed
-  Entity is landing
-  Airborne entity is on the ground
-  Entity is assigned to a 9-Line
-  Entity is assigned to a 5-Line
-  Entity has not 'pushed yet'
-  External entity from DIS or HLA
-  Entity has concealment

## Long Lines:

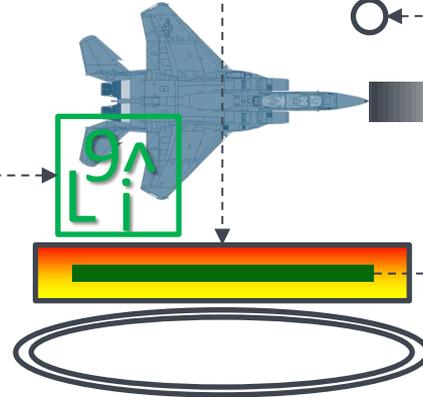
-  Sensor line and swathe
-  Attached to entity (formation)
-  Target line
-  Track Line

## Short Lines:

-  Jamming Acquisition
-  Jamming Search
-  Jamming Tracker

-  Visuals and displays locked to this entity

-  Camera/sensor locked to this entity



## Lower Ellipse:

-  Primary selected entity
-  Other selected entities in a group

## Vector Line:

-  Intent (following waypoints)
-  Delta mode
-  Moving to target
-  Running Away
-  Taking Cover
-  Rallying to point
-  Random walk
-  Joystick Controlled

## Health Bar:

-  Full Health
-  Damaged
-  Severely damaged

# MACE SIMPLE ENTITY CONTROL

Student Exercise - [Link to Online Solution Video](#)

1. (00:13) Add 3 Aircraft, 3 vehicles, and 3 humans to a NEW mission and start the mission
2. (00:58) Select 1 air unit from the bottom status bar list
3. (01:12) Open the entity control window (ALT+S ALT+H) and change aircraft heading, speed and altitude
4. (01:50) Return the aircraft to intent
5. (01:54) Remove the aircraft weapons then add an air to ground missile, a laser target designator, and a generic guided bomb to the aircraft – make them Auto Enabled
6. (02:36) Copy and paste a map location into the entity control window coordinate box
7. (02:49) Centre aircraft sensor on coordinate, make aircraft orbit coordinate, attack coordinate – return to intent
8. (03:50) Toggle Entity control ribbons on
9. (04:02) Use Entity control ribbons to instantly change heading, altitude and speed – return to intent
10. (04:19) Put the air unit into a delta state orbit using the Mouse or the keyboard shortcut
11. (04:24) Change the orbit shape to 8 and pentagon and back to circle
12. (04:26) Change the width of the orbit and the center position
13. (04:36) Select 2 ground units
14. (04:42) Rally the ground units to a point
15. (04:50) Command an air unit to attack a ground entity
16. (05:12) Use the entity control target button to target a point on the ground
17. (05:20) Use the entity control weapons release dropdown to activate the laser target designator
18. (05:28) Use the detonation tool to destroy some ground entities
19. (05:38) Resurrect one then kill it using platform properties then resurrect all entities

# REVISION EXERCISE (OPTIONAL)

## Student Exercise

1. Start and connect to Open Street Maps (if you have it) – SSD Drive `BSI_Windows_OSM\BSIOSM.exe`
2. Load **tutorial\_3.mis** and Load ARMOR
3. Free fly the ARMOR Camera to see north half of Sardinia looking down from above - Save a viewpoint here
4. Display labels for blue and red, compact labels, platforms and guided weapons
5. Display trails for blue and red but platforms and guided weapons only
6. Play the mission & Attach ARMOR to NASTY 01 in trail view
7. Make NASTY 01 loiter at its location – change loiter: size, direction and shape
8. Attach ARMOR to THUNDER 01
9. Change THUNDER 01 to MSL flight, Set altitude to 5000ft msl using the ‘Entity Control’ window
10. Set THUNDER 01: speed to 450kts using the side tapes, and Set heading instantly to 180
11. Return THUNDER 01 to waypoint route and move the last waypoint over the sea
12. Delete all THUNDER 01 waypoints before waypoint 4 and then reverse the waypoints using the shortcut (CTRL+W)
13. Make THUNDER 01 steer to waypoint 2
14. Select all of the red entities in the northwest of the island and then move them as a group to the south
15. Remove 1 red entity from the selection and then Delete the remaining selected entities
16. Lock the Ownship to THUNDER 02 (Top Lock)
17. Copy a map location near NW Auto Sam and then use the manoeuvre window ‘Coord Action’ to make THUNDER 02 orbit that point
18. Manually release a weapon from THUNDER 02 then assign a target of NW\_auto\_Sam to THUNDER 02
19. Open THUNDER 02’s weapons and equipment, remove all bombs, add an air to ground missile, deselect auto on everything except it
20. Make THUNDER 02 ‘Move to target’, and set it’s weapons posture weapons tight
21. Release chaff and flares using the shortcut buttons (ALT+C/F/B)
22. Now Attack NW-AAA with just the attack button using NASTY 01



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Learning objective:

- Understand how MACE own-ship views controls are configured and manifest in control within ARMOR

## Enabling objectives

- Understand what an own-ship is
- Understand the joystick controls associated with own-ship control and own-ship camera views
- Know how to set and save joystick configurations
- Know how to lock views in a MACE mission
- Understand HUD symbology
- Know how to allocate a target to the own-ship in MACE
- Know how to control the own-ship out of window view with a joystick
- Know how to control the own-ship out of camera view with a joystick
- Know how to control the own-ship out of camera view with a MACE Sensor Form
- Understand how avionics and combat displays are locked to the own-ship
- Know how to setup and save MACE-ARMOR window configurations
- Know how to change the weather settings in a MACE Mission
- Understand how to import live weather data regions into MACE

# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Ownship/Sensor – Top/Bottom Lock

- Own-ship = What is selected in MACE ...
- ... until we 'LOCK' an entity as own-ship
- Joysticks and displays control/view THAT entity

System Settings → Visual

**Ownship / Man-In-The-Loop**

Query LOS from Visual:  CIGI View ID: 0 Group ID: 0

Site: 0 App: 0 Entity: 0 IP: 0.0.0.0

**Attachment**

Enabled Attach Mode: Platform Default

Offset (m) Distance: 40.00

Offset (m) X (fwd): 4.40 Y (right): 0.00 Z (down): -1.00

FOV (deg): 60.00 Zoom FOV (deg): 15.00  Fixed View

Near Clip (m): 0.2  Toggle Client Mode (NOT COMMON)

**Selectable Spectrums**

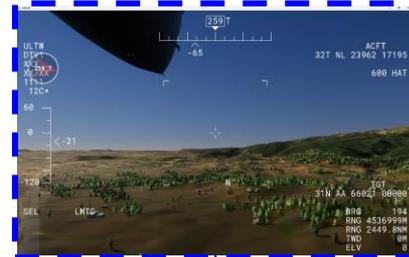
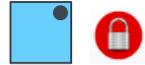
EO B/W  EO Color  IR W/H  IR B/H  NVG

**HUD**

Enabled Size: 6.0 Width: 1920 Height: 1080



**TOP LOCK**  
Visuals & Displays  
(Ownship)  
Locked to this platform



**BOTTOM LOCK**  
Sensors / Camera  
Locked to this platform



System Settings → Joystick

**Joystick Buttons**

**Air / Ground Platform Control**

Axis for Flight Model / Lock Axis: Z-Axis  Logitech Dual Action

Axis for Thrust / Movement: Y-Axis  Logitech Dual Action

Thrust Slider (Replaces Axis): 1

Engine Mixture: Z-Axis

Propeller (Variable Pitch Prop): Z-Axis

Select Next Weapon: 4  Logitech Dual Action

Select Next Target: 9  Logitech Dual Action

Release Weapon: 8  Logitech Dual Action

Shoot Guns: 6  Logitech Dual Action

Extend Speed Brake / Zoom In: 7  Logitech Dual Action

Retract Speed Brake / Zoom Out: 5  Logitech Dual Action

Extend Flaps: 31

Retract Flaps: 32

Toggle Landing Gear / Not Used: 20

Dispense ECM / Pickup Item: 12  Logitech Dual Action

Release Joystick Control: 10  Logitech Dual Action

Trim / Character Stance (POV): POV 1  Logitech Dual Action

Cycle Visual Spectrum: 2  Logitech Dual Action

Axis for Toe Brakes: Axis 3

Axis for Rudder: Rcv-Axis

Enter Vehicle (humans only): 1  Logitech Dual Action

Exit Vehicle (humans only): 3  Logitech Dual Action

Toggle Weapon Mode: 1

Glance Left: 32

Glance Right: 32

**Camera Control**

Axis for Camera Control: Axis 2

Zoom In Button: 1

Zoom Out Button: 11

Zoom Slider (Replaces Buttons): 1

Zoom Axis (Replaces Buttons):

Track Target: 6

Slew to Target: 12

Lase Target: 14

Boresight Camera: 16

Nadir Camera: 17

Laser/IR Toggle: 15

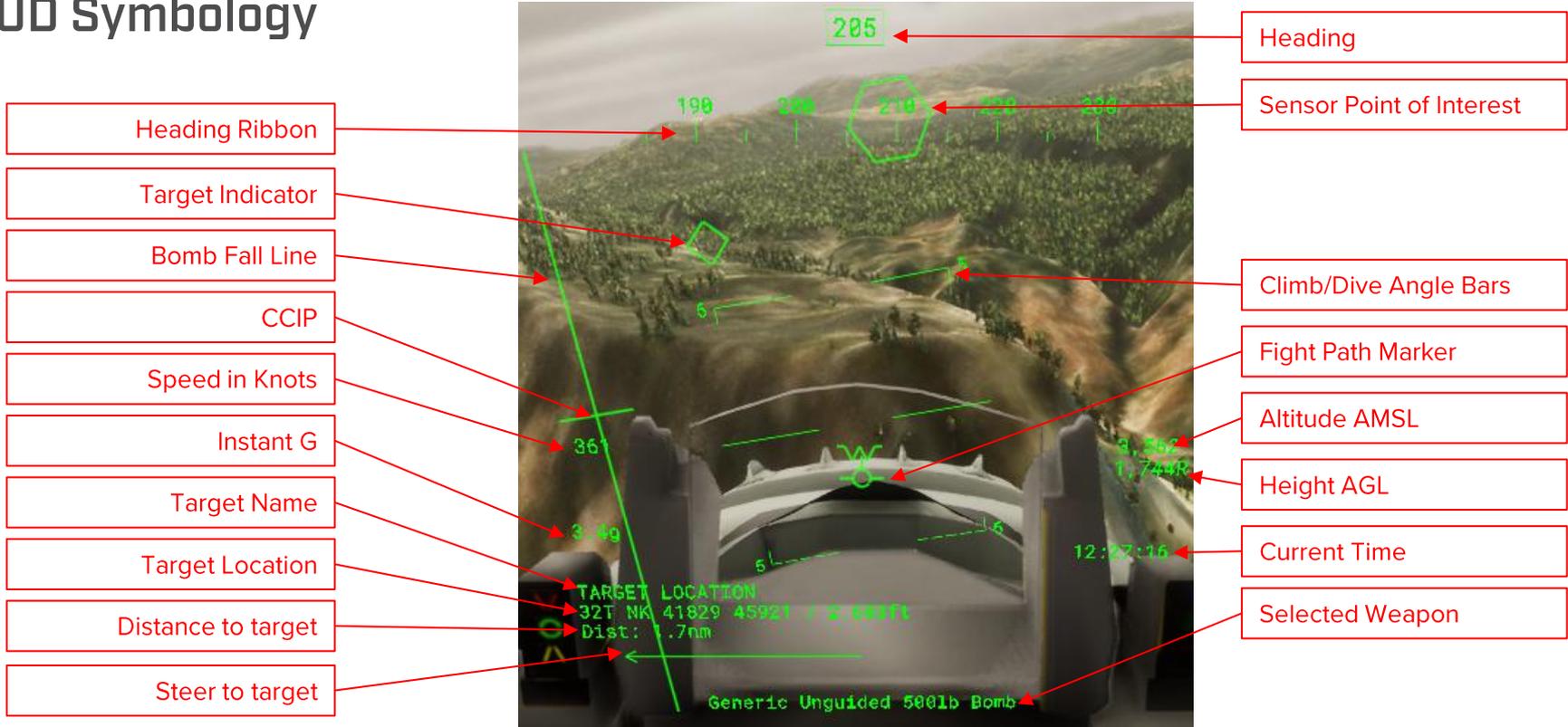
Cycle Camera Spectrum: 13

Lock on Laser Spot: 13



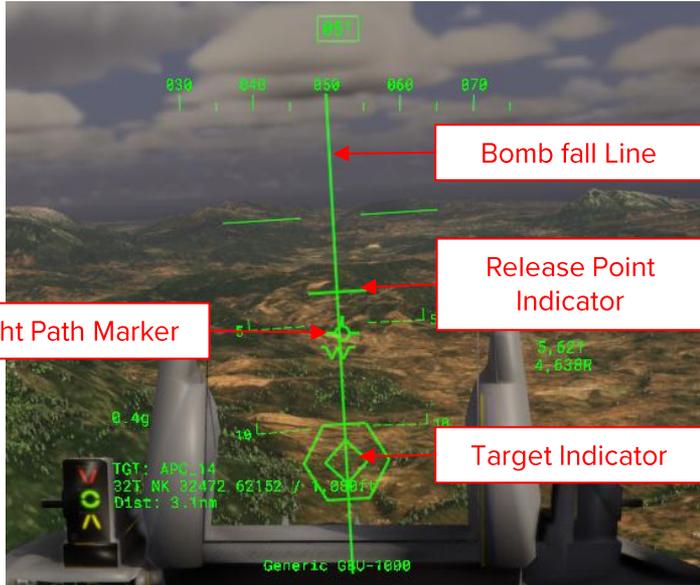
# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## HUD Symbology



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## HUD Symbology – Air to Ground

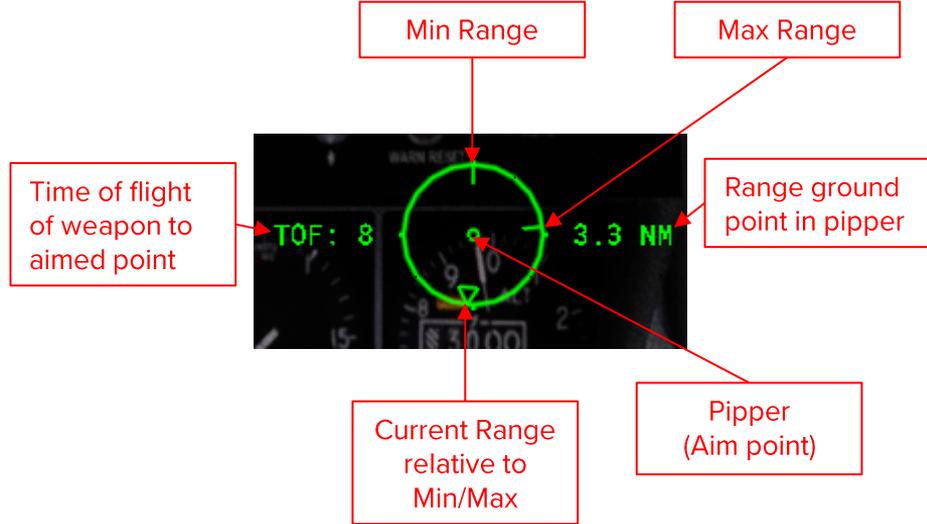


Flight Path Marker

Bomb fall Line

Release Point Indicator

Target Indicator



Time of flight of weapon to aimed point

Min Range

Max Range

Range ground point in pipper

Current Range relative to Min/Max

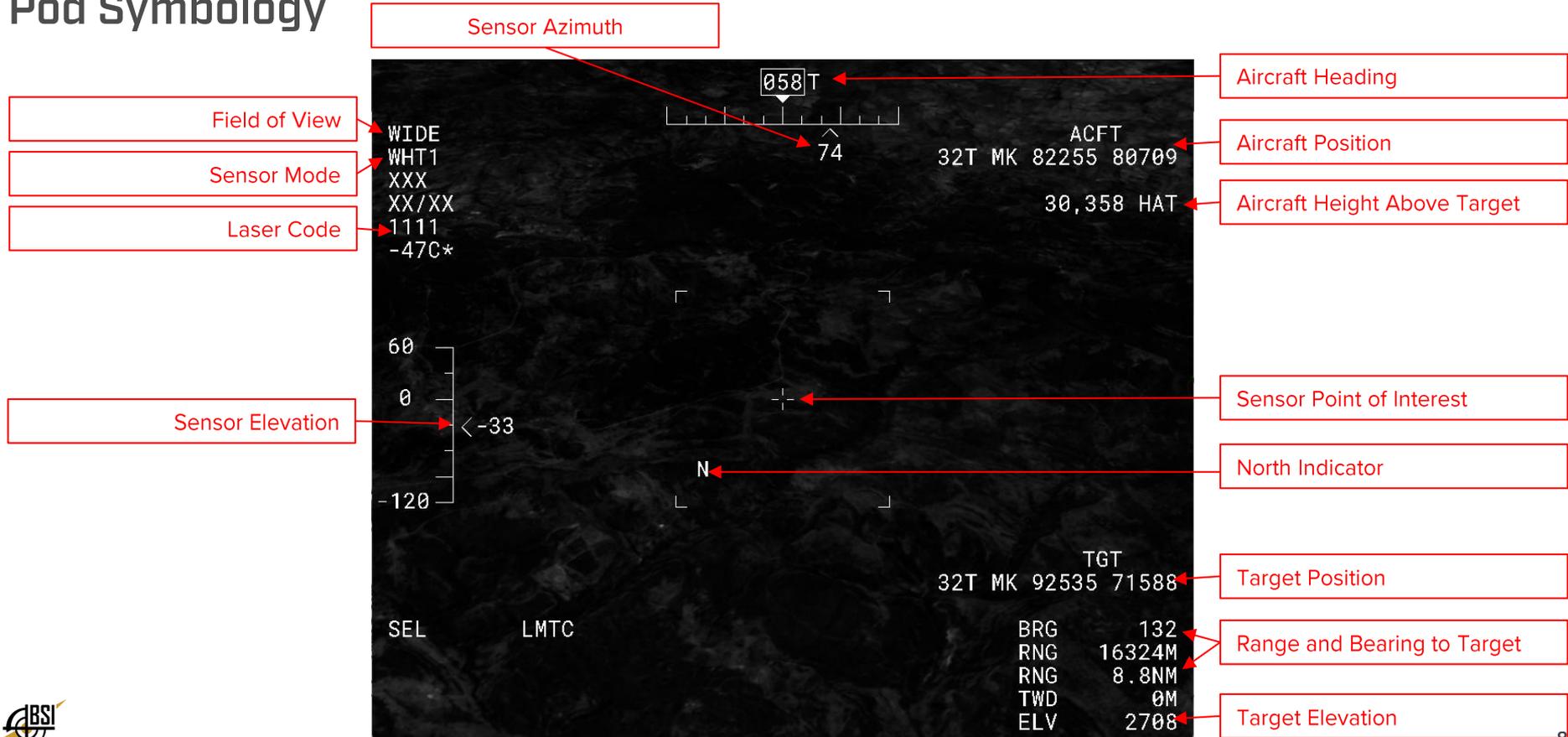
Pipper (Aim point)

- Release Point Indicator is in view = in range of target
- Release Point Indicator crosses Flight Path Marker = Optimum release point

- Aim at target with pipper
- Fire when Current Range Triangle between Min and Max Range Markers

# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Pod Symbology



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

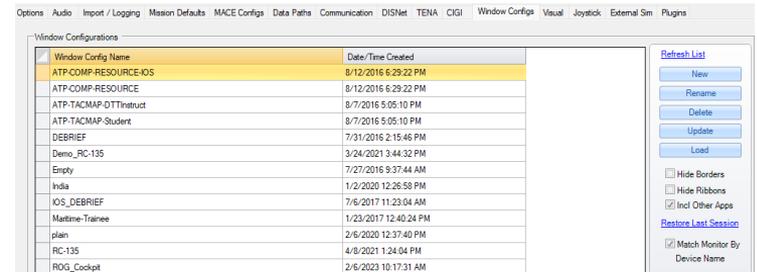
## Avionics and Combat Displays



- Displays can be repositioned only when borders showing
- Double RMB Click on display to remove borders
- **System Settings > Window Configs**
  - Save and Restore Window Arrangements
  - Bind to a joystick button



**TOP LOCK**  
Visuals & Displays  
(Ownership)  
Locked to this platform



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Typical Joystick Controls – Logitech F-310

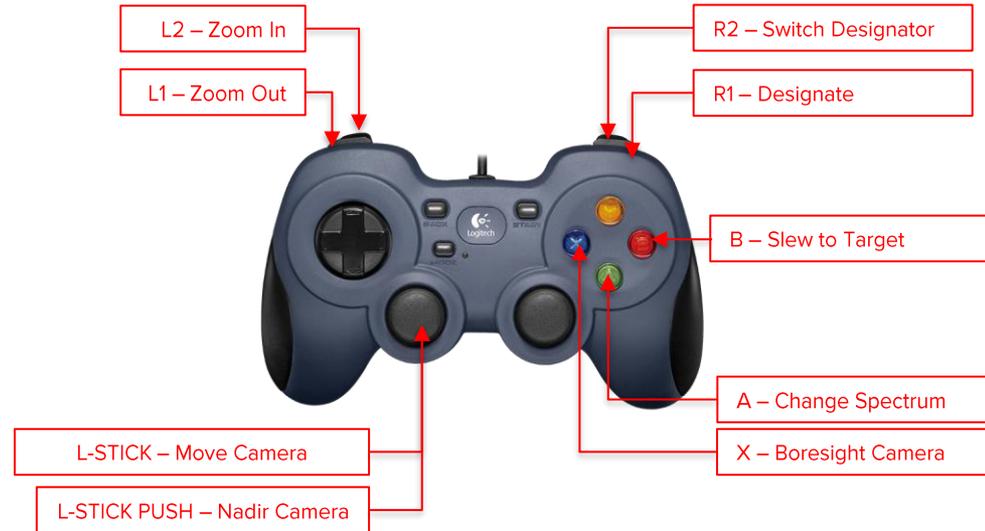
System Settings → Joystick

### TIP – FINDING THE JOYSTICK BUTTONS

⌨ + R opens the Run dialog; Type “joy.cpl” to open the joystick properties so you can determine the function of each button on any given controller

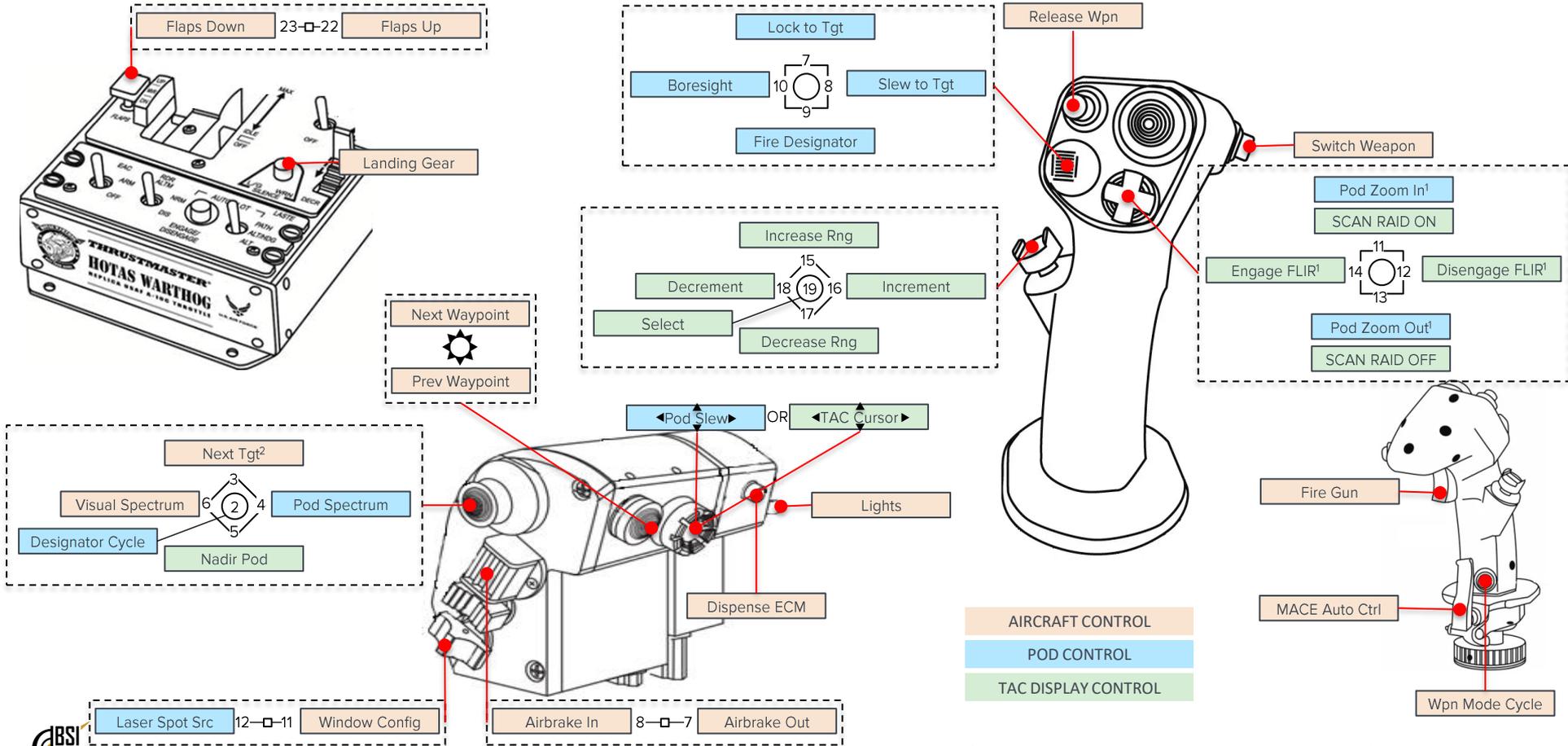


### OWNSHIP CONTROL



### CAMERA CONTROL

# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL



Note 1: if using Tactical-Display plugin to enable zoom on the pod FLIR must be engaged 90  
 Note 2: Next Target is disabled when using Tactical Display

# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Sensor Form



System Settings → Visual

**Camera**

Enabled CIGI View ID: 0

Site: 0 App: 0 Entity: 0 IP: 0.0.0.0

**Control**

Sensor Form Not required in MACE 2025

Joystick

Use Loaded Equipment for Zoom / Spectrum

Zoom: [Slider] Slew Rate (deg/FOV): 0.0100

Continuous  Step Joystick Dead Zone %: 10

Selectable Spectrums

EO B/W  EO Color  IR W/H  IR B/H  NVG



Entity Controls → Actions

Sensor Operator

Focus  IR / Contrast  Level

Sensor Modes

EO: Color B/W NVG

IR: BH WH

Zoom: + - x / 1

Camera Direction

Nadir Boresight Slew to Target Set Target

Image Capture

# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Student Exercise [Link to Online Solution Video](#)

1. (00:16) Open and start Tutorial\_3.mis in MACE
2. (00:30) Ensure Own-ship/man-in-the-loop and camera are enabled in MACE System Settings
3. (00:48) Load Logitech Gamepad Joystick settings
4. (01:03) Reprogram the 'Release Joystick Control' button to be 'mashing' the left stick or right stick
5. (01:34) Ensure Top-lock is not selected
6. (01:42) Attach to entity in ARMOR [Spacebar]
7. (01:55) Select different entities in MACE and observe the locked view change in ARMOR
8. (02:17) Top-Lock MACE ownship visuals and displays to an aircraft entity
9. (02:23) Select a ground entity – observe the ARMOR view does not change
10. (02:29) Select another air entity from the one you are top-locked to - Bottom lock to it
11. (02:41) Take control of the top-locked entity with the joystick and move around
12. (02:48) Release joystick control or manually return the entity to intent using MACE controls
13. (02:58) Load Logitech Camera control settings
14. (03:25) Switch to full screen camera view in ARMOR - note which entity this is attached to (bottom locked entity)
15. (03:44) Move the camera around, lock, slew to target, change spectrum, designate (see MACE indications)
16. (04:19) Switch to sensor form control instead of joystick in System Settings
17. (04:26) Open the sensor control form and use it to control the camera

Cont..



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

## Student Exercise [Link to Online Solution Video](#)

18. (05:09) Attach in 1<sup>st</sup> person cockpit view to the top-locked aircraft and add the camera sensor to the view
19. (05:22) Independently control aircraft and camera (on the bottom locked aircraft)
20. (05:49) Open some avionics and combat displays and place on screen
21. (06:13) Save 2 different window arrangements and restore them
22. (06:59) Move the top locked aircraft near the bottom locked aircraft and put them at a medium level altitude
23. (07:33) Assign pushing in (mashing) the left or right controller stick to the 'Lock on Laser Spot' action
24. (07:44) Change the camera visual settings so that it is controlled by the joystick not sensor form
25. (07:48) Assign a ground position as a target for the top-locked entity
26. (08:02) In the layer manager ensure 'Platform>Camera Line' is displayed
27. (08:20) On the top-locked aircraft, use the manual weapon release button to fire the laser designator
28. (08:31) Move the bottom-locked aircraft pod (and if required aircraft) to ensure the target lies within the swathe of the camera
29. (08:39) Use the newly assigned 'Lock on Laser Spot' button to snap the pod camera to the laser designation
30. (09:11) Open MACE Mission settings – change clout to 4/8 @5000ft Thickness 2000ft
31. (09:31) Make it snow moderately from 10,000ft
32. (Optional) Add a region from a METAR (if available online)

# MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS

## Learning objective:

- Learn how to setup missions so that platforms are controlled with basic semi-autonomous behaviours in MACE

## Enabling objectives

- Know what platform reaction postures do
- Know what team affiliations do
- Know what weapon postures do
- Know how to use teams, reaction postures, and weapon postures to create specific scenario effects
- Know how to destroy and resurrect platforms quickly
- Know how to use basic entity control to get entities to engage each other – Target, Move to target, Weapons Free
- Understand foam weapon mode

# PLATFORM SEMI AUTONOMOUS BEHAVIOURS

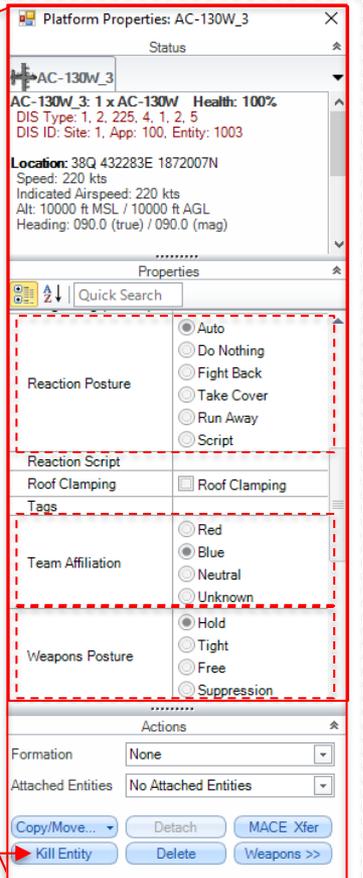
## CHANGING WEAPON POSTURE, REACTION POSTURE

FROM PLATFORM PROPERTIES

1. RMB on Platform



2. LMB on Properties



Platform Properties: AC-130W\_3

Status

AC-130W\_3

AC-130W\_3: 1 x AC-130W Health: 100%  
DIS Type: 1, 2, 225, 4, 1, 2, 5  
DIS ID: Site: 1, App: 100, Entity: 1003

Location: 39Q 432283E 1872007N  
Speed: 220 kts  
Indicated Airspeed: 220 kts  
Alt: 10000 ft MSL / 10000 ft AGL  
Heading: 090.0 (true) / 090.0 (mag)

Properties

Quick Search

Reaction Posture

- Auto
- Do Nothing
- Fight Back
- Take Cover
- Run Away
- Script

Reaction Script

Roof Clamping  Roof Clamping

Tags

Team Affiliation

- Red
- Blue
- Neutral
- Unknown

Weapons Posture

- Hold
- Tight
- Free
- Suppression

Actions

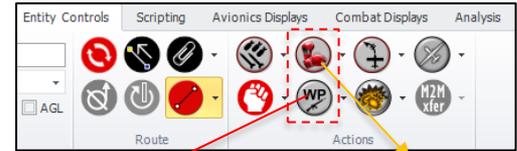
Formation: None

Attached Entities: No Attached Entities

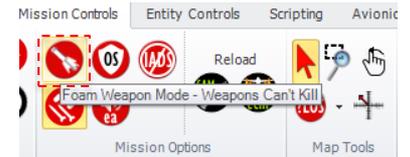
Copy/Move... Detach MACE Xfer

Kill Entity Delete Weapons >>

FROM ENTITY CONTROLS MENU



Mission Controls → Mission Options



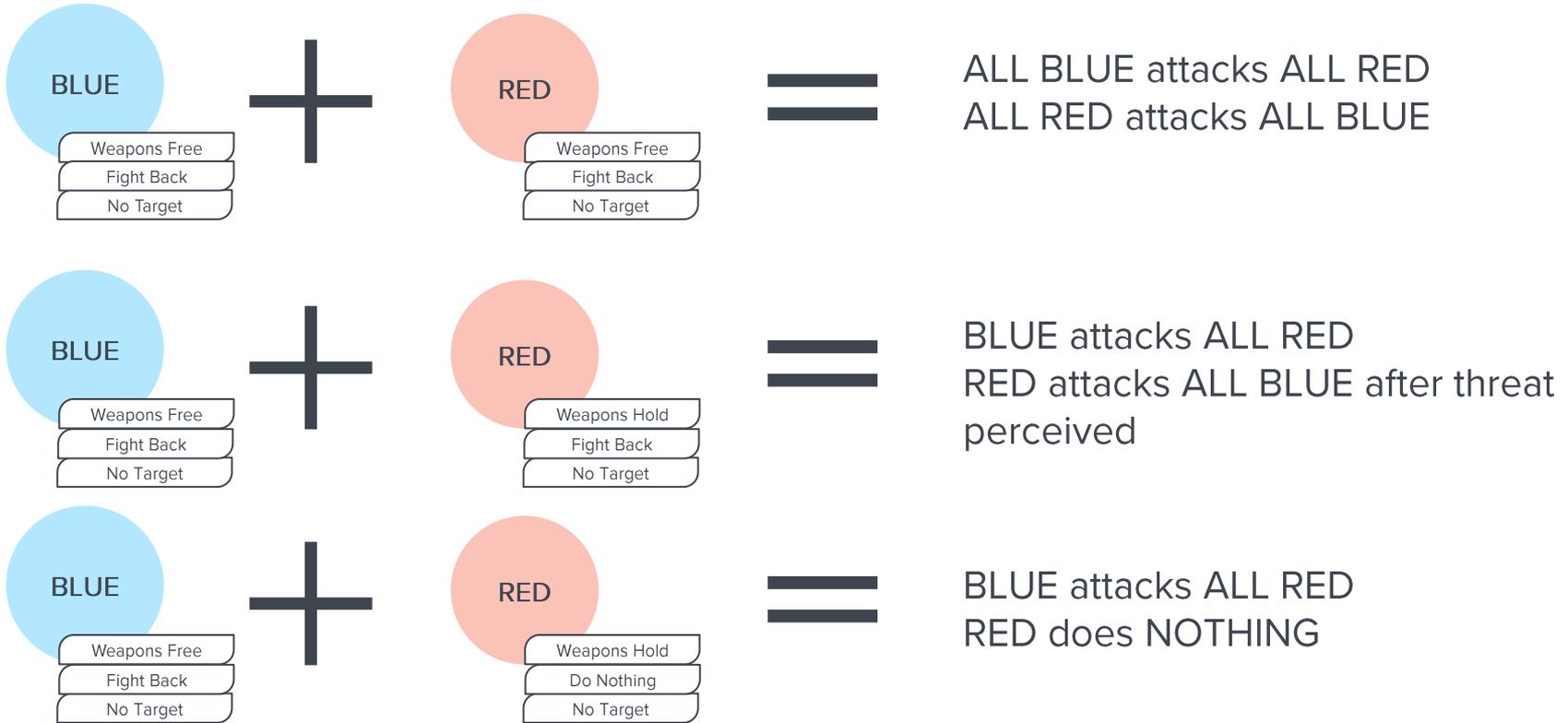
Kill/Resurrect

# PLATFORM SEMI AUTONOMOUS BEHAVIORS

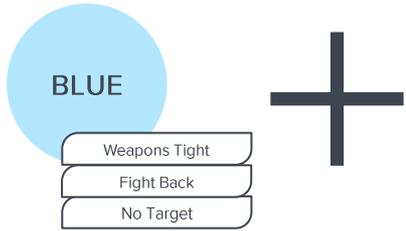
## Weapon and Reaction Posture

Weapon Posture	Hold 	Prevents the release of any weapons (can be changed by reaction posture)	
	Tight 	Allows selective allocation of a target and only that target will be engaged. Must have LOS and meet weapon parameters	
	Free 	Platforms will automatically engage opposing team entities. Must have knowledge of target (e.g. LOS, Sensors etc) and meet weapon parameters	
	Suppression 	For ground units only. All commanded platforms fire in the direction they are facing	
Reaction Posture	Do Nothing 	Platform will do nothing	
	Run Away 	Platform will run away	
	Take Cover 	Platform will stop, go weapons free and attempt to return fire	
	Fight Back 	Platform will go weapons free and attempt to return fire	
	<div style="border: 1px solid red; padding: 2px;"> <p>Weapon ▲</p> <ul style="list-style-type: none"> <li>Infrared Warning Receiver</li> <li>Laser Indicator Warning Device</li> <li>RADAR Warning Receiver</li> <li>Visual Detection Airborne (A/L/S)</li> </ul> </div>	Auto React 	<u>Unarmed Lifeform</u> – will run away, <u>Unarmed Vehicle</u> – will stop <u>Armed Lifeform</u> – will take cover, <u>Armed Vehicle</u> – will stop – Both go weapons free and attempt to return fire <u>Armed Aircraft</u> – will evade then go weapons free and attempt to return fire

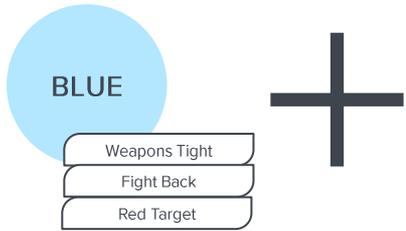
# MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS



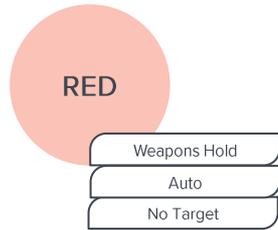
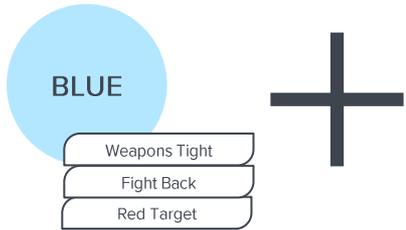
# MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS



No one attacks anyone

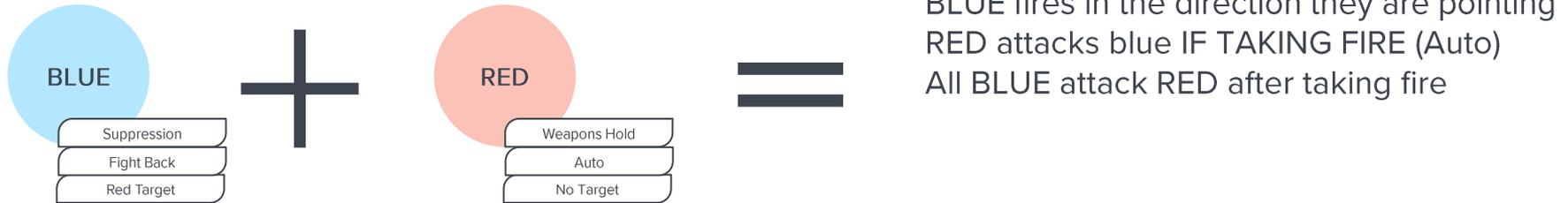


BLUE attacks TARGETED RED  
RED runs away



BLUE attacks TARGETED RED  
RED attacks blue after taking fire (Auto)  
All BLUE attack RED after taking fire

# PLATFORM SEMI AUTONOMOUS BEHAVIOURS



# MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS

## Student Exercise [Link to Online Solution Video](#)

1. (00:16) Add 2 FW Ground Attack Aircraft, 2 Cars, 4 EF Ground Forces as group 1 and 4 Friendly Forces as group 2
2. (01:33) Recall the groups and move them so that they are in line of sight of each other
3. (01:52) Set the weapon posture on 1 EF to 'Free' and the other to 'Tight' and on the 'Tight' entity target a FF entity
4. (02:08) Set FF postures to 'Do Nothing', 'Run Away', 'Fight Back', and 'Take Cover
5. (02:40) Set 'Foam Weapon Mode' for the mission
6. (02:45) Start the mission and observe the engagements between FF and EF
7. (03:10) Deselect 'Foam Weapon Mode' - observe platform death
8. (03:26) Stop the mission, resurrect the dead entities, return to intent, and make all entities 'Weapons Hold
9. (03:51) Add a cultural building, destroy it with the detonation tool, then start the mission
10. (04:30) Ensure one of the FW attack aircraft has as its selected weapon an air to ground weapon
11. (04:41) Assign a vehicle as the aircraft's target, then select 'Move to Target' and 'Weapons Tight'
12. (05:40) After it releases the weapon, return to intent
13. (05:57) Use the instant Blue vs Red attack [Ctrl + RMB] to attack an enemy entity with the FW aircraft

# BUILDING BASIC MISSIONS

## Learning objective:

- Learn how to build basic missions in MACE using platform properties, formations, attachments, and waypoints

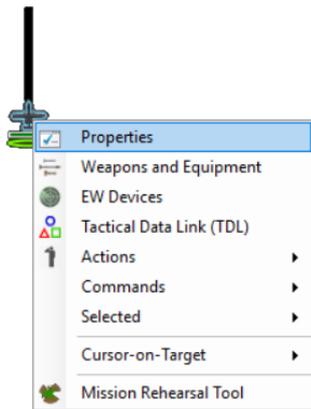
## Enabling objectives

- Know how to display platform properties
- Understand the parts of the properties form
- Understand the methodology of a 'Parameter Sweep'
- Know how to rename platforms
- Know how to label platforms
- Know how to use attachments
- Know how to use formations
- Know how to add waypoints from the mission builder tab
- Know how to move, add, delete, paste and offset waypoints
- Understand the information presented in the waypoint properties window
- Know the difference between Leg and Route waypoint values
- Know the effect of entering Route or Leg values in the Platform Properties window
- Know different ways to steer a platform to different waypoints
- Understand how to attach platforms to shape vectors and how to create complex routes
- Know how waypoint actions work
- Understand the workings and utility of the most common waypoint actions

# BUILDING BASIC MISSIONS

## Platform Properties Form

- RMB on any platform – Select ‘Platform Properties’
- Group Platform Properties for Multiple Selected Platforms
  - **Green Ellipse** indicates the ‘Active Platform’ being edited / controlled / viewed
- Text at very top of form window shows ‘Active Platform’
- Platforms in Group are **Tabs** within the properties form shown by callsign
- Select each tab to edit individual platforms within the group
- Use [APPLY TO GROUP] button to make single property changes to all



The screenshot shows the 'Platform Properties: JEFF-02' window. At the top, a status bar shows 'Status' and a group of tabs for 'JEFF-02', 'JEFF-03', 'JEFF-01', and 'JEFF-04'. The main area displays platform details for 'JEFF-02: 1 x A-10C', including health, location, speed, and heading. Below this is a 'Properties' section with various fields and radio buttons for behaviors, engagement posture, and proficiency. At the bottom is an 'Actions' section with buttons for 'Formation', 'Attached Entities', 'Copy/Move...', 'Kill Entities', 'Detach', 'Delete', 'MACE Xier', 'Weapons >>', 'Apply', 'Apply To Group', and 'Status >>'. Red dashed boxes and arrows highlight specific areas: 'Active Platform' (top status bar), 'Platforms in Group' (tabs), 'Status Window' (platform details), 'Data Entry' (properties section), and 'Actions' (bottom section).

- Active Platform
- Platforms in Group
- Status Window
  - DIS Type & ID
  - Location - speed - altitude - heading
  - Target details
  - Auto Weapon Info – WEZ time in/to
  - Waypoint info
  - Fuel / Aero Model et – set in System Settings
- Data Entry
  - Groups in alphabetical order – collapse if n/a
  - Data fields in alphabetical order in groups
  - Use ‘Quick Search’ – remember to clear
  - Press enter when entering data
  - Apply to Group 1 at a time if applicable
- Actions
  - Formation – the follower does the ‘formatting’
  - Attached entities to this platform – detach
  - Copy / move platform / Waypoints
  - Apply to Group

# BUILDING BASIC MISSIONS

## Parameter Sweep → Waypoints → Copy & Paste

- Add a Platform
- Platform Properties
  - Parameter Sweep
  - Most common properties

### Add waypoints

- Route Values
- Leg Values

### Copy Platform

- Or use platform Move/Paste
  - Keep waypoints same
  - OR
  - Offset Route

General	
Aimed Pitch (deg)	0
Assigned Role	Fighter
Call Sign	THUNDER02
Engagement Posture	<input type="radio"/> Normal <input type="radio"/> Passive <input type="radio"/> Aggressive
Label	
Laser Designator Code	1111
Model	Generic Fighter [Supplementals: /
Number in Cell	1
Powered	<input checked="" type="checkbox"/> Powered
Preferred Platform	<input type="checkbox"/> Preferred Platform
Proficiency	<input type="radio"/> Expert <input type="radio"/> Competent <input type="radio"/> Beginner
Radar Control	<input type="radio"/> Auto <input type="radio"/> Manual
Range Ring	0.00 ft
Reaction Posture	<input type="radio"/> Auto <input checked="" type="radio"/> Do Nothing <input type="radio"/> Fight Back <input type="radio"/> Take Cover <input type="radio"/> Run Away <input type="radio"/> Script
Reaction Script	
Roof Clamping	<input type="checkbox"/> Roof Clamping
Tags	
Team Affiliation	<input type="radio"/> Red <input checked="" type="radio"/> Blue <input type="radio"/> Neutral <input type="radio"/> Unknown
Transport State Control	<input checked="" type="radio"/> Auto <input type="radio"/> Stowed <input type="radio"/> Deployed
Unlimited Ammo	<input type="checkbox"/> Unlimited Ammo
Weapons Posture	<input checked="" type="radio"/> Hold <input type="radio"/> Tight <input type="radio"/> Free <input type="radio"/> Suppression

Navigational	
Camera Location (Lat/Lon)	40.34364, 8.43271
Latitude	40.34364
Longitude	8.43271
Camera Location (MGRS)	32T MK 51820 66053
Containment Layer	
Formation Offset Distance	2000 ft
Formation Offset Elevation	0 ft
Ignore Terrain Effects	<input type="checkbox"/> Ignore Terrain Effects
Landing Zone Callsign	
Leg Altitude	800 ft
Leg Altitude AGL or MSL	<input type="radio"/> AGL <input checked="" type="radio"/> MSL
Leg Speed	500
Location (Lat/Lon)	40.22102, 8.46779
Location (MGRS)	32T MK 54717 52425
Loop Route	<input checked="" type="checkbox"/> Loop Route
Maximum Attach/Rally Speed	0
Movement Frozen	<input type="checkbox"/> Movement Frozen
Next Waypoint	1
On Ground	<input type="checkbox"/> On Ground
Parking Spot Callsign	
Push Delay	0
Push Time	13:00:00 01/24/2023
Random Walk Destination	<input type="checkbox"/> Random Walk Destination
Refueler Callsign	
Route Altitude	800 ft
Route Altitude AGL or MSL	<input type="radio"/> AGL <input checked="" type="radio"/> MSL
Route Speed	500
Speed Units	<input checked="" type="radio"/> KTS <input type="radio"/> MPH <input type="radio"/> KPH <input type="radio"/> MPS
Target Location (Lat/Lon)	0.00000, 0.00000
Target Location (MGRS)	

Properties

Quick Search

- Behaviors
- Connections
- Data Link
- General
- IFF
- Lighting
- Navigational
- Physical

Multiple categories  
Use search bar  
(Remember to clear)

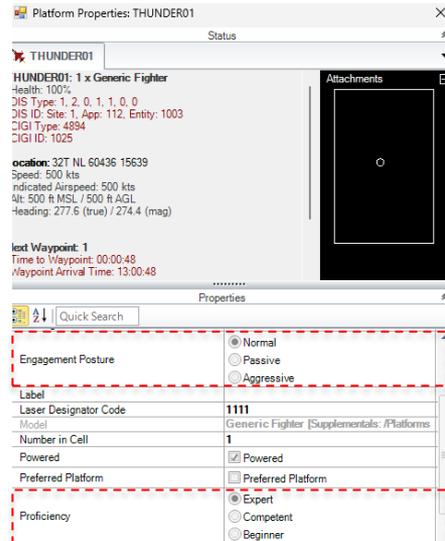
Green Symbols on Platform Icon:

- i Entity invulnerable
- G Airborne entity is on the ground
- C Entity has concealment



# BUILDING BASIC MISSIONS

## Proficiency and Engagement Posture



Engagement Posture	Normal	Activate TTR sites when platforms are at a typical doctrinal range
	Passive	Wait until the target is well within the weapon engagement zone so the target is unable to escape
	Aggressive	Activate target tracking radar sites when a target is just within the max kinematic range of the associated SAM

Proficiency	Expert	<b>Defence:</b> Responds quickly to being targeted. Intelligently selects the correct countermeasures within 2 seconds. Effective at target engagement. Will release chaff and flares based on threat e.g. flares for IR chaff for flares <b>Unguided weapons</b> are accurate. <b>SOC:</b> reacts within 1 second
	Competent	<b>Defence:</b> Responds moderately to being targeted. Intelligently selects the correct countermeasures within 5 seconds. Moderately effective at target engagements. Will drop both chaff and flares no discrimination. <b>Unguided weapons</b> have heading and pitch errors of up to 0.5° <b>SOC:</b> reacts within 3 seconds
	Beginner	<b>Defence:</b> Responds slowly to being not release countermeasures and will take 10 seconds. May take several attempts to engage targets. <b>Unguided weapons</b> have heading and pitch errors of up to 1.5° <b>SOC:</b> reacts within 6 seconds



# BUILDING BASIC MISSIONS

## Adding Waypoints & Value Priority

### WAYPOINT PRIORITY

Order of priority

Platform  
ROUTE

(if waypoint following)  
Overrides all legs in route to this value  
*This is why it's best to set this BEFORE  
Placing waypoints (Parameter Sweep!)*

Platform  
LEG

Applies only to this leg  
*This is required for pre-waypoint-1 (Leg 0)*

Waypoint  
ROUTE

Overrides all subsequent legs on route to this value but not the ones before  
*Good to start 'Up-route' and change these as  
WP numbers increase*

Waypoint  
LEG

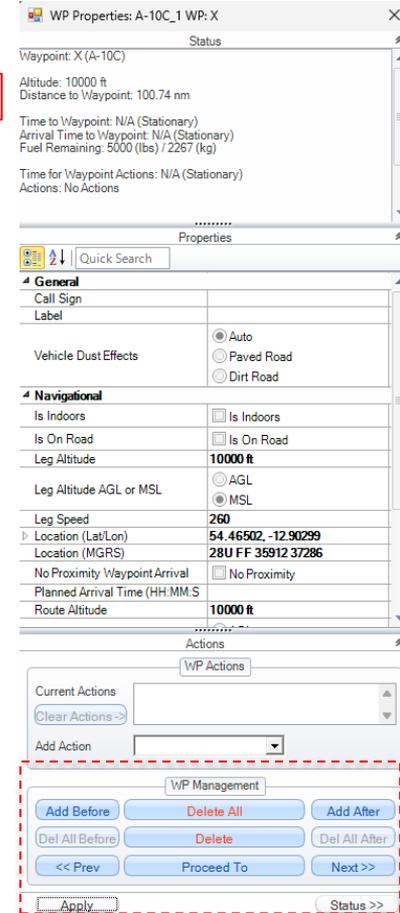
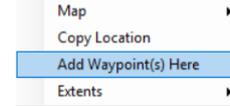
Applies only to this leg



Add Waypoint

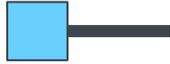
OR

RMB on Map



# BUILDING BASIC MISSIONS

## Steering to waypoints



In Intent (follows Waypoints)

- Platform must be in INTENT
- Use Next Waypoint Cycle Button



OR

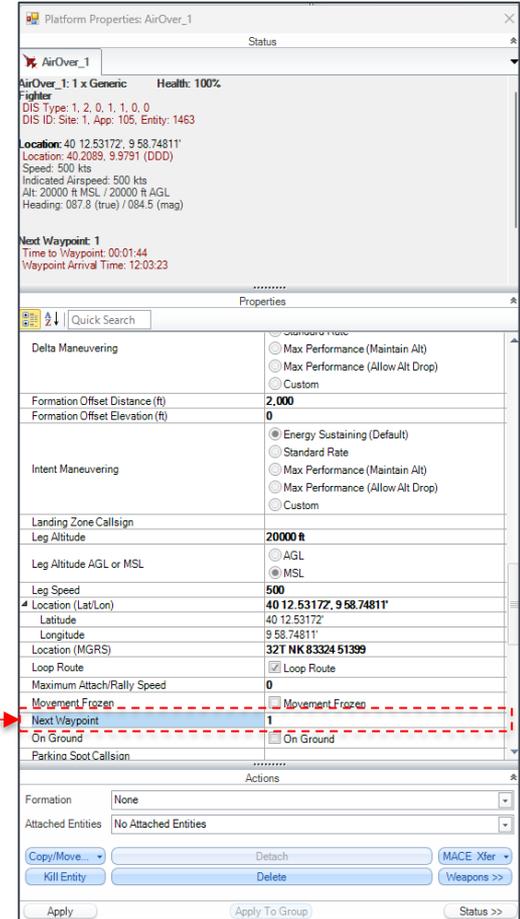
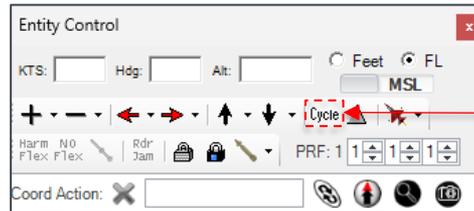
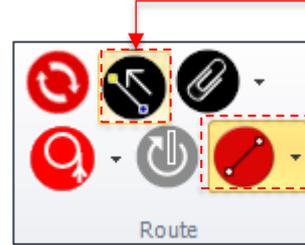
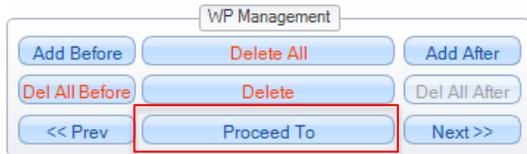
- Type Desired Waypoint in Platform Properties (Navigation)

OR

- Use the pop-out Entity Control window – [Cycle] Button

OR

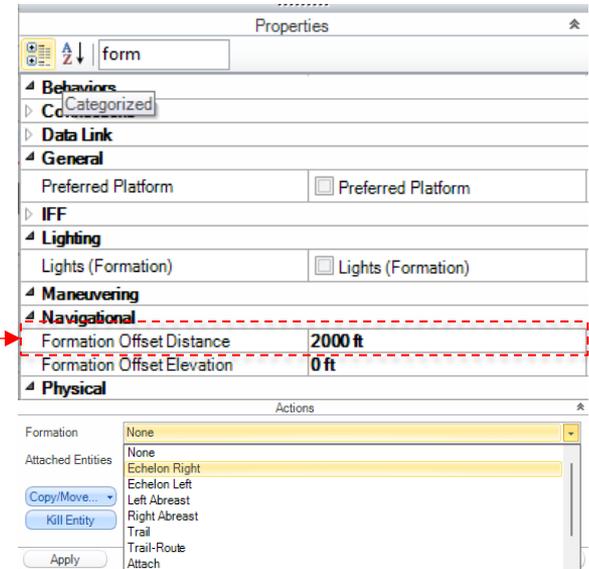
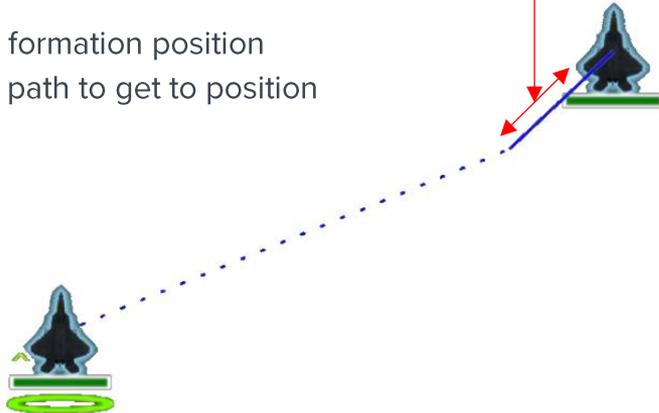
- RMB on Waypoint – [Proceed To]



# BUILDING BASIC MISSIONS

## Formations

- ‘Wingmen do the work’
  - Platform Properties → Action on wingman
  - Select Formation Type
    - From Dropdown
    - Or ‘Advanced’
  - Select Leader 
  - Blue Line
    - Solid – shows formation position
    - Dotted shows path to get to position

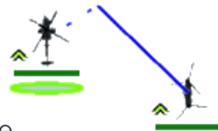


- Select Formation Offset
  - Formation Offset Distance
  - Formation Offset Elevation

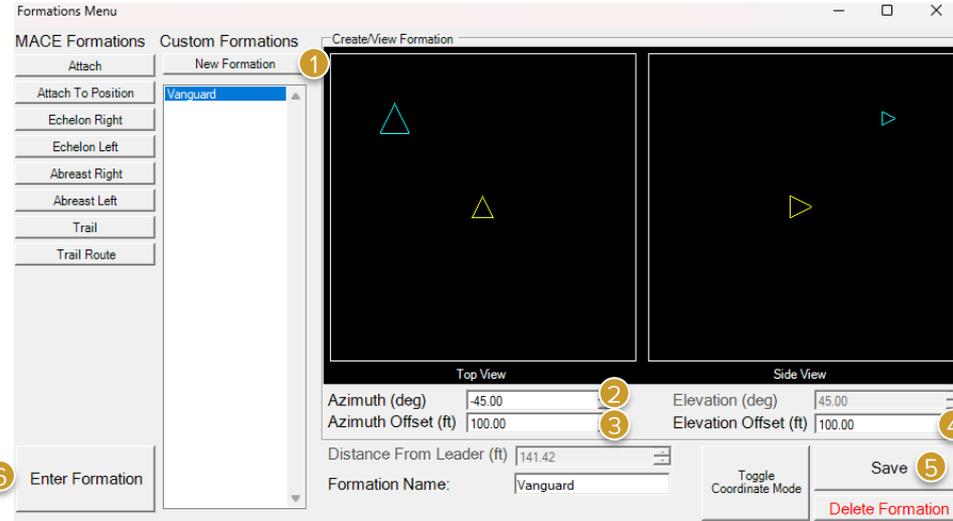
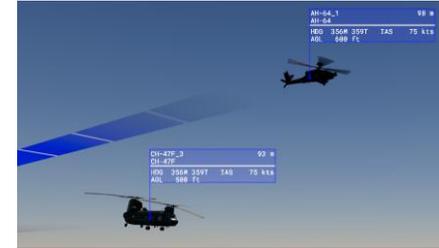
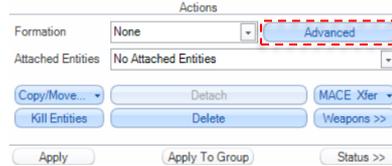
# BUILDING BASIC MISSIONS

## Formations - Advanced

- ‘Wingmen do the work’
  - Platform Properties → Action on wingman
  - [Advanced] – Normal Mode (Plan and Side View)
    - (1) New Formation
    - (2) Set Azimuth Vector From Leader
    - (3) Set Azimuth Offset From Leader
    - (4) Set Elevation Offset
    - (5) Save formation to list
    - (6) Select formation in list then [Enter Formation]
      - Select leader from map
- Coordinate Mode
  - Specify horizontal and vertical vector angle
  - Specify distance along vector



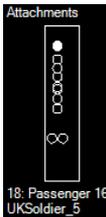
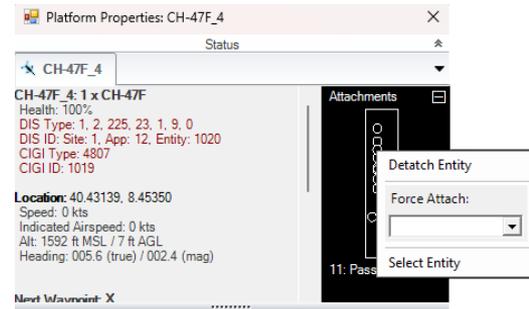
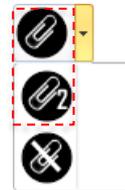
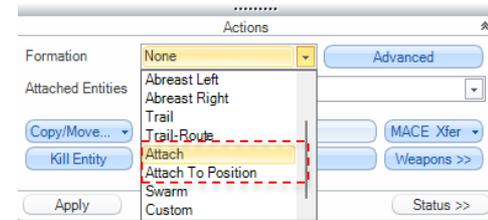
### Platform Properties → Actions [Advanced]



# BUILDING BASIC MISSIONS

## Attaching Platforms to Other Platforms

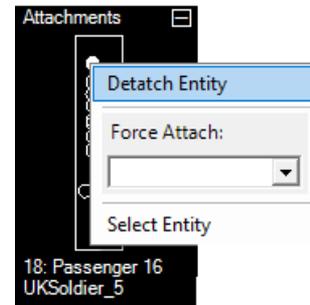
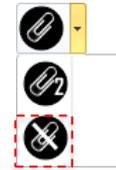
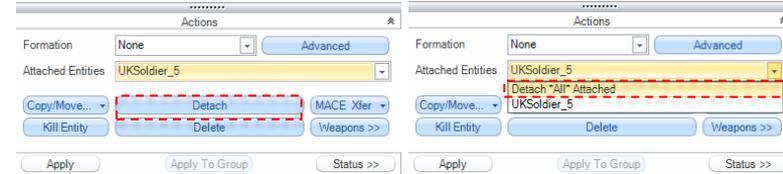
- ‘Attaching platforms do the work’... usually
  - Method 1: Platform Properties → Action → Formation
    - Select platform which will attach to another – open formation dropdown
    - Attach or Attach to Position ✦
    - Select Entity to Attach To
    - (If applicable) Select position from dropdown list
    - ‘Pick Up’ and move entity on map over the attach to entity – will attach
  - Method 2: Entity Controls → Route
    - Select platform which will attach to another – open formation dropdown
    - Select Paperclip icon to attach ✦ or attach 2
    - Select Entity to Attach To
    - (If applicable) Select position from dropdown list
    - ‘Pick Up’ and move entity on map over the attach to entity – will attach
  - Method 3: Force Attach
    - Select the platform that other platforms are to attach to
    - Open the attach panel next to status window
    - RMB on attach point
      - Free attach points are empty circles
      - Attached points are white circle – LMB over to see name of attached entity
    - Select entity to ‘force attach’ – they will attach instantly



# BUILDING BASIC MISSIONS

## Detaching Platforms to Other Platforms

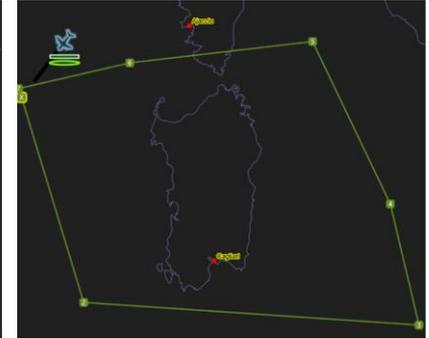
- Method 1: Platform Properties → Action → Attached Entities
  - Select platform with attached entities
  - Select entity to be detached from 'Attached Entities' dropdown
  - Press [Detach]
- Method 2: Entity Controls → Route
  - Select platform with attached entities
  - Select cross thru paperclip to detach all attached entities
- Method 3: Force Detach
  - Select the platform that other platforms are attached to
  - Open the attach panel next to status window
  - RMB on attach point – Select D
    - Free attach points are empty circles
    - Attached points are white circle – LMB over to see name of attached entity
  - Select entity to 'force attach' – they will attach instantly



# BUILDING BASIC MISSIONS

## Attaching to Vectors and Roads

- Platforms can have waypoint routes created from vectors
  - .shp files
  - Open Street Map (OSM) road vectors
- ESRI Shape/Vector Files .shp
  - Select platform
  - RMB Click on shape file, select
    - Proceed Via
    - OR
    - Proceed Via Outbound



- Road Vectors – Method 1 (No Path Finding)
  - Select vehicle platform
  - Use paper clip or Platform Properties → Action → Attach
    - Click ahead of platform up-route
    - Delete unwanted waypoints – attach again



- Road Vectors – Method 2 (Path Finding)
  - Select vehicle platform
  - Select 'Pathfinding Mode' in entity controls
  - <CTRL> + RMB on destination – MACE will work out the route

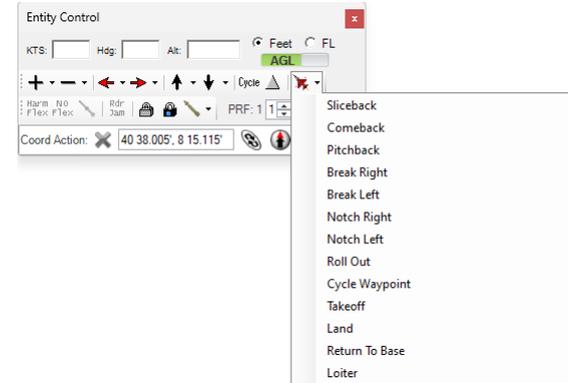
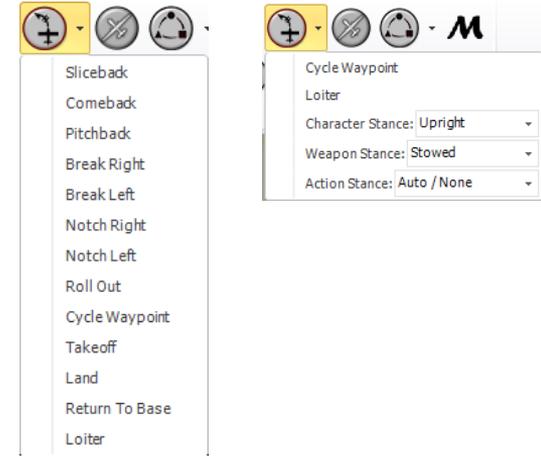


# BUILDING BASIC MISSIONS

## Simple Platform Manoeuvres / Tactics

### ENTITY CONTROLS or ENTITY CONTROL WINDOW

- A List of common manoeuvres/tactics
- Duplicated on waypoint actions
- Duplicated in scripts
- Most Useful
  - RTB – proceeds to landing zone and lands
  - Take-off – Aircraft that is on the ground takes off
  - Loiter – Loiters in place
  - Stop – Sets speed to 0 (if possible)

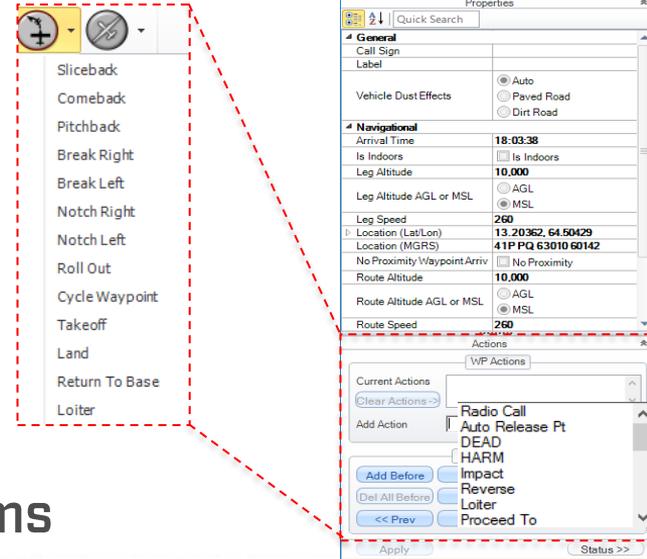


# BUILDING BASIC MISSIONS

## Waypoint Actions

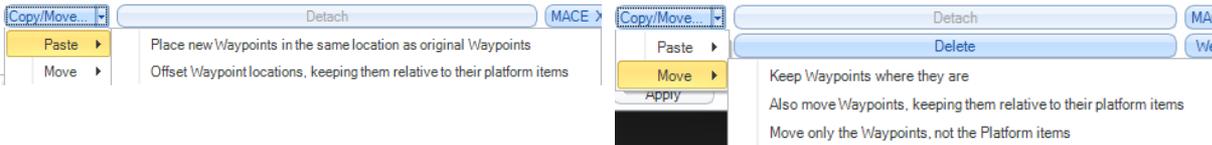
Same as **ENTITY CONTROLS>PLATFORM MANOEUVRE**

PROPERTY	EXPLANATION
LOITER	RW – Hover, FW – Radius / Direction, Duration (s)
PROCEED TO	Pick a waypoint
RTB	Platform goes to LANDING ZONE in Platform Properties
STOP	Entity stops at waypoint (if possible)
LAND	Land near waypoint (if no landing zone)
WEAPONS HOLD	Switch to engage nothing weapon posture
WEAPONS FREE	Switch to engage any opposing team weapon posture
WEAPONS TIGHT	Switch to engage your target weapon posture
REVERSE	Reverses the waypoints
SCRIPT	Execute a script – opens a dialogue



## Copying Waypoints / Copying Waypoints & Platforms

### Platform Properties> Copy / Move Platform



### WAYPOINTS AND ROUTES

-  Copy Selected Platform and Route
-  Waypoint (Not Delta) Orbit Tool
-  Paste selected platform route to another platform



# BUILDING BASIC MISSIONS

## Student Exercise - [Link to Online Solution Video](#)

1. (00:16) Make a mission with 2 to 3 air platforms and 10 to 15 ground including vehicles and people
2. (01:06) Attach at least 1 person to a vehicle and ensure they are inside the vehicle ('A' displayed on vehicle icon)
3. (01:51) Change the callsigns of your air platforms but give them different label names
4. (02:23) Give the air platforms circular sets of waypoints using the 'Racetrack Orbit Tool' then give one a delta state orbit
5. (02:43) Start the mission, return the delta orbit to intent - observe it steering to waypoint
6. (02:56) Steer one of the aircraft to a different waypoint using its waypoint properties and another using entity controls
7. (03:28) Attach one aircraft in 'right abreast' formation at a distance of 200ft to the other aircraft
8. (04:08) Add a series of waypoints for one of the ground vehicles using the mission builder tab, move the waypoints to different positions and delete one of them
9. (04:53) Select the ground platform with waypoints, using platform properties, copy the platform, offsetting the waypoints from the original
10. (05:19) Select one of the air platforms and using platform properties and its waypoints but keep them in their original positions
11. (05:46) Select the ground platform with the waypoints and assign very different speeds to leg: 1,2, and 3, and then a speed that will continue to the end of the route from waypoint 4
12. (06:48) Using platform properties, assign a leg speed to the vehicle so that it approaches the first waypoint and then observe the speed changes between waypoints
13. (07:56) Passing waypoint 4 assign 'Platform Properties - Route Speed' to the entity - confirm that all waypoint speeds have been overridden
14. (08:13) If you don't have a helicopter, add one with waypoints at low level, at one waypoint make it loiter for 30s in place and at a later waypoint make it land

Cont..



# BUILDING BASIC MISSIONS

Student Exercise - [Link to Online Solution Video](#)

15. (11:16) Use the entity controls tab to make the helicopter to take off, and return to the route and at the next waypoint, proceed to another waypoint, where it should stop
16. (13:25) (if you have road vectors) attach one of your ground vehicles to the road; if not, draw a line and attach to the line

# BUILDING MISSIONS WITH PATTERN OF LIFE

## Learning objective:

- To be able to use the collision avoidance and basic pattern of life capabilities within MACE

## Enabling objectives

- Understand the concept of collision avoidance
- Know how to display road vectors and building footprints (vector files)
- Understand how to use Layers and the layer manager to view and enable collision avoidance
- Know how to set collision avoidance for the whole mission
- Know how to disable collision avoidance for selected entities
- Know how to make platforms concealed and invulnerable, and understand the implications of doing so
- Understand pathfinding
- Know how to reload the auto-avoid grid
- Know how to use random walk constrained and unconstrained
- Know how to use EZ people
- Know how to use EZ traffic
- Demonstration of Traffic light control

# BUILDING MISSIONS WITH PATTERN OF LIFE

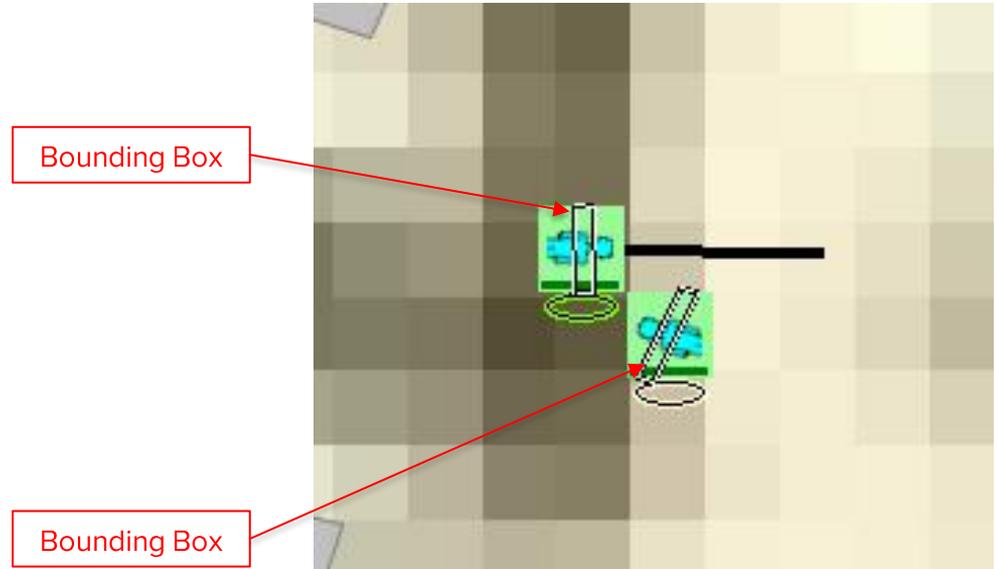
## What Is Collision Avoidance

### Collision Avoidance

- Without collision avoidance enabled platforms will travel through each other and buildings

### Bounding Box

- The platforms all have bounding boxes which is the physical area they take up in space
- The platforms will move out of each other's way (until the boxes don't touch)



# BUILDING MISSIONS WITH PATTERN OF LIFE

## Collision Avoidance

### Layers – Footprints

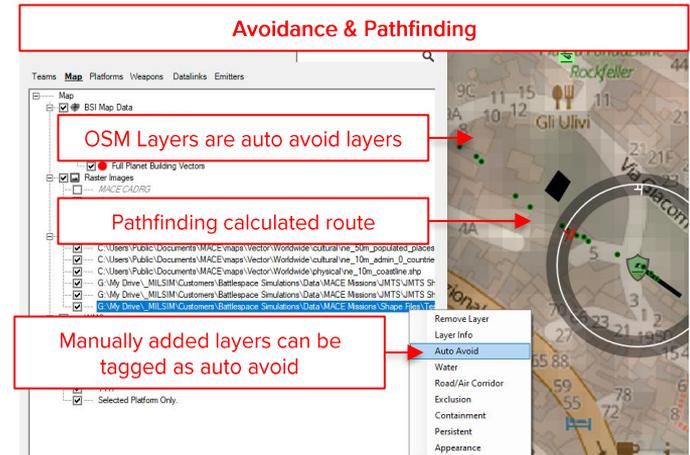
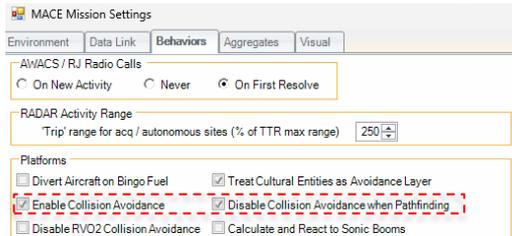
- All OSM Buildings are automatically avoided by pathfinders
- Non OSM Building footprints (polygon shapes) can be made AUTO-AVOIDANCE Layers
- Layer Manager – Avoidance
- Means that platforms with collision avoid enabled will not pass through

### Path Finding (Humans Only)

- To save adding masses of waypoints to form a path through complex areas
- Activate pathfinding and intent, platform find its own path to a waypoint

### Mission Setting – Disable Collision Avoidance While Path Finding

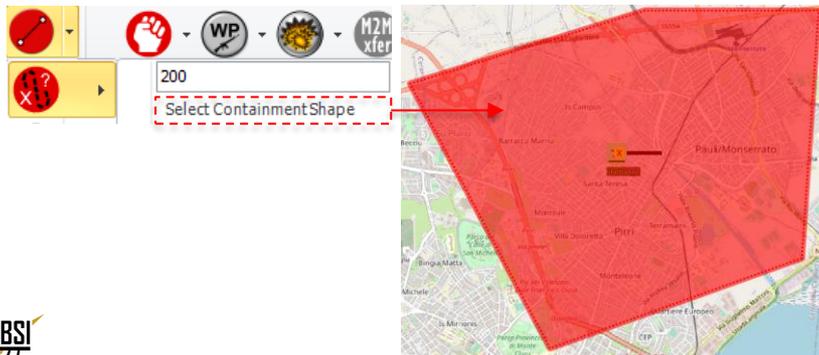
- Where areas are very tight the bounding box can stop people from getting down alleyways etc.
- Disable Collision Avoid While Pathfinding – Mission Settings



# BUILDING MISSIONS WITH PATTERN OF LIFE

## Random Destination

- Random destination
  - Select human entities
  - Select pathfinding
  - Select random walk – set boundary or containment shape
- Containment shape for random destination
  - Polygons can contain random walkers
  - Select containment shape (flashes red)
  - Select 'random destination' maneuver mode



# BUILDING MISSIONS WITH PATTERN OF LIFE

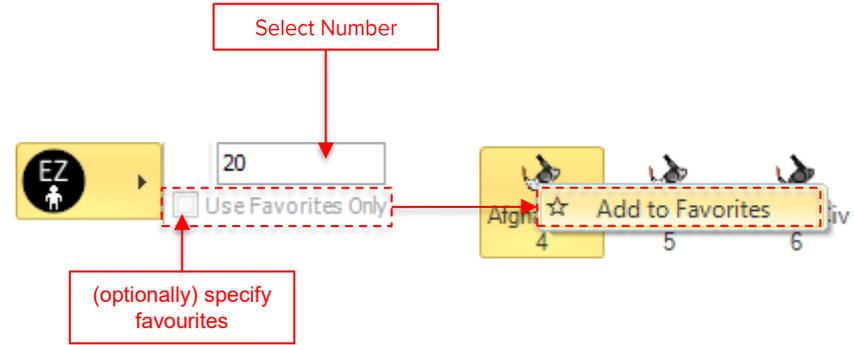
## Easy People

### Easy People

- Places (user selectable number) human entities at random locations within the currently visible area, in:
  - 'Random destination' 
  - and
  - 'Path find' 
- Only human entities that are tagged as being 'neutral' (not red/blue or unknown) will be generated
- CTRL + G – Updates auto-avoid Grid

### Random Walk Destination

- Any platform can be designated a 'Random Walk Destination' in 'Platform Properties'
- Entities placed into 'random destination' mode will occasionally walk to 'random walk destinations' (e.g. a street vendor)

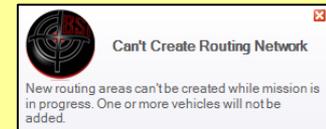


### Platform Properties → Navigational



### NOTE – EZ BUTTONS VS MISSION RUNNING & DSM DATA

- EZ People can be used when the mission is running
- EZ Traffic can only be used when the mission is stopped



# BUILDING MISSIONS WITH PATTERN OF LIFE

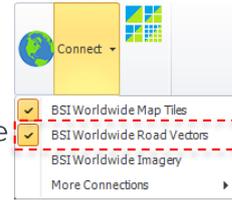
## Easy Traffic

### Easy Traffic

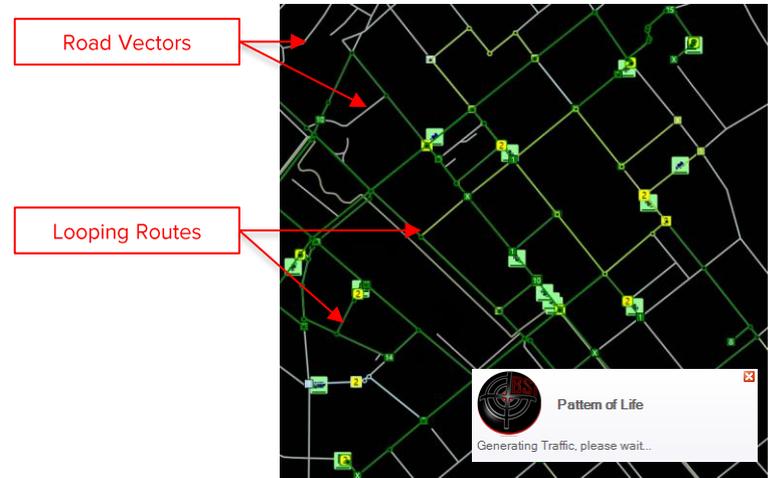
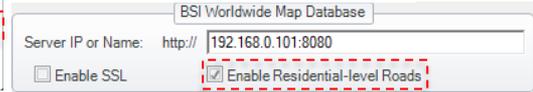
- Places (user selectable number) ground vehicles at random locations within the currently visible area:
  - Attaching to road vectors
  - Vehicles tagged EZ in the MOCT
  - Automatically routed (if using MACE OSM Database)
    - Vehicle will auto route to a random destination
    - Then find another route back
- Vehicles in a loop pattern – will continuously move throughout the scenario
- Can result in ‘Traffic Jams’ at intersections if not using traffic lights (see next)

### Recap – Attaching Single Vehicles To Roads:

- Platform must be in:
  - Intent 
  - and
  - Pathfinding 
- CTRL + RMB on an OSM Road Vector – and subsequent as required



### System Settings → Communication



### -SHORTCUTS-

CTRL + G

Update MACE auto-avoid grid

CTRL + W

Reverse waypoints

CTRL + RMB (on OSM Road Vector)

Attach to Road

LMB = Left Mouse Button  
RMB = Right Mouse Button



# BUILDING MISSIONS WITH PATTERN OF LIFE

## Student Exercise - [Link to Online Solution Video](#)

1. (00:16) Construct a mission using road vectors and building footprint data (OSM) that has at least 3 vehicles driving on roads using vectors.
2. (02:22) Add and save a line shape file of about 500m in length
3. (03:11) Add a vehicle and attach to the line (proceed via)
4. (03:30) Copy the vehicle and place the copy on the opposite end of the line - reverse the waypoints [CTRL+R] and steer to closest
5. (03:45) Give both vehicles speed using the entity control window or the entity control 'Maneuver' group
6. (04:04) In 'Mission Settings' Enable collision avoidance for the mission but disable when pathfinding.
7. (04:19) Add 4 FF and 4 EF facing each other - make all of them weapons free and fight back; make the FF 'Concealed' and the EF 'invulnerable'.
8. (06:21) Make a polygon and save it - make a group of 20 civilians random walk inside the polygon at 2mph - make the reaction postures of the civilians different.
9. (08:18) Add a civilian and give them a route of 2 waypoints across a built up area; give them speed and enable select pathfinding.
10. (08:45) Make a small area of EZ people
11. (09:01) Make a small area of EZ Traffic
12. (09:13) Enable foam weapons and unlimited ammo for the whole mission
13. (09:24) Start the mission and observe all the behaviors in the FF and EF group.
14. (10:03) Selectively disable concealment and invulnerability on the FF and observe the EF response
15. (10:25) Disable foam weapons mode for the mission
16. (10:38) Selectively disable collision avoidance on each vehicle in the head-on waypoint paths
17. (10:59) Using the detonation tool, fire some small caliber weapons near the civilians in the constrained random walk area - see the different behaviors & vector colors



# IADS AND AUTONOMOUS AD

## Learning objective:

- To be able to construct an IADS and Autonomous Air Defence Systems

## Enabling objectives

- Understand the 'rules and components of the IADS'
- Understand how components of the IADS are linked
- Understand how to make and save an aggregate IADs SAM Site
- Understand how Autonomous sites differ from IADS Sites
- Know how to create end export aggregate group of platforms
- Know how to select map layers to display IADS information such as ranges and emissions
- Understand aircraft auto reactions to AD engagements
- Know how to add/remove Aircraft EW equipment
- Know how to manually control emitters and weapons on an air defence platform

# IADS AND AUTONOMOUS AD

## INTEGRATED AIR DEFENCE SYSTEM (IADS)

IADS platforms require IADS TDL Radio

must have & may have many

Early Warning (EW) Radar

must have only one

Sector Operations Centre (SOC)

must have & may have many

Acquisition Radar (ACQ)

must have & may have many

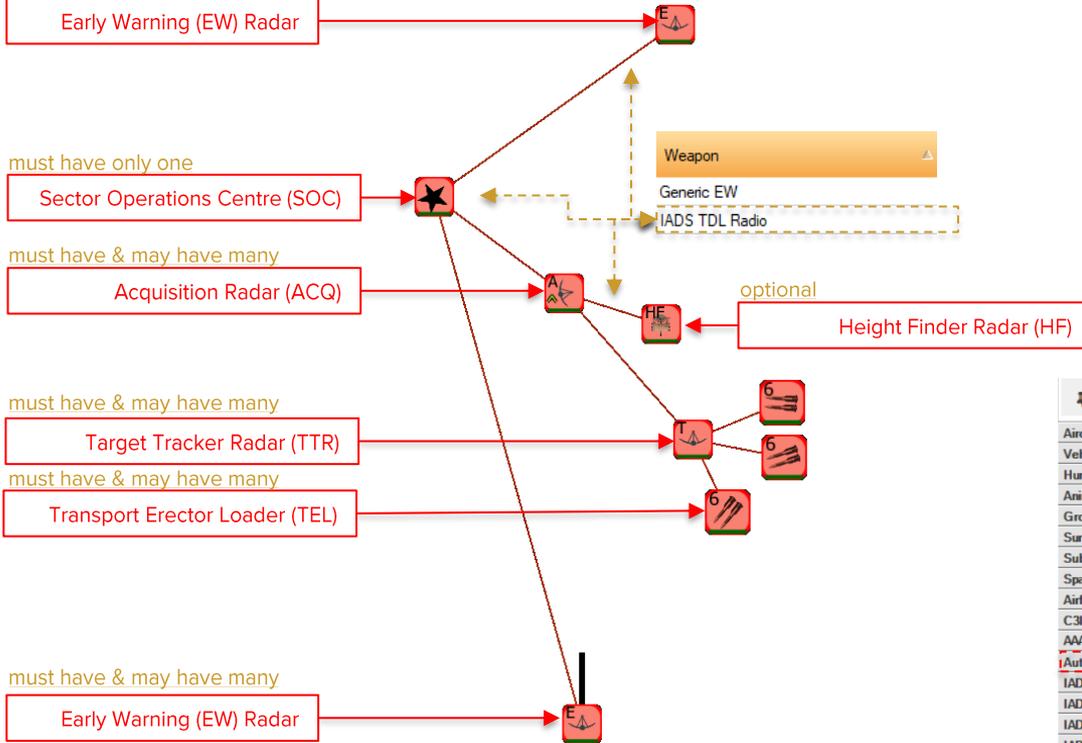
Target Tracker Radar (TTR)

must have & may have many

Transport Erector Loader (TEL)

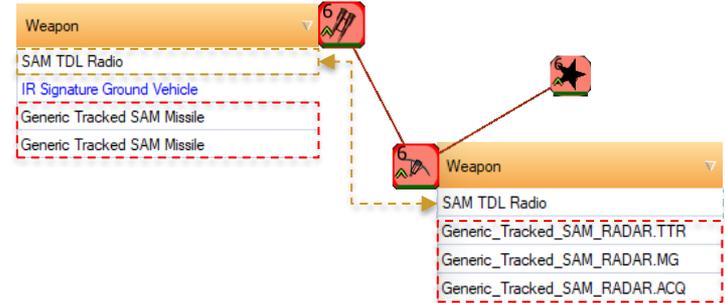
must have & may have many

Early Warning (EW) Radar



## AGGREGATED AUTONOMOUS SITE

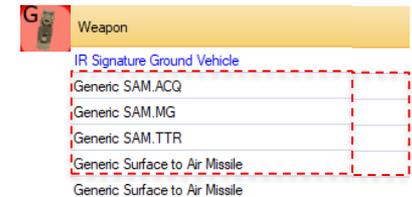
Separate platforms require SAM TDL Radio



Category	Count	Status
Aircraft	(336)	+
Vehicles/Land	(406)	+
Humans	(138)	+
Animals	(11)	+
Ground (Mines)	(9)	+
Surface (Water)	(116)	+
Subsurface (Water)	(7)	+
Space	(8)	+
Airfield Operations	(8)	+
C3I Buildings	(10)	+
AAA	(44)	+
Autonomous SAM	(67)	+
IADS Command Post (CPSOC)	(40)	+
IADS SAM	(29)	+
IADS Early Warning (EW)	(35)	+
IADS Height Finding (HF)	(6)	+
IADS Acquisition (ACQ)	(32)	+
IADS Target Tracking / Fire Control	(58)	+
IADS Launcher / TEL	(53)	+

## AUTONOMOUS PLATFORM

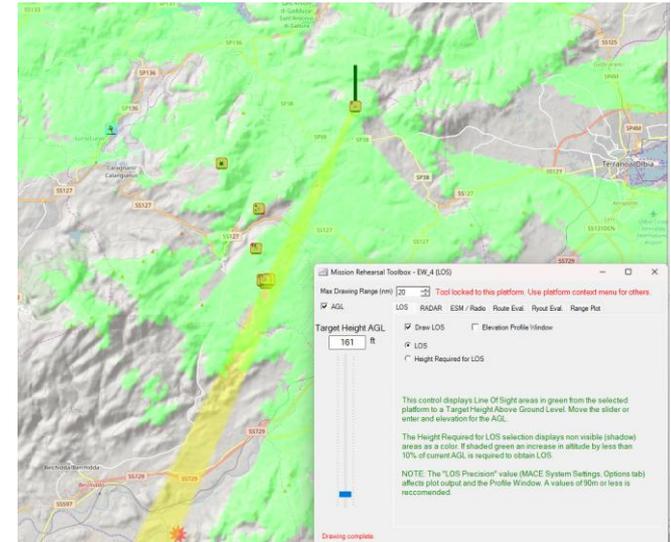
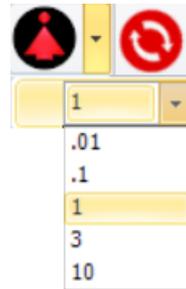
Single platforms do not require TDL



# IADS AND AUTONOMOUS AD

## Placing Air Defence Platforms – Tools That Help

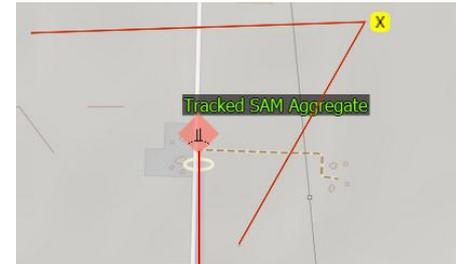
- LOS Tools
  - Mission Rehearsal Tool (more later)
    - RMB on any entity – select ‘Mission Rehearsal Toolbox’
    - LOS tab
    - Select incoming ‘Target Height AGL’
    - Draw LOS
      - Colour indicates where there IS Line of Sight
      - FROM the selected Entity
      - TO a target – at the height specified
  - Snap to Hight Point Tool
    - Mission Builder
    - Choose range from entity to scan for high point
    - Use with LOS tool



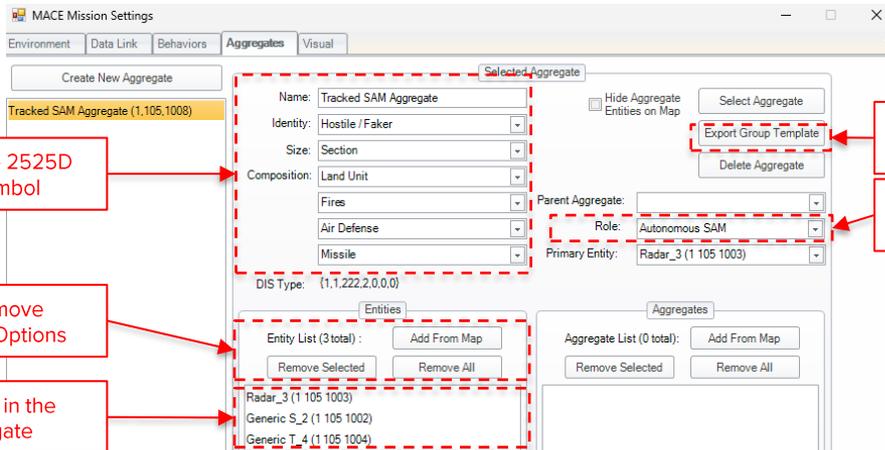
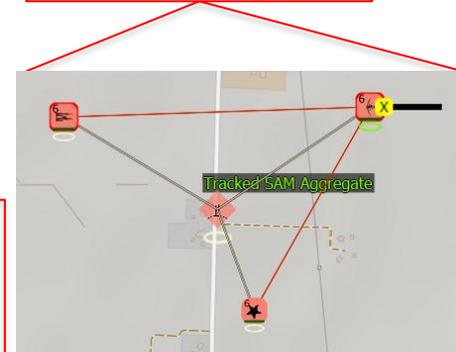
# IADS AND AUTONOMOUS AD

## Saving and exporting aggregates

- Aggregates = groups of more than 1 entity
- Can be assigned MIL STD 2525D Symbol
- Can be assigned to a 'Parent Aggregate' – aggregates of aggregates
- For Air Defence Systems – the simplest way to create 'Autonomous Sites'
  - Defined by the ROLE dropdown
  - Automatically assigns IADS TDL or SAM TDL radio based on selected role



Expands on Double LMB Click



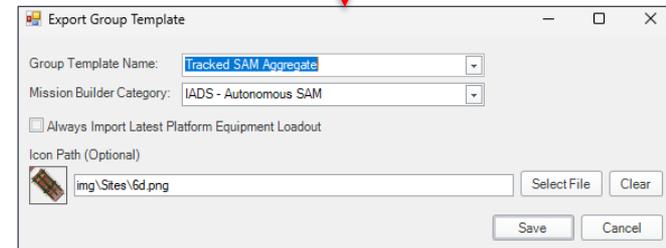
Defines the 2525D Map Symbol

Add/Remove Platforms Options

Platforms in the Aggregate

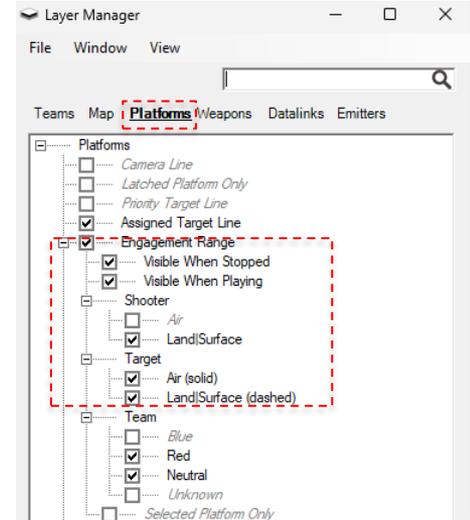
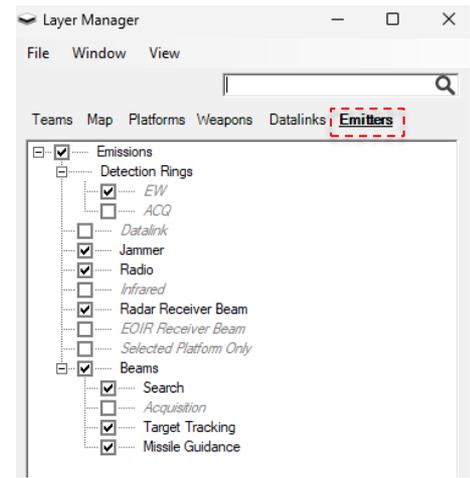
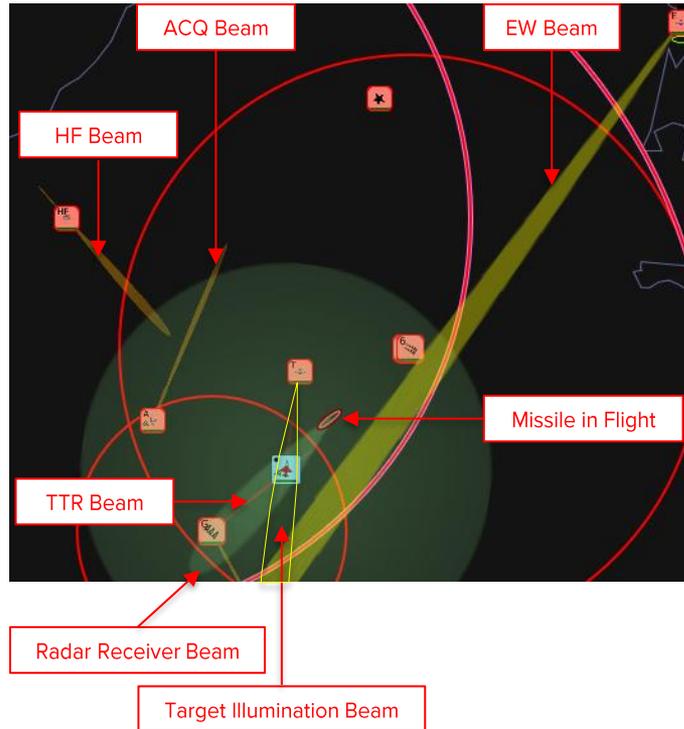
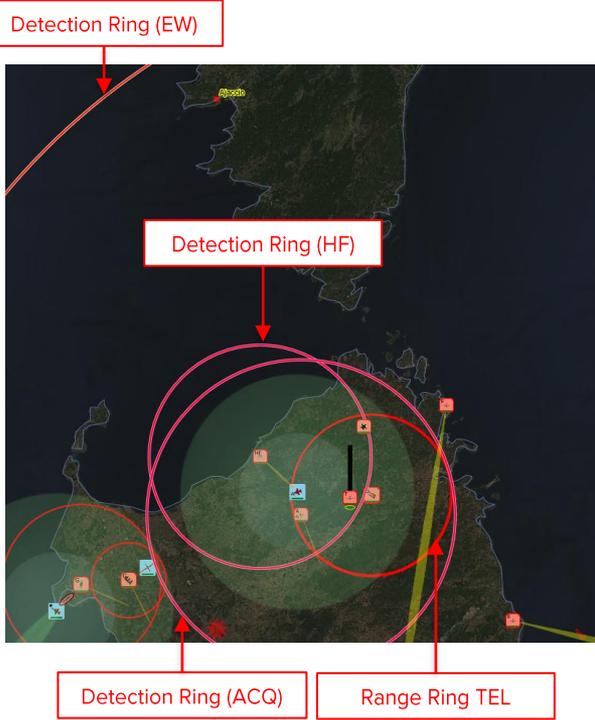
Export to appear in Mission Builder Entity List

Select AUTONOMOUS Or IADS SAM Role



# IADS AND AUTONOMOUS AD

## Layer Manager – Emissions and Ranges



# IADS AND AUTONOMOUS AD

## IADS Link Types

VIEW → Mission Settings → Data Link → Networks

The screenshot shows the 'MACE Mission Settings' interface. The 'Data Link' tab is active, and the 'Networks' sub-tab is selected. The 'Enable Network Propagation Modeling' checkbox is checked. Under 'Available Networks', 'SAM TDL - SOC\_3' is selected. The 'Entities on Network' list shows several radio entities, with 'TT\_10 (1 101 1010)' highlighted. A context menu is open over 'TT\_10', showing options: 'Show Entity Properties', 'Show Equipment Properties', and 'Connection Types'. The 'Connection Types' menu is expanded, showing 'Set Subordinates' and 'Set All Subordinates'. The 'Set All Subordinates' menu is further expanded, showing 'Landline Datalink' and 'RF Datalink'. Below the main interface, a table titled 'Network Connections for TT\_10 (1 101 1010)' is displayed.

Entity Name	Equipment	Connection Type	Alternate Type	Relationship	Signal Strength
ACQ_2 (1 101 1002)	SAM TDL Radio	RF	GenericTDL	Superior	100.0%
TEL_11 (1 101 1011)	SAM TDL Radio	RF	GenericTDL	Subordinate	100.0%
TEL_12 (1 101 1012)	SAM TDL Radio	RF	GenericTDL	Subordinate	100.0%
TEL_13 (1 101 1013)	SAM TDL Radio	RF	GenericTDL	Subordinate	100.0%
TEL_14 (1 101 1014)	SAM TDL Radio	RF	GenericTDL	Subordinate	100.0%

- Mission Settings > Data Link > Networks
- Select from 'Available Networks'
- SAM TDL or IADS SDL Networks for each group of air-defense assets
- In 'Entities on Network' – RMB to assign data link types to the subordinates
- OR select individual entities in the list below to assign links individually
  - RF Link
  - Land Line
- With 'Enable Network Propagation Modeling' ticked the RF links will be affected just like any other radio in MACE

# IADS AND AUTONOMOUS AD

## Manual Emitter Control

### Entity Controls>Actions>Manual Emitter Control



- (1) Select on the MACE Map the platform for manual emitter control
  - Tick 'Stay on Platform' – so further map selections don't jump to a new platform
  - Tick leave in manual mode if you do not want to return to MACE control after manual control
- (2) Choose a target to aim the beam at
- (3) Switch sensors on as required
  - If there is a return it will be seen in the waveform window
- (4) Fire Weapons (if required)

#### NOTE – MANUAL VS AUTO CONTROL

Leaving in manual mode is the same as unticking the 'Auto / Enabled' checkbox in weapons and equipment

Weapon	Location	Qty	Auto / Enabled
IR Signature Ground Vehicle			<input checked="" type="checkbox"/>
Generic SAM.ACQ	ACQ		<input type="checkbox"/>
Generic SAM.MG			<input type="checkbox"/>
Generic SAM.TTR			<input type="checkbox"/>
Generic Surface to Air Miss...			<input type="checkbox"/>
Generic Surface to Air Miss...			<input type="checkbox"/>
Generic Surface to Air Miss...			<input type="checkbox"/>
Generic Surface to Air Miss...			<input checked="" type="checkbox"/>

The screenshot shows the 'Manual Emitter Control - SAM\_5 (1 105 1232)' window. It is divided into several sections:

- Threat:** Contains checkboxes for 'Stay on Platform' and 'Leave in Manual Mode', both of which are checked.
- Target:** A dropdown menu shows 'CS-01'. To the right are fields for 'Site' (1), 'App' (105), and 'Entity' (1362).
- Sensors:** A list of three sensors with status indicators and waveform displays:
  - ILLUMINATOR Generic SAM.MG: Status 'ON', waveform active.
  - TARGET TRACKING RADAR Generic SAM.TTR: Status 'ON', waveform active.
  - ACQUISITION RADAR Generic SAM.ACQ: Status 'OFF', waveform inactive.
- Weapons:** A row of four weapon slots, each containing 'SAM\_5 Generic Surface to Air Missile (1)'.

Numbered callouts (1-4) are placed on the left side of the interface to correspond with the steps in the text.

# IADS AND AUTONOMOUS AD

## Student Exercise - [Link to Online Solution Video](#)

1. (00:31) Filter and simplify the 'Mission Builder Platform Selector' to display IADS only
2. (00:36) Add a Command Post (CP/SOC) platform to the mission
3. (00:54) Add 2 x EW radar onto the mission area - snap to high point within 1nm
4. (01:32) Add an acquisition radar (ACQ) site to the mission - snap to high point within 1nm
5. (02:06) Add a height finding radar (HF) - snap to high point within 0.1nm
6. (02:24) Check the 'Line of Sight Mask' for the radar at 500ft agl then erase
7. (02:50) Add a TTR radar and 3 TELs
8. (03:32) If you don't see 'IADS TDL Links' displayed, use the layer manager to display them
9. (03:56) Add one more ACQ radar and relink all sites
10. (04:42) Add an aggregated autonomous IADS site far away from the other IADS
11. (06:12) Add an autonomous single SAM and snap to a high point
12. (07:06) Add an Autonomous Generic Tracked SAM site and snap elements to high points
13. (07:50) Add components of a SAM site that don't meet IADS rules (TEL & TTR) and create an aggregated autonomous SAM Site - Observe the links change from IADS TDL to SAM TDL
14. (09:00) Add a few AAA sites
15. (09:51) Add 3 Generic FW Aircraft that have routes that take them into the IADS and auto-SAM sites
16. (11:43) Remove one of the aircraft's self protection jammer (SP Jammer) and ensure the other aircraft has an auto/enabled SP Jammer
17. (12:05) Lock the displays to one aircraft and open the RWR Combat Display

Cont..



# IADS AND AUTONOMOUS AD

## Student Exercise - [Link to Online Solution Video](#)

18. (12:23) Use the layer manager to display 'Platform Engagement Range' visible when playing for ground platforms with air targets
19. (12:54) Use the layer manager to display - Jammer, Radar, Receiver Beam, Search, Track, and Missile Guidance emissions
20. (13:24) Start the mission and observe the aircraft response (and the emissions displayed on the map) as it makes it's way through the IADS
21. (14:14) Change the aircraft response to do nothing and return it to intent to make it go back through the IADS site
22. (15:19) Pick an autonomous SAM site and use the 'Manual Emitter Control' to manually target an aircraft working through the emitters and launching a missile

# MACE & ARMOR EW VISUALIZATION & JAMMING

## Learning objective:

- To visualize common EW effects in MACE and ARMOR

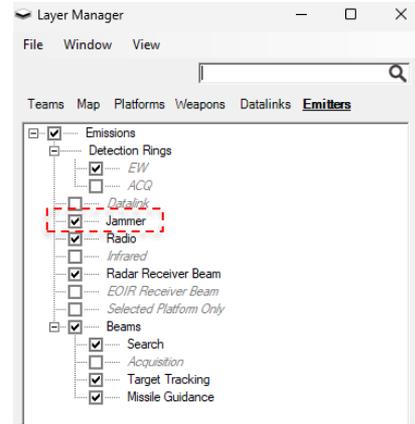
## Enabling objectives

- Know how to equip jammers
- Understand the 'Auto' selection in weapons and equipment
- Know how to see equipment sensors
- Understand what EW information is available in the platform properties window
- Understand the MACE platform icon EW symbols
- Recap how to display EW indications from the layer manager
- Understand the functions of the beam viewer
- Know how to display beams and jamming indications in ARMOR

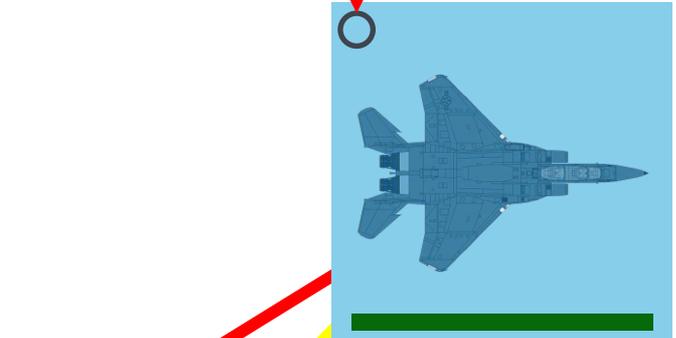
# MACE & ARMOR EW VISUALIZATION & JAMMING

## Equip Jammer / Emission & Jamming Indications

### Layer Manager



- Detected by early warning radar
- Detected by acquisition radar
- Platform is being engaged



- Jamming Search
- Jamming ACQ
- Jamming TTR

### Weapons and Equipment

Weapons & Equipment (THUNDER01)

Equipment List Filter

- Select/Deselect All
- RADARs
- Jammers
- Missiles / Rockets
- Bombs / Flares / Grenades
- Guns / AAA
- Artillery / Mortars / Tank
- Radio / TDL / IFF
- Laser / Handheld Devices
- Spawn Entities
- Expendables
- Other

Text Filter:

Platform Hard Points

Name	Auto / Enabled	Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
Generic SO Jammer	<input type="checkbox"/>	Generic Chaff	Right Dispe...	30	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic SP Jammer	<input checked="" type="checkbox"/>	Generic SP Jammer		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit



# MACE & ARMOR EW VISUALIZATION & JAMMING

## Jamming Data and Sensor Views

### Platform Properties

**THUNDER01**

**Next Waypoint: 6**  
 Time to Waypoint: 00:00:20  
 Waypoint Arrival Time: 13:03:45

**Target:** None

**Orders: MACE Generic Platform Engagement**  
 State: **Executing**

**Target Tracks:**

**SOC\_3**  
 Az (True): 135° El: 3° Rng (nm): 4.7  
 Trk Confidence: 63% Trk Priority: 31.0  
 Primary Trk Source: THUNDER01 / Generic Aircraft Visual Detection

**ACQ\_6**  
 Az (True): 137° El: 1° Rng (nm): 6.3  
 Trk Confidence: 47% Trk Priority: 21.4  
 Primary Trk Source: THUNDER01 / Generic SP Jammer

**HF\_7**  
 Az (True): 143° El: 1° Rng (nm): 7.1  
 Trk Confidence: 15% Trk Priority: 7.0  
 Primary Trk Source: THUNDER01 / RADAR Warning Receiver

**EW\_4**  
 Az (True): 104° El: 1° Rng (nm): 7.2  
 Trk Confidence: 45% Trk Priority: 20.1  
 Primary Trk Source: THUNDER01 / Generic SP Jammer

**TT\_8**  
 Az (True): 145° El: 1° Rng (nm): 8  
 Trk Confidence: 10% Trk Priority: 4.4  
 Primary Trk Source: None



### Weapons and Equipment – on Jamming Platform

Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
Generic Chaff	Right Dispe...	30	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic SP Jammer		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit



Jammed (in last 15s)

### Weapons and Equipment – on Jammed Platform

Weapon	Qty	Auto / Enabled	Selected Weapon	Edit
IR Signature Ground Vehicle	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic_Tracked_SAM_RADAR.MG	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic_Tracked_SAM_RADAR.TTR	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
Generic_Tracked_SAM_RADAR.ACQ	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit
SAM TDL Radio	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Edit

### Sensor View

**Generic SP Jammer Properties**

Generic SP Jammer - Enabled

EW\_5 : Generic EW : Search  
 EW\_4 : Generic EW : Search  
 ACQ\_6 : Generic SAM.ACQ : High Feed

### Sensor View

**Generic\_Tracked\_SAM\_RADAR.ACQ Properties**

Generic\_Tracked\_SAM\_RADAR.ACQ - Enabled

JR-66 (1 105 1001) Range: 21.7 km Jammer: Fwd I UEU Technique: Nois



# MACE & ARMOR EW VISUALIZATION & JAMMING

## ARMOR EW Indications

VIEW > IG View > Beam Viewer

**RCS changes beam size based on detectable range vs scale  
Scale multiplier (1 = correct size for RCS)**

**Enable/Disable beams**

**Enable 3D Beams in IG**

**ARMOR or CIGI**

**Disable Ownship Beams**

**Radio**

- Early Warning
- Acquisition
- Acquisition-Track
- Target Tracking
- Missile Guidance
- Illuminator
- Standoff Jammer
- SelfProtection Jammer
- Jammer Corridor
- RCS
- IR
- Radar Receiver
- EOIR Receiver
- Other

**Select beam type to display**

**RCS (m²):** 20.01000

**Beam Scale Multiplier:** 1.000

**Beam Opacity Adjustment:** 43

**Properties of Selected Beam Type**

**ID**

Name RCS

**Beam Properties**

Color (ARGB)  50, 180, 180, 180

Scale (m)

**Color (ARGB)**

The color of the beam as values from 0 to 255 for opaqueness, red, green, and blue. (AARRGGBB format)

**Customise Colours**

**Enable 3D Beams in IG** + **B BEAMS**

EA-18G_2	53 km
EA-18G	
HDG 009M 012T	IAS 0 kts
MSL 24000 ft	

**Jammer Corridor**

**Jammer Burn Through Area**

**ACQ Beam**

SA-19_3	32 km
SA-19	
HDG 357M 000T	S 0 mph

AH-64_4	26 km
AH-64	
HDG 199M 202T	IAS 0 kts
AGL 1005 ft	

**Missile Guidance Beam**

**EW Beam**

**TTR Beam**

**Properties of Selected Beam Function Type:**

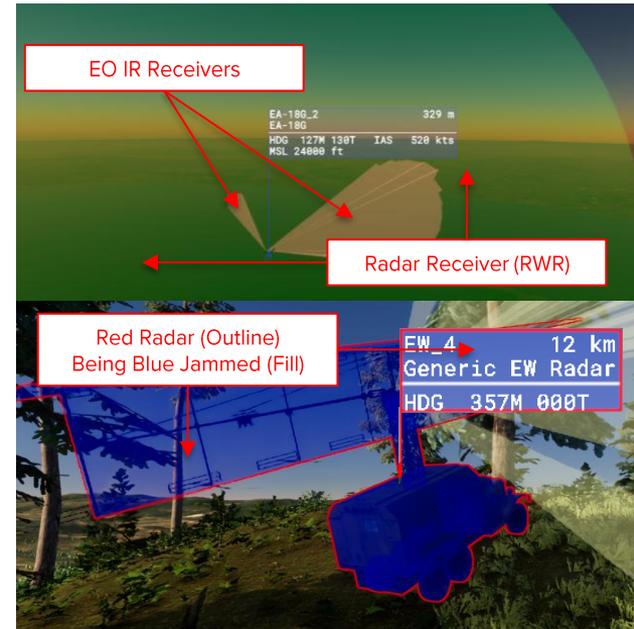
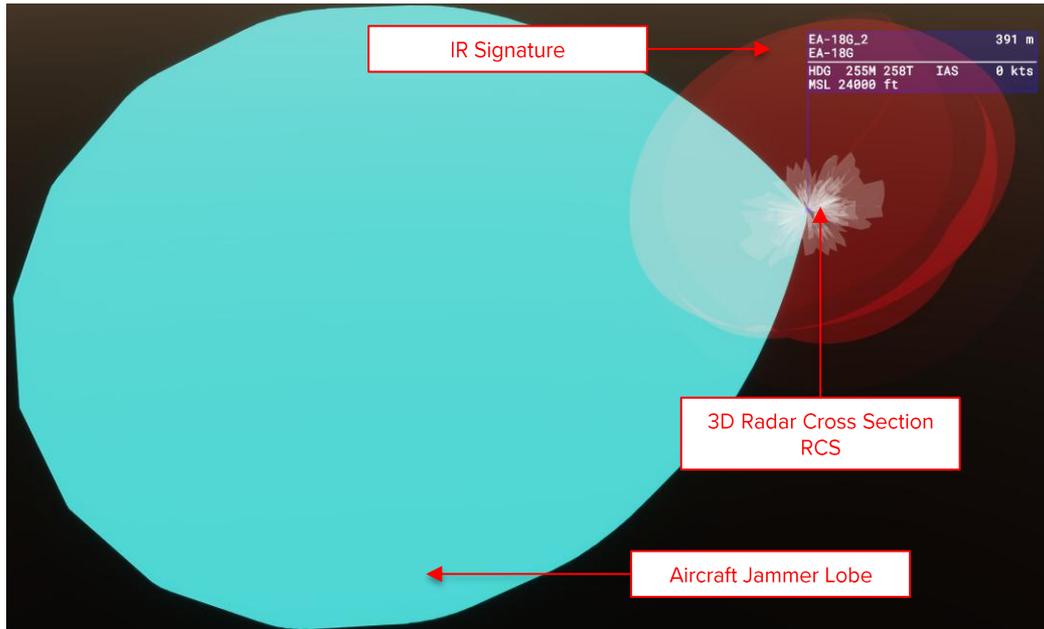
- Color – Select the color of the beam to display in the IG.
- Culling – False will show the beam even when inside it. Select true for better performance.
- Detail Level - Amount of beam shape detail shown from 3dB (low) to 128 dB (high).
- Scale – Maximum length of the beam in meters.



# MACE & ARMOR EW VISUALIZATION & JAMMING

## ARMOR EW Indications

VIEW > IG View > Beam Viewer 



# MACE & ARMOR EW VISUALIZATION & JAMMING

## GPS Jamming and Meaconing

- Can be added from Weapons & Equipment
- Active – when Auto/Enabled – Weapons Free
  - Weapon Effects
    - GPS Meaconer – spoofs target position for weapons
    - GPS Jammer – stops GPS guidance for weapons (Will not fire if GPS only)
  - Navigation Effects [N]
    - Only effect platforms loaded with GPS – equipment in their inventory
    - GPS Meaconer – offsets platform track from waypoints regardless of platform proficiency
    - GPS Jammer – offsets platform track from waypoints – distance based on platform proficiency
    - ‘N’ shown on platform icon



Name	Auto / Enabled	Weapon	Location	Qty	Auto / Enabled	Selected Weapon
GBU-24 PAVEWAY Mk-84	<input checked="" type="checkbox"/>	Flare (M206)	Left Wingtip...	60	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-45 S	<input type="checkbox"/>	GAU-8 30mm		575	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-81	<input checked="" type="checkbox"/>	GBU-12 PAVEWAY (Entry 1...		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-81 HD	<input checked="" type="checkbox"/>	GBU-38 JDAM (Entry 1005)		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-82	<input checked="" type="checkbox"/>	GBU-38 JDAM (Entry 1006)		1	<input type="checkbox"/>	<input type="checkbox"/>
Mk-82 HD	<input checked="" type="checkbox"/>	GPS		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-83	<input checked="" type="checkbox"/>	IR Signature A-10		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-83 HD	<input checked="" type="checkbox"/>	Laser Designator	R9	1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-84	<input checked="" type="checkbox"/>	Mk-82		2	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Mk-84 HD	<input checked="" type="checkbox"/>	RADAR Warning Receiver		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>
		TACAN NavAid		1	<input type="checkbox"/>	<input type="checkbox"/>
		Visual Detection Airborne (A/L/S)		1	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# MACE & ARMOR EW VISUALIZATION & JAMMING

## Student Exercise - [Link to Online Solution Video](#)

1. (00:14) Add a Generic IADS to the mission - snap radars to high points - confirm the data links (relink if necessary)
2. (00:41) Add an autonomous SAM elsewhere in the mission
3. (00:52) (if not already displayed) use the layer manager to display the range for the SAMs
4. (01:37) Add 2 x 'Generic Fighter' aircraft - Name one 'Attack' and one 'Jammer' - Place both at 8000ft amsl
5. (02:46) Place the 'Attack' aircraft on a circular waypoint route through the IADS
6. (02:59) Make the attacking aircraft invulnerable using platform properties
7. (03:12) Place the 'Jammer' aircraft in an out of intent 'racetrack' orbit on the edge of the IADs
8. (03:21) Add a standoff jammer aircraft and ensure it is auto-enabled
9. (03:41) Check the threat library for the SO Jammer includes the threats in the IADS that you placed
10. (04:07) Check / Add a self protection (SP) jammer to the attack aircraft - ensure it is auto-enabled
11. (04:43) Start the mission
12. (04:49) Use the 'Layer Manager' to display: Jammer, Radar Receiver Beam, Search Target Track and Missile guidance emissions
13. (05:12) Use the 'Layer Manager' to set Platform 'Engagement Range' to 'Visible When Playing'
14. (05:37) Observe the MACE icon indications for aircraft illuminated by different types of radar and the indications that enemy radars are being jammed
15. (06:09) Open the 'Weapons & Equipment' on the attack aircraft and 'Edit' the RWR to see threat indications
16. (06:46) Open 'Platform Properties' on one of the enemy radars and check the status window for target track information

Cont..



# MACE & ARMOR EW VISUALIZATION & JAMMING

Student Exercise - [Link to Online Solution Video](#)

17. (07:11) Use the 'Beam Viewer' to display in ARMOR all types of radar, jammer, and jammer corridor
18. (07:49) Turn on entity outlines - navigate to an enemy radar being jammed to observe the pulsing color jamming visualization
19. (08:22) On the jammer aircraft disable all the jammers - Observe missile launch and visualization in MACE and ARMOR)

# MACE ELECTRONIC WARFARE COMBAT DISPLAYS

## Learning objective:

- To be able to use the common combat displays in MACE

## Enabling objectives

- Recap own-ship – top lock relationship
- Know how to open ownship combat displays
- Understand the RWR indications
- Understand the IRWR indications
- Know how to use the CMDS
- Know how to manually dispense chaff and flares
- Recap basic scripting
- Know how to DF a ground radio transmission

# MACE ELECTRONIC WARFARE COMBAT DISPLAYS

## Ownship/Sensor – Top/Bottom Lock

- Ownship = What is selected in MACE ...
- ... until we 'LOCK' an entity as own-ship
- Joysticks and displays control/view THAT entity

### System Settings → Visual

**Ownship / Man-In-The-Loop**

Query LOS from Visual CIGI View ID: 0 App: 0 Entity: 0 IP: 0.0.0.0

Site: 0 App: 0 Entity: 0 IP: 0.0.0.0

Attachment

Enabled Attach Mode: Platform Default

Offset (m) Distance: 40.00

Offset (m) X (fwd): 4.40 Y (right): 0.00 Z (down): -1.00

FOV (deg): 60.00 Zoom FOV (deg): 15.00  Fixed View

Near Clip (m): 0.2  Toggle Client Mode (NOT COMMON)

Selectable Spectrums

EO B/W  EO Color  IR W/H  IR B/H  NVG

HUD

Enabled Size: 6.0 Width: 1920 Height: 1080

Camera

Enabled CIGI View ID: 0

Site: 0 App: 0 Entity: 0 IP: 0.0.0.0

Control

Sensor Form

Joystick

Use Loaded Equipment for Zoom / Spectrum

Zoom Slew Rate (deg/FOV): 0.0100

Continuous  Step Joystick Dead Zone %: 10

Selectable Spectrums

EO B/W  EO Color  IR W/H  IR B/H  NVG



**TOP LOCK**  
Visuals & Displays  
(Ownship)  
Locked to this platform



**BOTTOM LOCK**  
Sensors / Camera  
Locked to this platform



### System Settings → Joystick

Joystick Buttons

**Air / Ground Platform Control**

Axis for Flight Model / Look Axis: Z-Axis  [Logitech Dual Action]

Axis for Thrust / Movement: Y-Axis  [Logitech Dual Action]

Thrust Slider (Replaces Axis): 1

Engine Mixture: Z-Axis

Propeller (Variable Pitch Prop): Z-Axis

Select Next Weapon: 4  [Logitech Dual Action]

Select Next Target: 9  [Logitech Dual Action]

Release Weapon: 8  [Logitech Dual Action]

Shoot Guns: 6  [Logitech Dual Action]

Extend Speed Brake / Zoom In: 7  [Logitech Dual Action]

Retract Speed Brake / Zoom Out: 5  [Logitech Dual Action]

Extend Flaps: 31

Retract Flaps: 32

Toggle Landing Gear / Not Used: 20

Dispense ECM / Pickup Item: 12  [Logitech Dual Action]

Release Joystick Control: 10  [Logitech Dual Action]

Trim / Character Stance (POV): POV 1  [Logitech Dual Action]

Cycle Visual Spectrum: 2  [Logitech Dual Action]

Axis for Toe Brakes: Axis 3

Axis for Rudder: Rr-Axis

Enter Vehicle (humans only): 1  [Logitech Dual Action]

Exit Vehicle (humans only): 3  [Logitech Dual Action]

Toggle Weapon Mode: 1

Glance Left: 32

Glance Right: 32

**Camera Control**

Axis for Camera Control: Axis 2

Zoom In Button: 1

Zoom Out Button: 11

Zoom Slider (Replaces Buttons): 1

Zoom Axis (Replaces Buttons):

Track Target: 5

Slew to Target: 12

Lase Target: 14

Boresight Camera: 16

Nadir Camera: 17

LaserIR Toggle: 15

Cycle Camera Spectrum: 13

Lock on Laser Spot: 13

# MACE ELECTRONIC WARFARE COMBAT DISPLAYS



## COMBAT DISPLAYS



Threat Symbols

Handoff – manual cycle vs auto priority

Display Search Radars

Missile Launch Indication

Toggle Open (16 Threats) / Priority Mode (5 Threats)

Toggle Hi / Low Altitude mode (change threat pri)

Separates Collocated Symbols

Display Unknowns

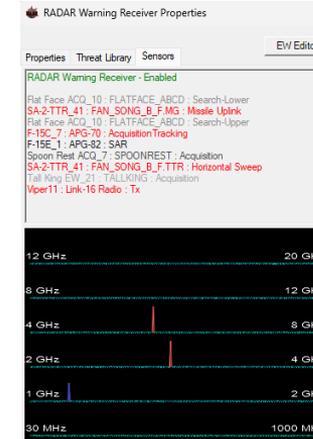
Power on/off

## Weapons & Equipment

Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
RADAR Warning Receiver		1	<input type="checkbox"/>	<input type="checkbox"/>	<a href="#">Edit</a>

- Opening Combat Displays RWR appends RWR Equipment to **ownership** (Top-Locked platform) Weapons and Equipment
- Seen in **RED** in Weapons and Equipment List
- RWR displays identified emitters using green symbols positioned in the Azimuth Display
- RMB** or **[Edit]** on RWR Device opens Properties
  - Displays precise threat and emitter names hitting RW receiver

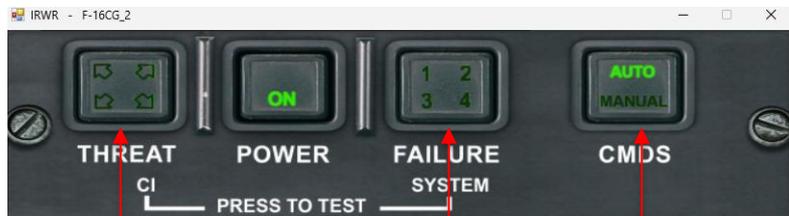
## Weapons & Equipment → Properties



List of emitters in threat library that are received by the device



# MACE ELECTRONIC WARFARE COMBAT DISPLAYS



Quadrant of detected threat

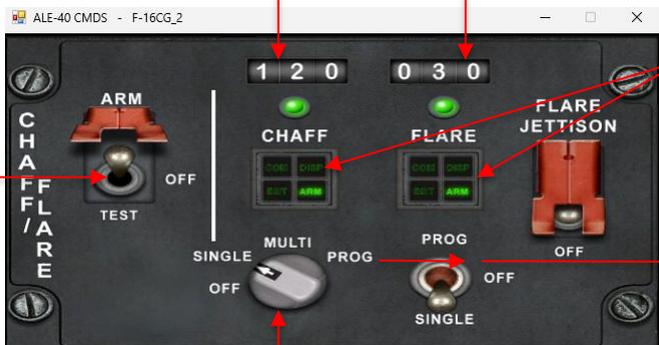
Indicates failure of sensor

AUTO mode - CMDS will dispense flares

## SHORTCUTS

- ALT + C Dispense Chaff on ownship platform
- ALT + F Dispense Flares on ownship platform
- ALT + B Dispenses Chaff AND Flares on ownship platform

- CMDS – can auto dispense based on IRWR (Auto Mode)
- CMDS – Programmes are programmed in CMDS SMS Panel
- Dispense manually pushing the [Chaff] & [Flare] buttons
- Quantities reflect what is in Weapons & Equipment for the platform
- Quantities can be changed:
  - in the CMDS SMS Panel
  - or in Weapons & Equipment
- Reload ALL entities weapons and expendables in **Mission Controls**



Chaff quantity

Flare quantity

Press for Flare / Chaff COM – indicates command has been received

On/Off

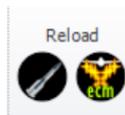
Single Chaff Or iaw CMDS SMS

EXPENDABLES INVENTORY			
DISPENSER	TYPE	QTY	
1	CHAFF	120	
2	FLARE	30	

EXPENDABLES PROGRAM FORMAT					
PROG	TYPE	BURST COUNT	BURST INTVL	SALVO COUNT	SALVO INTVL
1	CHAFF	4	4	2	2.0
2	FLARE	4	4.0		

## MISSION CONTROLS → Mission Options



## Weapons & Equipment

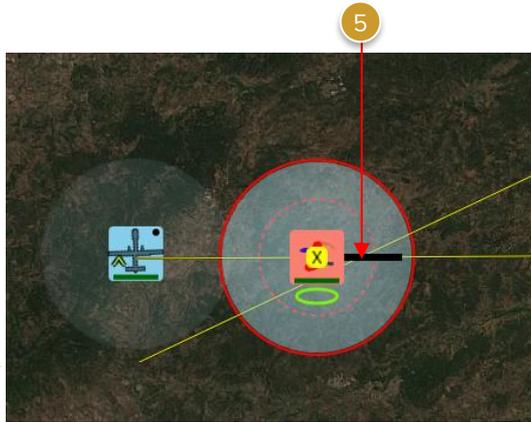
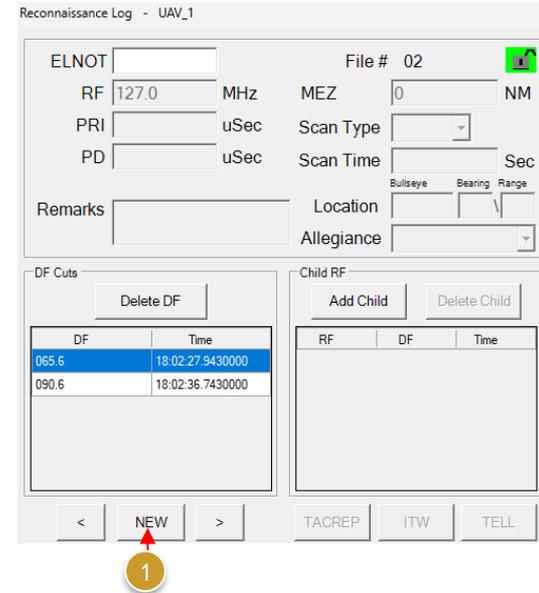
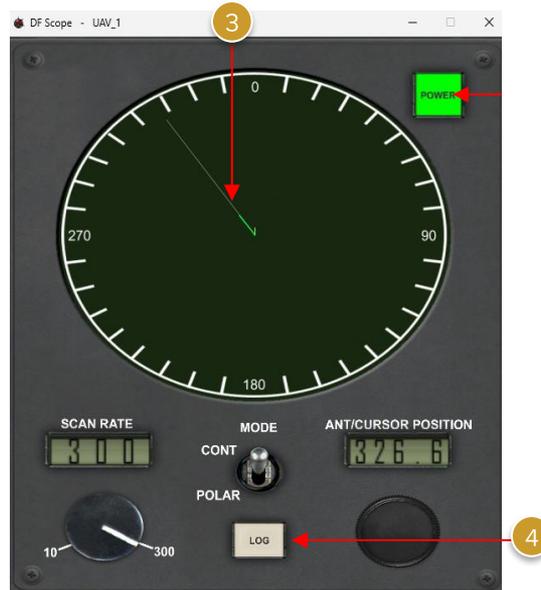
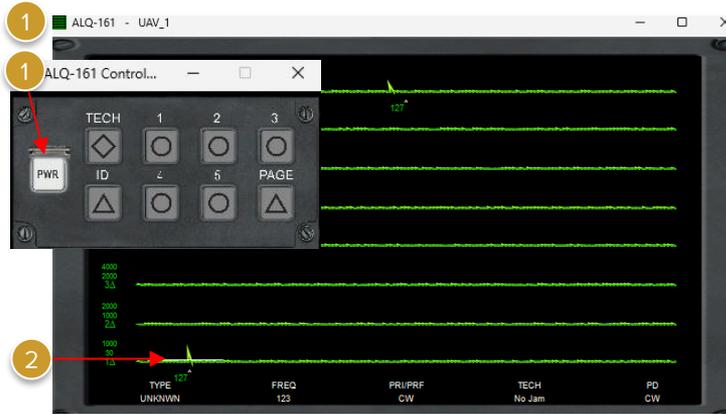
Weapon	Location	Qty
Chaff (RR-180)		120
Flare (MJU-7)	Right Dispenser	30



# MACE ELECTRONIC WARFARE COMBAT DISPLAYS



## Direction Finding a Signal With Combat Displays



- (1) Open and Power Up: Open ALQ-161 and Power on; Open DF Scope and Power on; Open Reconnaissance Log
- (2) Select Transmission: On receipt of transmission, select transmission line on ALQ-161
- (3) Set Direction of Transmission: Line up cursor with transmission line on DF-Scope
- (4) Log to Reconnaissance Log: Press Log
- (5) Triangulate: Repeat then look at triangulation on MACE Map



# MACE ELECTRONIC WARFARE COMBAT DISPLAYS

## Student Exercise [Link to Online Solution Video](#)

1. (00:09) Set up a mission with 1 x Generic Fighter aircraft which is equipped with a Self Protection (SP) Jammer, chaff and flares
2. (00:17) Add to the mission: - 1 x Auto SAM - 1 x AAA system with engagement zone overlapping the auto SAM - Relink if necessary and ensure radars are snapped to high points
3. (00:47) 'Top-Lock' the visuals, displays, and joystick, to the fighter aircraft
4. (00:53) Select own-ship invulnerability in Mission Controls
5. (01:00) Open the following 'Combat Displays': - RWR - CMDS - IRWR
6. (01:20) Start the mission and use the 'Entity Control Ribbons' to: - fly the aircraft through the engagement zones- observe the indications on the RWR and IRWR
7. (03:00) Dispense Chaff and Flares from MACE CMDS panel - and again using the Joystick controls and/or MACE Shortcuts
8. (04:00) Use the RWR:- 'Tgt Sep' button to separate the indications on the RWR display - 'Manual Handoff' to change priority target- Return to 'auto-handoff' mode
9. (04:20) Put the aircraft in a race-track orbit perpendicular to the threats outside the engagement zones
10. (04:32) Add a human platform
11. (04:48) Make a script that: - equips the human with a radio ('Mission-2' tab - 'Set Platform Equipment') - then transmits the text "A lot of Text A lot of Text" ('Radio/TDL' tab - 'Make Radio Call')
12. (05:30) Open the combat displays: - DF Scope - Pan-scope (ALQ-161) - Reconnaissance Log
13. (06:04) Execute the script
14. (06:08) Use the Pan-scope, DF Scope Log to find the source of the transmission – repeat the script execution as required

# MACE & ARMOR EW ANALYSIS TOOLS 1

## Learning objective:

- To be able to use the mission rehearsal toolbox and visualizations in MACE and ARMOR to conduct detailed EW Analysis

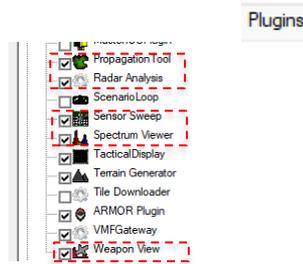
## Enabling objectives

- Know how to use the context menu to open platform specific MRT
- Know how to enable radar diffraction in system settings
- Know how to draw a Line of Site plot for a platform in the MRT
- Know how to draw a radar propagation plot for different target RCS's
- Know how to visualize an RCS in ARMOR
- Know how to draw a radio propagation plot for a given receiver sensitivity and altitude
- Know how to draw route evaluations for platforms vs particular threats and how to move and adjust waypoints to change the outcome
- Know how to run flyout evaluations for platforms vs particular threats and platform evasion parameters
- Know how to run a MARC route to evaluate route from and to a point based on user parameters

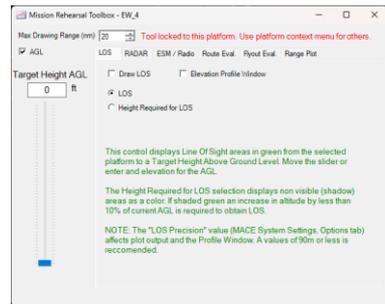
# MACE & ARMOR EW ANALYSIS TOOLS 1

## Activating Plugins – MACE Extensions

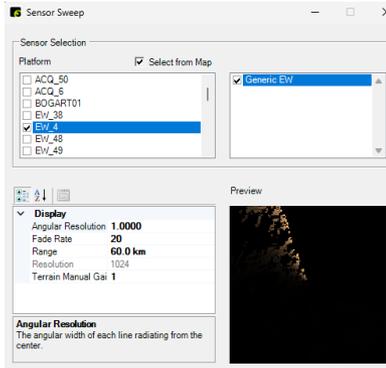
- The analysis tools may need to be activated in plugins
- **System Settings → Plugins → MACE Extensions**
- Mission Rehearsal Toolbox (Propagation Tool)
- Radar Analysis
- Sensor Sweep
- Spectrum Viewer
- Weapon View



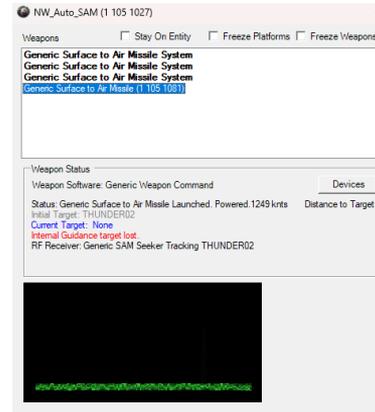
### Mission Rehearsal Toolbox



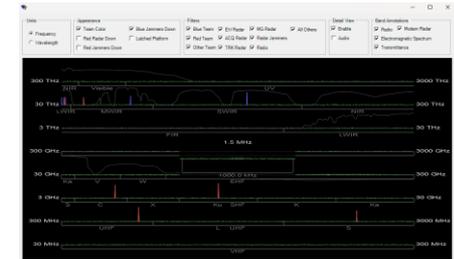
### Sensor Sweep



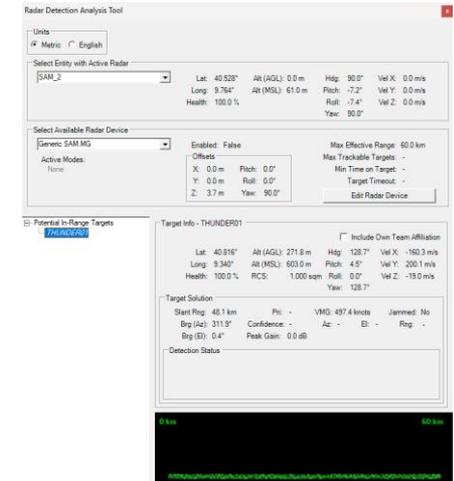
### Weapon Analysis



### Spectrum Viewer



### Radar Analysis Tool

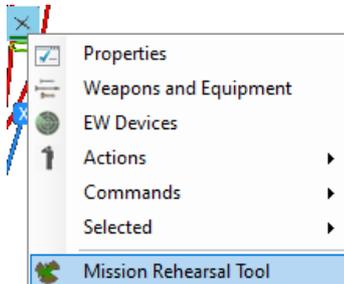


# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – General

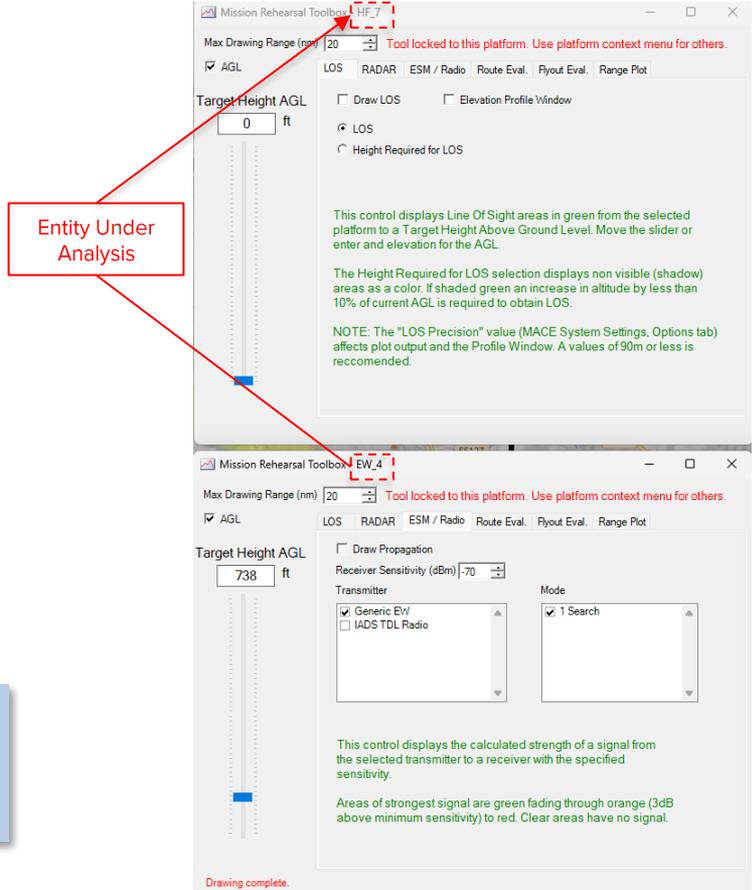
- Access from platform context menu (RMB on entity)
- Will be latched to that entity
- Always check the top of the form for entity name
- Does not change with subsequent entity selection
- May have many open

### Platform RMB Context Menu



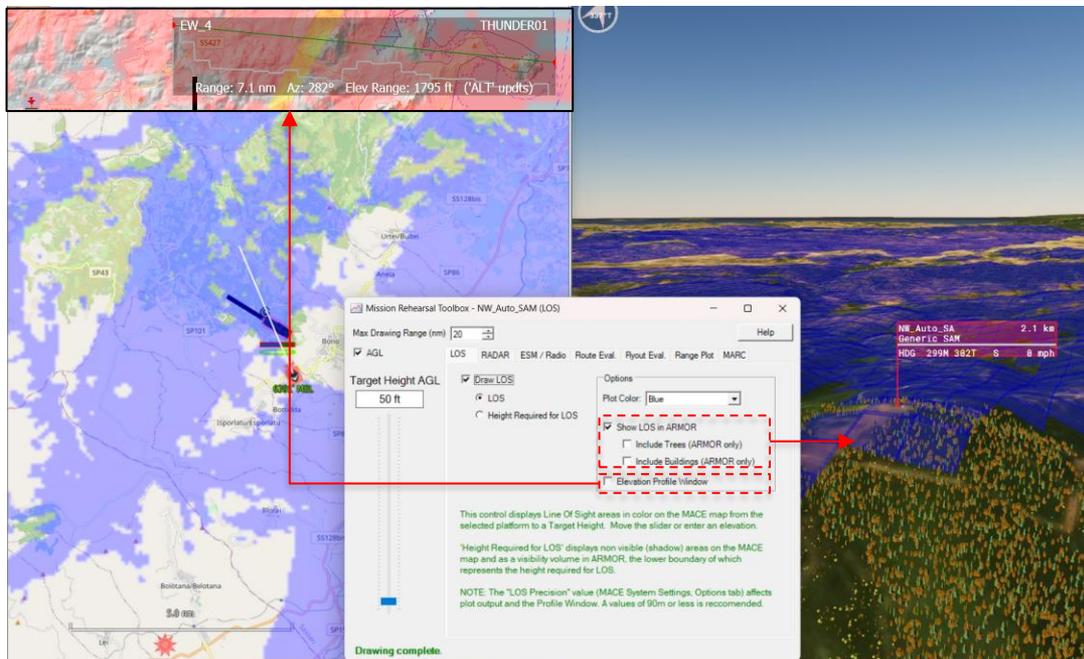
### TIP – CLEAN UP TOOLBOXES AFTER USE

It is easy to get confused which MRT relates to which entity. We suggest you close MRT windows when you are done with them – they are easy enough to reopen!



# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – Line of Sight Analysis



- LOS mode
- Colour indicates where there IS Line of Sight
  - FROM the selected Entity
  - TO a target – at the height specified
  - Colour can be changed – useful for multiple plots
  - Can be displayed in ARMOR – can include trees and buildings
- Height Required for LOS mode - Inverse of LOS
- Shows areas on the map where:
  - Yellow shows where there is NOT Line of Sight from the selected entity – at the height specified
  - Most often used on aircraft to show what can be seen at the current aircraft altitude (set target height to 0ft agl!)
- Elevation Window
  - Shows terrain profile to mouse pointer after pressing ALT
  - Line shows Green for LOS / RED for no LOS
  - If mouse pointer is
    - Over ground – Shows ground level Line of Site Line
    - Over platform – shows LOS from platform to selected entity

# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – Radar Propagation

Manual Target Height

Manual Target RCS

Auto Target RCS & Height

Target Height AGL  
100 ft

Target RCS 0.3000 Or Selected Target (AH-64-2) RCS

Radar

- Generic SAM ACQ
- Generic SAM MG
- Generic SAM TTR

Mode

- 1 High Feed
- 2 Middle Feed
- 3 Low Feed

Select a radar on the platform

Select a mode on the radar

- Select any equipped platform radar and mode for that radar
  - Displays signal strength of the radar return based on:
    - Radar Cross Section (manual or for selected target)
    - Beam Properties
    - Diffraction over terrain (DeyGout's Method) – Enable in form
  - Draw Radar Propagation
  - Colour Shading:
    - **Green** = Strong Signal Return
    - **Orange** = 3dB above the receivers' minimum sensitivity
    - **Red** = Signal return at receivers' floor
  - Selected Target
  - Will populate the RCS with selected target:
    - RCS based on aspect
- AND**
- Adjust Target Altitude Automatically

# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – ESM Radio

Receiver Height

Receiver Sensitivity

Select Radio Device

Select a mode on the radio

Virtual Jammers on Existing Platforms

Platforms with jammers equipped

Mission Rehearsal Toolbox - VENGEANCE19 (Radio)

Max Drawing Range (nm) 20

AGL

Rx Height AGL 100 ft

LOS RADAR ESM / Radio Route Eval. Flyout Eval. Range Plot MARC

Draw Propagation  Use Diffraction (changes System Settings)

Receiver Sensitivity (dBm) -90

Transmitter

GPS  PRC-117G

Mode  1 Tx

Jammers - Check box to enable or select from map.  Virtual Jammers

Use	Jammer Entity	Ant Ht	ERP	J/S
<input checked="" type="checkbox"/>	BMP-2_2	0 ft	10.0 w	0 dB
<input checked="" type="checkbox"/>	JAMMER	0 ft	10.0 w	0 dB
<input checked="" type="checkbox"/>	JAMMER (Generic Comms Jam...	11 ft	500.0 w	0 dB

This control displays the calculated strength of a signal, green fading through orange (3dB above minimum sensitivity) to red.

Drawing complete.

- Strength of a signal from the selected entity – Based on:
    - Transmitter signal parameters (e.g. power, freq, wavelength)
    - Sensitivity of the receiver
    - Altitude of the receiver (e.g. antenna height)
    - Includes diffraction over terrain (DeyGout's Method)
  - Colour Shading:
    - Green = Strong Signal Return
    - Orange = 3dB above the receivers' minimum sensitivity
    - Red = Signal return at receivers' floor
  - No Shading = Signal not received
  - Can be used to determine:
    - Susceptibility to detection / DF
    - Where to best place radio relays
  - Jamming Effect on Propagation
    - Select any entity equipped with comms jammer to see effect
- AND/OR
- Place a 'Virtual Jammer' – select any other entity and input jamming parameters

# MACE & ARMOR EW ANALYSIS TOOLS 1

## MACE Assisted Route Creation (MARC)

Endpoint Arc Tool

1 Select start point and end points from map

2 Select Ingress Altitude

3 Select General Profile For Route

4 Adjust scores for individual parameters

5 Adjust included threats and individual priorities

6 Generate Route

7 Add Waypoints

Use	Threat	Threat Priority
<input checked="" type="checkbox"/>	SA11CP_11	100
<input checked="" type="checkbox"/>	SA-15_1	100
<input checked="" type="checkbox"/>	SA-15_7	100
<input checked="" type="checkbox"/>	SA-19_8	100
<input checked="" type="checkbox"/>	SA20CP_13	100
<input checked="" type="checkbox"/>	SA-22_1	100

Route Eval Panel:

Start Point: 47.27829, -122.14459

Objective: 47.51891, -121.82109

Route Parameters:

- Speed: 75.0 knts
- Vert Deviation: 32.8 ft
- Indirect Masking: False
- Terrain: 260 meter
- Grid Resolution: 1000 m
- Bounds Factor: 1.1 x
- ARMOR LOS: False

Scoring Weights:

- Distance: 0.30
- Weapon Range: 0.10
- Tracking: 0.20
- Weapon Tracking: 1.00
- Detection: 0.50

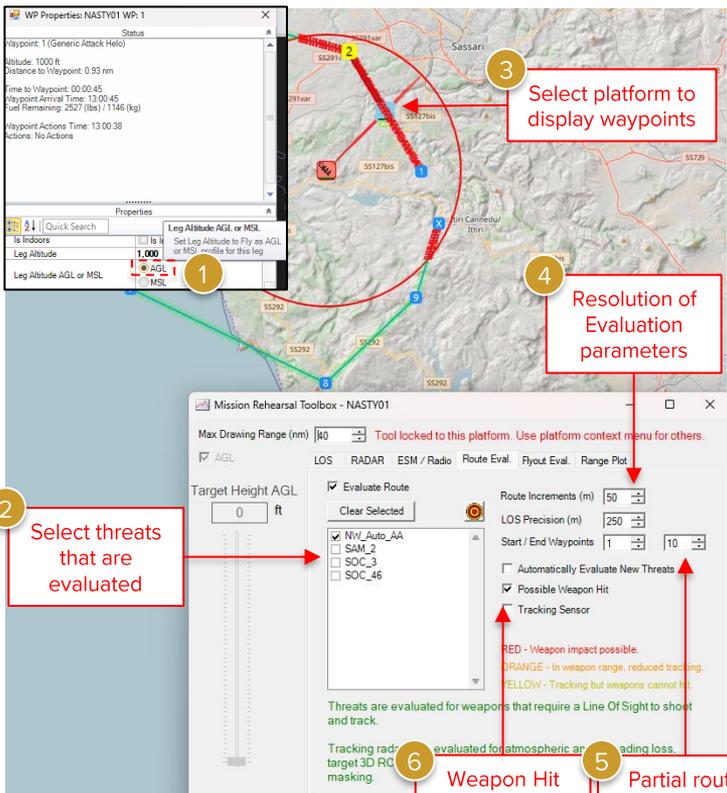
Speed: Speed along the route.

Creates a route based on - Start point, End Point, Included threats / priorities, Scores attributed to overall parameters

- (1) Select start an end points (pick from map)
- Use arc tool for end point if forcing an approach direction
- (2) Select Ingress Altitude
- (3) Select overall preference for Safest vs Shortest – Changes parameters on right-hand-side
- (4) Adjust individual parameters
  - Parameters
    - Speed – Route Speed (affects doppler)
    - Vert Deviation – Max altitude deviation from route (height of model)
    - Indirect Masking – considered or not
    - Grid Resolution – spacing
  - Scores (1 is 100% importance)
    - Distance – shorter vs longer route
    - Weapon Range – time in weapon range
    - Tracking – time tracked
    - Weapon Tracking – Tracking inside weapon range
    - Detection – time detected by any radar
- (5) Which threats are included in analysis - what priority to give to each
- (6) Generate route
- (7) Append or replace waypoints for selected platform

# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – Route Eval



Evaluates the route (or parts of it) based upon: Atmospheric conditions, Target 3D RCS, MTI Doppler Notch, Direct/Indirect Terrain Masking, weapon flyout parameters vs target presentation

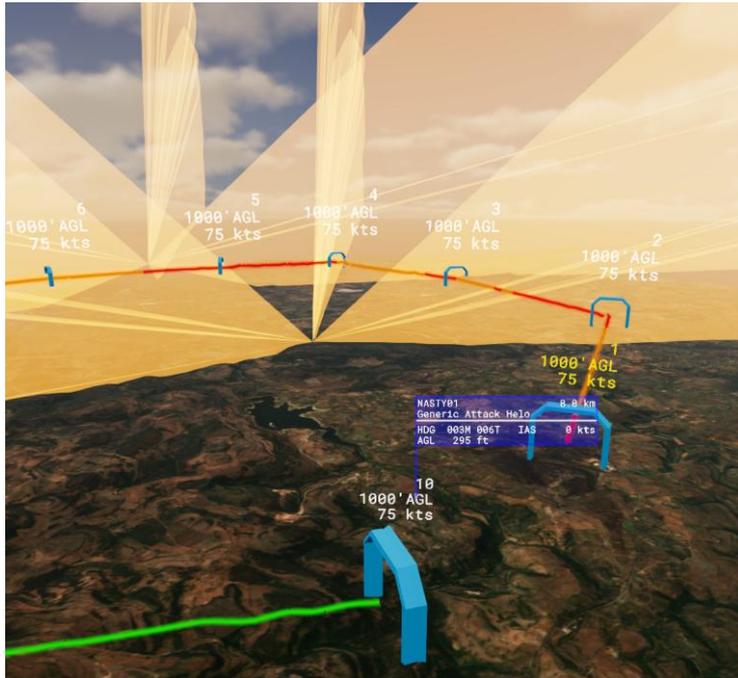
- (1) Leg altitude (best to select AGL!)
- (2) Tracking from selected threat platform(s) – sensors on platform
- (3) Must have platform selected in MACE to see waypoint route colouring
- (4) Select resolution
  - Segment width along route
  - LOS resolution from each threat to entity position along route
  - Smaller increments require more processing
- (5) Discount waypoints outside of threat area to speed up analysis
- (6) Colours depend on what option is checked
  - Possible Weapon Hit
    - **Red** – in range and good target tracking
    - **Orange** – within weapon employment range, but reduced target tracking
    - **Yellow** – tracking data sufficient to take a shot, but weapon cannot hit
    - **Green** – not in range or tracked
  - Tracking Sensor
    - **Red** – good tracking
    - **Orange** – within MTI or doppler notch
    - **Yellow** – hidden by indirect terrain masking
    - **Green** – not tracked

**NOTE – OUT OF AMMO VS ROUTE EVAL**  
Threats that have no ammunition will not be populated in the threat list



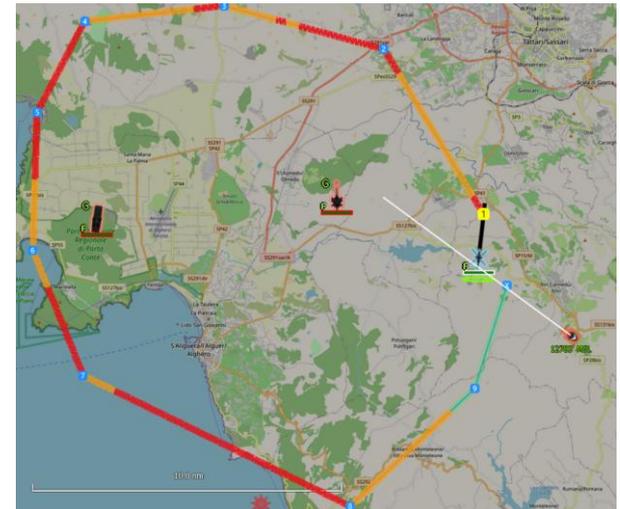
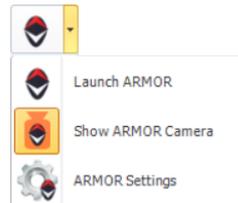
# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – Route Eval in ARMOR



- Use MACE Beam viewer plugin and **<B>** in ARMOR to display beams
- Use **<Y>** in ARMOR to display route waypoints
  - **<CTRL> + <Y>** Cycle Waypoint Entity (MACE Selected / Top-locked / Bottom-locked)
  - **<SHIFT> + <Y>** Cycle Waypoint Labels
  - **<ALT> + <+>** or **<->** Scale Waypoint Size
- Move waypoints in MACE see coloured route analysis update in ARMOR
- Use ARMOR camera view to help orientate when surveying route

View → IG View → ARMOR

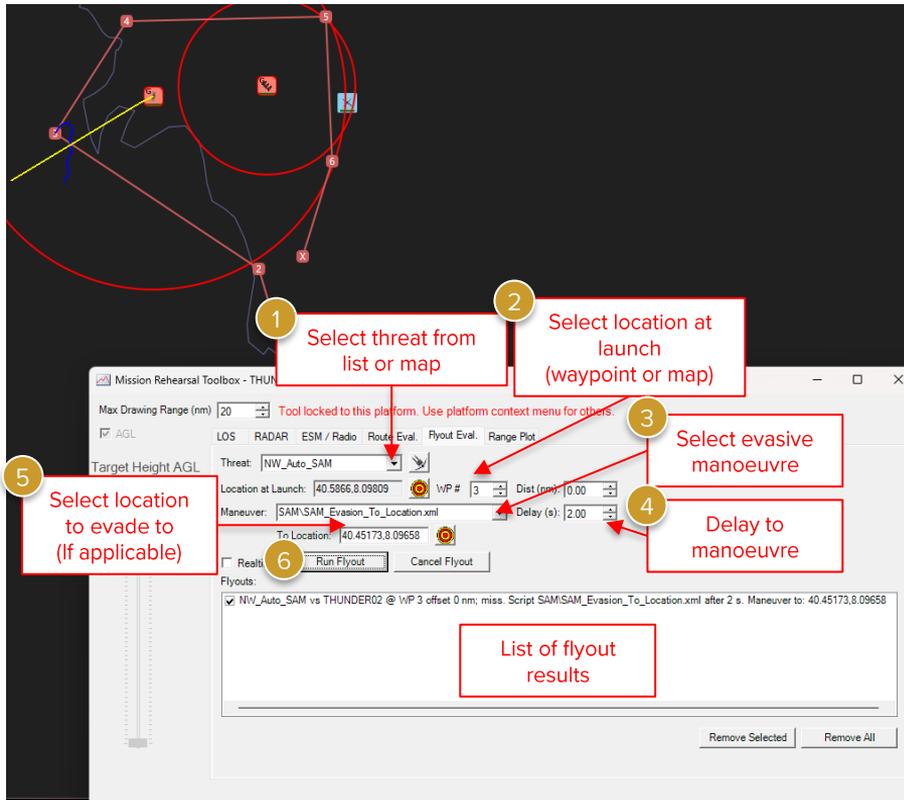


# MACE & ARMOR EW ANALYSIS TOOLS 1

## Mission Rehearsal Toolbox – Flyout Eval

Evaluates manoeuvres at specific locations along route against a single threat

- (1) Select threat from dropdown or from map
- (2) Select location of platform when threat launches (on its route)
- Optional selections:
  - (3) To select **manoeuvre** to be performed in response to launch
  - (4) To select a **delay** (reaction time) before manoeuvre is performed
  - (5) To run manoeuvre to **specific location** (e.g. to take advantage of terrain)
  - (6) To run in real-time OR 4x speed
- Ensure mission is saved before running flyout
- Colours after flyout indicate
  - **Yellow Missile Flightpath Line** = Successful manoeuvre
  - **Red Missile Flightpath Line** = Missile hit selected entity
  - **Blue Flightpath Line** = Entity flight path

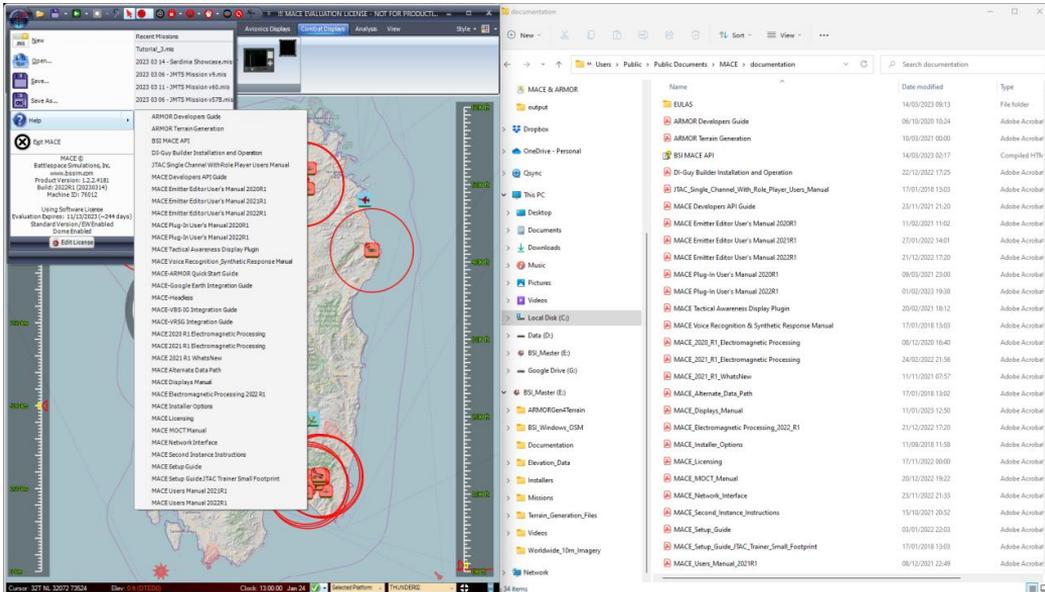


# MACE & ARMOR EW ANALYSIS TOOLS 1

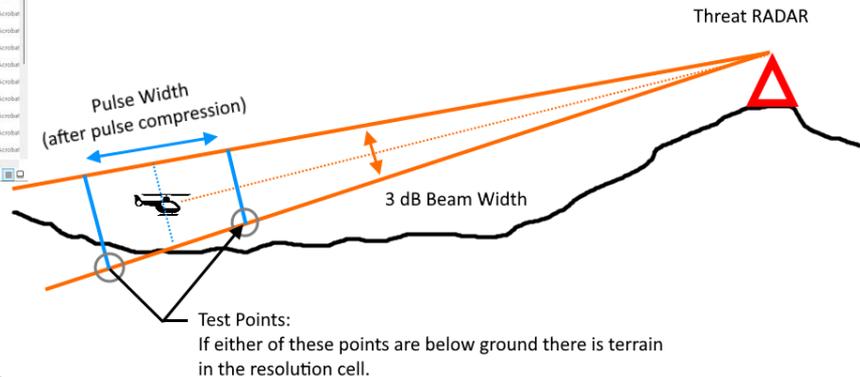
## About EM Modelling – Sources of Info

BSI-QUICK MENU → Help

C:\Users\Public\Public Document\MACE\Documentation



- MACE Documentation
- MACE Emmitter Editor User's Manual
- MACE Electromagnetic Processing



# MACE & ARMOR EW ANALYSIS TOOLS 1

## Student Exercise - [Link to Online Solution Video](#)

1. (00:09) Load Tutorial 3
2. (00:21) Open MRT on the NW\_Auto\_SAM site and run a LOS analysis at 200ft – then cancel it
3. (00:57) Use the Height Required for LOS to see if FW Fighter THUNDER02 has line of sight to the NW Auto SAM – what altitude would it need to be at to have it?
4. (01:49) Use the ‘Elevation Profile Window’ to display a terrain cross-section from NASTY 01 to the NW\_Auto\_AAA and then to the NW\_Auto\_SAM
5. (02:23) Use the MRT on the NW\_Auto\_AAA to run a Radar propagation plot - enter an RCS of 0.05 - select the different sensors - change to different altitudes
6. (03:19) Assign the NW\_Auto\_AAA Nasty01 as its target - change the radar plot to be for the 'Selected Target' - what is the value of the RCS and altitude now?
7. (03:48) Start the mission
8. (03:52) Use the beam viewer plugin to display acquisition, target track, missile guidance beams and RCS
9. (04:20) In ARMOR go to NASTY-01 - to see the RCS representation - pan the view to see the beams from NW\_Auto\_AAA
10. (05:06) In ARMOR display waypoints for the selected platform (Y) – attach to NASTY-01 externally
11. (05:29) Turn RCS off in the ‘Beam Viewer Plugin’
12. (05:50) Select THUNDER-02 in MACE - Attach to it in ARMOR (if not automatically attached) - Open the MRT 'Route Analysis' - Evaluate the route against NW\_Auto\_SAM

Cont..



# MACE & ARMOR EW ANALYSIS TOOLS 1

Student Exercise - [Link to Online Solution Video](#)

13. (06:13) Pan the ARMOR camera to see the route color
14. (06:51) Change the route in MACE - move waypoints to change the risk level - move the camera in ARMOR to see the route color change
15. (07:29) Use the MRT to evaluate a missile flyout from the NW\_Auto\_SAM vs THUNDER02 - pick a point on the route - using a SAM Evasion to location 'Maneuver' - response time of 2.00s
16. (08:28) On the original route run the analysis again: - from a different location - to a different location
17. (09:06) Add an APC to the mission - add to its equipment a generic radio - make it 'Auto-enabled'
18. (09:49) Use the MRT on the APC to: - run 'ESM/Radio' plot - detection receiver at 13ft (i.e. an antenna from ground entity) - sensitivity -90dB

# MACE EW ANALYSIS TOOLS 2

## Learning objective:

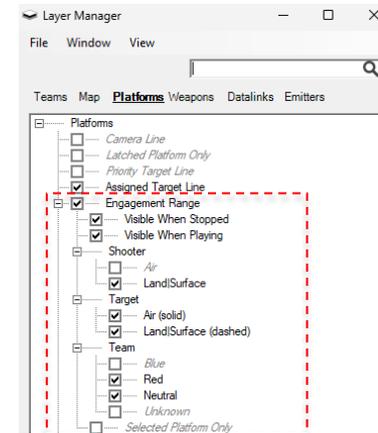
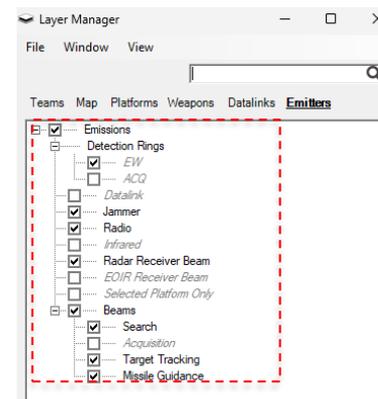
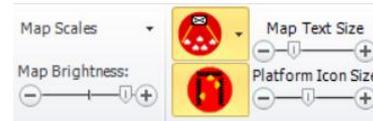
- Know how to use the MACE EW analysis tools to display useful EW information about weapons and sensors

## Enabling objectives

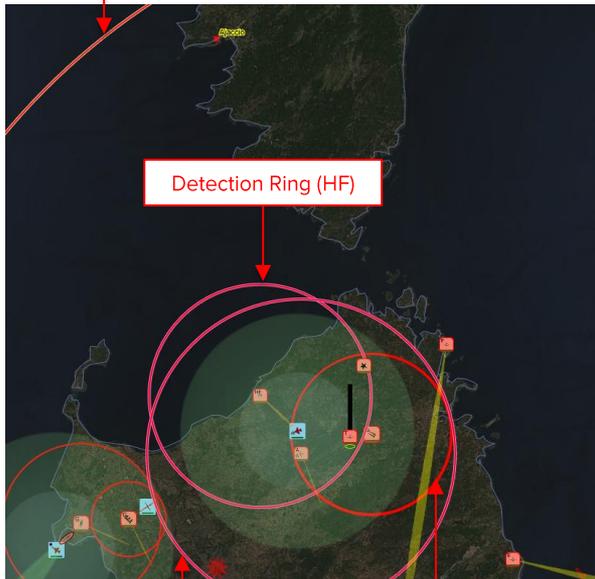
- Recap layer manager emissions display, range rings, assigned target line, WEZ
- Know how to change icon size and map brightness
- Know the difference between the Map LOS tool, the Analysis LOS tool and Mask Analysis
- Know how to display and configure a radar sensor sweep on the MACE Map
- Understand how to use the MACE Spectrum viewer and its filters to analyze signals
- Know how to use the detail view in the Spectrum Viewer to analyze specific signals
- Know how to use the weapon information analysis plugin to view weapon sensor information
- Understand the MACE weapon on weapon engagement capability
- Know how to use the Radar Detection Analysis Tool to see detailed radar track information

# MACE EW ANALYSIS TOOLS 2

## Layer Manager – Emissions and Ranges



Detection Ring (EW)



Detection Ring (ACQ)

Range Ring TEL



Radar Receiver Beam

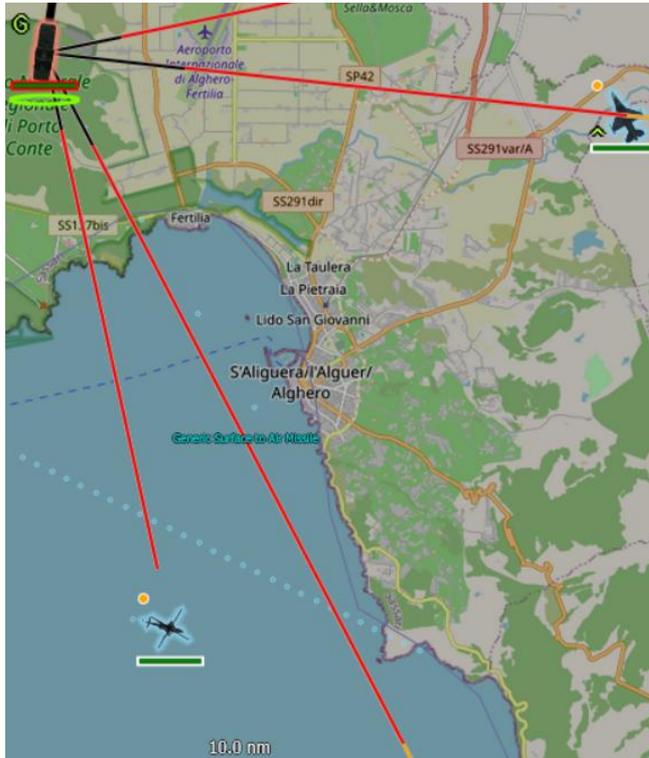
Target Illumination Beam

**NOTE – DETECTION RINGS**  
Detection rings only show 'modelling range' for maximum detection range – not detection range for a particular RCS



# MACE EW ANALYSIS TOOLS 2

## Layer Manager – Engagement Zones



Shows for all possible targets a vector towards each coloured as follows:

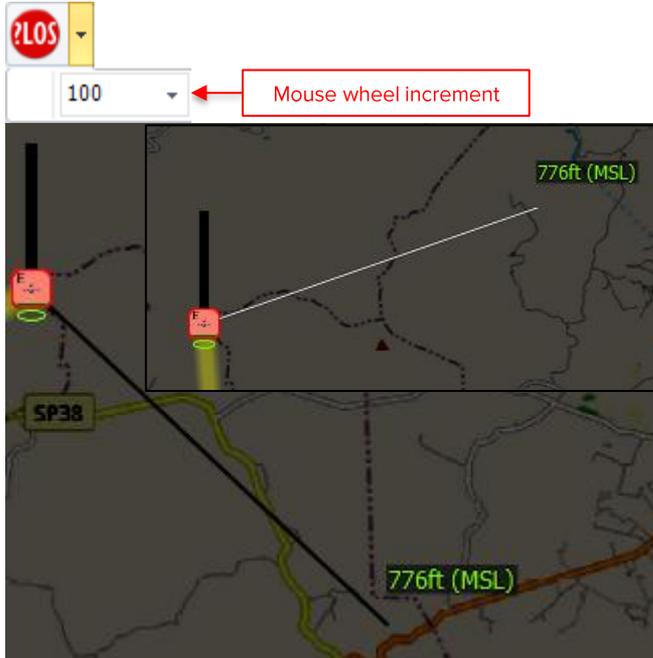
- $R_{Max1}$  – Max doctrinal employment range for attacking a non-maneuvering target.
- $R_{Max2}$  – Maximum doctrinal employment range for attacking a maneuvering target.
- $R_{NoEscape}$  – Range at which a target will be unable to evade the weapon even if it immediately turns to flee.
- $R_{min}$  – The minimum range at which a weapon can successfully engage.

# MACE EW ANALYSIS TOOLS 2

## 3 More Line of Sight Tools

Can I see things from my position, at this altitude along this line?

MISSION CONTROLS > Map Tools > Line of Sight Tool



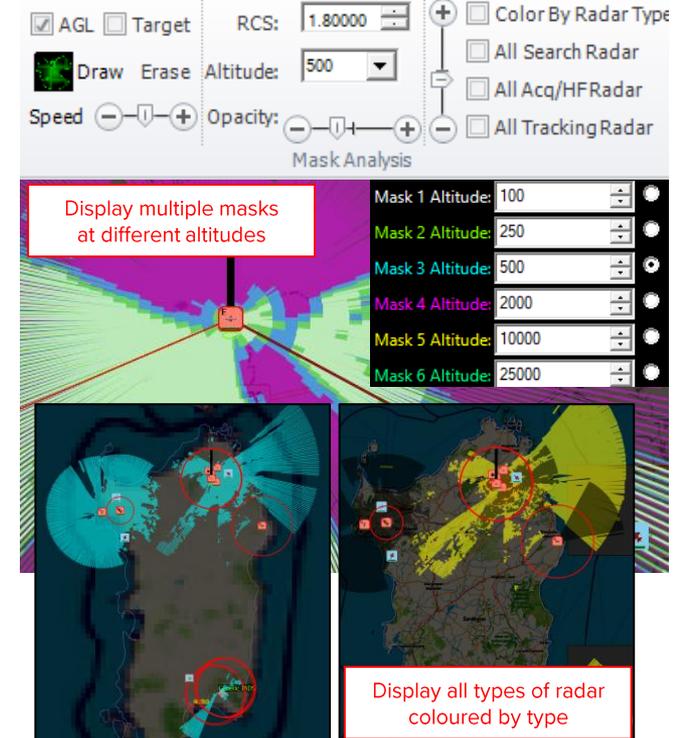
Can this platform see that platform?

MISSION CONTROLS > Analysis > Check Line of Sight



How far can this/these radar(s) see things at that altitude?

MISSION CONTROLS > Analysis > Mask Analysis



### NOTE - MASK VISIBILITY

Masks are visible when mission not running if selected in the layer manager

To view when mission is running press <CTRL> + <ALT>

# MACE EW ANALYSIS TOOLS 2

## Radar Sensor Sweep Display



ANALYSIS → Info/Status Windows → Radar Sweep

1

Sensor Sweep

Sensor Selection

Platform  Select from Map

- ACQ\_50
- ACQ\_6
- BOGART01
- EW\_38
- EW\_4
- EW\_48
- EW\_49

2

3

4

5

Display

- Angular Resolution 1.0000
- Fade Rate 2
- Range 100.0 km
- Resolution 1024
- Terrain Manual Gain 1

Preview

Fade Rate

The rate the drawing is faded from 0 to 255 where 0 = No fade, 255 = Instant Fade.

Shows a sweep of the radar overlaid on the mission area

- (1) Mission must be running
- (2) Pick platform (from map or list)
- (3) Pick sensor on platform
- (4) Options
  - **Fade Rate** – Controls how fast the image fades from 0 (no fade) to 255 (instant).
  - **Range** – Max radius of terrain cached for image generation.
  - **Terrain Manual Gain** – Brightens 0 = no brightness, 1 = normal, >1 = increased brightness.
- Deselect before closing plugin

# MACE EW ANALYSIS TOOLS 2

## Spectrum Viewer



ANALYSIS → Info/Status Windows → Spectrum Viewer

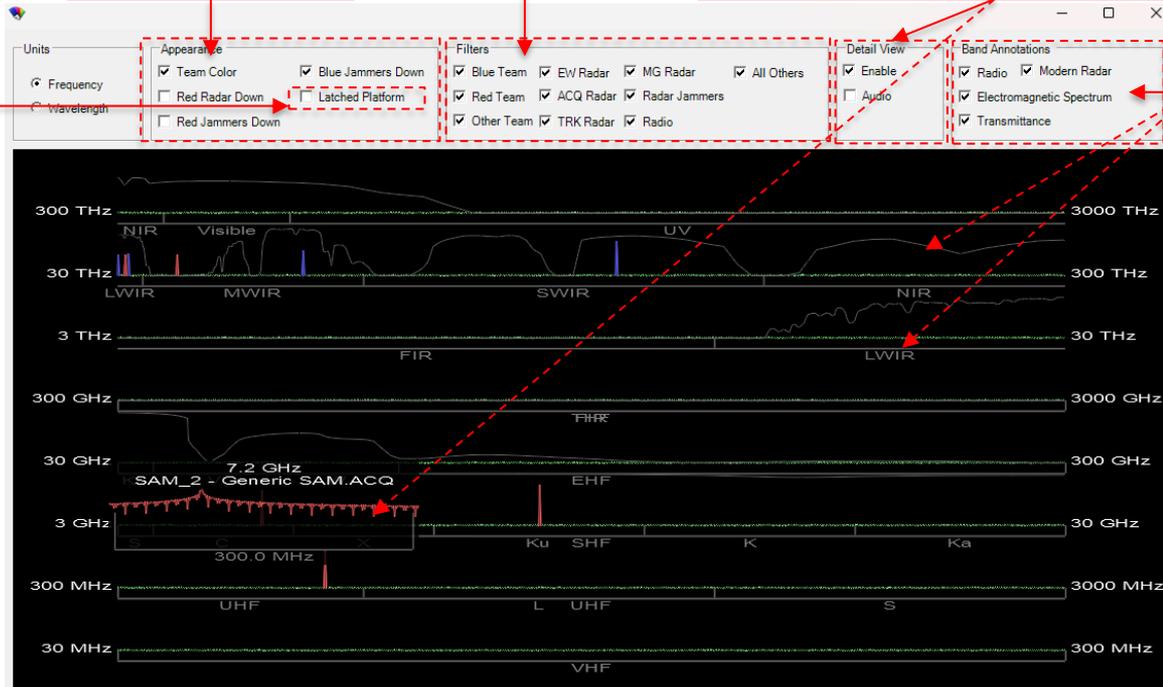
- Shows all transmitting EM Signals
- Unless Latched Platform is checked

Change position of emissions based on team / Jammer Or Radar

Filter based on emission type and team colour

Enables the 'draggable' spectrum magnifier emits audio for the emission of interest  
Rolling the mouse wheel will adjust the display bandwidth.

Only shows emissions as would be received by the latched platform  
**ELSE**  
shows entire EM Spectrum for mission



Grey Spectrum Titles  
Transmittance Lines

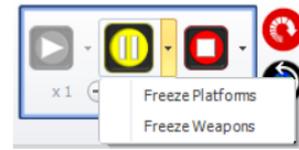
# MACE EW ANALYSIS TOOLS 2

## Weapon analysis

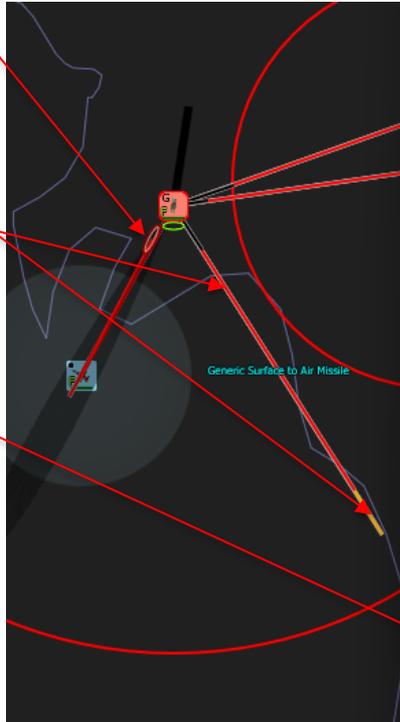


ANALYSIS → Info/Status Windows → Weapon Analysis

- Shows what each weapon on a platform is tracking
- Enables freezing of platforms and weapons



**Weapon Icon**



Don't switch when selecting other entities



'F' Indicates Frozen

NW\_Auto\_SAM (1 105 1027)

Weapons  Stay On Entity  Freeze Platforms  Freeze Weapons

**Generic Surface to Air Missile System**  
**Generic Surface to Air Missile System**  
**Generic Surface to Air Missile System**  
 Generic Surface to Air Missile (1 105 1081)

Select Weapon to view status below

**BOLD TYPE = Weapons ON selected platform**

**NORMAL TYPE = Weapons RELEASED by selected platform**

Weapon Status

Weapon Software: Generic Weapon Command

Status: Generic Surface to Air Missile Launched. Powered. 1089 knts  
 4.5 nm

Initial Target: THUNDER02  
 Current Target: THUNDER02  
 Internally Guiding to THUNDER02  
 RF Receiver: Generic SAM Seeker Tracking THUNDER02

Devices

Distance to Target:

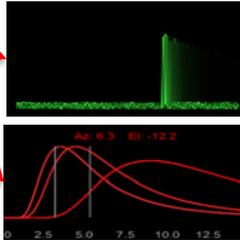
Opens EW Editor

**Status**

- Distance to target
- Initial Target
- Current Target
- Source of Guidance

Signal data

- A-Scope
- EOIR Wavelength vs. Amplitude
- Imaging Comparison View



# MACE EW ANALYSIS TOOLS 2

## Radar Detection Analysis Tool



ANALYSIS → Info/Status Windows → Radar Analysis Tool



Select platform with an active radar

Select a radar on the platform

Select an in-range target  
Grey = not detected  
Red = detected

The screenshot shows the Radar Detection Analysis Tool interface with several sections highlighted by red dashed boxes and numbered callouts (1-4). The interface includes a 'Units' section with 'Metric' selected, a 'Select Entity with Active Radar' dropdown showing 'C-RAM\_1', a 'Select Available Radar Device' dropdown showing 'Generic CIWS Radar', and a 'Potential In-Range Targets' list with '82mm Mortar HE' selected. The 'Platform telemetry' section displays coordinates, altitude, heading, velocity, and health. The 'Radar status and requirements to track' section shows radar settings like 'Enabled: True', 'Max Effective Range: 37.0 km', and 'Max Trackable Targets: 1'. The 'Tracked target Data' section shows target information for the '82mm Mortar HE' target, including coordinates, altitude, heading, velocity, and RCS. The 'Firing solution data' section shows target solution parameters like 'Slant Ring: 0.0 km', 'Pri: -', 'VMG: -362.8 knots', and 'Jammed: No'. The 'Detection status' section shows search and tracking capabilities. A 'Freeze Platforms' and 'Freeze Weapons' control panel is visible at the bottom.

Platform telemetry

Radar status and requirements to track

Tracked target Data

Firing solution data

Detection status for each platform on the sensor

Shows individual targeting information for every detected target for a specific radar on a specific platform

- (1) Mission must be running
- (2) Pick platform (with an active radar)
- (3) Pick sensor on platform
- (4) View data
- (5) Optional: Use 'Freeze Platforms' and 'Freeze Weapons'



# MACE EW ANALYSIS TOOLS 2

Student Exercise - [Link to Online Solution Video](#)

1. (00:09) Open Tutorial\_3.mis
2. (00:17) Use (Analysis Tab) 'Check LOS' tool and message window to see if the NW\_Auto\_AAA has line-of-sight to NASTY-01
3. (00:45) Do a 'Mask Analysis' for NW\_Auto\_AAA for the height and RCS of its target (NASTY-01) – then erase it
4. (01:33) Add a Generic CWIS system to the scenario (ensure it is 'powered' in platform properties)
5. (02:01) Use the Check LOS (Map Tool) to check LOS between the CWIS and a map point at an altitude of 1500 ft
6. (02:20) Add a generic SP Artillery system that is in range of the CWIS (use layer manager to see weapon ranges)
7. (02:46) Start the mission - switch off foam weapons - switch on unlimited ammo
8. (03:06) Assign a piece of ground near the CWIS as a target for the SP Artillery - assign weapons tight - check platform properties status window to check it is in range and if required - move the artillery closer to the target if required
9. (03:25) Use the 'Radar Detection Analysis' tool to display information about incoming artillery for the CWIS system
10. (04:09) Use the radar sweep display tool to display the radar sweep for the NW\_Auto\_SAM ACQ radar – change map brightness to make it more obvious – change the fade rate to 2s – close the radar sweep window
11. (05:21) Re-activate foam weapon mode - resurrect all entities - select unlimited ammo - close the radar sweep window
12. (05:42) Ensure the FW fighter is inside the MEZ of NW Auto SAM and being engaged - Open the 'Weapon Analysis Tool'
13. (06:17) When the SAM launches: - use the 'Weapon Analysis Tool' to 'freeze platforms' and 'freeze weapons'
14. (06:33) Open the EW devices on the weapon and note its receiver frequency
15. (07:04) Open the EW Spectrum Viewer - filter on 'Red Team' and 'MG Radar' - use the detail view window to look at the emissions - find the Missile Guidance emission for NW\_Auto\_SAM

Cont..



# MACE EW ANALYSIS TOOLS 2

## Student Exercise - [Link to Online Solution Video](#)

16. (07:50) Recheck the filters back on - find the IR plume for the missile in flight
17. (08:06) Enable the SP Jammer on THUNDER-02 - (if required) select 'blue-jammers down' on the spectrum viewer - use the 'detail view' to find the blue jamming signal - what radar is it jamming?
18. (08:46) Unfreeze platforms and weapons and stop the mission
19. (09:11) Using the 'Mask Analysis' show 3 simultaneous masks on the northeastern EW radar - for an RCS of 10 - at agl heights of 500ft, 1000ft, and 2500ft - in different colors
20. (10:00) Start the mission - display the analysis while the mission is running - stop the mission - erase the masks
21. (10:14) Display all tracking radar LOS masks at 500 agl then erase

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Learning objective:

- To be able to construct basic trigger-actions scripts in MACE

## Enabling objectives

- Know how to open the script editor
- Know how to create and name a new script
- Understand the different types of triggers
- Understand the AND / OR conditions for multiple triggers
- Know how to add and edit triggers
- Know how to enable / disable triggers
- Understand the different types of actions
- Understand the action completion condition
- Know how to add and edit actions
- Know how to reorder actions
- Understand the script completion actions
- Know how to skip actions during script execution
- Know how to import and export scripts for use in other missions

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Script Editor Overview

- Script Status List
  - Add New and Name
  - Unique Identifier
  - Copy and adjust
  - Manual Start/Stop
  - Buttonize for Later Missions
- Trigger Status List
  - Rename Script
  - Add Triggers
  - Edit Triggers
  - Set conditions AND/OR
- Action Status List
  - Per Script
  - Add Multiple Actions
  - Delete Actions
  - Change Order of Actions
  - Repeat/Skip
- End of Script Actions
  - Never Again
  - Reactivate Triggers
  - Continuous Repeat

SCRIPTING > Manage > Script Editor



The screenshot shows the MACE Script Editor interface with several key areas highlighted:

- SCRIPT NAMES AND STATUS:** A table listing scripts with columns for Index, Name, Time Trigger, Triggers Enabled, Executing, and Last Time Executed. A red box highlights the table, with labels for 'Unique Identifier' (pointing to the Index column) and 'Enable / Disable Triggers' (pointing to the Triggers Enabled column).
- TRIGGERS:** A section for editing triggers, including a 'TRIGGERS' table with columns for Index, Trigger, and Status. A large red text overlay 'IF THIS' is present. A red box highlights this section, with labels for 'AND / OR Toggle' (pointing to the Condition dropdown) and 'Script Name Make New Delete Edit Reorder' (pointing to the right-hand buttons).
- ACTIONS:** A section for editing actions, including an 'ACTIONS' table with columns for Index, Action, and Status. A large red text overlay 'THAT' is present. A red box highlights this section, with labels for 'Make New Delete Edit Reorder Repeat/Skip' (pointing to the right-hand buttons).
- Buttons:** A vertical column of buttons on the right side of the editor, including 'Add Script', 'Remove Script', 'Copy Script', 'Assign Script', 'Start Script', 'Stop Script', and 'Buttonize'. A red box highlights these buttons, with labels for 'Make New Delete Copy Assign Start/Stop Buttonize' and 'Reactivate / Stop / Repeat / Remove' (pointing to the bottom-most buttons).
- Variables:** A section for editing variables, including 'Number Variable' and 'String Variable' fields. A red box highlights this section, with a label for 'Variables'.

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## TRIGGERS

Scripting | Time | Entity | Entity 2 | Input

Persist "Met" status even if condition fails after it is met.

### Scripting

- Scripts executing or not
- Variable values met
- MACE Events

### Time

- Elapsed time
- Clock time
- Platform arrival time

### Entity 1

- Waypoint arrival / proximity
- Platform status (health speed etc)
- Platform weapon / target status
- Entity Properties

### Entity 2

- Aggregate status
- Radio calls

### Input

- Joystick buttons
- Receiving PDUs

## TIP – ACTIONS ARE USUALLY APPLIED TO PLATFORMS

Actions are usually applied to one or more platforms (but not always)

## TIP – TRIGGERS CAN BE AND – OR

**AND** means both triggers must be satisfied for the actions to commence; **OR** means only one must be. 'Persist Met' – triggers stay active

## ACTIONS

Scripting 1 | Scripting 2 | Mission 1 | Mission 2 | Navigation 1 | Navigation 2 | Behavior | Appearance | Equipment | Radio / TDL | Environment | ARMOR

### Scripting 1

- Delay / Start / Stop Scripts
- Enable / Disable Script triggers
- Set variable values
- Create scripts

### Scripting 2

- Execute code script
- Conditionals (If, Else, While, GoTo...)
- Raise Event
- Comment

### Mission 1

- Detonate munition
- Create platform
- Delete / Change
- Execute 9-line / CFF / 5 Line ...

### Mission 2

- Entity property
- Lock platform
- Set platform equipment
- Set variables / tags

### Navigation 1

- Climb / Descend / Accelerate / Turn
- Alt / Speed / Waypoints / Formation
- Tactic commands
- Assign landing zone / refueller

### Navigation 2

- Reposition
- Collision avoidance / Pathfinding
- Apply / Copy / Remove routes
- Loiter / Trailing effects

### Behaviour

- Posture – Weapon / Reaction / Team
- Assign Target / Proficiency
- Damage / Power States
- Invulnerable

### Appearance

- Weapon / Character / Action Stance
- Animation
- Articulated parts
- Custom appearance bits

### Equipment

- Change selected weapons
- Shoot Weapon
- Control Emitter

### Radio/TDL

- Play Audio
- Make Text to Speech call
- Make check in to entity

### Environment

- Visibility / Precipitation / Effects
- Cloud layers
- Winds / Seas States

Assign To Platforms

▼ Add

Add from Map

Group # 0 Add

Add from Last Action

Remove Selected Remove All

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## ACTION RULES

- Often actions need to be assigned to platforms but not always
- Actions execute in order
- Unless **“Action must finish before continuing”** is ticked next action starts immediately
- Can change order with [MOVE UP] / [MOVE DOWN] Buttons
- Actions can be skipped at runtime - good for testing

ACTIONS		
Index	Action	Status
0	Proceed En Recce_1, En Recce_2 to next waypoint. Adjust intent. Adjust speed to 10 MPH.	Waiting
1	Start Script: 1	Waiting
2	Speed <Ownship's Leaders> to 20 Knots. Apply to leg only	Waiting

Add ActionInsert ActionEdit ActionRemove ActionMove UpMove DownSkip/Repeat

## SCRIPT COMPLETION

- Do nothing** – usually for a script with not triggers
- Stop Execution and Disable Triggers** – script won't automatically execute again
- Stop Execution and Enable Triggers** – Script will automatically execute again if triggers met
- Repeat Actions** – continuously perform the actions in the action list
- Remove Script** – Deletes the script

### SCRIPT COMPLETION

- Stop Execution  Stop Execution & Disable Triggers  Stop Execution & Enable Triggers  Repeat Actions  Remove Script

**Script Action Editor**

**ACTION TYPES**

Scripting 1 | Scripting 2 | Mission 1 | Mission 2 | Navigation 1 | Navigation 2 | Behavior | Appearance | Equipment | Radio / TDL

Entity Property Equipment: [ ] Hardpoint: [ ]  
Property: [ ] Value: [ ]  
 Log Event Other: [ ] Message: [ ]  
 Set Platform Lock Apply to: Ownship [ ]  
Don't Change Offset [ ]  
 Set Platform Equipment Add [ ] 1 [ ] Equipment: [ ] Hardpoint: [ ]

**WHAT THE ACTIONS ARE**

Set Layer Tag Layer: [ ] Tag: Avoidance [ ] Set [ ]  
 Set Mission Number Var. Variable: [ ] Value: [ ]  
 Increment Mission Var. Variable: [ ] Increment: [ ]  
 Set Mission String Var. Variable: [ ] To Value [ ] Value: [ ]

**WHO WILL EXECUTE THE ACTIONS**

Assign To Platforms [ ] Add [ ]  
Add from Map [ ]  
Group # [ ] Add [ ]  
Add from Last Action [ ]  
Remove Selected [ ] Remove All [ ]

**WHEN NEXT ACTION IS ALLOWED TO START**

Completion  
Action is instantaneous; it is complete as soon as it is executed.

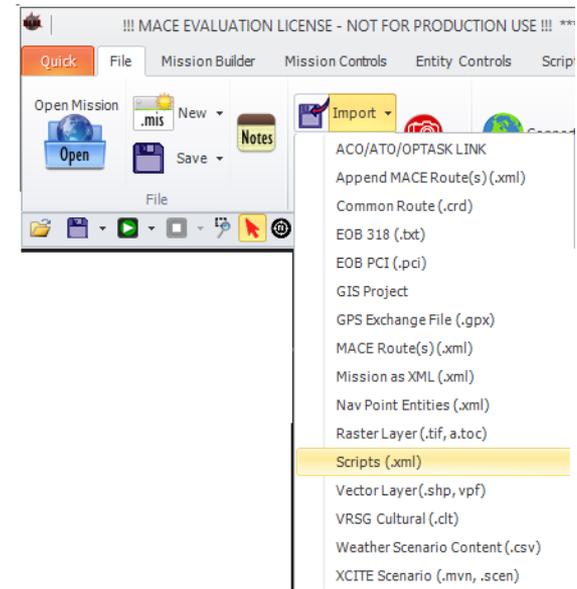
OK [ ] Cancel [ ]



# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Exporting and Importing Scripts

- **Beware:**
  - **Mission Specific Scripts** (i.e. with named platform callsigns) won't automatically work in a new mission – they will need to be edited to change the callsigns to match entities in the mission
  - **Buttonized scripts** will be fine – just apply to platform
- **Export via:**
  - **FILE → EXPORT → Scripts(.xml)**
  - Exports all scripts in editor to a folder
- **Import via:**
  - **FILE → IMPORT → Scripts(.xml)**
  - Can multi-select (with SHIFT Key)
- **Buttonized scripts** are saved outside of the mission file anyway – so can be viewed by importing as above



# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

### ▪ Script 1 – Basic Manual Execution Vehicle Delay

- Create new script: 01 Delay APC Advance (Manually Triggered)
- Actions
  - Stop APC\_3
  - Dealy 30s
  - Set APC\_3 speed 10mph

### ▪ Script 2 – Single Trigger Vehicle Delay

- Copy 01 Delay APC Advance (Manually Triggered)
- Name 02 Delay APC Advance (Time Triggered)
- Trigger
  - Mission Elapsed Time 5s (Persist Met)

*Persist met means that if trigger is no longer true, trigger stays ON*

### ▪ Script 3 – AND Trigger Vehicle Delay

- Copy 02 Delay APC Advance (Time Triggered)
- Name 03 Delay APC Advance (Time AND WP Triggered)
- Trigger
  - Add: WP Arrival APC\_5 WP3 (Persist Met)
  - Switch Triggers to AND type

*AND – both must be met at the same time – persist met leaves trigger ON so as soon as next trigger met actions are executed*

The image shows three screenshots of the MACE Mission Editor interface, illustrating different trigger and action configurations for a mission script.

**Script 1: 01 Delay APC Advance (Manually Triggered)**

- Name: 01 Delay APC Advance (Manually Triggered)
- Number Variable: 0
- String Variable: (empty)
- TRIGGERS: Condition: OR (selected), AND (unselected), Check Tr (checked)
- ACTIONS:
  - 0: Speed APC\_3 to 0 knots. (wait for action to finish.)
  - 1: Delay: 0 hours 0 minutes 30 seconds (wait for action to finish.)
  - 2: Speed APC\_3 to 10 MPH. (wait for action to finish.)

**Script 2: 02 Delay APC Advance (Time Triggered)**

- Name: 02 Delay APC Advance (Time Triggered)
- Number Variable: 0
- String Variable: (empty)
- TRIGGERS: Condition: OR (selected), AND (unselected), Check Tr (checked)
- ACTIONS:
  - 0: Mission Elapsed Time: 0 hours 0 minutes 5 seconds. (Persist)
  - 1: Delay: 0 hours 0 minutes 30 seconds (wait for action to finish.)
  - 2: Speed APC\_3 to 10 MPH. (wait for action to finish.)

**Script 3: 02 Delay APC Advance (Time Triggered)**

- Name: 02 Delay APC Advance (Time Triggered)
- Number Variable: 0
- String Variable: (empty)
- TRIGGERS: Condition: OR (selected), AND (unselected), Check Tr (checked)
- ACTIONS:
  - 0: Mission Elapsed Time: 0 hours 0 minutes 5 seconds. (Persist)
  - 1: Delay: 0 hours 0 minutes 30 seconds (wait for action to finish.)
  - 2: Speed APC\_3 to 10 MPH. (wait for action to finish.)

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 4 – Enter Formation based on another platform’s speed with delayed action

- Create new script: 04 Killer-02 Enter Trail Formation (Delay Trigger in Actions)

- Trigger

- Platform Speed PICKUP-99 greater than 80kts

*Single trigger – AND/OR doesn’t matter*

- Actions

- Formation Trail Killer-02 1km on PICKUP-99

- Delay until – Platform proximity Killer-01 within 3000ft of PICKUP-99

*Simply a trigger within the actions sequence that stops the sequence until met*

- Shoot Weapon – Flare regardless – Killer-01

Index: 4	Name: 04 Killer-02 Enter Trail Formation (Delay Trigger in Actions)
Number Variable: 0	String Variable:
<b>TRIGGERS</b> Condition: <input type="radio"/> OR <input checked="" type="radio"/> AND <input type="checkbox"/> Check Triggers Once	
Index	Trigger
0	Platform PICKUP-99 speed is greater than or equal to 80 knots. (Persist)
<b>ACTIONS</b>	
Index	Action
0	Formation Trail killer-02 with PICKUP-99.
1	Delay Until Platform Proximity Killer-01 is within 3000 feet of PICKUP-99. (wait for action to finish.)
2	Shoot weapon Flare (U.S.) from Killer-01 regardless if loaded.

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 5 – Pickup-99 to intent Killer-02 Maneuver then formation change
  - Create new script: 05 Pickup-99 Take Up Own Route - Killer-02 Maneuver and Change Formation
  - Trigger
    - Platform Killer-01 enroute to WP-3 *Single trigger – AND/OR doesn't matter*
  - Actions
    - Maneuver Mode Pickup-99 Intent
    - Proceed Pickup-99 to WP-3
    - Turn Killer-02 right 30 degrees
    - Altitude Killer-02 to 150ft (Wait force after 30s) *If you are unsure a condition will be met – use “force action after”*
    - Formation – Abreast Left Killer-02 with Pickup-99

Index:	5	Name:	05 Pickup-99 Take Up Own Route - Killer-02 Maneuver and Change Formation
Number Variable:	0	String Variable:	
<b>TRIGGERS</b>		Condition:	<input checked="" type="radio"/> OR <input type="radio"/> AND <input type="checkbox"/> Check Triggers Once
Index	Trigger		
0	Platform Killer-01 enroute to waypoint 3.		
<b>ACTIONS</b>			
Index	Action		
0	Maneuver Mode PICKUP-99 to Intent (route).		
1	Proceed PICKUP-99 to waypoint 3, Don't adjust intent, Don't adjust speed.		
2	Turn Killer-02 right 30 degrees.		
3	Altitude Killer-02 to 150 Feet. (Wait for action to finish, force next action after 30 seconds.)		
4	Formation Abreast Left Killer-02 with PICKUP-99.		

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 6 – Random Chance no persistent trigger with a non persistent prox trigger
  - Create new script: 06 - Killer-02 - Random Chance Malfunction Divert to Ship
  - Trigger - AND
    - Platform proximity Killer-02 within 15km of Mark Hamil (NOT persistent)
    - Random number with 50% chance checked every 20s (NOT Persist)
    - If both are true at same time actions commence
  - Actions
    - Set Landing Zone of Killer-02 to Mark Hamil (pick from map or type)
    - Assign Tactic RTB to Killer-02

*AND – both must be met **at the same time** – persist met leaves first trigger ON*

*Random number – continuously checks over period until true so as soon as random number is met AND aircraft within 15km of ship actions are executed*

Index: 6	Name: 06 - Killer-02 - Random Chance Malfunction Divert to Ship
Number Variable: 0	String Variable:
<b>TRIGGERS</b> Condition: <input type="radio"/> OR <input checked="" type="radio"/> AND <input type="checkbox"/> Check Triggers Once	
Index	Trigger
0	Platform Proximity Killer-02 is within 15 kilometers of Mark Hamil.
1	Random number with 30% chance checked every 20 seconds.
<b>ACTIONS</b>	
Index	Action
0	Set landing zone of Killer-02 to Mark Hamil and clear parking location.
1	Assign tactic return to base to Killer-02. (Wait for action to finish.)

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 7 – Weapon fired and Line of sight check (mixed persistent and non)– rally and behavior change

- Create new script: 07 Ground Troops Disengage go to LZ

- Trigger - AND

- Platform has shot weapon JEFF-01 (Persist)

- Line of Sight Between: JEFF-01 and Pickup-99

- Actions

- Offensive State (Group-1) Jeff and others – Weapons Hold

- Reaction Posture (Add from last action) Jeff and others – Do Nothing

- Rally (Add from last action) – LZ-1 offset 100m 150 degrees (force next after 300s) *In case one of the group is dead – the rest do the next action after delay*

- Character stance (Group-1) Jeff and others – Crouch

- Start Script that contains “08 Smoke”

*AND – both must be met at the same time – persist met leaves first trigger ON*

*Weapon shot even once – trigger stays ON*

*When Jeff “sees” the inbound helicopter both are met*

*Instead of using trigger – executing another script from this script*

The screenshot shows the MACE Mission Editor interface for a script named "07 Ground Troops Disengage go to LZ". The script is configured with the following triggers and actions:

TRIGGERS	
Index	Trigger
0	Platform JEFF-01 has shot a weapon. (Persist)
1	Line Of Sight Between: JEFF-01 and PICKUP-99

ACTIONS	
Index	Action
0	offensive state JEFF-01,Human_1,Human_2 to Weapons Hold.
1	Reaction Posture JEFF-01,Human_1,Human_2 to Do Nothing.
2	Rally JEFF-01,Human_1,Human_2 to LZ-1. Offset 100 meters. Offset 150 degrees. (wait for action to finish, force next action after 300 seconds.)
3	Character Stance Human_2,Human_1,JEFF-01 to Crouching.
4	Start scripts with name that contains "08 Smoke" and any script platform.

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 8 - Embedded trigger in script triggered by another – multiple actions

- Create new script 08 Smoke on LZ when at pickup and Helo in range

- Triggers – None

*Instead of using trigger – this script is executed from actions of another script*

- Actions

- Assign tactic RTB to Pickup 99 (do NOT wait to finish)

*Trigger in script – delays actions until trigger is met*

- Delay until Proximity Pickup-99 500m of LZ-1

- Assign Tactic Loiter Killer-01 – Racetrack radius 500m, length 2000, 330 deg at LZ1

- Detonate Munition Smoke grenade – on Mark

- Offensive State Kiler-01 Weapons Free

The screenshot displays the MACE Mission Editor interface for a script named "08 Smoke on LZ when at pickup and Helo in range". The script index is 8. The triggers section is empty, and the condition is set to "OR". The actions section contains five entries:

Index	Action
0	Assign tactic return to base to PICKUP-99.
1	Delay Until Platform Proximity PICKUP-99 is within 500 meters of LZ-1. (Wait for action to finish.)
2	Assign tactic loiter to Killer-01. Parameters: circular, clockwise, radius 500 m, race track 2000 m, orientation 330 deg, at location LZ-1.
3	Detonate munition Smoke Grenade (Blue) on Mark.
4	Offensive State Killer-01 to Weapons Free.

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 9 - Attaching to aircraft before takeoff with force action after 60s

- Triggers (AND)

- Helicopter Property on Ground = True
    - Platform Proximity Pickup-99 is within 100m of LZ-1

*AND script to make sure helicopter has landed at or near the LZ only*

- Actions

- Character stance (Jeff Squad) Jeff and others – Upright
    - Weapons Stance (Jeff Squad) Jeff and others to Stowed
    - Attach (Jeff Squad) Jeff and others to Pickup 99 (force after 60)
    - Assign tactic Takeoff Pickup-99 (Wait for action to finish)
    - Reverse Waypoints Pickup-99
    - Proceed Pickup-99 to nearest waypoint, intent, 100kts

*Force after – accounts for the condition where one of the group is dead*

The screenshot displays the configuration for Script 9 in the MACE Mission Editor. The script is named "09 Pickup and depart (force action after 60s)". It is configured with an AND condition for its triggers and a series of actions.

TRIGGERS	
Index	Trigger
0	Entity PICKUP-99 property IsOnGround is true.
1	Platform Proximity PICKUP-99 is within 100 meters of LZ-1.

ACTIONS	
Index	Action
0	Character Stance Human_2,Human_1,JEFF-01 to Upright.
1	Weapon Stance JEFF-01,Human_1,Human_2 to Stowed.
2	Attach JEFF-01,Human_1,Human_2 to PICKUP-99, Next Available Attachment Point. (Wait for action to finish, force next action after 60 seconds.)
3	Delay: 0 hours 0 minutes 4 seconds (Wait for action to finish.)
4	Assign tactic takeoff to PICKUP-99. (Wait for action to finish.)
5	Reverse Waypoints of PICKUP-99.
6	Proceed PICKUP-99 to nearest waypoint, Adjust intent, Adjust speed to 100 Knots.
7	Delay: 0 hours 0 minutes 0 seconds (Wait for action to finish.)

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Examples to automate Basic MACE Mission:

- Script 10 Separate Script for formation on Pickup for all AH includes T/O – Triggered by script 9 executing and not executing (has run)
  - Triggers (AND) – Script has run
    - Script Index 9 (or whatever it is) Executing (Persist Met)
    - Script Index 9 (or whatever it is) Executing (don't persist)
  - Actions
    - Delay Until Pickup-99 enroute WP-2
    - Assign Tactic Takeoff Killer-01 and Killer 02 (if airborne it is ignored)
    - Formation Killer 02 – Pickup-99 315 degrees 1km
    - Formation Killer 01 – Pickup-99 045 degrees 1km

*A script has run monitoring trigger – first trigger active when script runs and persists ON – when script finishes running second trigger activates*

Index: 10	Name: 10 Vanguard Fomation for Killers on Pickup
Number Variable: 0	String Variable:
<b>TRIGGERS</b> Condition: <input type="radio"/> OR <input checked="" type="radio"/> AND <input type="checkbox"/> Check Triggers Once	
Index	Trigger
0	Script Index 9 Executing. (Persist)
1	Script Index 9 Not Executing.
<b>ACTIONS</b>	
Index	Action
0	Delay Until Platform PICKUP-99 enroute to waypoint 2. (wait for action to finish.)
1	Assign tactic takeoff to Killer-01,Killer-02. (wait for action to finish.)
2	Formation Killer-02 with PICKUP-99 at 315 degrees. Set formation distance to 1 kilometers.
3	Formation Killer-01 with PICKUP-99 at 45 degrees. Set formation distance to 1 kilometers.

# MACE INTERMEDIATE MISSION EDITING SCRIPTING

## Student Exercise - [Link to Online Solution Video](#)

1. (00:11) Make a mission that includes: 1x Enemy vehicle (in a flat area) with a waypoint route (ideally on a road), and route speed of 5mph - 5 x Civilians - 1 x Friendly attack aircraft
2. (01:25) Add a 'known point' with callsign 'IED' and label 'Boom' near the end of the vehicle route
3. (02:12) Create a script that has 2 triggers that must both be satisfied: - (1) Mission elapsed time >5s - (2) Proximity of the aircraft to the vehicle <1000ft
4. (03:17) Add the actions: - (1) the vehicle returns to intent - (2) it steers to waypoint 2 - (3) it has a speed of 30 mph - (4) detonation of a large weapon at the known point
5. (04:24) Set the script completion action to 'stop execution & enable triggers'
6. (04:36) Start the mission and use the entity control window to fly the aircraft within 1000ft of the vehicle
7. (05:21) Observe the script execution in the script window and in ARMOR/MACE
8. (06:36) Disable the triggers for the script
9. (06:46) Set up a route for the aircraft that passes over the vehicle repeatedly at 500ft agl - place the aircraft in intent
10. (07:08) As the triggers are disabled the script won't execute automatically - Manually execute the script
11. (08:37) Remove the script

# MISSION EDITING BUTTONIZED SCRIPTS

## Learning objective:

- To be able to make buttonized scripts that can be applied in different missions

## Enabling objectives

- Recap if this then that scripting
- Understand buttonized scripts must be abstracted from referring to specific mission entities
- Know how to make a simple script suitable for buttonization
- Understand the different save options for buttonized scripts
- Know how to save a buttonized script and move into the correct category
- Know how to retrieve a buttonized script
- Know how to apply a buttonized script in a mission
- Understand the functions of the pseudo code logical functions in the script editor

# MISSION EDITING BUTTONIZED SCRIPTS

## Script Editor Overview

### Script Status List

- Add New and Name
- Unique Identifier
- Copy and adjust
- Manual Start/Stop
- Buttonize for Later Missions

### Trigger Status List

- Rename Script
- Add Triggers
- Edit Triggers
- Set conditions AND/OR

### Action Status List

- Per Script
- Add Multiple Actions
- **(Usually) Assigned to a Platform**
- Delete Actions
- Change Order of Actions
- Repeat/Skip

### End of Script Actions

- Never Again
- Reactivate Triggers

SCRIPTING > Manage > Script Editor



**Unique Identifier**

**Enable / Disable Triggers**

**Manual Execution**

**SCRIPT NAMES AND STATUS**

Index	Name	Time Trigger	Triggers Enabled	Executing	Last Time Executed
16	AddRadio		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
15	09 - North Uhl Helo	+00:00:05	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00:11
14	02 - Lofted Laser Guide and Des	+00:00:05	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00:11
13	99 - (Unused) Regen Tanks		<input checked="" type="checkbox"/>	<input type="checkbox"/>	
12	03 - East Joint Fires Fighters + NGS	+00:00:05	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	12:00:11
10	08 - Central Helo Free EF Attack RTB for Fuel and Repeat		<input checked="" type="checkbox"/>	<input type="checkbox"/>	

**TRIGGERS**

IF THIS

**ACTIONS**

Index	Action	Status
0	Execute CFF on form #3 mission #1.	Completed
1	Delay: 0 hours 0 minutes 30 seconds (wait for action to finish.)	Completed
2	Execute CFF on form #4 mission #1.	Completed
3	Delay: 0 hours 1 minutes 0 seconds (wait for action to finish.)	Executing
4	Execute 9-Line attack w/o IP on form #2.	Waiting
5	Assign tactic takeoff to Smdrone_1,Smdrone_2,Smdrone_3,Smdrone_4,Smdrone_5,Smd...	Waiting
6	Set Target for Smdrone_1,Smdrone_2,Smdrone_3,Smdrone_4,Smdrone_5,Smdrone_6,SMD...	Waiting
7	Maneuver Smdrone_3,Smdrone_4,Smdrone_5,Smdrone_6,Smdrone_7,Smdrone_8,SMD...	Waiting
8	Offensive state Smdrone_1,Smdrone_2,Smdrone_3,Smdrone_4,Smdrone_5,Smdrone_6,SMD...	Waiting
9	Delay: 0 hours 1 minute 30 seconds (wait for action to finish.)	Waiting
10	check fire CFF on form #4 mission #1.	Waiting
11	Delay until Platform vs-86 has shot a weapon. Type: Generic Air to Ground Miss...	Waiting
12	Delay: 0 hours 1 minutes 0 seconds (wait for action to finish.)	Waiting
13	Offensive state Smdrone_1,Smdrone_2,Smdrone_3,Smdrone_4,Smdrone_5,Smdrone_6,SMD...	Waiting

**SCRIPT COMPLETION**

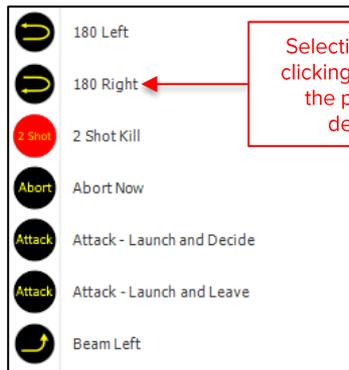
Reactivate / Stop / Repeat / Remove

# MISSION EDITING BUTTONIZED SCRIPTS

## Making scripts abstracted - usable in any mission

- **SPECIFIC:** Scripts that refer to specific platforms can only be used in the mission in which they were created
- **ABSTRACTED:** Scripts that refer to script variable rather than specific callsign can be applied to platforms in any mission
  - These scripts can be Buttonized and appear on the **Scripting toolbar**
  - These scripts are saved in folders outside of a mission file – they can be imported to edit
  - Select a platform and click the button to apply the script

### Buttonized Scripts



Selecting an air platform and clicking this button would turn the platform through 180 degrees to the right

### Mission Specific Entities

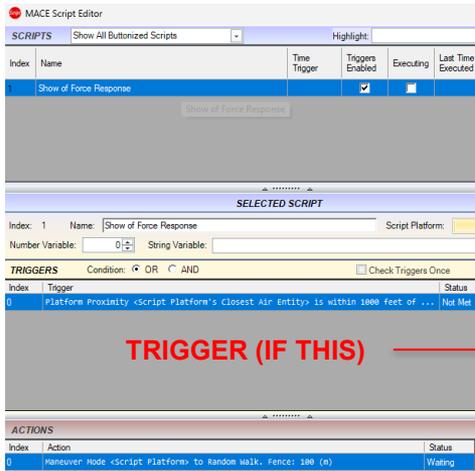
Scripting Variables	Mission Entities
	Generic S_2
	Generic S_6
	Generic T_4
	Generic T_7
	Radar_3
	Radar_5

### Abstract Entities (Scripting Variables)

Scripting Variables	Mission Entities
<Ownship>	
<Ownship's Next Callsign>	
<Ownship's Target>	
<Ownship's Leader>	
<Camera Platform>	
<Camera Target>	
<Script Platform>	
<Script Platform's Next Callsign>	
<Script Platform's Next Callsign + 1>	
<Script Platform's Next Callsign + 2>	
<Script Platform's Next Callsign + #>	
<Script Platform's Assigned Target>	
<Script Platform's Formation Leader>	
<Script Platform's Last Formation Leader>	
<Script Platform's Leader's Target>	
<Script Platform's Wingman in Formation>	
<Script Platform's Attached Platform>	
<Script Platform's Closest Ground Entity>	
<Script Platform's Closest Ground Friendly>	
<Script Platform's Closest Ground Enemy>	
<Script Platform's Closest Ground of Other Team>	
<Script Platform's Closest Air Entity>	
<Script Platform's Closest Air Friendly>	
<Script Platform's Closest Air Enemy>	
<Script Platform's Closest Air of Other Team>	
<Script Platform's Closest Vehicle>	
<Script Platform's Closest Friendly Vehicle>	
<Script Platform's Closest Vacant Friendly Vehicle>	
<Script Platform's Closest Enemy Vehicle>	
<Script Platform's Closest Friendly Type##TYPE##>	
<Script Platform's Closest Enemy Type##TYPE##>	

# MISSION EDITING BUTTONIZED SCRIPTS

## Example of using script variables

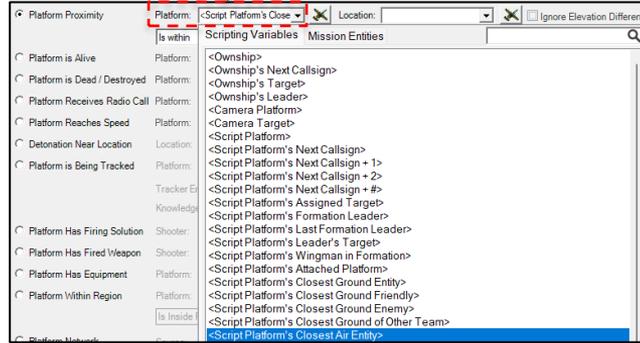


TRIGGER (IF THIS)

ACTION (THEN THAT)

TRIGGER

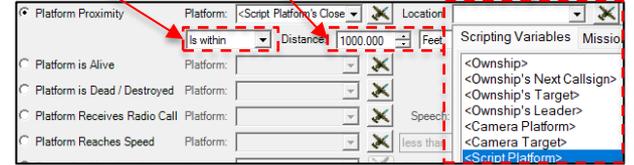
<Script Platform's Closest Air Entity>



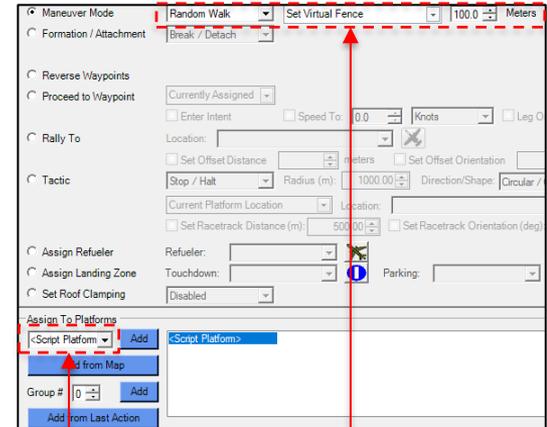
Is Within

1000ft

<Script Platform>



ACTION



<Script Platform>

Random Walk

227



# MISSION EDITING BUTTONIZED SCRIPTS

## Buttonize save options and storage

- When script is complete:
  - (1) Select script and click [Buttonize]
  - (2) Select a path (The appropriate folder)
    - Air to Air
    - Air to Ground
    - Platform
    - etc.
  - (3) Choose an Icon
  - (4) Select Options
- Buttonized scripts can be imported into any mission – edited and re-saved

**Buttonize Script Path**  
Select where to save the script to.

Buttonize Path  
C:\Users\Public\Documents\MACE\xml\Scripts\Buttonize\Show\_of\_Force\_Response.xml

**Buttonize Icon Path**  
Select the button icon for the script.

Icon Path (Optional)  
commit\_conditional\_32.png

**Buttonize Options**  
Select additional options for the buttonized script.

Display in Script List When Executed     Create Independently of Selected Platform

Show map select cursor when buttonized script is created. Allow selection of:  Platform  Location  
Selected item is saved in script.string variable.

Show String Dialog, label: \_\_\_\_\_ populate with: Nothing

Show Integer Dialog, label: \_\_\_\_\_

< Back    Finish    Cancel

If many of these executing don't tick or it will cause clutter

Required for scripts that accept a script string variable input e.g. location

For scripts that don't require an assigned platform (e.g. weather change)

Allows user to pick from a list to enter a string variable

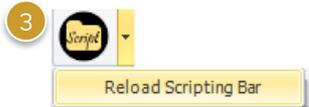
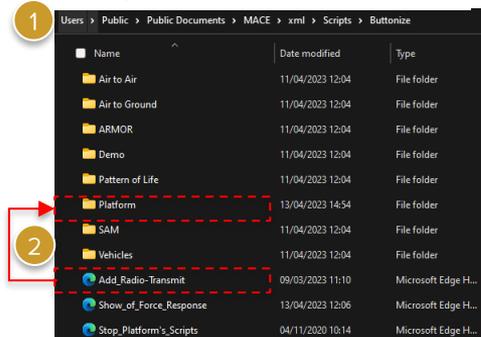
Allows user to enter a number variable

# MISSION EDITING BUTTONIZED SCRIPTS

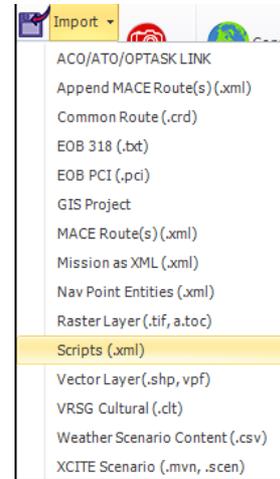
## Moving and Editing buttonized scripts

- Edit scripts where the original mission is missing
  - FILE → Import/Export → Import → Scripts (.xml)
- Moving Scripts
  - (1) C:\Users\Public\Documents\MACE\xml\Scripts
  - (2) Move script to new folder
  - (3) If MACE is running – Reload Scripting Bar to reorganise the buttons

### Moving Scripts



### FILE → Import



# MISSION EDITING BUTTONIZED SCRIPTS

## Pseudo Code – Conditions in Scripts

- In addition to basic sequential flow
  - First to last action
- Scripts can use logical basic statements
  - Delay Until – Stop the sequence until something is true
  - Perform loops
  - Conditional statements
  - Go-to's
- Statements can be nested inside each other

○ Comment

○ If  Select Trigger

○ Else If  Select Trigger

○ Else

○ End If

○ While  Select Trigger

○ End While

| ACTIONS |  |
|---------|--|
| Index   | Action   |
| 0       | <b>If Platform &lt;Script Platform&gt; does not have equipment Generic Radio at any hard ...</b>               |
| 1       | Set Platform Equipment Generic Radio up 1 for <Script Platform>.   |
| 2       | Make Radio Call: I have a new radio and I am using it to transmit messages f...                                |
| 3       | <b>Else</b>  |
| 4       | Make Radio Call: I have an old radio and I am using it to transmit messages ...                                |
| 5       | <b>End If</b>  |
| 1       | <b>While Platform Proximity &lt;Script Platform&gt; is within 1 nautical miles of &lt;Any Red Team Grou...</b> |
| 2       | Set Target for <Script Platform> to call sign <Script String Variable - This Script>.                          |
| 3       | Maneuver Mode <Script Platform> to Move To Target.   |
| 4       | Offensive State <Script Platform> to weapons Tight.  |
| 5       | Delay Until Platform <Script String Variable - This Script> is dead. (Wait for action to...                    |
| 6       | <b>End While</b>   |

- **Comments** – Don't perform any action used to explain to the user what the next collection of actions is for
- **While** – Takes a trigger; all the time trigger condition is true the actions within the while statement will be repeated; if the while condition fails the next action run is AFTER the **End While** statement
- **If** – takes a trigger; and runs the actions ONCE inside the if statement
- **Else If** – follows an **if** and is an additional statement to check and execute actions within – if the first **if** is not true, it cycles through each **else if** statements to see if their condition is true and executes the actions within
- **Else** – is catch all after **If** or **If Else** statements – it executes if none of the conditions in the other if statements are true

# MISSION EDITING BUTTONIZED SCRIPTS

## Pseudo Code – Conditions in Scripts

### Independent IF Statements

- ⊕ IF A
  - ⊕ ... do C actions
- ⊕ End IF
- ⊕ If B
  - ⊕ ... Do D actions
- ⊕ End IF

One or both of these actions may be accomplished.

- If only A is met, then C actions are performed.
- If only B is met, then D actions are performed.
- If A and B are met, then both C and D actions are performed.
- If neither A nor B are met, then no actions are performed.

### If / Else If / Else

- ⊕ IF A
  - ⊕ ... do C actions
- ⊕ Else If B
  - ⊕ ... do D actions
- ⊕ Else
  - ⊕ ... Do E actions
- ⊕ End IF

Only one set of actions will be accomplished.

- If A is met, then C actions are performed. Once the C actions are complete, the script will continue after the End If.

- If A is not met, then the B condition is checked. If B is met, then D actions are performed. Once the D actions are complete, the script will continue after the End If.

- If both A and B are not met, then the E actions are performed. Once the E actions are complete, the script will continue after the End If.

### Nested IF and Else IF Statements

- IF A
  - ... do V actions
  - If B
    - do W actions
  - Else
    - do X actions
  - End IF
- Else
  - Do Z actions
- End IF

Multiple sets of action may be accomplished

- If A is met, then V actions are performed. Rather than jumping to the End If, scripting will check if the B condition is satisfied. If it is met, then W actions are performed. The script skips past the X actions because B was met, performs the Y actions, then continues after the last End IF shown.

- If A is met, then V actions are performed. Rather than jumping to the End If, scripting will check if the B condition is satisfied. If it is not met, then W actions are skipped and X actions are performed. The script then performs Y actions, then continues after the last End If shown.

- If A is not met, then scripting skips everything within the A block and jumps to the last Else case to perform the Z actions, then continues after the last End If Shown.

# MISSION EDITING BUTTONIZED SCRIPTS AND PSEUDO CODE

## Calling/Creating Buttonized Scripts from Other Scripts

- Call a buttonized script from any other script
  - Replaces selecting platform manually
  - Pressing button
  - Entering data / clicking map
- Need to Specify:
  - <Script Platform>
  - User Inputs
    - <Script String Variable>
    - <Script Integer Variable>
- Name – what appears when script is ‘created’ in scripts list

The screenshot shows the 'Script Action Editor' window. The 'Create Script' section is active. A red dashed box highlights the 'Name' field (containing 'Land at LZ'), the 'Script' dropdown (containing 'Buttonize Land\_at\_Known\_LZ.xml'), and the 'String Variable' dropdown (containing 'LZ-2'). A red arrow points from the 'Name' field to a label 'Name to appear in script list'. Another red arrow points from the 'Script' dropdown to a label 'Buttonized Script to Execute'. A third red arrow points from the 'String Variable' dropdown to a label 'User Inputs'. Below the 'Create Script' section, the 'Assign To Platforms' section is visible, with a red dashed box around the 'Add' button and the platform list (containing 'AH-64\_5'). A red arrow points from this box to a label 'Scripted Platform(s)'. The 'Execute Code Script' section is also visible, with a 'Source File' dropdown and a 'Select' button.

# MISSION EDITING BUTTONIZED SCRIPTS

## Example – Air to Air Post Shot Crank

- Trigger
  - (1) <Script Platform> property: IsSupportingAirborneMissile = TRUE
- Actions
  - (2) Calling Another Buttonized Script on <Scripted Platform>
  - (3) ‘Wait while loop’ – Condition: IsSupportingAirborneMissile = TRUE
  - (4) Standard 180 turn relative to <Closest Air Enemy>

The screenshot shows the MACE Script Editor window. At the top, there's a 'SCRIPTS' table with columns for Index, Name, Time Trigger, Triggers Enabled, Executing, and Last Time Executed. A script named 'Post Shot Crank' is selected. Below this is the 'SELECTED SCRIPT' section with fields for Index (1), Name (Post Shot Crank), and Script Platform (Typhoon\_9). The 'TRIGGERS' section shows a single trigger with Index 0, Trigger 'Entity <Script Platform> property IsSupportingAirborneMissile is true.', and Status 'Not Met'. The 'ACTIONS' section contains four actions: 0 'Offensive State <Script Platform> to weapons hold.', 1 'Create Script "" from "buttonizeAir to AirCrank\_Left.xml", Integer = 0, String = "", Assigned to: <Scr...', 2 'While Entity <Script Platform> property IsSupportingAirborneMissile is true.', 3 'End While', and 4 'Turn <Script Platform> 180 degrees relative to: <Script Platform's Closest Air Enemy> (wait for action t...'. The 'SCRIPT COMPLETION' section at the bottom has radio buttons for 'Stop Execution', 'Stop Execution & Disable Triggers', 'Stop Execution & Enable Triggers', 'Repeat Actions', and 'Remove Script'.

This dialog box is titled 'Entity Property'. It has fields for 'Entity' (set to '<Script Platform>'), 'Equipment', and 'Hardpoint'. The 'Property' is set to 'IsSupportingAirborneMissile' and the value is 'Is True'. There are 'OK' and 'Cancel' buttons at the bottom.

This dialog box is titled 'Create Script'. It has a 'Name' field (set to 'buttonizeAir to AirCrank\_Left.xml') and a 'Script' field with a 'Select...' button. There are fields for 'String Variable' and 'Integer Variable'. There are checkboxes for 'Evaluate Variable', 'Save This Script's Index to New Script's Integer Variable', and 'Save New Script's Index to This Script's Integer Variable'. There is an 'Assign To Platforms' section with an 'Add' button and a list of platforms including '<Script Platform>'. There are also 'Add from Map', 'Add', and 'Add from Last Action' buttons.

This dialog box is titled 'Turn Left / Right'. It has a 'Turn' field (set to 180.0) and a 'Degrees' field. There are checkboxes for 'Relative To' (checked) and 'Shortest Direction of Turn' (checked). The 'Relative To' field is set to '<Script Platform's Closest Air Enemy>'. There is a 'Turn' button.

# MISSION EDITING BUTTONIZED SCRIPTS

## Evasion (Reaction Posture) Scripts

- Beam Break Lock
  - Trigger
    - Is the response to threat – no other conditional triggers required
  - Actions
    - Scripting 1 – Set Number Variable to 0 (Counter)
    - Scripting 2 – **While** – Trigger
      - While Script Number Variable Less than 2
    - Equipment – Shoot Weapon “Chaff” regardless
    - Scripting 1 – Delay “0.2”
    - Scripting 1 – Increment script number variable
    - Scripting 2 – **End While**
    - Navigation 1 – Turn Left/Right “90” – Relative to <Scripted Platform’s Highest RADAR Threat>
    - Navigation 1 – Speed to “40”
    - Set Landing Zone – “” – clears it
    - Assign Tactic “Land”

```
Set number variable of this script to 0.
While Is Number Variable of this script Less than 2
  Shoot weapon Chaff (U.S.) from <Script Platform> regardless if loaded.
  Delay: 0 hours 0 minutes 0.2 seconds (wait for action to finish.)
  Increment number variable of this script by 1
End While
Turn <Script Platform> 90 degrees relative to: <Script Platform's Highest RADAR Threa...
Speed <Script Platform> to 40 Knots.
Set landing zone of <Script Platform> to nothing and clear parking location.
Assign tactic land to <Script Platform>. (wait for action to finish.)
```

# MISSION EDITING BUTTONIZED SCRIPTS

## Student Exercise

1. Make a new mission
2. Open the script editor
3. Add a new script called “Add Radio and Transmit”
4. There are no triggers – the button will be the trigger
5. In the actions add the IF action from Scripting 2 tab and select a Trigger ‘Entity Has Equipment’ - <Script Platform> - Does Not Have - Generic Radio  at any hardpoint
6. Insert inside the IF statement an action from Mission 2 tab to ‘Set platform equipment’ – Add – 1 – Generic Radio – no hardpoint; assign this to <Script Platform>
7. Insert another action inside the IF statement from the Radio/TDL tab – Make a Radio Call – “Text for the call” – on a frequency of your choice; assign this to <Script Platform>
8. Insert an Else statement from the Scripting 2 tab
9. Inside the Else statement Insert action from the Radio/TDL tab – Make a Radio Call – “Text for the call” – on a frequency of your choice; assign this to <Script Platform>
10. Ensure the end IF comes after all of the above – use the Move Up/Down buttons to get all in the right place
11. Save your mission
12. Play your mission and test your script by adding a Generic Human to the map – Assign this as the Script platform for you script and Execute
13. If your script function correctly for both conditions buttonize it pressing the Buttonize button
14. Change the folder where the script is to be stored to the ‘Platform’ folder
15. Choose an icon for you script
16. Select the appropriate options for the script – none – and finish
17. Load and start a new mission – e.g. Tutorial 3 – add a human without a radio and test your script



# MACE FORM CONTROLLED ATTACKS COMMON

## Learning objective:

- To understand the common elements of the MACE Form-based attacks and be able to use to conduct simple attacks from each form.

## Enabling objectives

- Understand the common sequence of steps for all form-based attacks (ATOPE)
- Know how to assign attacking asset in each form type
- Know how to assign target in each form type
- Know how to select ordnance/weapons in each form type
- Know how to select attack parameters in each form type
- Know how to select execution type in each form type

# MACE FORM CONTROLLED ATTACKS COMMON

Sequence for ALL form based attacks

## ATOPE!

- Select **ASSET(s) ATTACKING**
- Select **TARGET(s)**
- Select **ORDNANCE/WEAPONS** (Type, Number, fuse etc)
- Select **PARAMETERS OF ATTACK** (FAH, Distribution, Asset Spacing, Release Range etc)
- Select **EXECUTION TYPE** (Now, TOT, TTT, Fire-Plan)

# MACE FORM CONTROLLED ATTACKS COMMON

## Select Attacking ASSET

### CAS 9-Line

9-Line (Close Air Support) (4)

Type: 1 | IP / BP: Alt: 10000 ft | MSL

2. Heading: Offset: None

3. Distance: Calc

4. Tgt Elev: 0 ft MSL

5. Tgt Desc: Tgt Loc: Mark: 1111

6. Tgt Loc: Code: 1111

7. Location of Friendlies: Observer: FAH 360 Alt: 10000 ft Distance: 10 nm

Final Leg Dist (Level/Lof): 50% Max Range

Guns Strafe Dist: 0 (m)

# of Bombs / Rockets: 1 at 0.05 (s)

Attack Timing / Initiation

Asset Spacing: 00:30

Time: Push When Ready

Allow Reciprocal Send VMF Status

Attack via IP Attack via IP Reattack Show of Force Hold at IP

Air Assets

Some Final Attack Heading All Aircraft Insert Into Existing Route Enter Formation at Egress

Asset 1: FAH 360 Alt: 180 Any Direction PRF: 1111 Aircraft Self-Designates

Asset 2: FAH 360 Alt: 180 Any Direction PRF: 1111 Aircraft Self-Designates

Asset 3: FAH 360 Alt: 180 Any Direction PRF: 1111 Aircraft Self-Designates

Asset 4: CV-22-KNFE-72 CV-22-KNFE-71 A-10C-HG-01 AH-64-UGLY-11 AH-64-UGLY-12 PRF: 30 Aircraft Self-Designates

### 5-Line

5-Line Form (Gunship / Rotary Wing) (2)

Asset Type: Gunship Rotary Wing

Attack Type: Later Run-In Stand-Off EP Hold @ BP

Observer: Warning Order

Actual Location: Given Location: Marked By: Target Location: Set From Given Friendly Location Rng: 0 (m) Mag Bearing: 0 (m) (deg) D (deg) Target Location: Adjust Dir: North Rng: 0 (m) Target Description / Mark: Remarks: Other: Time: At My Command

Message to Observer

Run-In Fire and Control

Attack Direction: 360 Direct Dive Angle: Standard Asset Spacing: 15 (s)

Altitude (ft): 250 Pop Direction: Left Egress: Right

Execute Check Fire Later Target CCA

Air Assets

Asset #1: CV-22-KNFE-72 CV-22-KNFE-71 AH-64-UGLY-11 PRF: 30 Aircraft Self-Designates

Asset #2: UK V880at HMA Mk2-R32 PRF: 30 Aircraft Self-Designates

Asset #3: Quadcopter\_lammer\_South\_Lam\_1 PRF: 30 Aircraft Self-Designates

### Call For Fire

Call For Fire (Artillery) (4)

Observer: Platform: Aggregate Artillery Unit: 120mm Mortar (M120-M120\_1) Max # of guns: 6 within: 800 (meters)

# of Missions: 1 Send MTD

Target: Keen Point: Target Location: Target Altitude: Target Description: # AB1000

Amunition: Coord Rum: Delay: 30

Ordnance: Last Round: Adjust Fire

Direction: Observer to Target: Gun to Target: GTL: (m) (deg) (deg) (Auto)

Distribution: Pattern: Circular

Speed: 1000 Trajectory: Low High

Vertical Offset (Parachute): Relative Up/Down Offset: Parachute Release at AGL

Offset: Time On Target: 00:00 Time To Target: 00:02 Continuous: 00:00 Fire Plan: 18:00 (18:00)

Method of Control: At My Command

Mission Type: N/A

Calculate

5-Line Form (Gunship / Rotary Wing) (1)

Asset Type: Gunship Rotary Wing

Observer: Warning Order

Actual Location: Given Location: Marked By: Target Location: Set From Given Friendly Location Rng: 0 (m) Mag Bearing: 0 (m) (deg) D (deg) Target Location: Adjust Dir: North Rng: 0 (m) Target Description / Mark: Remarks: Other: Time: At My Command

Message to Observer

Run-In Fire and Control

Attack Direction: 360 Direct Dive Angle: Standard Asset Spacing: 15 (s)

Altitude (ft): 250 Pop Direction: Left Egress: Right

Execute Check Fire Later Target CCA

Air Assets

Gunship: Target: Asset #1

Ordnance: Burst: 15

5-Line Form (Gunship / Rotary Wing) (1)

Asset Type: Gunship Rotary Wing

Observer: Warning Order

Actual Location: Given Location: Marked By: Target Location: Set From Given Friendly Location Rng: 0 (m) Mag Bearing: 0 (m) (deg) D (deg) Target Location: Adjust Dir: North Rng: 0 (m) Target Description / Mark: Remarks: Other: Time: At My Command

Message to Observer

Run-In Fire and Control

Attack Direction: 360 Direct Dive Angle: Standard Asset Spacing: 15 (s)

Altitude (ft): 250 Pop Direction: Left Egress: Right

Execute Check Fire Later Target CCA

Air Assets

Asset #1: CV-22-KNFE-72 CV-22-KNFE-71 AH-64-UGLY-11 PRF: 30 Aircraft Self-Designates

# MACE FORM CONTROLLED ATTACKS COMMON

## Select TARGET

### CAS 9-Line

The screenshot shows the CAS 9-Line interface with four assets (Asset 1-4) and target selection options. A red dashed box highlights the 'Multiple Targets' button for each asset. A second red dashed box highlights a list of target IDs: 251\_10, 251\_11, 251\_6, 251\_7, 251\_8, and 251\_9.

### 5-Line

The screenshot shows the 5-Line interface with two assets (Asset #1 and Asset #2). A red dashed box highlights the 'Multiple Targets' button for each asset. A second red dashed box highlights a list of target IDs: BALL-BELL, MGR-PLT FV, EF-CRP, EF-WCR-1, EF-FOR, and EF-Supply Arty Base. A third red dashed box highlights the 'Ordnance' field for Asset #1.

### Call For Fire

The screenshot shows the Call For Fire interface with various fire control parameters. A red dashed box highlights the 'Target Location' field. Other parameters include 'Observer', 'Platform', 'Artillery Unit', 'Attack Type', 'Ordnance', 'Rate', 'Vertical Offset', and 'Method of Fire'.

The screenshot shows the Target List Asset 1 interface with target selection options. A red dashed box highlights the 'Add Current Tgt' and 'Multi Select From Map' buttons. A table below shows target call signs and PRF values.

| Target Callsign | Target Location | PRF  |
|-----------------|-----------------|------|
|                 |                 | 1111 |

The screenshot shows the 5-Line (Gunship / Rotary Wing) (1) interface with target selection options. A red dashed box highlights the 'Target' field.

The screenshot shows the 5-Line (Gunship / Rotary Wing) (1) interface with target selection options. A red dashed box highlights the 'Target' field.



# MACE FORM CONTROLLED ATTACKS COMMON

## Select ORDNANCE

### CAS 9-Line

9-Line (Close Air Support) (4)

Type: 1. IP / BP: Alt: 10000 ft  
2. Heading: Offset: None  
3. Distance: 0.5 MSL  
4. Tgt Elev: 0.5 MSL  
5. Tgt Desc: 1.2 at 0.05 (s)  
6. Tgt Loc: Code: 1111  
7. Mark: Code: 1111  
8. Location of Friendlies: Observer: FAH 360 +/- 180 Any Direction  
9. Egress: 360 Alt: 10000 ft Distance: 10.5 nm

Final Leg Dist (Level/Loft): 50% Max Range  
Guns Strafe Dist: 0 (m)  
# of Bombs / Rockets: 1.2 at 0.05 (s)

Attack Timing / Initiation  
Asset Spacing: 00:30  
Time: Push V/then Ready  
Allow Reciprocal Send VMF Status  
Attack via IP Attack via IP Reattack Show of Force Hold at IP

Air Assets  
Same Final Attack Heading All Aircraft Insert Into Existing Route Enter Formation at Egress  
Asset 1: FAH 360 +/- 180 Any Direction PRF: 1111 Aircraft Self-Designates Multiple Targets  
Asset 2: FAH 360 +/- 180 Any Direction PRF: 1111 Aircraft Self-Designates Multiple Targets  
Asset 3: FAH 360 +/- 180 Any Direction PRF: 1111 Aircraft Self-Designates Multiple Targets  
Asset 4: FAH 360 +/- 180 Any Direction PRF: 1111 Aircraft Self-Designates Multiple Targets  
Ordnance: GBU-32V2B FMU152 Impact AGM-155 JASSM GAU-4 20mm GBU-32V2B GBU-32V4B

### 5-Line

5-Line (Gunship / Rotary Wing) (2)

Observer: Warning Order  
Asset Type: Gunship Rotary Wing  
Attack Type: EP Hold @ BP  
Asset 1: No asset selected  
Asset 2: No asset selected  
Asset 3: No asset selected  
Asset 4: No asset selected

Ordnance: AGM-114 HELIX AGM-179 JAGM M29 Rocket HE M29 Rocket HE M29 Rocket HE

Run-In Fire and Control  
Attack Direction: 360 Direct Dive Angle: Standard Asset Spacing: 15 (s)  
Altitude (ft): 250 Pop Direction: Left Egress: Right  
Execute Check Fire Later Target CCA

### Call For Fire

Call For Fire (Artillery) (4)

Observer: Platform: Artillery Battery  
# of Missions: 1 Send MTD Aggregate Artillery Unit Max # of guns: 6 within: 800 (meters)

Target: Keen Point Target Location: Target Altitude: Target Description: # AB1000  
Ordnance: 120mm Mortar Blum 120mm Mortar HE 120mm Mortar HE 120mm Mortar HE 120mm Mortar HE  
Method of Fire: Coord Blum Delay: 30 (s) Requires 2+ Guns Round: 1.5 # Per Tube  
Distribution: Pattern: 120mm Mortar DPCM 120mm Mortar HE 120mm Mortar Blum 120mm Mortar HE 120mm Mortar HE  
Spread: 120mm Mortar HE 120mm Mortar HE

Vertical Offset (Parachute): Offset: Grid LR: (m) AD: (m) Relative Up/Down Offset: Parachute Release at AGL: Method of Control: At My Command  
Time On Target: 18:00:00  
Time To Target: 00:02:00  
Continuous: Fire Plan: 18:00:00 to 18:00:00

5-Line (Gunship / Rotary Wing) (1)

Observer: Warning Order  
Asset Type: Gunship Rotary Wing  
Attack Type: EP Hold @ BP  
Asset 1: No asset selected  
Ordnance: AGM-114 HELIX AGM-179 JAGM M29 Rocket HE M29 Rocket HE M29 Rocket HE



# MACE FORM CONTROLLED ATTACKS COMMON

## Select Profile & Delivery PARAMETERS

### CAS 9-Line

The screenshot shows the CAS 9-Line mission editor. The 'Attack Type' dropdown is set to 'BP' and is highlighted with a red dashed box. The 'Asset 1' through 'Asset 4' sections are visible, each with a 'Dive' dropdown menu. The 'Dive (20)' option is selected for Asset 1 and is highlighted with a red dashed box. The 'Final Leg Dist' and 'Guns Steer Dist' are also visible in the 'Approach / Delivery' section.

### 5-Line

The screenshot shows the 5-Line mission editor. The 'Attack Type' dropdown is set to 'BP' and is highlighted with a red dashed box. The 'Asset 1' through 'Asset 4' sections are visible, each with a 'Dive' dropdown menu. The 'Dive (20)' option is selected for Asset 1 and is highlighted with a red dashed box. The 'Attack Direction' and 'Dive Angle' are also visible in the 'Run-In Fire and Control' section.

### Call For Fire

The screenshot shows the Call For Fire mission editor. The 'Method of Fire' dropdown is set to 'Circular' and is highlighted with a red dashed box. The 'Fire For Effect' section is also visible, showing options for 'Rounds', 'Rate', and 'Trajectory'. The 'Message to Observer' section is also visible.

The screenshot shows the 5-Line mission editor. The 'Asset Type' dropdown is set to 'Gunship' and is highlighted with a red dashed box. The 'Ordnance' dropdown is set to '15' and is highlighted with a red dashed box.

The screenshot shows the 5-Line mission editor. The 'Attack Type' dropdown is set to 'Stand-Off' and is highlighted with a red dashed box. The 'Asset 1' section is visible, showing a 'Dive' dropdown menu.



# MACE FORM CONTROLLED ATTACKS COMMON

## Select EXECUTION Type - Timing For Initiation

### CAS 9-Line

9-Line (Close Air Support) (4)

Type: 1- Line

1. IP / BP: Alt: 10000 ft

2. Heading: Offset: None

3. Distance:

4. Tgt Elev: 0 ft MSL

5. Tgt Desc:

6. Tgt Loc:

7. Mark: Code: 1111

8. Location of Friendlies:

Observer: AA

9. Egress: 360 Alt: 10000 ft

Distance: 10 nm

Final Leg Dist (Level/Loft): 50% Max Range

Guns Strafe Dist: 0 (m)

# of Bombs / Rockets: 1 at 0.05 (s)

Attack Timing / Initiation

Asset Spacing: 00:30

Time: Push When Ready

Push When Ready

Time On Target

Time To Target

Fire Plan

### 5-Line

5-Line Form

Asset Type: Gunship Rotary Wing

Attack Type: Loner Run-In Stand-Off

Observer: Warning Order

Actual Location: Given Location: Marked By:

Target Location: Set From Given Friendly Location: Ring: 0 ft (m) Mag Bearing: 0 (m) (deg) Target Location: Adjust Dir: North Prog: 0 (m)

Target Description / Mark: Other

Remarks:

Timing: At My Command

At My Command

Time On Target At Time

Time To Target From Now

Continuous Repeat Interval

Fire Plan

Run-In Fire and Control: Asset Spacing: 15 (m)

### Call For Fire

Call For Fire (Artillery) (4)

Observer: Platform: Artillery Battery

# of Missions: 1 Send MTD

Target: Weaven Point

Target Location: Adjust Fire

Target Altitude: 0 (m) Auto

Target Description: # AB1000

Direction: Observer to Target Mag Gun to Target OTL: 0 (m) (deg) Auto GTL: 0 (m) (deg) Auto

Ammunition: Coord Num: Delay: 30 (s) Requires 2+ Guns

Ordnance: Last Round:

Distribution: Pattern: Circular

Speed: Trajectory: Low High

Vertical Offset (Parachute): Relative Up/Down Offset: Parachute Release at AGL

Offset: Grid LR: 0 (m) AD: 0 (m) Polar Dist: 0 (m) Angle of Sight: Auto U/D: Auto

Method of Fire: Fire For Effect Rounds: 1 Per Tube

Rate: Initial Volley: Interval: # Respected Volleys: # Suppression: All Guns: Interval: Duration: Method of Control: At My Command

At My Command

Time On Target: 18:00:00

Time To Target: 00:02:00

Continuous: 18:00:00 (s) (18:02:00)

Message to Observer: Actual GTL (img) Angle T: Shut Pluck: Parachute AB AGL: Max On MSL: Dist / AB To Tgt: Time of Flight: PER / PED: Impact Time

Mission Type: N/A

Record Target End of Mission

# MACE FORM CONTROLLED ATTACKS COMMON

## Execute

### CAS 9-Line

9-Line (Close Air Support) (4)

Type: 1-IP / BP

Alt: 10000 ft

Offset: None

Heading: 0

Distance: 0

Tgt Elev: 0

Tgt Desc: MSL

Tgt Loc: 0

Mark: 1111

Code: 1111

Observer: FA

Egress: 360 Alt: 10000 ft

Distance: 10 nm

Approach / Delivery

Final Leg Dist (Level/Loft): 50% Max Range

Guns Strafe Dist: 0 (m)

# of Bombs / Rockets: 1 at 0.05 (s)

Attack Timing / Initiation

Asset Spacing: 00:30

Time: Push When Ready

Allow Reciprocal Send VMF Status

Attack via IP Attack via IP Reattack

Show of Force Hold at IP

### 5-Line

5-Line Form (Gunship / Rotary Wing) (2)

Asset Type: Gunship Rotary Wing

Attack Type: Loiter Run-In Stand-Off

EP: Hold @ EP

Observer: FA

Actual Location: Friendly Location (Mark)

Given Location: Marked By

Set From Given Friendly Location Ring: 0

Mag Bearing: 0 (m) 0 (deg)

Target Location: Target Location

Adjust Dir: North Ring: 0 (m)

Target Description / Mark: Marked By: Other

Remarks: Other

Timing: Time: At My Command

Message to Observer

Run-In Fire and Control

Attack Direction: 360 Direct Dive Angle: Standard Asset Spacing: 15 (s)

Altitude (ft): 250 Pop Direction: Left Egress: Right

Execute Check Fire Loiter Target

### Call For Fire

Call For Fire (Artillery) (4)

Observer: FA

Platform: Artillery Battery

Attack Type: Aggregate

# of Missions: 1 Send MTD

Max # of guns: 6 within: 800 (meters)

Target: Weaven Point

Target Location: Adjust Fire

Target Altitude: 0 (m) Auto

Target Description: # AB1000

Ammunition: Coord Num: Delay: 30 (s) Requires 2+ Guns

Method of Fire: Fire Effect: Rounds: 1 Per Tube

Rate: Initial Volley: 1

Suppression: All Guns

Vertical Offset (Parachute): Relative Up/Down Offset: Parachute Release at AGL

Message to Observer: Actual GTL (mag) Angle T: Shut Pluck: Parachute AB AGL: Max On MSL: Dist / AB to Tgt: Time of Flight: PER / PED: Impact Time

Mission Time: 18:00:00

Time On Target: 00:02:00

Continuous: 18:00:00 (sec)

Fire Plan: 18:00:00 to 18:00:00

Record Target End of Mission

Execute Check Fire Return To Intent

Fire and Control

Loiter Target

Execute Check Fire Return To Intent

# MACE FORM CONTROLLED COMMON

Student Exercise – No Solution Video Yet

1. (.)

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Learning objective:

- To be able to use the 9-Line form to carry out simple controlled air to ground attacks within MACE

## Enabling objectives

- Understand the components of the 9-Line form (Aircraft control, Weapon Delivery, and Information)
- Know how to enter attack start point data
- Understand how target location is handled within the form
- Know how to enter target location data and transfer to attacking aircraft
- Know how to enter egress data
- Know how to perform a show of force on a given line of attack
- Know how to attack a specific moving vehicle on a given line of attack without using an IP
- Know how to attack a target using a known point (IP) for ingress and a known point for Egress
- Understand how what will happen if a reattack is commanded
- Know how to abort an attack, and what the aircraft will do when aborting
- Know how to output flares
- Understand the weapon parameters (multiple bombs, strafe distance, close far release etc)

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Recap Adding Weapons

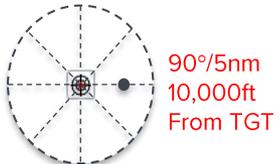
- (1) Access Weapons and Equipment Form
  - Via the Context Menu
    - RMB on Platform > Weapons and Equipment
  - Via Platform Properties
    - Bottom of form – Weapons >>
- (2) Use the filters to find weapons
- (3) Use to add / Remove weapons
  - > Add 1 x Weapon
  - <-- Remove 1 x Weapon
  - <<-- Remove ALL weapons
- (4) Change Quantity of Weapons
- (5) Enable/Disable Auto
  - Allows constructive (semi automatic) use weapons/ equipment

The screenshot displays the MACE interface with several key components:

- Platform Properties: US\_UAV\_3**: Shows status, location (39 52 31420', 9 1.38861'), speed (90 kts), and target information (39 9103, 9 2254).
- Weapons & Equipment (HG-02)**: A table listing various weapons and their properties. A red dashed box highlights the 'AGM 852Z/L MAVERICK' row, with callout 3 pointing to the 'SCL' column and callout 4 pointing to the 'Auto Enabled' checkbox. Callout 5 points to the 'Selected Weapon' column.
- Standard Conventional Load**: A dialog box showing the current loadout. A red arrow points to the 'Load' button.
- Properties**: A panel on the right showing various parameters like Landing Zone Callsign, Leg Altitude (15900 ft), and Location (39 52 31385', 9 1.57115').
- Actions**: A panel at the bottom right with buttons like 'Copy/Move', 'Kill Entity', and 'Delete'. A red dashed box highlights the 'Weapons >>' button with callout 1.

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

4 -START POINT – IP (3D) (Optional)



Or Known Point From List  
Or generate keyhole points

5 –END POINT (3D)



Or Known Point From List

6 -NO. OF WEAPONS AND RELEASE RANGE

- Select Number
- Select Release Range (%/nm)
- Select Release Interval (s)
- Strafe Distance (if required)

1 -AIR ASSET, WEAPON, PROFILE

- Select Aircraft
- Select Weapon
- Select Fuse
- Select Attack Profile

2 –TARGET(S)

- Either:
- Type
  - Pick From Map
  - Pick From List
  - Multiple Any of the above

3 –ATTACK HEADING (+DESIGNATE)

- FAH +/- Tolerance
- PRF (if required)
- Self Designate (if no external mark)
- Set Laser code

8 –DURING ATTACK  
DON'T FORGET

Clear Hot Abort

9-Line (Close Air Support) (1)

Type: 9-Line

1. IP / BP: 90 Alt: 10000 ft  
Distance: 5 nm

2. Heading: Offset: None

3. Distance:

4. Tgt Elev: 0 ft MSL

5. Tgt Desc:

6. Tgt Loc:

7. Mark: Code: 1688

8. Location of Friendlies:

Observer: Generic Human - Human\_2

9. Egress: 360 Alt: 10000 ft  
Distance: 10 nm

---

Approach / Delivery

Final Leg Dist (Level/Loft): 25% Max Range

Guns Strafe Dist: 130 (m)

# of Bombs / Rockets: 1 at 0.05 (s)

---

Attack Timing / Initiation

Asset Spacing: 00:30 MSL

Time: Push When Ready

Allow Reciprocal

Attack via IP Attack w/o IP Reattack

Show of Force Hold at IP

---

Air Assets

Same Final Attack Heading All Aircraft  Insert Into Existing Route  Enter Formation at Egress

Asset 1: Generic Fighter - AirOv Generic Aircraft Bullet Default

FAH: 360 +/- 180 Any Direction Laser: Good Heading Dive (30)

PRF: 1111  Aircraft Self-Designates  Multiple Targets

32T QK 00199 80381

Flare Clear Hot Abort

Asset 2: Default

FAH: 360 +/- 180 Any Direction

PRF: 1111  Aircraft Self-Designates  Multiple Targets

Flare Clear Hot Abort

Asset 3: Default

FAH: 360 +/- 180 Any Direction

PRF: 1111  Aircraft Self-Designates  Multiple Targets

Flare Clear Hot Abort

Asset 4: Default

FAH: 360 +/- 180 Any Direction

PRF: 1111  Aircraft Self-Designates  Multiple Targets

Flare Clear Hot Abort

7 -COMMENCE ATTACK METHOD

- Select Spacing (1s Aircraft)
- PWR / TOT / TTT / Fire Plan
- Attack From: IP/No IP
- Show of Force / Hold at IP



# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Attack Without IP – No Start Point

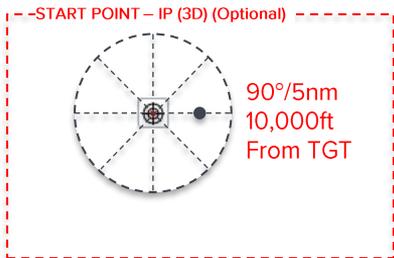
- Air asset will self-generate waypoints to arrive on final attack heading. Must have:
  - Air Asset Info**
    - (1) Weapon – Fuse – Profile
    - (2) Target Location
    - (3) Attack Heading
    - (4) Who designates (matched PRF with designator if not self designating)
  - Ingress Altitude + Egress Altitude and Position**
    - (5) Ingress Altitude
    - (6) Egress Altitude and end position (relative to target)
  - (7) Approach and Delivery Parameters**
    - Can leave as default if required
  - Attack Timing / Initiation**
    - (8) Spacing – between assets (wpm on target) – not required if only 1 asset
    - (9) Time
      - Push when ready = immediate attack
      - Time to Target = time from pressing the button e.g. 2mins 35 secs
      - Time on Target = Mission time for weapons to impact target e.g. 12:45:30
      - Fire Plan = on fire plan (see later lesson)

The screenshot shows the '9-Line (Close Air Support) (1)' mission configuration window. It is divided into several sections:

- 9-Line:** Contains fields for Type (1), IP/BP (90), Alt (10000 ft), Distance (5 nm), Heading, Tgt Elev (0 ft MSL), Tgt Desc, Tgt Loc, Mark, Code (1688), and Location of Friendlies.
- Air Assets:** A list of four assets. Asset 1 is selected, showing 'Generic Fighter - AirOx' and 'Generic Aircraft Bullet'. Other fields include 'Laser: Good Heading', 'Dive (30)', and 'RED'. Callout 1 points to this section.
- Approach / Delivery:** Includes 'Final Leg Dist (Level/Loft): 25% Max Range', 'Guns Strafe Dist' (slider), and '# of Bombs / Rockets: 1 at 0.05 (s)'. Callout 7 points to this section.
- Attack Timing / Initiation:** Includes 'Asset Spacing: 00:30', 'Time: Push When Ready', and 'Attack via IP / Attack w/o IP / Reattack' options. Callout 8 points to the spacing field and callout 9 to the 'Push When Ready' button.
- Messages:** A text area at the bottom showing 'JTAC, AirOver\_3, Targeting location 32T QK 00199 80381, Over.'

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Attack Via IP – A specified 3D Start Point



- Air asset will fly via a specified start point to target
- Must have – All the required elements for Attack w/o IP and:
  - IP/BP – Either
    - (1) Select a heading and distance FROM target – to be start point OR
    - (2) A Known Point 
    - OR
    - (3) Generate Keyhole Points from target – then select as Known Point
      - (4) Pick an Echo Point and a radius to generate **known points** at North/East/South/West Compass points
    - (5) Select from list as with **Known Points** (2) 

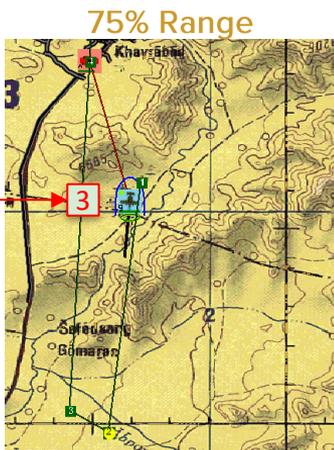
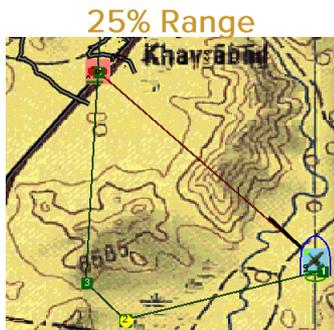
# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Attack Without IP – No Start Point

### % Max Range

- Changes run in length for the attack and point at which weapon is released

Final Leg Dist (Level/Loft): 25% Max Range



Original line up waypoint

### Strafe Distance

- Strafe distance across the ground beyond the target along the FAH

Guns Strafe Dist: 0 (m)



### Number of Bombs and Interval

- Number of weapons released PER AIRCRAFT in the attack and interval between releases

# of Bombs / Rockets: 1 at 0.05 (s)

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

## Student Exercise - [Link to Online Solution Video](#)

1. (00:10) Place a JTAC and several EF platforms on the ground including: - moving vehicles on a route - cultural buildings (from MACE Cultural)
2. (03:28) Add to the mission: - 2 x Fighter type ground attack aircraft (e.g. Generic Fighter) - 1xBomber Aircraft - 1xUAV (in a figure-8 orbit)
3. (04:44) Add at least 5 unguided bombs to the bomber
4. (05:08) Add 2 known points about 7nm from the target area - Change their callsign and labels to something sensible - Ensure the labels are visible on the mission area
5. (06:50) Start the mission
6. (07:05) Use the 9-Line Form to: - instruct a 'Fighter Aircraft' to perform an immediate show of force - not using an IP- on a southeast to northwest FAH over the target set- egressing to the north 5nm / 20,000ft
7. (09:19) Manually dispense flares at the overflight point
8. (09:27) Use the 9-line to set up 2 fighter aircraft 30s trail attack at 500ft ingress AGL from an IP with a sensible FAH for the IP position, pop dive an unguided bomb on to target. Egress to 6000ft North 3nm.
9. (11:59) Clear first aircraft Hot
10. (12:18) Abort the second aircraft
11. (12:42) Perform a reattack on the same form
12. (13:14) Abort the first aircraft and clear the 2<sup>nd</sup> hot
13. (13:49) Repeat using only 1 Aircraft but this time: - a loft profile - on a different FAH - attacking without IP - cleared hot
14. (14:39) In the layer manager Weapons tab ensure: - target line, guidance, altitude and type are ticked
15. (15:10) Use a new 9-Line to instruct 'Fighter Aircraft' to: - use a guided weapon (e.g. GBU), self designated - attack from medium level (10,000ft) – starting from a key-hole point B-5 on a northerly attack heading - egressing to the overhead

Cont..

# MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

Student Exercise - [Link to Online Solution Video](#)

16. (17:05) Clear the aircraft hot
17. (17:20) Observe the weapon release to impact: - weapon target line - aircraft guidance line and PRF - impact
18. (18:20) In environment settings set surface wind 180 10kts and a 5,000ft wind of 30kts from 180 and 10,000ft wind 180 at 50kts – then tick winds effect aircraft and winds effect weapons
19. (19:04) Setup a new CAS-9 Line form with the bomber – drop 4 unguided weapons from 25,000ft onto one of the ground targets attacking on 90° or reciprocal – using 270 / 7nm as a start point
20. (20:09) Send the bomber to hold at the IP
21. (20:21) Attack via IP
22. (20:45) Clear the aircraft hot and watch the trajectory of the aircraft and the bombs
23. (21:40) Use CTRL+ALT to view the bomb impact points on the MACE map
24. (21:57) Reset winds to not affect weapons or aircraft
25. (22:09) Use a new 9-Line to instruct a 'Fighter Aircraft' to: - attack a moving target - high angle dive strafe (guns) - without-IP - with a spread of rounds over the ground
26. (24:47) Use CTRL+ALT to view the bullet impact points on the MACE map

# MACE FORM CONTROLLED ATTACKS 2 – ADVANCED CAS

## Learning objective:

- To be able to use the 9-Line form to carry out advanced coordinated attacks within MACE

## Enabling objectives

- Understand what the range and weapon release timing parameters of the 9-Line form do
- Know how to ground designate using a ground platform entirely from the MACE GUI
- Understand what laser attenuation system settings do
- Know how to change aircraft and designation platform pulse repetition frequencies for laser attacks
- Know how to complete a Time on Target autonomous self lased PGM attack
- Understand how MACE displays laser designation in the mission area
- Know how to conduct a bomb on coordinate ground designated laser attack
- Know how to conduct a multiple aircraft attack with multiple targets

# MACE FORM CONTROLLED ATTACKS 1 - CAS

## Off Platform Laser Designation

- SET UP 9-LINE FOR LASER WEAPON DELIVERY

- ENSURE 'Aircraft Self-Designates' is **UNCHECKED**
- Set the ASSET PRF in the 9-LINE Form

Same Final Attack Heading All Aircraft  
Asset 1: A-10C - A-10C\_1  
FAH: 350 +/- 20 330° to 10°  
PRF: 1688  Aircraft Self-Designates

- SELECT PLATFORM FROM MISSION AREA (AIR OR GROUND) TO BE DESIGNATOR

- LMB on entity in Mission Area
- OR
- Use Bottom Status Bar Entity List
- If platform has no Laser Designator: Use PLATFORM PROPERTIES **Weapons >>** to Load one in inventory

**Add Equipment**  
Click to add the highlighted equipment from the left list to the platform.

| Name                        | Auto / Enabled                      |
|-----------------------------|-------------------------------------|
| Active Denial System        | <input checked="" type="checkbox"/> |
| ALXJ Directed Energy Weapon | <input checked="" type="checkbox"/> |
| Flarelight                  | <input type="checkbox"/>            |
| Flarestick                  | <input type="checkbox"/>            |
| GPS                         | <input checked="" type="checkbox"/> |
| IR Pointer                  | <input type="checkbox"/>            |
| IR Pointer (Check)          | <input type="checkbox"/>            |
| IR Strobe                   | <input type="checkbox"/>            |
| Laser Designator            | <input checked="" type="checkbox"/> |

- SET LASER CODE (PRF) FOR THE DESIGNATOR TO MATCH AIR ASSET PRF

- ENTITY CONTROL WINDOW (PRF)
- OR
- Use PLATFORM PROPERTIES (General>Laser Designator Code)

Entity Control  
KTS: Hdg: Alt: Feet MSL FL  
PRF: 1688

Platform Properties: USAJTAC\_19  
Status  
USAJTAC\_19  
USAJTAC\_19 1 x U.S. Health: 100%  
JTAC  
DIS Type: 3, 1, 225, 1, 32, 1, 2  
DIS ID: Site: 1, App: 100, Entity: 1019  
Location: 41P 652461E 1465081N  
Speed: 0 mph  
Alt: 0 ft MSL, 0 ft AGL  
Heading: 050.0 (true) / 050.0 (mag)  
Properties  
Connections  
Data Link  
General  
Armed Fitch (deg) 0  
Call Sign: USAJTAC\_19  
Is Squarter  Is Squarter  
Label  
Laser Designator Code: 1688  
Log Route Data  Log Route Data

- ALLOCATE TARGET TO DESIGNATOR

- Use and select from mission area
- OR
- Type in target coordinate into PLATFORM PROPERTIES (>Navigational)

- MANUALLY FIRE DESIGNATOR LASER (VERIFY PRF)

- Use ENTITY CONTROL Menu
- Select LASER DESIGNATOR from dropdown
- Check on Mission Area for yellow designation line with correct PRF

Release Selected  
IR Strobe  
Smoke Grenade (Green)  
Smoke Grenade (Red)  
Laser Designator  
Laser Range Finder with GPS  
Laser Range Finder with GPS



|                           |                         |
|---------------------------|-------------------------|
| Target Location (Lat/Lon) | 39 12.62308; 9 26.56328 |
| Target Location (MGRS)    | 325 NJ 36769 40210      |

# MACE FORM CONTROLLED ATTACKS 1 – CAS

## Multiple Targets

- Multiple targets per asset
- Use for JDAM multi-DPI
- Can use for multiple LGB/LGM with different PRF

The screenshot displays the MACE FORM software interface, divided into two main panels. The left panel, titled 'Air Assets', contains configuration settings for four assets. Each asset configuration includes a dropdown for the asset type, a 'Generic' weapon selection, and numerical input fields for FAH (Final Attack Heading) and PRF (Pulse Repetition Frequency). Asset 1 is configured with 'Generic Fighter - Deat', 'Generic GBU-500', FAH 70, and PRF 1788. Asset 2 is 'Generic Fighter - Glory' with 'Generic JDAM', FAH 360, and PRF 1212. Assets 3 and 4 are currently blank. The right panel, titled 'Target List Asset 2', shows a table of target assignments. The table has columns for 'Target Callsign', 'Target Location', and 'PRF'. The 'SPArty\_14' target is highlighted in yellow. Below the table are buttons for 'Copy Targets to All Assets' and 'Close'.

| Target Callsign | Target Location    | PRF  |
|-----------------|--------------------|------|
| SPArty_14       | 32T ML 36088 23596 | 1111 |
| Tank_2          | 32T ML 36047 23557 | 1111 |
| G-SSM_10        | 32T ML 36098 23504 | 1111 |
| Tank_7          | 32T ML 35956 23545 | 1111 |

# MACE FORM CONTROLLED ATTACKS 1 – CAS

## Time on Target / Time to Target

- Attack Timing

- Push when ready = immediate attack
- Time to Target = time from pressing the button e.g. 2 mins 00 secs

Time: Time To Target 00:02:00

- Time on Target = Mission time for weapons to impact target e.g. 18:00:00

Time: Time On Target 18:00:00

- To help with selecting a good TTT or TOT

- Use the Attack via IP OR Attack w/o IP dropdown to – Estimate TTT

Attack Timing / Initiation

Asset Spacing: 00:30 MSL

Time: Push When Ready

Allow Reciprocal

Attack via IP Attack w/o IP Reattack

Show of Force Hold at IP

Attack via IP Attack w/o IP Reattack

Show of Force Estimate TTT Hold at IP

Same Final Attack Heading All Aircraft

Asset 1: Su-27 - CS-01

FAH: 250 +/- 10 240° to 260°

PRF: 1111  Aircraft Self-Designates

Estimated TTT: 02:00 TOT: 12:02:00

# MACE FORM CONTROLLED ATTACKS 2 – ADVANCED CAS

## Student Exercise - [Link to Online Solution Video](#)

1. (00:09) Place a JTAC and several EF platforms on the ground including: - moving vehicles on a route - cultural buildings (from MACE Cultural)
2. (03:24) Add a ground-attack aircraft (e.g. Generic Fighter) - ensure it has a mixture of laser guided bombs, missiles and a laser designator - place it in an out of intent racetrack
3. (03:54) Duplicate the platform and place the duplicate in formation with the first aircraft
4. (04:09) Use the 'System Settings' options to select weather attenuation on
5. (04:18) Use 'Mission Settings' set the environment visibility to 5,000m
6. (04:26) Add a human entity about 1km from one of the static targets - Equip them with a laser designator - Allocate a target and check line of sight to it
7. (05:23) Change the human's 'Laser Code' (PRF) in 'Platform Properties' to 1688 - Manually fire the laser at the target and cease - Verify the PRF by looking at the code displayed by the target on the MACE map.
8. (05:39) Start the mission - (Optionally) setup ARMOR in a way that best allows you to observe attacks with trails and labels as you like them
9. (06:02) Set up a 9 Line so that the aircraft does not designate its own weapon - select a laser-guided weapon (e.g. Generic GBU) - ensure the PRF on the air asset matches the PRF for your ground platform (1688) - pick the target from the map but click near to the target that is to be designated by the ground platform by about 50m - check the FAH is within a good laser arc for the lasing ground entity - set release point for 50% max weapon range
10. (06:45) Set a reasonable TTT (using the Estimate TTT function)
11. (07:01) Attack without IP & Clear Hot
12. (07:32) Ensure Weapons Guidance and Target Line are selected in the layer manager Weapons Section

# MACE FORM CONTROLLED ATTACKS 2 – ADVANCED CAS

## Student Exercise - [Link to Online Solution Video](#)

13. (07:32) Ensure Weapons Guidance and Target Line are selected in the layer manager Weapons Section
14. (07:55) Immediately after weapon release - manually fire the laser from the human at their targeted entity
15. (08:15) Note when the weapon starts guiding to the target - guidance line and laser designator line terminate at same point - limited by the environment visibility
16. (08:34) Switch off the laser - Change the environment visibility to greater than 20km
17. (09:04) Repeat the attack using: - a suitable TOT instead of TTT - 25% max weapon range release point
18. (09:57) While the fighter is routing for the attack - select another target for the human to lase - recheck line of sight for the designator
19. (10:47) As the aircraft approaches the release point, fire the laser from the ground entity onto its targeted entity
20. (11:31) Set up a 9-Line with 2 assets for self-designation of laser guided bombs and/or laser guided missiles on a 4 x separate targets (2 per aircraft) with different laser codes (PRFs) on different FAHs and rejoining formation after the attack at a TOT at least +5min into the future – with a 45s spacing between air assets. Set 75% Range Level Delivery
21. (12:45) Attack without IP and Clear Hot

# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Learning objective:

- To be able to use 5-line form to carry out rotary wing attacks and Gunship attacks

## Enabling objectives

- Understand the components of the 5-line including those essential for the attack
- Know how the 5-line flight parameters – loiter, egress, attack hdg, altitude, bump, dive effect the attacks
- Know how to add 5-line locations – map, range and bearing
- Know how to conduct Loiter (orbit) attacks
- Know how to conduct BP to target (Run-in) attacks
- Know how to attack from BP (Stand-off) attacks
- Know how to conduct Gunship attacks from a target position relative to friendly location
- Know how to adjust fire with gunship attacks

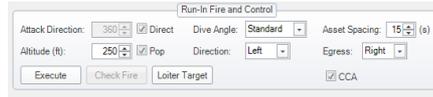
# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Rotary Wing

- Three attack types:

- Loiter

- Asset circles the target until ordered to attack
- Continue circle to pick up FAH
- Re-join loiter after attack
- Requires a target position 1<sup>st</sup> to know where to loiter



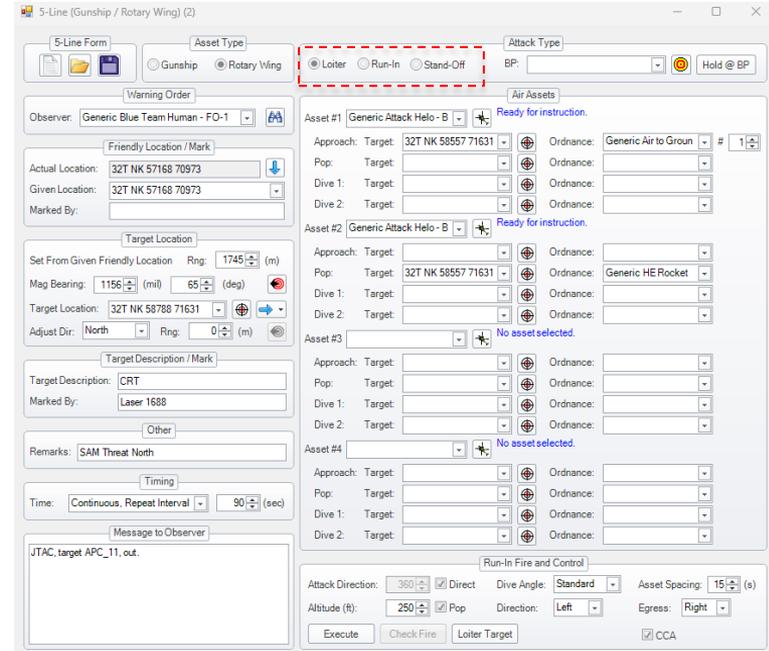
- Run-In

- Originate from and return to a battle position (BP)
- Requires a BP to be selected
- Hold at BP will route asset to the BP and stop them
- Execute would route via BP to the target



- Stand-Off

- Assets descend for cover from either their current position or from a Battle Position (BP)
- When attacking they ascend fire then descend back into cover
- “Take Cover” = assets descend to 50 ft AGL and hover in place OR Rally to BP and do the same



# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Rotary Wing – Attack Types vs Behaviours

LOITER

Attack Type:  Loiter  Run-In  Stand-Off

BP: BPC  Hold @ BP

Target Position

Direct Attack ignores Attack Direction and points directly at the target from the current position

Direct Attack

Attack Direction

Attack Direction: 330  Direct

Loiter Target Direction: Left  Execute

Loiters Until Execute Selected Start approach to target (cleared hot if CCA )

RUN-IN

Attack Type:  Loiter  Run-In  Stand-Off

BP: BPC  Hold @ BP

Direct Attack ignores Attack Direction and points directly at the target from the BP

Direct Attack

Attack Direction

BP

Attack Direction: 330  Direct

STAND-OFF

Attack Type:  Loiter  Run-In  Stand-Off

BP: BPC  Hold @ BP

Direct Attack ignores Attack Direction and points directly at the target from the BP

Direct Attack

Attack Direction

BP

Fire in Place (No BP Selected)

Fire In Place

Fire in Place (BP Selected)

BP

Stand-Off Battle Position Attack

Take Cover Fire In Place Check Fire Return To Intent

Take Cover aircraft descends to 50ft AGL at BP (if selected) or in place if no BP Selected

Fire in Place aircraft ascends – fires – descends

# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Rotary Wing – Final Attack Profiles

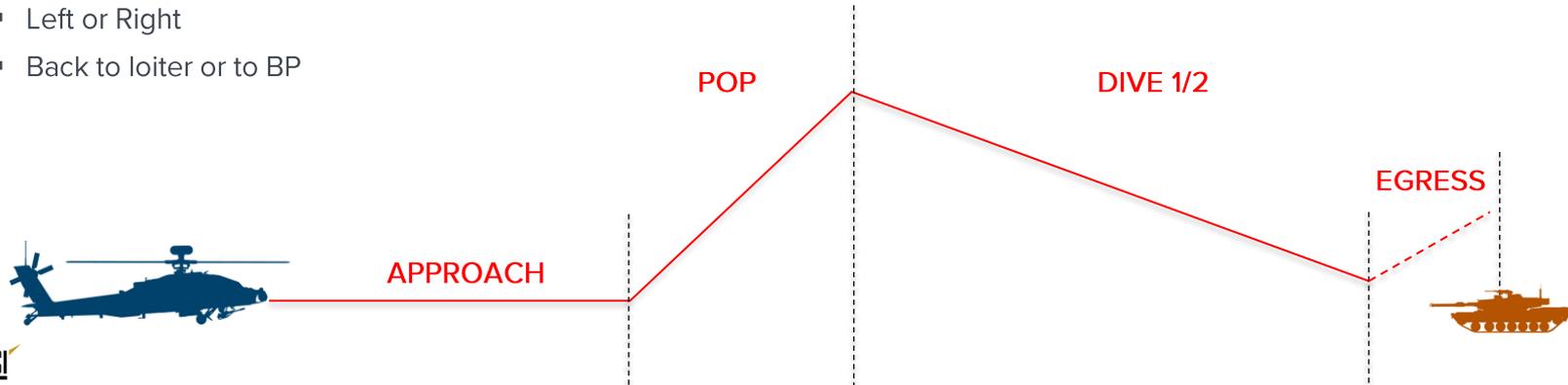
- **Approach**
  - On FAH but before pop
- **POP**
  - Gaining altitude before dive
- **Dive 1/2**
  - Occur simultaneously
  - Can allocate separate ordnance for up to 2 targets
- **Egress**
  - Left or Right
  - Back to loiter or to BP

Air Assets  
Ready for instruction.

Asset #1 Generic Attack Helo - B

|           |         |                    |  |           |                        |   |   |
|-----------|---------|--------------------|--|-----------|------------------------|---|---|
| Approach: | Target: | 32T NK 58789 71631 |  | Ordnance: | Generic Air to Groun   | # | 1 |
| Pop:      | Target: | 32T NK 58789 71631 |  | Ordnance: | Generic Aircraft Bulle |   |   |
| Dive 1:   | Target: | 32T NK 58557 71631 |  | Ordnance: | Generic HE Rocket      |   |   |
| Dive 2:   | Target: | 32T NK 59145 71466 |  | Ordnance: | Generic HE Rocket      |   |   |

Egress: Right



# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

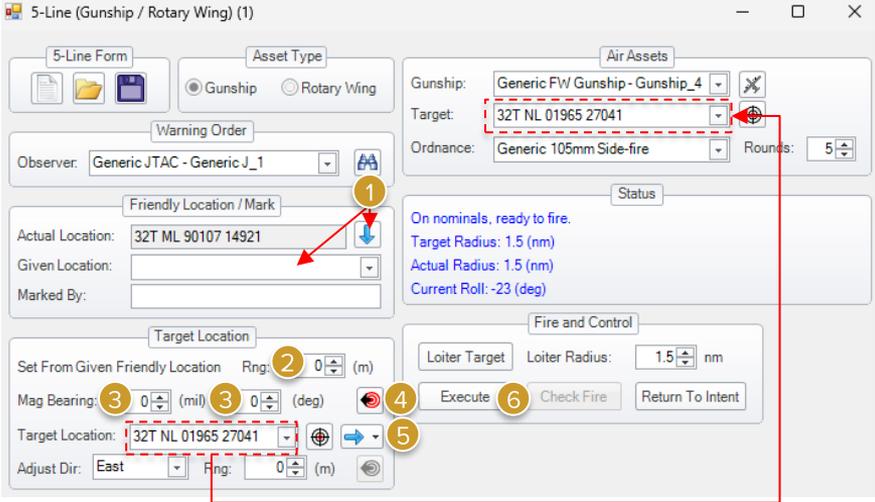
## Gunship – Initial Attack

- (1) Select Asset
- (2) Select Target ((5)Move to Loiter)
- (3) Select Weapon
- (4) Select number of rounds
- (5) Loiter on Target (if not already)
- (6) Select Timing
- TTT
- TOT
- AMC
- Continuous
- (7) Execute
- (8) Adjust Fire If Required (see next)

# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Gunship – Target location relative to friendly

- (1) Type in friendly location
  - OR (1) populate with Observer Location (using blue arrow)
- (2) Select range of Target from friendly location
- (3) Select bearing (Mils or Deg) from friendly location
- (4) Press the calculate button to populate target location
- (5) Assign the target to the Air Asset 
- (6) Execute the attack (as required) 



The screenshot shows the '5-Line (Gunship / Rotary Wing) (1)' control interface. It features several sections: '5-Line Form' with file icons, 'Asset Type' with radio buttons for 'Gunship' and 'Rotary Wing', 'Air Assets' with dropdowns for 'Gunship', 'Target', and 'Ordnance', and a 'Status' section. The 'Friendly Location / Mark' section includes 'Actual Location', 'Given Location', and 'Marked By' fields. The 'Target Location' section has 'Set From Given Friendly Location', 'Rng', 'Mag Bearing', 'Target Location', and 'Adjust Dir' fields. The 'Fire and Control' section includes 'Loiter Target', 'Loiter Radius', and 'Execute', 'Check Fire', and 'Return To Intent' buttons. A red dashed box highlights the 'Target' field in the 'Air Assets' section, which contains the value '32T NL 01965 27041'. A red arrow points from the 'Actual Location' field to the 'Target Location' field. Numbered callouts (1-6) are placed over various UI elements: 1 is over the 'Actual Location' field, 2 is over the 'Rng' field, 3 is over the 'Mag Bearing' field, 4 is over the 'Execute' button, 5 is over the 'Target Location' field, and 6 is over the 'Check Fire' button.

# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Gunship – Adjusting Fire

- (1) Select Adjust Direction (from last impact)
- (2) Select range (from last impact)
- (3) Calculate new target Location 
- (4) Assign Target to Ait Asset 
- (5) Execute Attack

### TIP – VIEW IMPACTS ON THE MACE MAP

Press <CTRL> + <ALT> to see numbered in order impact points on the map



5-Line Form

Asset Type:  Gunship  Rotary Wing

Warning Order

Observer: Generic JTAC - Generic J\_1

Friendly Location / Mark

Actual Location: 32T ML 90107 14921

Given Location:

Marked By:

Target Location

Set From Given Friendly Location Rng: 0 (m)

Mag Bearing: 0 (mil) 0 (deg)

Target Location: 32T NL 01954 26842

Adjust Dir: South 200

Target Description / Mark

Target Description:

Marked By:

Other

Remarks:

Timing

Time: At My Command

Message to Observer

JTAC, adjust bearing South, range 200, out.

Fire and Control

Loiter Target Loiter Radius: 1.5 nm

Execute 5 Check Fire Return To Intent

Status

Not loitering 5-line target.

# MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

## Student Exercise - [Link to Online Solution Video](#)

1. On the IOS Create a mission with 2xAH – 1 has a racetrack of waypoints, the other is in Line abreast formation. Add a selection of EF personnel on random walk and a selection of static vehicles all within 100m of each other – at least 10 targets.
2. Add 2 known points one north and one south of the target by about 6km
3. Add a Blue Team Soldier or JTAC to the scenario and check they have line of sight to the target set – make them invulnerable and concealed using platform properties and set their reaction posture to ‘Do Nothing’
4. Conduct an attack from loiter with 1 AH ASAP using guns from the loiter on any direction using standard dive angle. Check fire halfway through the attack.
5. Conduct a Run-in attack from one of the known points as the BP – with both AH split by 15s on a specific attack direction with standard dive angle from 250 ft – Each helo should fire on different targets to each other – and fire on 3 targets each during the attack: using a long range weapon (missile) on approach, guns on pop, and rockets on the dive
6. Select Stand-off attack and instruct the aircraft to Hold @BP – then fire in place at the remaining targets using a long-range weapon (missile)
7. Make the aircraft take cover – then return them to intent
8. Resurrect all targets and Rally the AH out of the area (CTRL + RMB)
9. At Runtime add a Gunship aircraft and use the Delta Orbit function to orbit away from the target set
10. Use the range and bearing map tool to estimate the correct range and bearing parameters to define the target position relative to the observer in the 5-Line form – enter them on the form, calculate target position and assign to the gunship
11. Get the AC130 to loiter the target point and wait until it is ‘on nominals’
12. Select ammunition and conduct an at my command attack. Adjust fire to destroy each of the remaining targets switching ammo type on some of the attacks as appropriate for the target

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Learning objective:

- Understand how to use indirect fire units within MACE using the call for fire form

## Enabling objectives

- Understand the component parts of the CFF Form
- Know how to select multiple fires units
- Know how to select an observer
- Know how to input a Target grid in2D and 3D
- Understand auto-elevation and its effect on the rest of the form
- Understand how polar distance and OT or GT Bearing create a new target grid on calculation
- Understand different distribution patterns and how to specify them
- Understand how to Aim and check trajectory for a mission
- Know how to use OTL and GTL adjustment in MACE
- Know how to execute and adjust a basic adjust fire mission with Grid Adjust
- Know how to convert adjust fire to Fire For Effect
- Understand the effect of PER/PED
- Know how to instantly detonate
- Know how to record a target

## Enabling objectives cont...

- Know how to conduct a basic rate of fire mission
- Know how to conduct a suppression mission
- Know how to fire 'at my command', TTT and TOT, or continuous
- Know how to set up a basic illum mission
- Know how to change an illum mission to get illum on the deck
- Understand how coordinated illumination works
- Understand what End Mission does

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

Call For Fire (Artillery) (1)
UNIT SELECTION

Warning Order
Artillery Battery

Observer: Generic Blue Team Hum

# of Missions: 5 Send MTO

Platform

Aggregate

Artillery Unit: Generic SP Artillery - SPArty\_16

Max # of guns: 6 within: 800 (meters)

1 2 3 4 5

**Target**

Known Point:

Target Location: 32T NK 04686 74765

Target Altitude: 0 (m)  Auto

Target Description:  # AB1000

**Direction**

Observer to Target Mag

OTL:  (mil)  (deg) Auto

Gun to Target

GTL:  (mil)  (deg) Auto

**Offset**

Grid L/R:  (m) A/D:  (m)

Polar Dist:  (m)

Angle of Sight: Auto

U/D: Auto

Last Adjust: Calculate

**Ammunition**

Coord Illum:

Delay: 30 (s)

Ordnance: Generic Artillery HE Auto

Last Round:

**Distribution**

Pattern: Linear

Altitude: 5600 (mils)

Distance: 500 (m)

Trajectory:  Low  High

**Vertical Offset (Parachute)**

Relative Up/Down Offset 0 (m)

Parachute Release at AGL 0 (ft)

**Airburst / Fusing**

Default

Distance 0 (m)

Time 0.00 (s)

**Method of Fire**

Fire For Effect

Rounds: 1  Per Tube

Adjust Fire

Rate

# Initial Volleys: 1

Interval: 30 (sec)

# Repeated Volleys: 1

Suppression All Guns

# Initial Volleys: 0

Interval: 10 (sec)

Duration: 60 (min) 0 (sec)

**Method of Control**

At My Command

Time On Target 18:00:00

Time To Target 00:02:00

Continuous 30 (sec)

Fire Plan 12:00:00 to 12:10:00

**Message to Observer**

Actual OTL (mag): 4623 (mil) 260 (deg)

Actual GTL (mag): 3956 (mil) 223 (deg)

Angle T: 666 (mil) 37 (deg)

Shot Pitch: 907 (mil) 51.01 (deg)

Parachute Alt AGL:

Max Ord MSL: 3764 (m) 12350 (ft)

Dist / Alt To Tgt: 9555 (m) / 14 (m)

Time of Flight: 53 (s)

PER / PED: 46 / 12 (m)

**Impact Time:**

JTAC this is FDC, message to observer, battery SPArty\_16, Generic Artillery HE / C1,rate, 1 initial rounds with 1 repeated rounds, target number AB1000, time of flight 53 (s), max altitude 3764 (m), out.

Mission Type: N/A

Aim Execute Check Fire

Fail Next Parachute Instant Detonate

Record Target End of Mission

TARGET POSITION  
AND  
ADJUST

AMMUNITION AND  
DETONATION  
CHARACTERISTICS

METHOD OF FIRE  
AND  
TIMINGS

KEY INFORMATION  
MESSAGES AND  
EXECUTION

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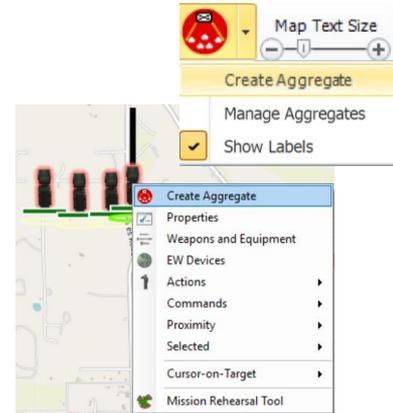
# AGGREGATE REFRESHER

## Saving and exporting aggregates

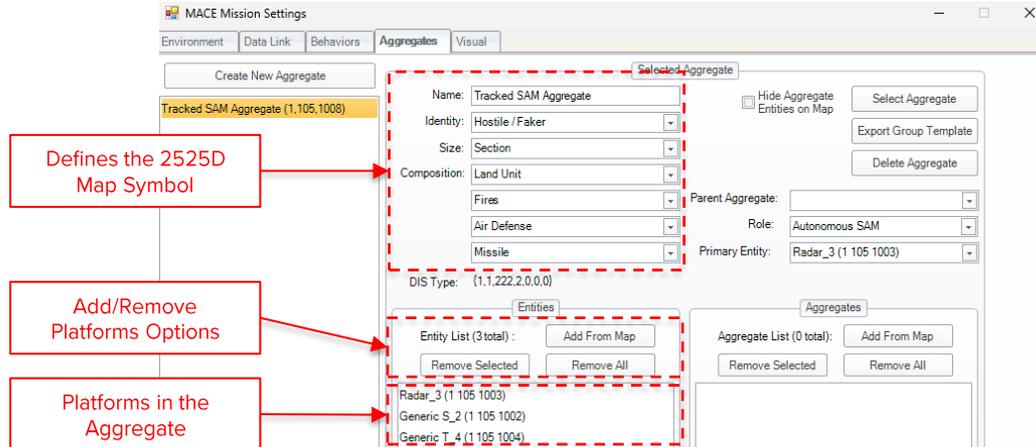
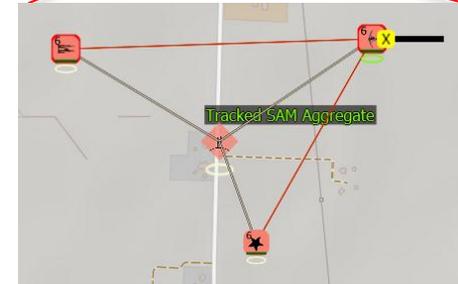
- Aggregates = groups of more than 1 entity
- Can be assigned MIL STD 2525D Symbol
- Can be assigned to a 'Parent Aggregate'

### Create an Aggregate by:

- Select multiple entities
- **VIEW → Entity View → Aggregate > Create Aggregate**
- MACE 2025 – Select group – RMB on Group – Create Aggregate



Expands on Double LMB Click



# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Selecting Units

Observer: Generic Blue Team Hum

# of Missions: 5 Send MTO

Artillery Battery

Platform (selected) Aggregate

Artillery Unit: Generic SP Artillery - SPArty\_16

Max # of guns: 6 within: 800 (meters)

- Observer – pick 1 from map or list
- Artillery Battery – 2 Methods
  - Platform and Distance – Pick Lead Gun (Dropdown or Map Pick) and max number of guns within a distance radius from the lead
  - Aggregate – Any (artillery enabled) aggregate in the mission – includes all the guns in the aggregate

Artillery Battery

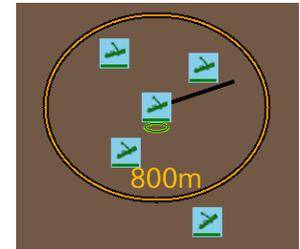
Platform Aggregate (selected)

Artillery Unit: FF-Mor-2

- EF-Arty-1
- EF-Arty-2
- EF-Arty-3
- EF-CRP-1
- EF-IADS
- EF-MBT-1
- FARP

EF-Arty-1

- Example 1
  - Centre gun as shown
  - Max Number of Guns 4
  - Within 800m
  - RESULT: 4 Guns Selected
- Example 2
  - Centre gun as shown
  - Max Number of Guns 2
  - Within 800m
  - RESULT: 2 Guns Selected



- When Artillery Battery is Selected – Message Window displays units and available ammo

6 assets type Generic SP Artillery available, munitions Generic Artillery HE, Generic Artillery Illum, Generic Artillery Smoke.

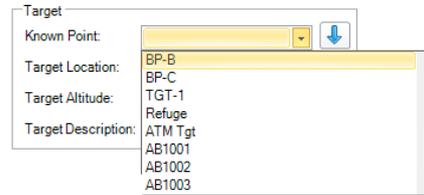
# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Target Location

- 3 Methods

- Known Point

- Select from list
- Assign as Target 



- Type Target Location

- Can specify target altitude or Auto Calculate



- Pick From Map 

- Or specify in the Adjust Section as a Polar Position (see next)

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Target Location – Adjustment

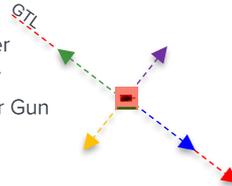
- Adjustments will be made along a line that joins
  - Observer position to target position (OTL) Or Gun position to target position (GTL)
  - The line can be entered incorrectly / arbitrarily
  - Either: Specify a GTL or OTL Manually OR Auto calculate the GTL or OTL

### To Adjust Target Position

- Pick the line to adjust along – Auto / Manual – GTL or OTL

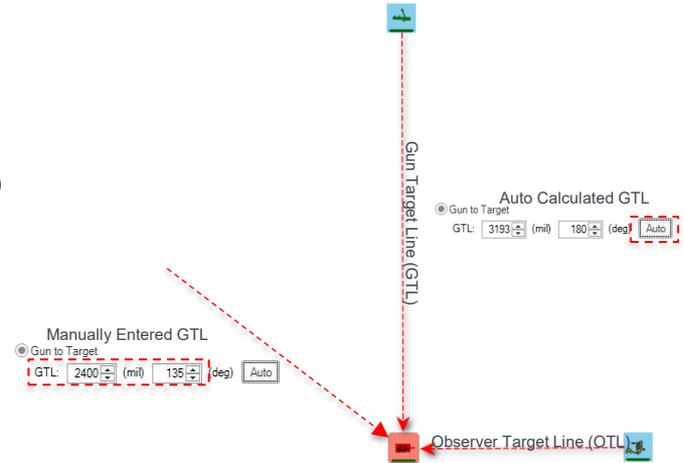
#### Grid Adjust

- Adjusts from **LAST TARGET POSITION**
  - ADD** meters along the line away from the Gun or Observer
  - DROP** meters along the line towards the Gun or Observer
  - LEFT** or **RIGHT** of the line orientated from the Observer or Gun
- For confirmation, last adjustment made is displayed



#### Polar Adjust

- Will Place new target position at 'Dist' specified along the specified GTL/OTL
- If 'auto altitude; not selected, then additional options for angle of sight are active



Offset

Grid L/R: 0 (m) A/D: -500 (m)

Polar Dist: 300 (m)

Angle of Sight: Auto

U/D: Auto

Last Adjust: Gun D500 m

Calculate

Direction

Observer to Target True

OTL: 4797 (mil) 270 (deg) Auto

Gun to Target

GTL: 1600 (mil) 90 (deg) Auto

Offset

Grid L/R: 0 (m) A/D: -500 (m)

Polar Dist: 800 (m)

Angle of Sight: Auto

U/D: Auto

Last Adjust: Gun 1600 mil 800 m

Calculate

Auto Calculated OTL

Observer to Target

OTL: 4797 (mil) 270 (deg) Auto

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Ammunition / Distribution

Ammunition

Coord Illum: 81mm Mortar Illum

Delay: 30 (s)

Ordnance: 81mm Mortar HE

Last Round: 81mm Mortar RP

Distribution

Pattern: Linear

Attitude: 5600 (mils)

Distance: 500 (m)

Trajectory:  Low  High

Vertical Offset (Parachute)

Relative Up/Down Offset 100 (m)

Parachute Release at AGL 0 (ft)

Airburst / Fusing

Default

Distance 50 (m)

Time 0.00 (s)

### Ammunition

- Fill in if you want last round to be different e.g. Marking round after suppress
- Coordinate Illum – set delay before first non-illum round impact

### Distribution

- Linear – Centre point aim (attitude & width)
- Circular – Currently random within width
- Converge – Point detonation with PER

### Trajectory

- High or Low = Large effect on TOF and Maximum Height of Ordnance (Max Ord)

### Vertical Offset

- Illum ammunition is fired with an optimum (default) bloom and release point at burnout
- Can reduce height to make illum burn on deck or release chute early
- NB Parachute fail option in Execution Section

### Airburst/Fusing

- Default sets the default for the ammunition- but can be overridden by distance or time
- Adjust up and down in m from target OR time from target



Fail Next Parachute

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Method of Fire / Control

### Method of Fire

- Fire For Effect
  - Maximum rate for each gun
  - Per tube = all units, without = 1 unit
- Adjust Fire
  - Single Unit – Single Round will fire
  - Use the adjust controls in targeting section to make each adjustment (See Adjusting Fire Slide)
  - Must hit CALCULATE – see Target Grid Change (See Adjusting Fire Slide)
- Rate
  - No. of initial rounds at max rate followed by...
  - Repeated volleys at an Interval of ?? s for ?? number of volleys
- Suppression
  - Same as rate except repeated rounds replaced with DURATION

### Method Of Control

- **At My Command** = As soon as Execute is pressed
- **TOT** = at a Mission Time e.g. 18:00:00
- **TTT** = at a Time from now e.g. 00:02:00
- **Continuous** = Repeats the mission at selected interval
- E.g. one-minute Suppression mission with smoke rounds in a wide pattern =scheduled to fire every three minutes
- **Fire Plan** = All timings determined by fire-plan page

Method of Fire

Fire For Effect  
Rounds: 1  Per Tube

Adjust Fire

Rate

# Initial Volleys: 3

Interval: 20 (sec)

# Repeated Volleys: 5

Suppression All Guns

# Initial Volleys: 0

Interval: 10 (sec)

Duration: 60 (min) 0 (sec)

### Rate:

- All guns
  - Fire 3 volleys at max rate
  - Then wait 20s and fire another volley
  - Repeated volleys every 20s until 5 reached
- Continuous:**
- Then the above repeats after 30s

Method of Control

At My Command

Time On Target 18:00:00

Time To Target 00:02:00

Continuous 30 (sec)

Fire Plan 12:00:00 to 12:10:00

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

## Execution / Check Fire / Record Target / Messages

### Message to Observer

- Designed to mimic the radio communication from the artillery units

Populated by

Aim

- Checks the rounds can reach the target
- Populates the message window with trajectory info

Execute

- Executes the configured mission
- Impact time and Time to Impact Displays **Impact Time:** 12:56:18 00:24

Check Fire

- Immediately stops the executing attack

Record Target

- Creates a Known Point at the target location using callsign in 'Target Section'

Instant Detonate

- Detonates the rounds on target instantly

End of Mission

- Reset the form

Message to Observer

|                    |                   |             |
|--------------------|-------------------|-------------|
| Actual OTL (true): | 4808 (mil)        | 270 (deg)   |
| Actual GTL (true): | 3158 (mil)        | 178 (deg)   |
| Angle T:           | 1650 (mil)        | 93 (deg)    |
| Shot Pitch:        | 1284 (mil)        | 72.22 (deg) |
| Parachute Alt AGL: |                   |             |
| Max Ord MSL:       | 1209 (m)          | 3967 (ft)   |
| Dist / Alt To Tgt: | 1181 (m) / 45 (m) |             |
| Time of Flight:    | 28 (s)            |             |

PER / PED: 13 / 3 (m)

Impact Time:

JTAC this is FDC, message to observer, battery MtrM252\_5, 81mm Mortar HE / C1,rate, 2 initial rounds with 3 repeated rounds, target number AB1000, time of flight 28 (s), max altitude 1209 (m), out.

PER/PED:  PER / PED: 12 / 3 (m)

- Use probable error in range and deflection values
- Affects impact points by up to that value

Mission Type: N/A

Fail Next Parachute

Target Description:  # AB1000

# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

Student Exercise: - [Link to Online Solution Video](#)

1. (00:12) Place a number (at least 10) of enemy vehicles within 500m of each other in a line
2. (00:56) Place a blue force soldier / JTAC nearby - Make it invulnerable and concealed - Set reaction posture to do nothing for the it and the enemy
3. (01:45) Check line of sight to enemy units from the blue unit
4. (02:05) In the layer manger select Platform Engagement Rings for Land Shooters on Land Targets visible when stopped
5. (02:40) Place 6 Artillery Units within 500m of each other (generic artillery or mortars) and so that they are in range of the enemy targets
6. (03:11) Create an aggregate out of 3 of the artillery units - Give it an appropriate Mil Std 2525 Symbol by selecting the correct role
7. (03:27) Open a CFF and select the blue unit as the observer
8. (03:39) Using platform selection method on the CFF – select one of the artillery units and a radius that results in all 6 units being available for the mission
9. (03:51) Using the map tool pick a target that is ‘long’ of the enemy units along the gun-target-line (GTL)
10. (04:17) Select HE ammunition and a smoke round as the last round in a linear distribution that would encompass all the enemy units (use map range and bearing tool to measure orientation and distance of target set to help if required)
11. (04:38) Choose Adjust fire as the method of fire
12. (04:44) Use the ‘Aim’ button to check for valid firing solution (adjust position of firing units if unable to find a solution)
13. (04:53) Zoom out to see firing units and target on the MACE Map - (Optional) set up armor to see label markers and weapon trails
14. (05:12) Start the mission and execute the fire mission – watch the weapon paths and impact
15. (05:40) Display the impact point on the MACE Map

Continued...



# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

**Student Exercise Continued:** - [Link to Online Solution Video](#)

16. (05:50) Select GTL in the direction section and auto calculate the GTL
17. (05:56) Perform a Grid adjustment from the impact point to target - By adding/dropping and/or left/right as required - Calculate the new target position - Aim and re-execute the mission
18. (06:18) Watch to see if the round is now on target
19. (06:35) When the round is on target - Change the method of fire to Fire for Effect - 3 rounds per tube - The Method of control TTT of 2 mins then execute
20. (07:04) Watch the mission and halfway through the execution check fire the mission
21. (07:14) Select the aggregate of 3 units as the artillery unit - Smoke rounds as the ordnance - Circular pattern of distribution
22. (07:35) Select a target position using Polar offset from the Observer - Select parameters to place the smoke just in front of the targets between them and the observer - Calculate new target position and observe the indication on the MACE Map
23. (08:17) Change the Method of fire to Rate: - 3 Initial volleys - 3 repeated at 30s intervals - Method of control to Time on Target - Set a sensible time in the future (about 2 mins)
24. (08:37) Execute the mission - Watch one of the intervals - Check fire the mission
25. (09:15) Change the Method of Control to Continuous – repeating at 45s, the pattern to converge - Send MTO or Aim to check there is a solution (Adjust gun positions if required),
26. (09:40) Execute the mission - Record the target as a known point
27. (10:05) After one interval check fire

Continued ...



# MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

**Student Exercise Continued:** - [Link to Online Solution Video](#)

28. (10:17) Change the time of day to night (observe in ARMOR if possible)
29. (10:29) Change the Ammunition back to HE but add a Coord Illum Round Relative Up/Down offset 500m
30. (10:51) Change Method of Fire to suppression all guns - 2 initial volleys then 5 mins duration interval 30s
31. Aim to check the firing solution
32. (11:00) Select Method of Control 'At My Command' and execute
33. (11:06) (Optional) Use the layer manager to display the Weapon Type - Observe the different types of rounds on the MACE map
34. (11:27) Check Fire and change the mission to be an adjust fire mission - 1 illum round - change the parachute release height to 0 ft to give 'illum on the deck effect' - Aim and Execute
35. (12:20) End the mission to reset the CFF form

# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## Learning objective:

- Understand how to use the fire plan form to execute and control a series of coordinated joint fires attacks

## Enabling objectives

- Know how to create aggregates of aggregates (parents)
- Understand the Fire Plan Components
- Know how to conduct simple single unit fire planning – Multiple Serials per line (multiple missions per unit)
- Know how to conduct multiple unit fire planning
- Know how to integrate CAS and RW 5 Lines into the Fire Plan
- Know how to change H Hour and understand what affect this has on the timings within the fire plan
- Understand dwelling and rejoining, both individually and for all fire units
- Understand what the Quick SEAD function does

# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## Learning objective:

- Understand how to use the fire planning form with all the other form-controlled attacks in a coordinated way

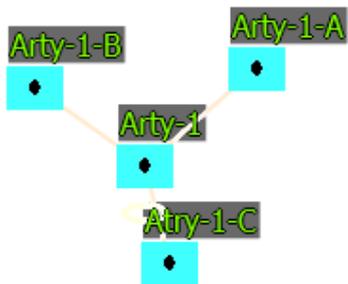
## Enabling objectives

- Know how to create aggregates of aggregates (parents)
- Understand the components of the Fire Plan form and what they do
- Know how to put MACE Forms for CFF / CAS / 5-Line on the fire plan
- Know how to adjust timings on the fire plan and the individual forms
- Know how to execute the Fire Plan
- Know how to use quick SEAD
- Understand how Fire Plan timings work with respect to H-Hour
- Know how to Dwell and Rejoin the fire plan, ad-hoc or at specified point
- Understand the different coloured indications on the Fire Plan

# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## Aggregates of Aggregates

- Aggregates can have 'Parent Aggregates'
- Can make sections of Fires Batteries for Example
- Make the parent first – with no units
- Then make the subordinate aggregates then select the 'Parent Aggregate' in the dropdown



MACE Mission Settings

Environment | Data Link | Behaviors | **Aggregates** | Visual

Create New Aggregate

Selected Aggregate

Name: Arty-1-A

Identity: Friend

Size: Section

Composition: Land Unit

Fires

Field Artillery

Parent Aggregate: Arty-1 (1,105,1046)

Role:

Primary Entity:

DIS Type: {1,1,225,2,0,0,0}

Entities

Entity List (3 total):

- Artiller\_33 (1 105 1037)
- Artiller\_35 (1 105 1039)
- Artiller\_34 (1 105 1038)

Aggregates

Aggregate List (0 total):

# MACE FORM CONTROLLED ATTACKS 5 - FIRE PLANNING

## Fire Plan Form

Set H-Hour will adjust all timings relative to time set (manual or to current time / mission start)

Open Individual Forms (per second adjustment)

Method of Control

- At My Command
- Time On Target 18:00:00
- Time To Target 00:02:00
- Continuous 0 (sec)
- Fire Plan 18:20:00 to 18:25:00

To Mission Start  
To Current Time

All Lines Actions

Execute All

Execute

Adjust Start Minute

Adjust End Minute

'Mouseover' to see timings

H=00 to H+10  
: AB1000  
1810 to 1820

Not Correctly Configured (e.g. no asset set)

'Executing' Mission Execute Replaced With 'Check Fire'

Execute

Check Fire

Messages

18:00:00, CFF #2: JTAG this is FDC, message to observer, battery Artiller\_33, Generic Artillery HE / C4,suppression, 1 minute, 0 seconds, target number AB1000, time of flight 35 (s), max altitude 1781 (m), out.  
ASOC: AB1000, PAH 32S MJ 56971 96002, TAH 32S MK 63759 07259, TOF: 35 s, GTL: 28 deg, max ord: 1781 m / 5844 ft, munition: Generic Artillery HE / C4

Execute All

- Check Fire / Abort All
- Check Fire All CFFs
- Abort All 9-Lines
- Check Fire All 5-Lines
- End All
- End All CFFs
- End All 9-Lines
- End All 5-Lines

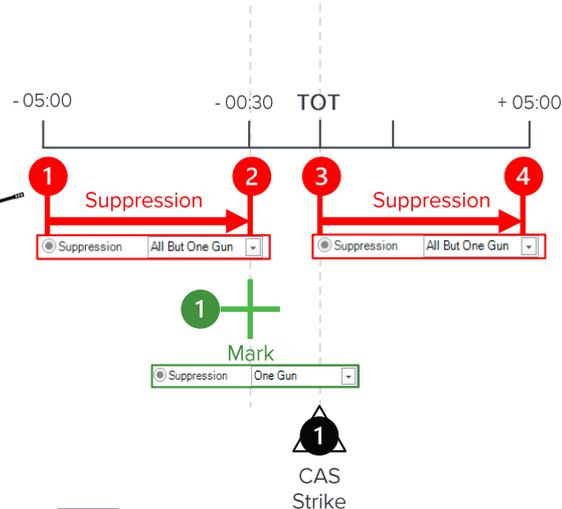
Individual Execute / Abort / Check Fire (Per Line)



# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## Quick SEAD

- Allows a set of timings to applied to selected lines in the fire plan
  - 'Non-Standard' – allows complete customisation of timings
  - 'Interrupted' – has only one set of suppression
  - 'Continuous' – allows a break in suppression but has default timings



### Applies ticked CFF and CAS Forms:

- Both need to be on 'Fire Plan' within their own forms
- CFF needs to be configured with ammo and target for each mission within the form
- Single CFF will have 3 (or 2 for interrupted) missions **suppress – mark – (suppress)**
- CAS needs asset, weapon, target etc
- Both need to be ticked on the fire plan

Fire Plan 18:19:30 to 18:19:30

### NOTE – ONE VS MANY CFFS IN QUICK SEAD

'Set Timings' will assign suppress and mark timings to all selected CFF forms – it won't separate a mark CFF from a suppress CFF – both will have all 3 missions

**Attack Time**

Time on Target  
18:20:00

Time to Target  
00:02:00

---

**Offsets & Durations**

Non-Standard

Mark Time at  
1 00:30 before TOT

Start Suppression at  
1 05:00 before TOT

Stop Suppression at  
2 00:30 before TOT

Restart Suppression at  
3 00:00 after TOT

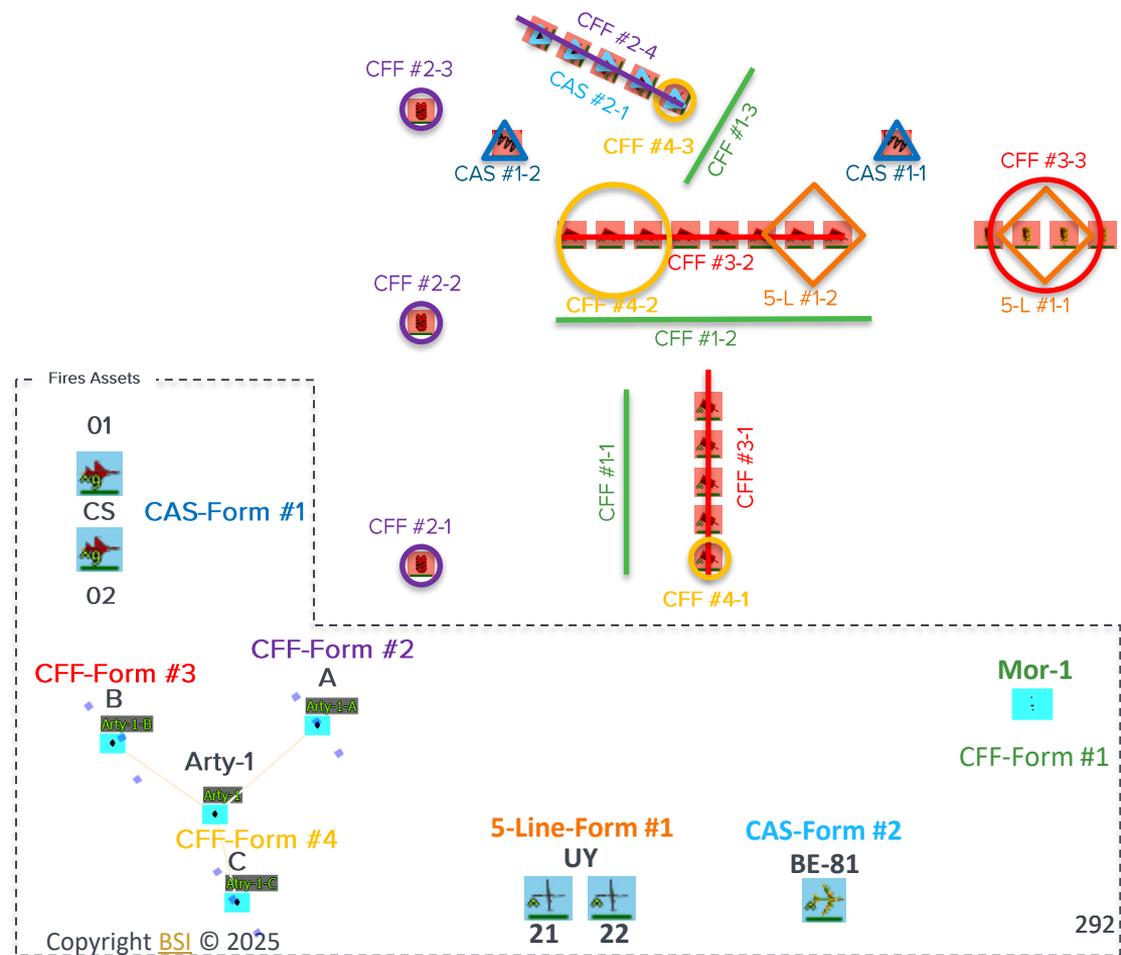
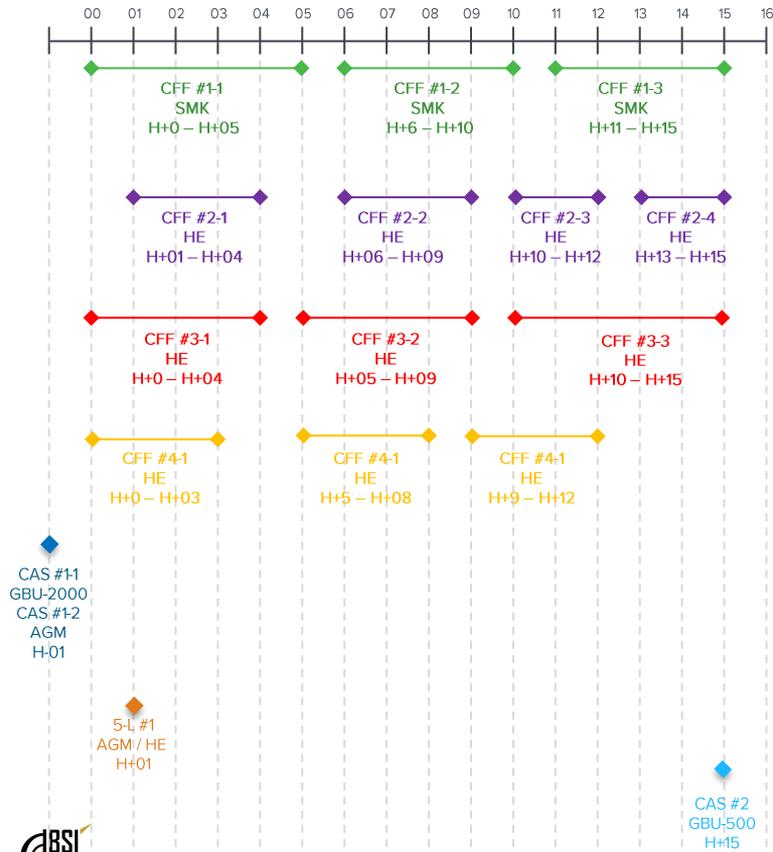
Restart Duration  
4 05:00

**Set Timings**



# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## Example Fire Plan



# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

## CFF Form – Dwelling and Rejoining

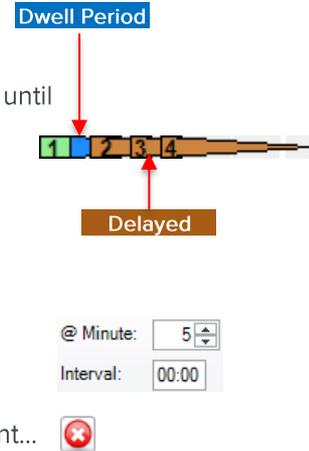
Dwell individual assets using data in 'Dwell' box

### Dwell

- Pauses the fire plan – firing asset remains firing at its current target until instructed to rejoin
- Dwell by selecting the:
  - 'Dwell' button on a specific asset
  - OR
  - by 'Dwelling ALL' assets with settings specified
- Dwell at a nominated minute in the plan OR if no time selected will dwell immediately
- A new firing interval can be specified for the duration of the dwell
- Cancel the dwell immediately by pressing 'X' or specify a rejoin point...

### Rejoin

- If not immediately cancelling a dwell – specify a time-line minute at which to rejoin the plan
- 'Add Time' (if required) to extend remaining 'on plan' serials
  - 'Rejoin' individual assets by line
  - 'Rejoin All' assets with settings specified



@ Minute:

Add Time: 00:00

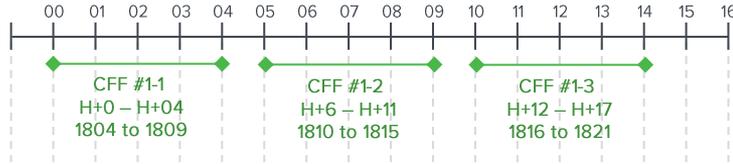


### NOTE – CHANGING INDICATIONS

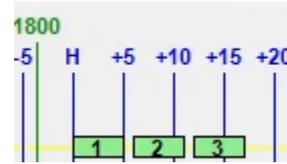
- The delay indications will disappear after a 'rejoin' is selected
- The added minutes will disappear and be appended to the light green plan as the timeline reaches that mission
- Dwells and Rejoins DO NOT affect 5-Line and CAS TOTs

# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

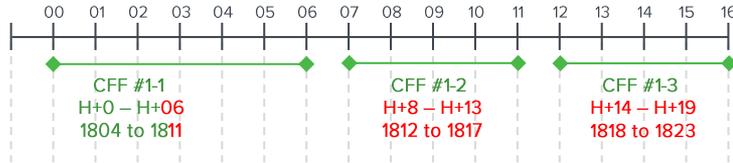
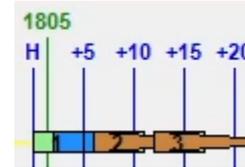
## CFF Form – Dwelling and Rejoining Worked Example H=18:04



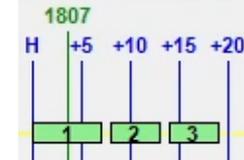
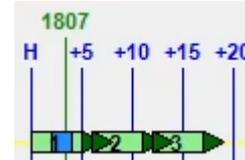
Initial Plan



Dwell at minute 2



Rejoin at minute 4  
Add 2 mins



# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

**Student Exercise:** - [Link to Online Solution Video](#)

1. (00:10) Find an area of relatively flat ground – place a group of 5 Enemy vehicles with 4 personnel (arranged within 100m of each other) – Set their reaction posture to ‘Do Nothing’
2. (00:54) Duplicate the group - Placing the duplicates in two rows of 3 - 700m to 1km apart in a rectangle, oriented north-south
3. (01:47) Open the layer manager - Switch on Land Shooter Land Target Range rings for the blue team only
4. (02:00) Place 3 groups of 3 Blue artillery units in range of all 6 target sets
5. (02:17) Make a parent aggregate and then 3 sub-aggregates of each of the 3 artillery units
6. (03:14) Make all the Blue units invulnerable and concealed
7. (03:32) Add one Fighter with air to ground weapons - Holding in an out of intent orbit to the west
8. (03:41) Add one Helicopter with air to ground weapons - Rallied to a point about 5 to 8km south of the target sets
9. (03:51) Add a known position near the helicopter to be used as a BP
10. (04:01) Make the blue air assets Invulnerable, and reaction posture to do nothing
11. (04:14) Add a Soldier / JTAC as a forward observer – make them invulnerable, concealed and reaction posture to do nothing
12. (04:44) Open the fire plan form

Continued...

# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

Student Exercise Continued... [Link to Online Solution Video](#)

13. (04:56) On 3 Call for fire forms (CFF-1 CFF-2 and CFF-3) - Assign 1 of the 'sub aggregates' as the firing unit - The Soldier/JTAC as the observer - Make each form have 3 missions - Set method of control to 'fire-plan' on all missions in all forms
14. (05:35) For CFF-1 - Mission 1 - Place a line of smoke, oriented N-S 200m - Between the southern most target sets - Mission 2 - Do the same but - Place it between the next 2 target sets to the north- Mission 3 - Do the same but - Place it between the next 2 target sets to the north - In a line orientated E-W 100m spacing
15. (06:03) For CFF-2 - Mission 1 target the southwestern most target set - In a circular pattern 100m with HE - Mission 2 target the western set - In converge pattern with HE - Mission 3 Target the Northwestern set - In circular pattern 200m with HE
16. (06:23) For CFF-3 Mission 1 target the southeastern most target set in a circular pattern 100m with HE – Mission 2 target the eastern set in converge pattern with HE – For Mission 3 Target the Northeastern set in circular pattern 200m with HE
17. (06:43) Open the CAS-9 Line #1 from the fire plan - Assign the air asset as the FW Fighter - Set 6 (multiple) targets, 1 GBU weapon to the centre point of each target set - Attack heading 360 +/-30, and sensible ingress/egress figures - Set timing to be on fire plan
18. (07:17) Open the 5 Line Form from the fire plan - Change to a rotary run-in attack - Assign the BP that you made earlier - Approach target - one vehicle in the southeastern most target set (missile) - Pop target - human in the same set (gun) - Dive target of another vehicle in the set (Rockets) - Set timing to be on Fire plan
19. (07:40) Set H hour to 4 mins after the mission start time – ensure Auto-Cleared Hot is selected
20. (07:56) Set the timings on each line of the fire plan - Either dragging on the fire plan or setting times in the CFF or both - Stagger so each CFF mission is 5 mins duration on each target set - Each mission spaced by 1 min between each other - Do the same for each CFF Form - Staggering each line by a further 1 min from the line above - CFF-1 starts at H+0 and CFF-2 starts at H+1 etc.
21. (09:16) Set the 5 line time to be H-1 and the CAS time to be H+21 – Check the timings on each form

Continued...



# MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

Student Exercise Continued... [Link to Online Solution Video](#)

22. (09:39) Save and start the mission
23. (09:50) Execute all on the Fire plan and observe the mission until after the RW strike at H-1
24. (10:26) Dwell all CFF at minute 2 at current rate – Wait for at least a minute - Then rejoin all at minute 4 adding 2 mins
25. (11:32) Abort the CAS Mission - Adjust its TOT to be 1min after last artillery mission - Re-execute
26. (11:50) During CFF-1 Mission 2 - Dwell CFF-1 then cancel the dwell
27. (12:14) Check fire CFF-2 Mission 2, then re-execute it
28. (12:42) Free play with ALL-Dwell / Individual Dwell / All Rejoin and Individual Rejoin - Until satisfied and final CAS strike is complete - Then End ALL

# MISSION DATA IMPORT AND EXPORT

## Learning objective:

- To be able to import and export multiple data types into and out of MACE

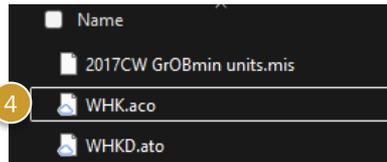
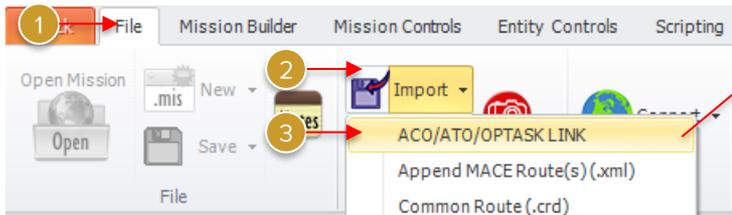
## Enabling objectives

- Know how to import and display Airspace Control Order (ACO) in MACE and ARMOR
- Understand the basic functions of the MACE Shape tool
- Know how to draw basic shapes in MACE
- Know how to save shape files
- Know how to manage and display shapes in MACE and ARMOR using the layer manager
- Know how to import shapes to MACE
- Know how to attach aircraft to vectors
- Know how to export and import aircraft routes
- Know how to export and import MACE Routes (Partial Mission)
- Know how to export MACE group templates for use in any mission
- Know how to import ATO into MACE
- Know how to adjust ATO entity and equipment matching in the MOCT
- Understand EOB import
- Know how to edit and import MACE Nav Point File
- Know how to import TAF and METAR into MACE environment settings
- Know how to import data and display controlled airspace in ARMOR

# MISSION DATA IMPORT AND EXPORT

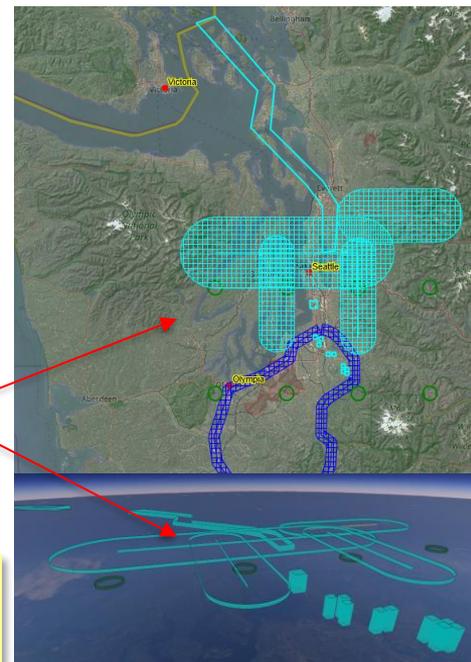
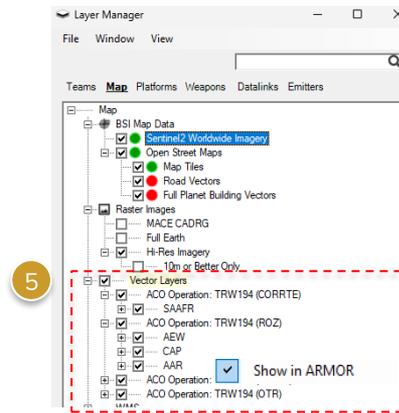
## Import and Display ACO

FILE → Import/Export



```
OPER/TRW194//
MSGID/ACO/ROC/WHK/JAN/CHG/--/
ACOID/NEW AREA//
GEOAURN/WB//
PERIOD/121100ZAPR2022/131059ZAPR2022//
GENTEXT/ACO MANAGEMENT INFORMATION/USMTP2004 ACO
/TRANSITION ALTITUDE:18500FT
//
ACMID/ACM:CORRTE/NAME:BOMAR/CORRIDOR/USE:SAAFFR/--/
CORRIDOR/3NM/LATS:471814N1221523W/LATS:471801N1221318W
/LATS:471708N1221028W/LATS:471500N1220659W/LATS:471241N1220444W
/LATS:470952N1220142W/LATS:470320N1220134W/LATS:465823N1221302W
/LATS:465622N1221517W/LATS:464811N1221536W/LATS:464557N1221103W
/LATS:463924N1221141W/LATS:463301N1221520W//
EFFLEVEL/RARA:003AMSL-035AMSL//
APERIOD/DISCRETE/121100ZAPR2022/131059ZAPR2022//
CONTAUTH/LANCER/139MHZ/--/
//
ACMID/ACM:ROZ/NAME:C2 TRACK/ORBIT/USE:AEW/--/
AORBIT/LATS:473956N1225943W/LATS:473956N1215950W/20NM/C//
EFFLEVEL/FLFL:FL270-FL300//
APERIOD/DISCRETE/121100ZAPR2022/131059ZAPR2022//
CONTAUTH/GOLIATH/300.125MHZ/--/
//
```

- (1) FILE → Import/Export
  - (2) Select [IMPORT]
  - (3) Select ACO/ATO/OPTASK LINK
  - (4) Select ACO File (.aco)
  - (5) Display in MACE and/or in ARMOR
- OR
- (1) Drag and Drop .aco file onto MACE mission area



### NOTE - IMPORT ACO FIRST

It is best to import the ACO before an ATO as the ATO may have routing that will only be added as waypoints if the relevant ACO object is present

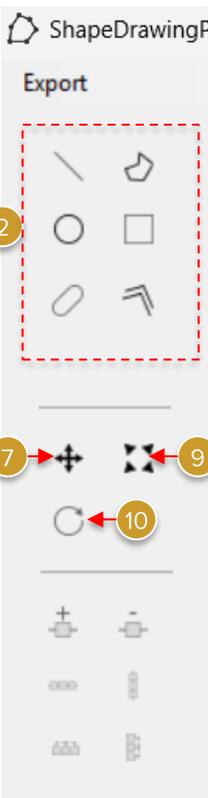
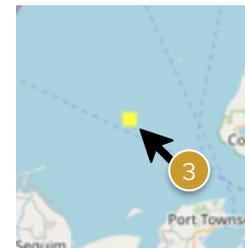
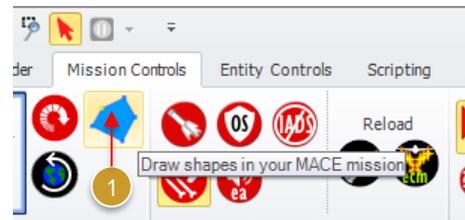
# [NEW] SHAPE BUILDER

## Work In Progress

- Not all functions are complete
- Use at own risk

# [NEW] SHAPE BUILDER

## Drawing Shape – Basic Functions



### Open Plugin Select Shape:

- (1) MISSION CONTROLS → Shap Drawing Plugin
- (2) Select Type of Shape (e.g. Circle, Polygon, Corridor)

### Draw on MACE Mission Area:

- (3) Press [ALT] + Left Mouse Button to add first node
- (4) Corridor & Polygon: Continue to Add Nodes with [ALT] + Left Mouse Button
- (4) Circle: Add the outer node (Radius) with [ALT] + Left Mouse Button

### Adjust Shape:

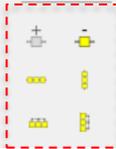
- (5) Press [CTRL] + Hold Left Mouse Button to drag a node
- (6) Drag Centre Node To move entire shape
- (7) Press the snap to mouse button to drag to new location
- (8) Press [CTRL] + [SHIFT] Left Mouse Button to delete a node
- (9) Use the scale button to scale the shape
- (10) Use the rotate button to rotate the shape

For now... always release ALT while mouse is over the map

# [NEW] SHAPE BUILDER

## Drawing Shape – Advanced Functions

File Mission

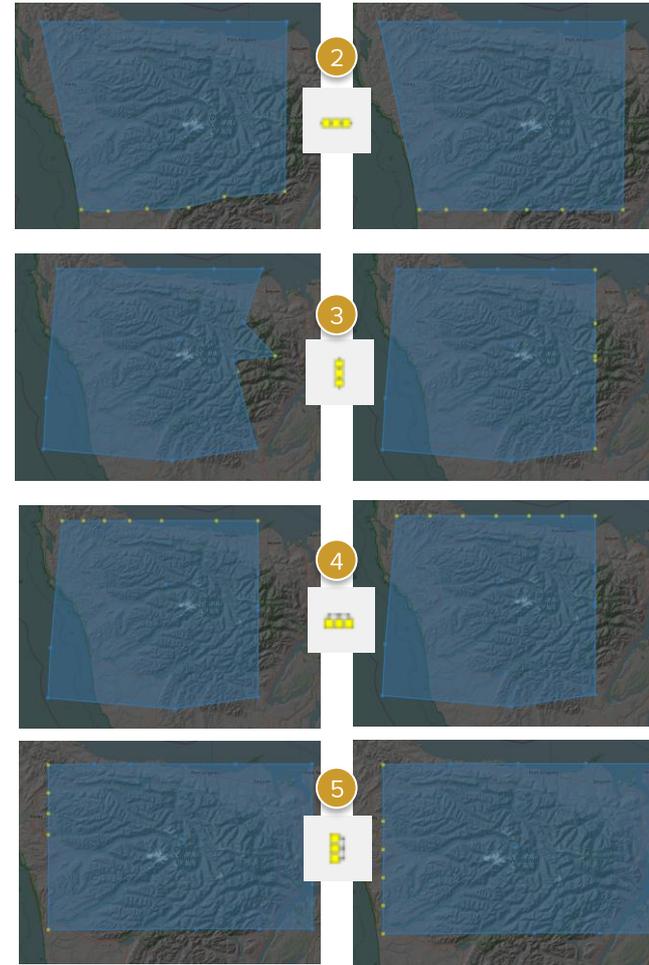


### Align to Lines of Latitude / Longitude

- (1) Press [SHIFT] + LMB Drag a box over nodes – selected go yellow
  - First node selected is the alignment node
- Press Align (2) latitude or (3) longitude to have all subsequent nodes align
- (1) Press [SHIFT] + LMB Drag a box over nodes – selected go yellow
  - Press Equal Spacing in (4) Longitude or (5) Latitude button

### Delete multiple nodes at once

- Press [SHIFT] + LMB Drag a box over nodes
- Press [Delete] or the (6) 'delete nodes button' to remove them



# [NEW] SHAPE BUILDER

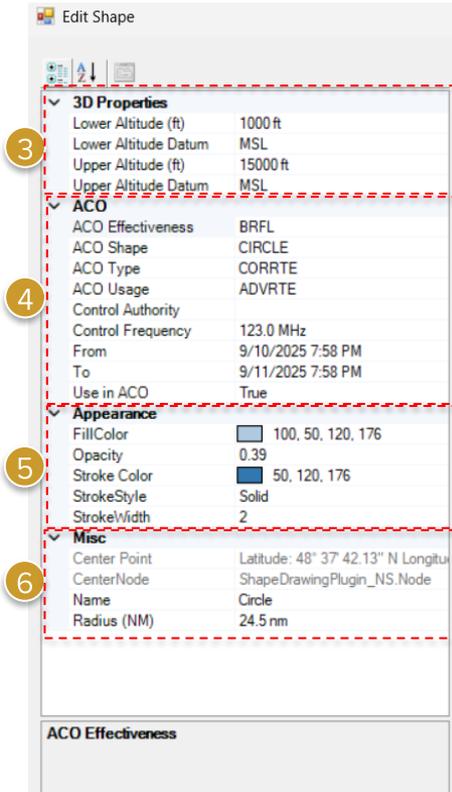
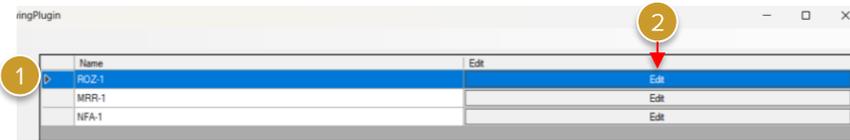
## Changing Appearance & ACO Parameters

### Editing Existing Shape – ACO and Appearance:

- All shapes listed in the UI
- (1) Select the shape for editing in the UI List
  - To move/delete nodes or the shape – select the shape in list – use the basic controls (CTRL, ALT, CTRL+SHIFT and Mouse) on MACE Map
- (2) Press [EDIT] to adjust ACO and appearance parameters

### Edit Shape Parameters:

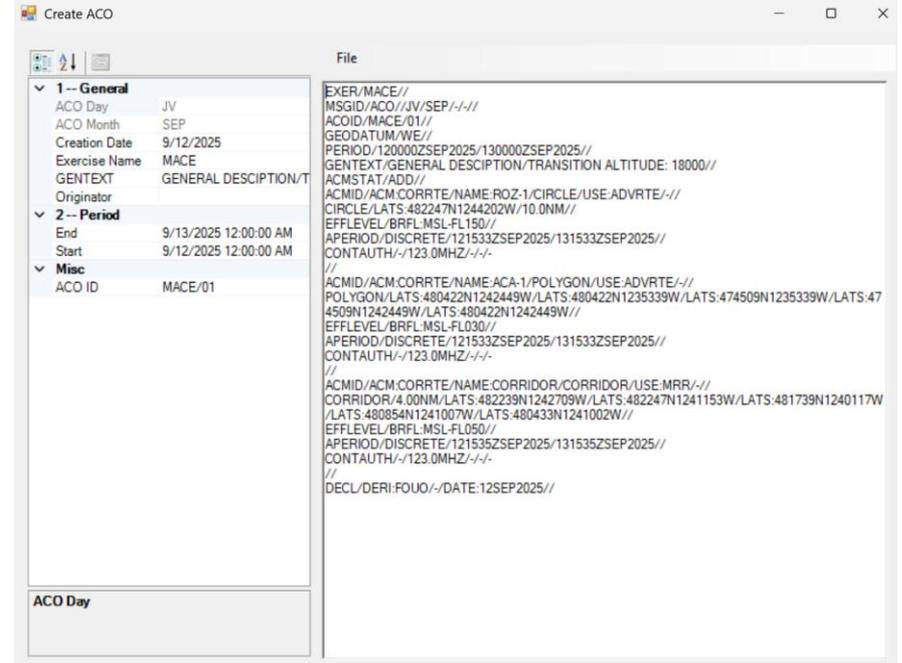
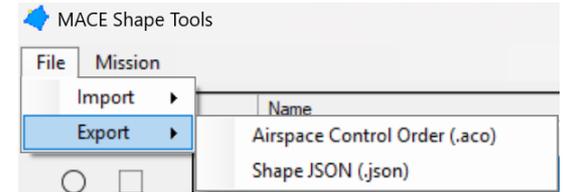
- (3) 3D Properties – Upper and Lower Altitudes and datums
- (4) ACO Parameters – Shape, Type Usage, Control Authority, Freq, Timing
  - Included in an ACO export to correct ACO Signal format
- (5) Appearance – Colours: lines, areas, opacity, widths
- (6) Misc – Change Name and Radii for circles



# [NEW] SHAPE BUILDER

## Export an ACO

- All the shapes have properties used in ACOs
  - Altitudes
  - Times
  - Type
  - Usage
  - Controlling agency etc
- Export from file menu in shape plugin
- Make overall ACO edits on left
  - General
  - Period
  - Copy paste text

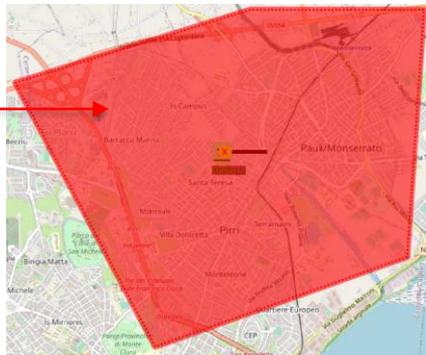
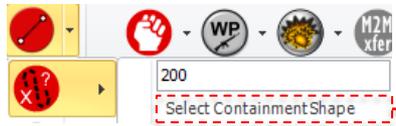


# MISSION DATA IMPORT AND EXPORT

## Uses for Shapes and Vectors

- Proceed via – waypoints
  - Right click on the line for context menu
  - Proceed via / proceed via outbound
  - Adds waypoints along the line
- Weapon waypoints
- Containment shape for random destination
  - Polygons can contain random walkers / patrols
  - Select containment shape (flashes red)
  - Select random destination 
- Triggers for script
  - Shapes can trigger other actions in scripts
  - If entity is within / outside .... Shape.... then

Right Mouse Click on the Line shape



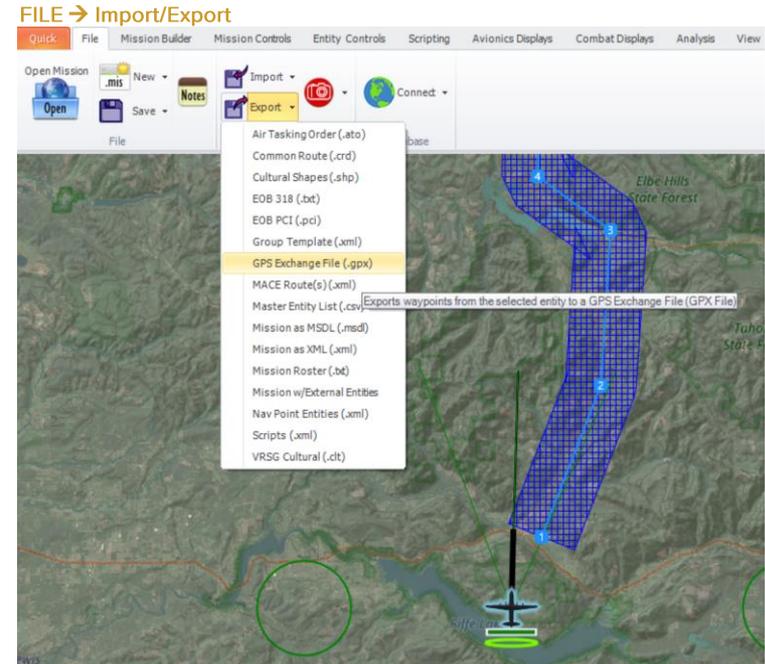
# MISSION DATA IMPORT AND EXPORT

## Exporting Routes

- Routes can be exported as CRD or GPX
  - For use in mission planning systems
  - For application to other MACE entities (Platforms and waypoint enabled weapons)
- (1) Select the platform with the route
- (2) **FILE → Import/Export**
- (3) Select [EXPORT] → 'GPS Exchange File (.gpx)' Or 'Common Route (.crd)'
- (4) Save the route file (see note)

### **NOTE – APPEND GPX ROUTES**

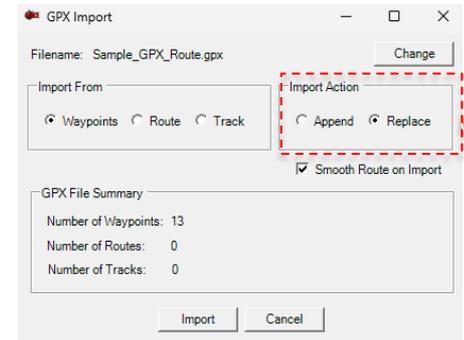
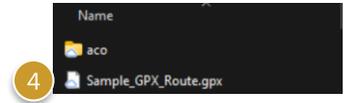
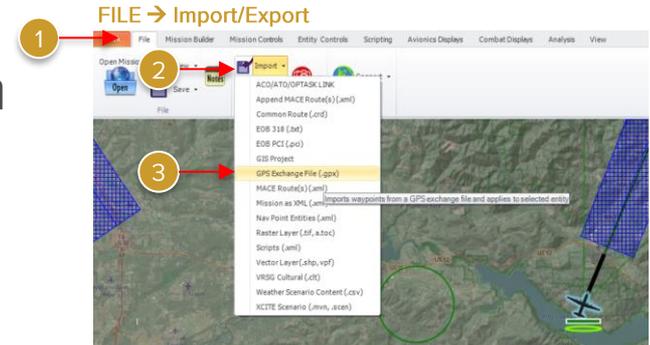
If exporting a GPX it is possible overwrite an existing GPX – replacing it **OR** append the new route to it (the option shows when saving over the .gpx file)



# MISSION DATA IMPORT AND EXPORT

## Importing Route to Apply to An Existing Platform

- GPX routes can be applied to platforms in MACE mission
- (1) Select the platform as the new route
- (2) **FILE** → **Import/Export**
- (3) Select [IMPORT] → 'GPS Exchange File (.gpx)'
- (4) Select the file
- (5) Replace or Append to existing route waypoints



### NOTE – GPX VS MACE AND CRD Routes

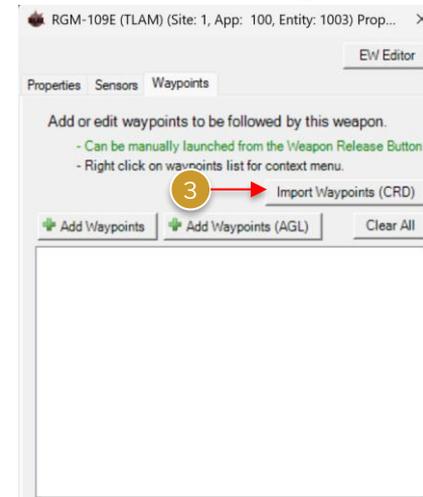
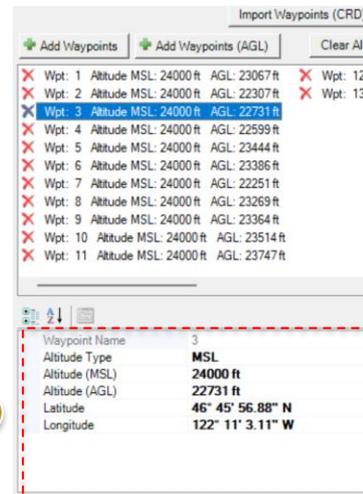
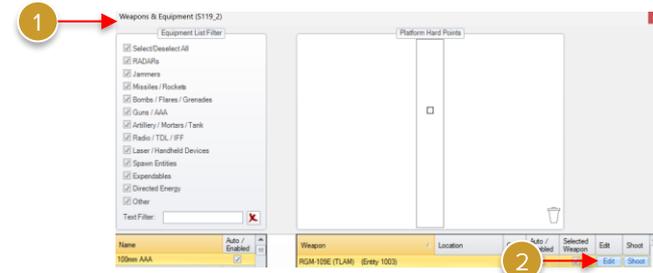
GPX routes can be appended or replace the route of the selected platform.

CRD and MACE routes will create a **new platform** with the route

# MISSION DATA IMPORT AND EXPORT

## Importing Route to Apply to Waypoint Enabled Weapon

- CRD routes can be applied to weapons in MACE mission
- (1) Select a platform with waypoint capable weapon (e.g. TLAM) – open weapons & equipment
- (2) Edit the waypoint capable weapon
- (3) Import Waypoints (CRD) – Select file and press OK
- (4) Verify/delete and/or edit individual waypoint data



# MISSION DATA IMPORT AND EXPORT

## Exporting/Importing Parts of Missions – ‘MACE Routes’

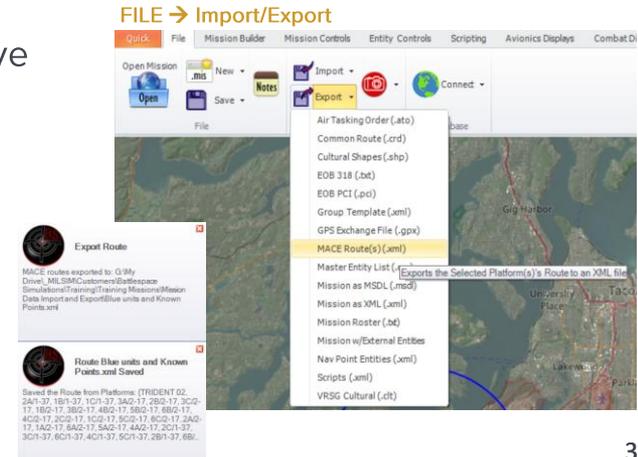
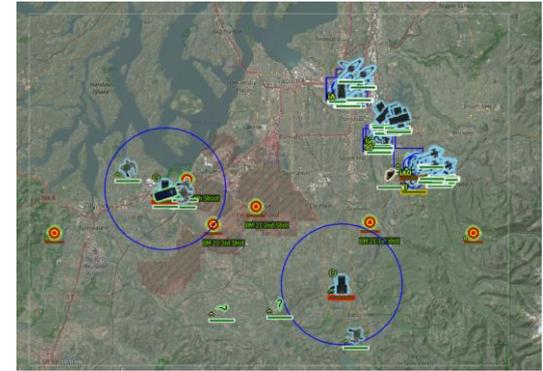
- Multiple Entities, their Properties and Routes can be exported and imported into other missions in the **same position**
  - Useful if one user is RED forces and the other BLUE
  - Or if one is creating Ground Attack Mission and the other is creating the Air Defense

### EXPORTING

- (1) Select all platforms to be exported as part of a mission
- (2) **FILE → Import/Export**
- (3) Select [EXPORT] ‘MACE Routes’, choose appropriate filename, Save

### IMPORTING

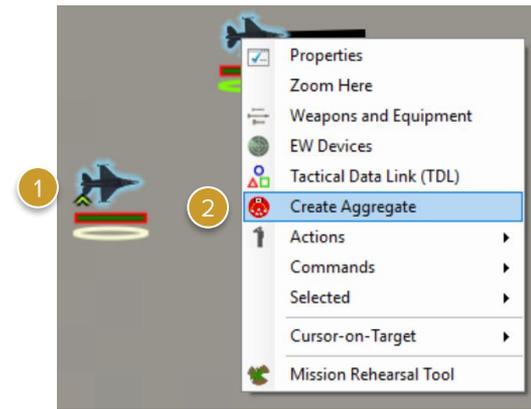
- (1) **FILE → Import/Export**
  - (2) Select [EXPORT] ‘MACE Routes’, choose file
- Platforms and Entities will be placed in the existing mission



# MISSION DATA IMPORT AND EXPORT

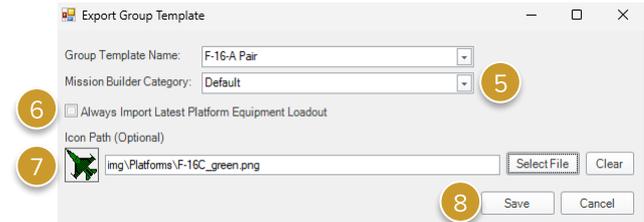
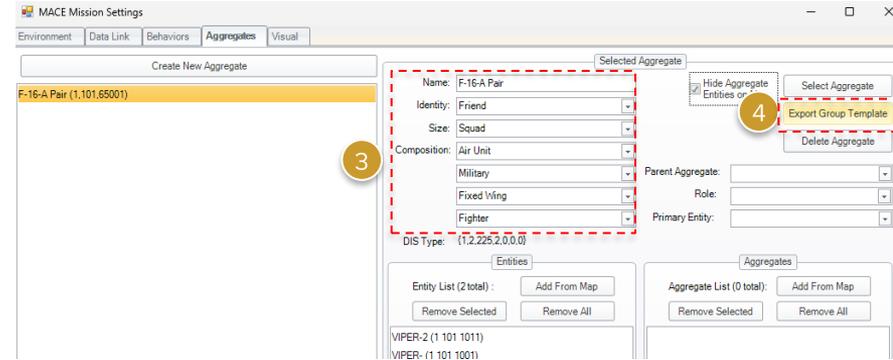
## Exporting/Importing Group Templates

- Multiple **Entities**, their **Properties**, and **waypoints** can be exported to the mission builder so they can be dragged and dropped as groups into new missions
  - This includes formations, laser code reaction + weapons postures, IFF, speeds, alts etc.
  - These do not export positions of the entity – the waypoints will be relative to where the user drops the group



## EXPORTING GROUP TEMPLATES: Method 1 (Aggregates)

- (1) Select all platforms to be exported as a group
- (2) RMB 'Create Aggregate'
- (3) Name Aggregate and create symbol from drop downs
- (4) Select [Export Group Template]
- (5) Choose Category or Leave as default
- (6) Choose if latest load out to replace the selected
- (7) Choose an icon if required
- (8) Save



# MISSION DATA IMPORT AND EXPORT

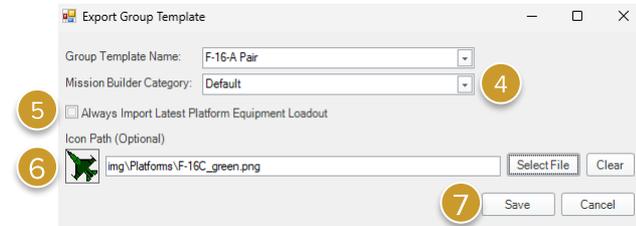
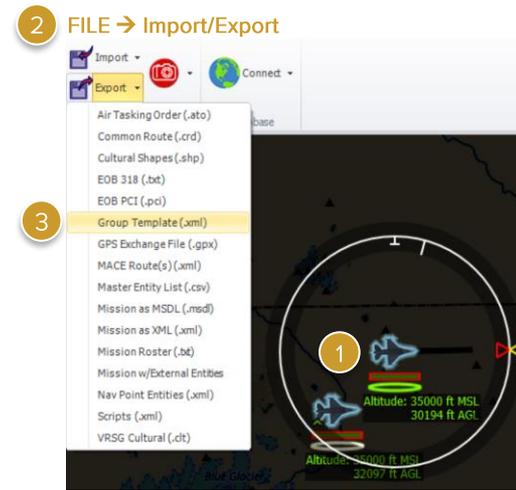
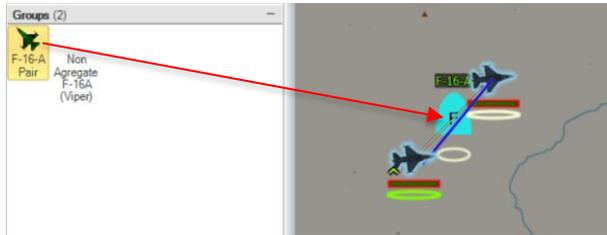
## Exporting/Importing Group Templates

### EXPORTING GROUP TEMPLATES Method 2 (Non-Aggregates)

- (1) Select all platforms to be exported as a group
- (2) **FILE** → **Import/Export**
- (3) Select [EXPORT] 'Group Template'
- (4) Choose Category or Leave as default
- (5) Choose if latest load out to replace the selected
- (6) Choose an icon if required
- (7) Save

### USING GROUPS

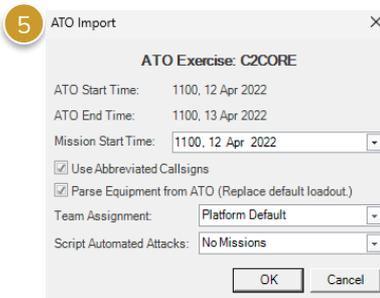
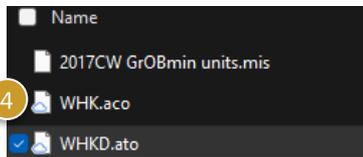
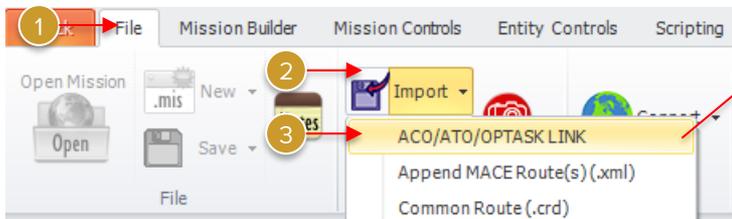
- Drag and drop from Groups in Mission builder onto MACE map



# MISSION DATA IMPORT AND EXPORT

## Import ATO

FILE → Import/Export

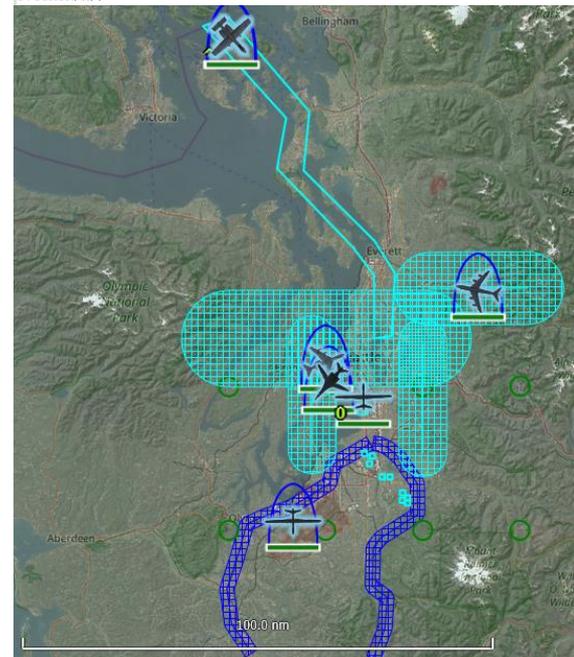


- (1) FILE → Import/Export
- (2) Select [IMPORT]
- (3) Select ACO/ATO/OPTASK LINK
- (4) Select ATO File (.ato)
- (5) Select Options –
  - Callsigns – use L16 Abbrev callsign, prevents MACE exceeding 11 char limit
  - Equipment – replace MACE default with what is listed on ATO
  - Teams – Make all blue or all red rather than MACE platform default
  - Script Automated Attacks – Adds scripts to script editor based on ATO tasks

### NOTE – IMPORT ACO FIRST

It is best to import the ACO before an ATO as the ATO may have routing that will only be added as waypoints if the relevant ACO object is present

```
EXER/C2CORE/-/  
MSGID/ATO/AC/DL/JAN/-/-/  
AKNLDG/NO/  
TIMEFRAM/FROM:121100ZAPR2022/TO:131100ZAPR2022/ASOF:091307ZJAN2019//  
AMPN/USMTF 2004//  
TSKCNTRY/UK//  
SVCTASK/F//  
TASKUNIT/9SQ/ICAO:CYVR/-/-/  
AMSN DAT/F/6543/-/-/-/GCAS/-/-/45M/DEPLOC:CYVR/121500ZAPR/ARRLOC:CYVR  
/131459ZAPR//  
AMPN/-/  
MSNACFT/2/OTHAC:GR4A/TUNA43/6G12X2A2W2/-/TA43/-/03633/A:100/03633  
/B:26543/03633/B:36543//  
AMSNLOC/121500ZAPR/131459ZAPR/VANCOUVER INTL/-/-/-/LATM:4912N12311W//  
AMSN DAT/N/6541/-/-/-/CAS/-/-/DEPLOC:CYVR/121414ZAPR/ARRLOC:CYVR  
/121645ZAPR//  
AMPN/-/  
MSNACFT/2/OTHAC:GR4A/TUNA41/6G12X2A2W2/-/TA41/-/03631/A:100/03631  
/B:26541/03631/B:36541//  
AMSNLOC/121430ZAPR/121630ZAPR/L16/170/-/-/LATM:4730N12230W//  
AMPN/NAME:L16/-/-/  
TSKCNTRY/US//  
SVCTASK/A//
```

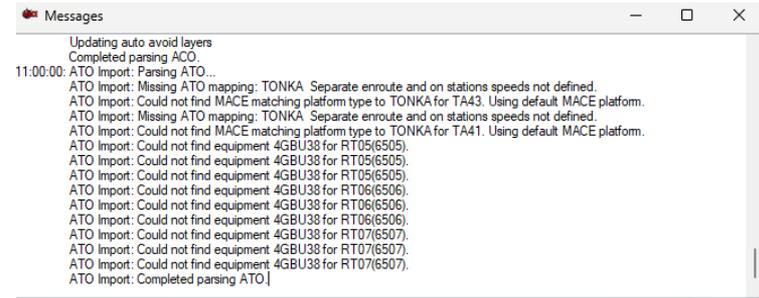


# MISSION DATA IMPORT AND EXPORT

## Import ATO

### DURING ATO IMPORT

- MACE will attempt to create a platform (aircraft) entity for each aircraft entry in the ATO - including one entity for each aircraft in a flight.
- MACE will attempt to parse:
  - Callsign
  - Weapons loadout
  - IFF settings
  - Takeoff time & location
  - Mission location
  - Route information, if present
- If a location can't be found from a platform on the map, MACE checks
  - "Known Places" followed by the DAFIF airport database.
  - If MACE has any problems loading an ATO, it will output the issues in the Messages window – e.g. *ATO Import: Could not find departing location LOC:UGGG of CAMELOT13*
  - If aircraft type cannot be found an unknown platform [?] will be created



```
Messages
Updating auto avoid layers
Completed parsing ACO
11:00:00 ATO Import: Parsing ATO...
ATO Import: Missing ATO mapping: TONKA Separate enroute and on stations speeds not defined.
ATO Import: Could not find MACE matching platform type to TONKA for TA43. Using default MACE platform.
ATO Import: Missing ATO mapping: TONKA Separate enroute and on stations speeds not defined.
ATO Import: Could not find MACE matching platform type to TONKA for TA41. Using default MACE platform.
ATO Import: Could not find equipment 4GBU38 for RT05(6505).
ATO Import: Could not find equipment 4GBU38 for RT05(6505).
ATO Import: Could not find equipment 4GBU38 for RT05(6505).
ATO Import: Could not find equipment 4GBU38 for RT06(6506).
ATO Import: Could not find equipment 4GBU38 for RT06(6506).
ATO Import: Could not find equipment 4GBU38 for RT06(6506).
ATO Import: Could not find equipment 4GBU38 for RT07(6507).
ATO Import: Could not find equipment 4GBU38 for RT07(6507).
ATO Import: Could not find equipment 4GBU38 for RT07(6507).
ATO Import: Completed parsing ATO
```



# MISSION DATA IMPORT AND EXPORT

## MOCT ATO Entity and Equipment Matching

MACE MOCT - Mission Objects Configuration Tool

MOCT Services << MOCT Objects << Configuration <<

Object Configuration >> ATO-to-MACE Entity Mappings >> A10 A65B CH47D

ATO-to-MACE Entity Mappings

- ATO-to-MACE Entity Mappings
- ATO-to-MACE Equipment Mappings
- Ballistic Aeros (Deprecated)
- Cultural Features
- EM Aeros
- Equipment
- FFM Aeros
- Heads-Up Display
- Helicopter Aeros

A10

A-10

A10A

A10C

A310R

AC130H

AC130U

AH1W

AH1Z

AH64

AH64D

AH6J

AV19

01. Identification

Data Source

Comments

Classification 1 = Unclassified

02. Mapping

ATO Name CH47D

MACE Type CH-47

03. Movement

Outbound Speed In Knots (min=0, max=10000, inc=10) 130.0000

On Station Speed In Knots (min=0, max=10000, inc=10) 100.0000

Return Speed In Knots (min=0, max=10000, inc=10) 130.0000

- Mission Object Configuration Tool (MOCT)
- ATO-to-MACE Entity Mappings
  - ATO Name match to MACE Entity Name
  - Select Outbound, On-Station, and Return Speeds for each type
- ATO-to-MACE Equipment Mappings
  - ATO Name match to MACE Equipment Name
  - Select quantity

A130 A154A G12

01. Identification

Data Source

Comments

Classification 1 = Unclassified

02. Mapping

ATO Name G12

MACE Type GBU-12 PAVEWAY

Quantity (min=0, max=10000, inc=1) 1

# MISSION DATA IMPORT AND EXPORT

## MOCT ATO Known Place Items

The screenshot displays the MOCT Objects Configuration tool. On the left, under 'MOCT Objects', a list of 'Known Place Items' includes KNYL, KSZL, NIKE, OAIX, OTBH, UG22, UG23, UGMM, UGSK, UGTB, and UGVZ. The 'KNYL' item is selected. On the right, the 'Configuration' pane for 'KNYL' is shown, containing two sections: '01. Identification' and '02. Place'. The '01. Identification' section includes fields for 'Data Source', 'Comments', 'Name' (set to 'KNYL'), and 'Classification' (set to '1 = Unclassified'). The '02. Place' section includes fields for 'MACE Type' (set to 'Runway'), 'Orientation In Degrees (min=0, max=360, inc= 44.00)', 'Latitude In Degrees (min=-90, max=90, inc= 32.648740)', and 'Longitude In Degrees (min=-180, max=180, i -114.612528)'. A red dashed box highlights the configuration pane.

- Mission Object Configuration Tool (MOCT)
- Known Place Items
  - ATO Name match to MACE Entity Name
  - MACE Type – E.g. Runway or Helipad
  - Orientation
  - Location

# MISSION DATA IMPORT AND EXPORT

## Electronic Order Of Battle Import

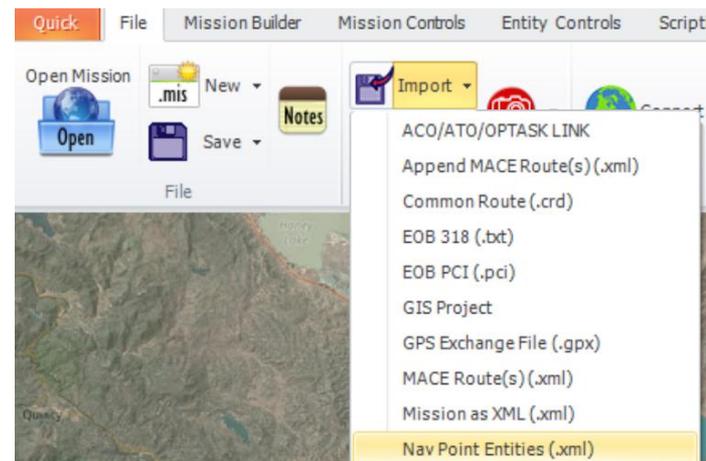
- EOB importable in EOB 318 format as a .txt file
- These require the MACE CLASSIFIED database to be installed
- All emitters must have unique ELNOTs
- Recommended to only use this feature with classified data version of MACE
- Otherwise use Nav Point Import

# MISSION DATA IMPORT AND EXPORT

## Nav Point Import

- Simple import via an xml
- Can be edited in Microsoft Excel
- Places known points or platforms at lat/long
- For EOB Substitute - recommend
  - Import as known points
  - Place Automated SAM sites at points
  - Delete the points if req or keep for briefing (ARMOR Known Points Display)

FILE → Import/Export



| enabled | name    | smallName | latitude_deg | longitude_deg | maceModel | maceType    | importModel |
|---------|---------|-----------|--------------|---------------|-----------|-------------|-------------|
| TRUE    | HOG-11  | TOM       | 38.894445    | -118.380555   | Platform  | A-10C       | TRUE        |
| TRUE    | SA-15-1 | SA-15-1   | 38.9666667   | -118.55       | Site      | Known Point | TRUE        |
| TRUE    | SA-15-2 | SA-15-2   | 39.44895     | -118.22655    | Site      | Known Point | TRUE        |
| TRUE    | SA-15-3 | SA-15-3   | 39.1916667   | -118.9833333  | Site      | Known Point | TRUE        |
| TRUE    | SA-20-1 | SA-20-2   | 39.4666667   | -118.7666667  | Site      | Known Point | TRUE        |
| TRUE    | SA-20-2 | SA-20-2   | 39.069445    | -118.5361117  | Site      | Known Point | TRUE        |

# MISSION DATA IMPORT AND EXPORT

## Environment Settings – METAR & TAF Entry (US ONLY)

Time of Day

Start Time (UTC): 13:00:00 January 24

Time Zone: (UTC) Co-ordinated Universal Time

Local Time: 13:00:00 January 24

Moon Phase

Weather Region: \* GLOBAL DEFAULT \*

Delete Region

Add Region

- Empty Region
- From METAR
- From TAF
- From Gridded CSV

Terminal Aerodrome Forecast

```
KDTS 220953Z AUTO 0000KT 10SM CLR 26/23
A2979 RMK AO2 SLP086 T02560233
```

Import METARs before TAFs. TAFs update loaded METARs.

Parse TAF(s)

- (1) Select Add Region Dropdown
- (2) Select METAR or TAF
- (3) Paste text from TAF or METAR (as appropriate to selection)
- (4) Parse
- (5) Select Weather Region and check the data in the environment settings

Weather Region: KNSE

- \* GLOBAL DEFAULT \*
- KNSE
- KDTS

Name: KNSE KDTS

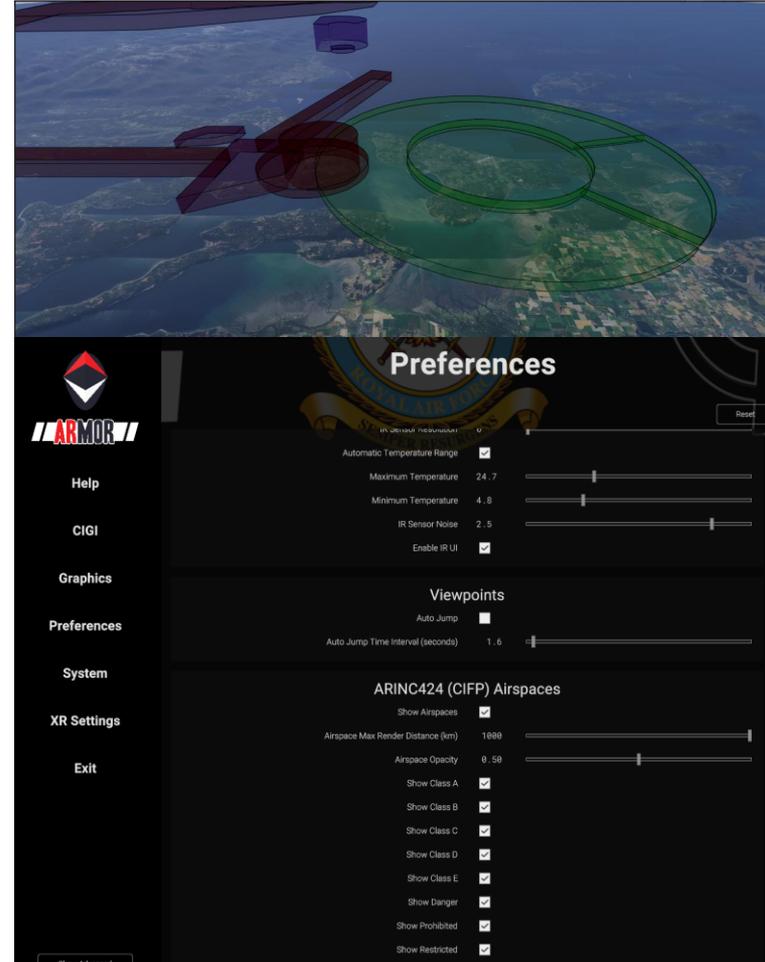
### NOTE – AIRFIELD DATA

MACE can pass only airfields that are published as ARINC data by respective country aviation authorities

# MISSION DATA IMPORT AND EXPORT

## ARMOR Controlled Airspace

- Show controlled airspace in ARMOR **only**
- Place .kmz files in C:\Users\Public\Documents\ARMOR\Airspaces
- Airspace – 3D Airspace (<https://3dairspace.org.uk/airspace/>)
- Activate from
  - OSI – Visualizations Menu
  - Keyboard Shortcut – K



# MISSION DATA IMPORT AND EXPORT

## Alternate Student Exercise: - No Video Yet

1. Import: Mission Data Import and Export PNW Sample ACO-1.aco into MACE
2. Show 1 by 1 from layer manager in ARMOR: CORRTE, ROZ, REFPT, OTR
3. Add some new shape content: Create a new 5nm ROZ 5-15kft in yellow 50% transparent and view in ARMOR
4. Add some more shape content: Create a new polygon NFZ from 0 to 5kft in 80% red and view in ARMOR
5. Add 2 aircraft Select one of the aircraft and import GPX Route: Mission Data Import and Export PNW Sample\_GPX\_Route.gpx
6. Now select the other aircraft and have it proceed via one of the corridors
7. Now export that route as a GPX selecting the original GPX import and appending waypoints to it
8. Add a 3rd aircraft and import the new route and see that it is the combination of both
9. Select the 3 aircraft and export a MACE route for them (Mission Data Import and Export PNW 3 Blue Aircraft MACE Route.xml)
10. Delete them and import the MACE route – see that they are restored
11. Import MACE Route: Mission Data Import and Export PNW IADS\_Platforms\_MACE\_Route.xml
12. Add a submarine or surface ship with tomahawk missile near Port Townsend
13. Edit one of the tomahawks in the weapons and equipment: import CRD route for waypoints: Mission Data Import and Export PNW TLAM Route.crd
14. Move the 3 Aircraft into an 2nm arrow formation, set them at 30kft, do nothing, weapons free – export them as a group template aggregate (Generic\_Fighter\_Arrow\_High.xml)
15. Drag the new template in from mission builder on to MACE map and confirm properties are preserved
16. Delete the second group
17. Import: Mission Data Import and Export PNW Sample ATO-2 (Bad Type).ato
18. See there is some [?] entities because there is a type not recognized in the ATO “TONKA”
19. Open the MOCT and add a new ATO mapping “TONKA” to map to “Tornado.”

# MISSION DATA IMPORT AND EXPORT

Alternate Student Exercise: - No Video Yet cont..

18. See there is some [?] entities because there is a type not recognized in the ATO “TONKA”
19. Open the MOCT and add a new ATO mapping “TONKA” to map to “Tornado”
20. Restart MACE and repeat the import and see the accurate mapping to Tornado
21. Use the layer manager to hide red team
22. If possible, open the Mission Data Import and Export PNW EF\_Sites\_Nav\_Points.xml file with Excel
23. Edit it to add another line for “EF-Airbase” of Type “Runway” and add the coordinate for the center of ‘Fall City’ airbase – save as a new NavPoint entity xml (Mission Data Import and Export PNW EF\_Sites\_Nav\_Points \_ and Airbase.xml)
24. In MACE import the NavPoint entity file

# ADVANCED WEAPONS AND EQUIPMENT

## Learning objective:

- To be able to use the advanced weapons and equipment features in MACE

## Enabling objectives:

- Understand the general weapons properties
- Know how to add target location for appropriate weapons
- Know how to add and edit waypoints to waypoint enabled weapons
- Know how to program weapons to auto-launch to achieve a TOT
- Know how to program impact parameters for appropriate weapons
- Know how to program threat library parameters for Anti-Radiation Weapons
- Know how to program parameters for AAMRAM weapons
- Understand the other weapon properties
- Know how to use Ground Radar Control Area (GRCA)

# ADVANCED WEAPONS AND EQUIPMENT

## Weapon Properties

- All weapons have them
- Accessed from platform 'Weapons and Equipment' form
  - Programmed weapons show in BOLD
  - [EDIT] opens weapon properties
- Weapon Properties Form
  - Has Tabs appropriate to the weapon (e.g. threat library on jammer or ARM)
  - GREY items are info only

| Weapon                               | Location    | Qty      | Auto / Enabled                      | Selected Weapon                     | Edit                 | Shoot                 |
|--------------------------------------|-------------|----------|-------------------------------------|-------------------------------------|----------------------|-----------------------|
| <b>RGM-109E (TLAM) (Entity 2259)</b> | <b>Mast</b> | <b>1</b> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2260)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2261)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2262)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2263)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2264)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2265)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2266)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2267)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2268)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2269)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2270)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2271)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2272)        | Mast        | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2273)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2274)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2275)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2276)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2277)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |
| RGM-109E (TLAM) (Entity 2278)        |             | 1        | <input type="checkbox"/>            | <input type="checkbox"/>            | <a href="#">Edit</a> | <a href="#">Shoot</a> |

RGM-109E (TLAM) (Site: 1, App: 100, Entity: 2259) Properties EW Editor

Properties Sensors Waypoints

**Aero**

Waypoints Enabled **True**

Aerodynamic Model **TLAM Vertical Launch**

Attack Profile Loft

Range Direct Trigger 10.0 nm

**Behaviors**

Inertial Guidance Period 0 s

Max Reciprocal Bearing 90°

**CCM**

Home on Jam **False**

**ID**

Ownership Name S119\_1

Equipment Name RGM-109E (TLAM)

Weapon Instance ID 2508

**Impact Parameters**

Vertical Angle (degrees)

Course (degrees magnetic)

**Location**

Height Offset 32.81 ft

Length Offset 39.37 ft

Width Offset 0.00 ft

**Modeling**

Capability Weapon

Refresh Time **0.10 s**

Assigned Commands **GPS Weapon Command**

**Target Location**

Target Location **10T FU 03674 06582**

Target Object (DPI) **TbAmACQ\_8**

Target Elevation **4995 ft**

Time on Target (Planned) **12:40:00 08/01/2024**

Time on Target 12:37:56 08/01/2024

Time to Target 00:07:57

Use Target Location **False**

**Weapon**

Callsign

DIS type **Type: 2.9.225.1.19.5.0**

Datalink **Link-16 / NET:0.0 (1131, 240000, FH, CPSM)**

Fuse

WEZ Name

Munitions Count 1

Salvo/Reload Time 10.00 s

Max Range 900.0 nm

Inertial Guidance Duration 0 sec

Terminal Guidance Activation Range 10.0 nm

Lock-On After Launch **False**

Weapon As Sensor **False**

Track # **11450**

Minimum Track Quality **95**

**Equipment Name**

Text name of this equipment.



# ADVANCED WEAPONS AND EQUIPMENT

## Adding Target Location to Weapons

- Most weapons allow target location programming
- Can be a coordinate or selected entity (Callsign)

### Adding Target Location

- (1) [Edit] Weapon Properties from Weapons & Equipment Form
- (2) [Properties] Tab
- (3) 'Target Location' Section
- (4) Type or Paste Location into 'Target Location'  
OR
- (4) Select target location from map [...] button  
OR
- Type Target Callsign into 'Target Object DPI'  
OR
- (4) Select target object from map [...] button

Target elevation is automatic, manually overwrite elevation if required

| Weapon                        | Location | Qty | Auto / Enabled                      | Selected Weapon                     | Edit                                | Shoot                                |
|-------------------------------|----------|-----|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|
| RGM-109E (TLAM) (Entity 2259) | Mast     | 1   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="button" value="Edit"/> | <input type="button" value="Shoot"/> |

RGM-109E (TLAM) (Site: 1, App: 100, Entity: 2259) Prop... X

EW Editor

Properties | Sensors | Waypoints

**Aero**

|                      |                      |
|----------------------|----------------------|
| Waypoints Enabled    | True                 |
| Aerodynamic Model    | TLAM Vertical Launch |
| Attack Profile       | Loft                 |
| Range Direct Trigger | 10.0 nm              |

**Behaviors**

|                          |     |
|--------------------------|-----|
| Inertial Guidance Period | 0 s |
| Max Reciprocal Bearing   | 90° |

**CCM**

|             |       |
|-------------|-------|
| Home on Jam | False |
|-------------|-------|

**ID**

|                    |                 |
|--------------------|-----------------|
| Ownership Name     | S119_1          |
| Equipment Name     | RGM-109E (TLAM) |
| Weapon Instance ID | 2508            |

**Impact Parameters**

|                           |  |
|---------------------------|--|
| Vertical Angle (degrees)  |  |
| Course (degrees magnetic) |  |

**Location**

|               |          |
|---------------|----------|
| Height Offset | 32.81 ft |
| Length Offset | 39.37 ft |
| Width Offset  | 0.00 ft  |

**Modeling**

|                   |                    |
|-------------------|--------------------|
| Capability        | Weapon             |
| Refresh Time      | 0.10 s             |
| Assigned Commands | GPS Weapon Command |

**Target Location**

|                          |                     |
|--------------------------|---------------------|
| Target Location          | 101 FU 03674 06582  |
| Target Object (DPI)      | TbArmACQ_8          |
| Target Elevation         | 4995 ft             |
| Time on Target (Planned) | 12:40:00 08/01/2024 |
| Time on Target           | 12:41:09 08/01/2024 |
| Time to Target           | 00:11:09            |
| Use Target Location      | False               |

**Target Location**  
The target's geographic location. Click the ellipses to set the location from the map.

# ADVANCED WEAPONS AND EQUIPMENT

## Waypoint Enabled Weapons

- Some weapons can follow waypoints – MALD, TLAM, JSOW, JASSM etc

## Adding & Editing Waypoints

- (1) [Edit] Weapon Properties from Weapons & Equipment Form
- (2) Waypoints added in the [Waypoint] Tab
- (3) Add from Map AGL or MSL
- (4) Select individual waypoints to edit after adding

## Apply a pre-exported route (CRD)

- [Edit] Weapon Properties from Weapons & Equipment Form
- Waypoints added in the [Waypoint] Tab
- (5) [Import Waypoints CRD] select CRD file
- Select individual waypoints to edit after adding

| Weapon          | Location      | Qty  | Auto / Enabled | Selected Weapon                     | Edit                                | Shoot                               |
|-----------------|---------------|------|----------------|-------------------------------------|-------------------------------------|-------------------------------------|
| RGM-109E (TLAM) | (Entity 2259) | Mast | 1              | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

Properties Sensing Waypoints

Add or edit waypoints to be followed by this weapon.

- Can be manually launched from the Weapon Release Button
- Right click on waypoints list for context menu.

Import Waypoints (CRD)

Add Waypoints | Add Waypoints (AGL) | Clear All

|   |        |               |         |      |        |
|---|--------|---------------|---------|------|--------|
| X | Wpt: 1 | Altitude MSL: | 150 ft  | AGL: | 150 ft |
| X | Wpt: 2 | Altitude MSL: | 150 ft  | AGL: | 150 ft |
| X | Wpt: 3 | Altitude MSL: | 314 ft  | AGL: | 104 ft |
| X | Wpt: 4 | Altitude MSL: | 274 ft  | AGL: | 159 ft |
| X | Wpt: 5 | Altitude MSL: | 305 ft  | AGL: | 158 ft |
| X | Wpt: 6 | Altitude MSL: | 24 ft   | AGL: | 23 ft  |
| X | Wpt: 7 | Altitude MSL: | 1994 ft | AGL: | 37 ft  |
| X | Wpt: 8 | Altitude MSL: | 1994 ft | AGL: | 329 ft |
| X | Wpt: 9 | Altitude MSL: | 2597 ft | AGL: | 329 ft |

Waypoint Name: 5 - RGM-109E (TLAM)

|                |                   |
|----------------|-------------------|
| Altitude Type  | AGL               |
| Altitude (MSL) | 305 ft            |
| Altitude (AGL) | 158 ft            |
| Latitude       | 47° 51' 51.12" N  |
| Longitude      | 121° 44' 19.32" W |

Waypoint Name  
Name of the waypoint

### NOTE – WAYPOINTS FOR ANY WEAPON

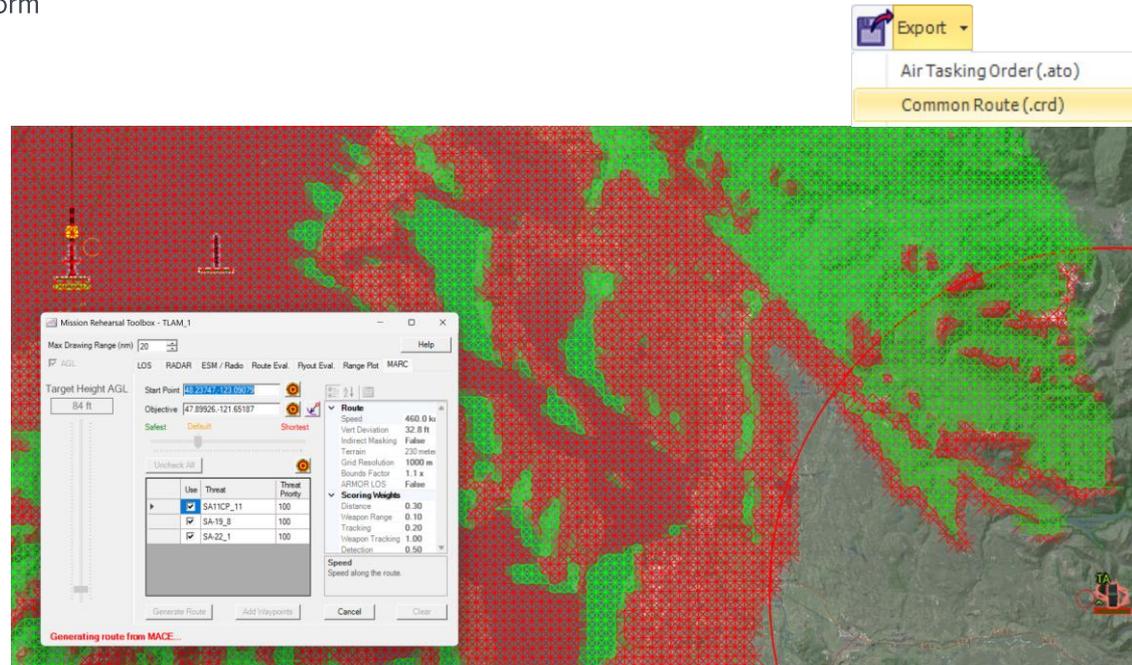
The weapon UI permits users to enable waypoints for any weapon. They will be disabled by default if the weapon doesn't normally follow waypoints.

|                   |       |
|-------------------|-------|
| Waypoints Enabled | False |
| Aerodynamic Model | True  |
| Attack Profile    | False |

# ADVANCED WEAPONS AND EQUIPMENT

## Waypoint Enabled Weapons

- Use MRT – MACE Assisted Route Creation
  - Add a TLAM from Platform Selector near launch platform
  - Use MRT and MARC to plot route
  - FILE → IMPORT/EXPORT – EXPORT CRD
  - Delete Platform
  - Import Route into Equipment on Launch Platform



# ADVANCED WEAPONS AND EQUIPMENT

## Auto-launch for TOT

- Weapon TOT can be programmed
- Launch will be automatic only if weapon is 'Auto-enabled' in weapons and equipment form
- **Best practice:**
  - Enter weapon route (if applicable) first
  - Shows TTT for whole route from origin
  - Allows setting of an achievable TOT (Planned)

## Setting planned TOT

- (1) [Edit] Weapon Properties from Weapons & Equipment Form
- (2) [Properties] Tab
- (3) 'Use Target Location' – usually set as true (or else time to last WP)
- (4) Check 'Time to Target'
- (5) Overtyping or Typing 'Time on Target (Planned)'
- (6) Ensure Weapon is 'Auto/Enabled' in Weapons & Equipment form

| Weapon                        | Location | Qty | Auto/Enabled                        | Selected Weapon                     | Edit                                | Shoot                                |
|-------------------------------|----------|-----|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------------------|
| RGM-109E (TLAM) (Entity 2259) | Mast     | 1   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="button" value="Edit"/> | <input type="button" value="Shoot"/> |

RGM-109E (TLAM) (Site: 1, App: 100, Entity: 2259) Prop... X  
EW Editor

Properties | Sensors | Waypoints

**Aero**

|                      |                      |
|----------------------|----------------------|
| Waypoints Enabled    | True                 |
| Aerodynamic Model    | TLAM Vertical Launch |
| Attack Profile       | Loft                 |
| Range Direct Trigger | 10.0 nm              |

**Behaviors**

|                          |     |
|--------------------------|-----|
| Inertial Guidance Period | 0 s |
| Max Reciprocal Bearing   | 90° |

**CCM**

|             |       |
|-------------|-------|
| Home on Jam | False |
|-------------|-------|

**ID**

|                    |                 |
|--------------------|-----------------|
| Ownership Name     | S119_1          |
| Equipment Name     | RGM-109E (TLAM) |
| Weapon Instance ID | 2508            |

**Impact Parameters**

|                           |  |
|---------------------------|--|
| Vertical Angle (degrees)  |  |
| Course (degrees magnetic) |  |

**Location**

|               |          |
|---------------|----------|
| Height Offset | 32.81 ft |
| Length Offset | 39.37 ft |
| Width Offset  | 0.00 ft  |

**Modeling**

|                   |                    |
|-------------------|--------------------|
| Capability        | Weapon             |
| Refresh Time      | 0.10 s             |
| Assigned Commands | GPS Weapon Command |

**Target Location**

|                          |                     |
|--------------------------|---------------------|
| Target Location          | 10T FU 03674 06582  |
| Target Object (DPI)      | TbArmACQ_8          |
| Target Elevation         | 4995 ft             |
| Time on Target (Planned) | 12:40:00 08/01/2024 |
| Time on Target           | 12:41:09 08/01/2024 |
| Time to Target           | 00:11:09            |
| Use Target Location      | False               |

**Target Location**  
The target's geographic location from the map.

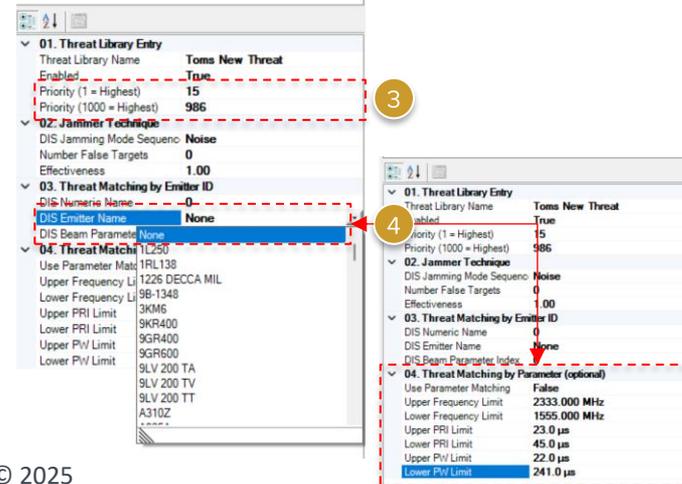
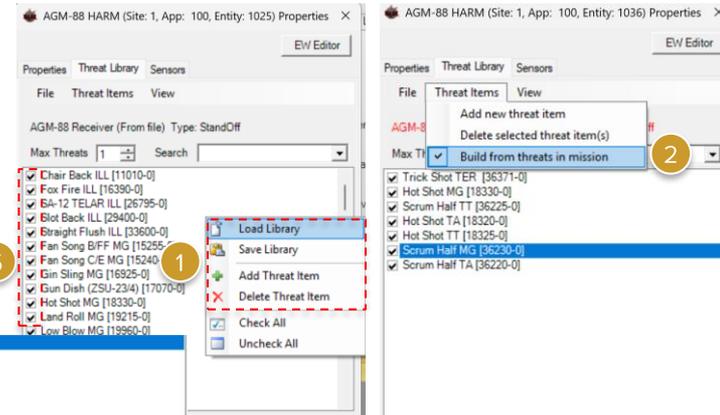
# ADVANCED WEAPONS AND EQUIPMENT

## Anti Radiation Missiles – Threat Library

ARM weapons can be shot at a location or entity as with any programmable weapon – program target location in [Properties] tab

### Threat Library Editing

- Any equipment that detects threat emissions has Threat Library
- Threat libraries can be loaded and saved (1)
- Can be built from the threats in the mission (MACE 2025)
- And edited and saved for future use
- Add New Threat – By Name or by parametric (4)
- Delete Threats (1)
- Change Priority for engagement (3)
- Threat items can be included/excluded from the library by checking/unchecking in threat list (5)
- E.g. Uncheck ALL and check 1 only to target a specific system

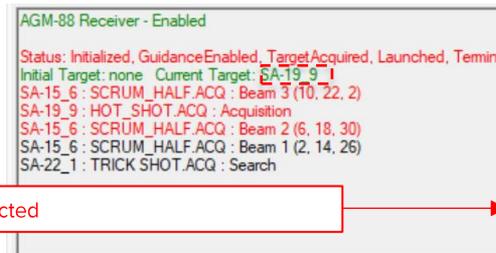
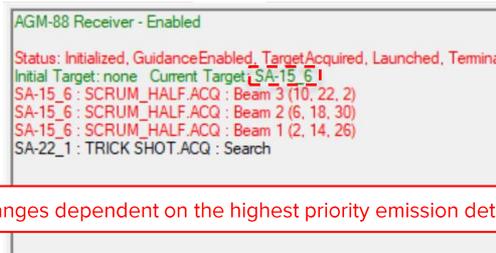
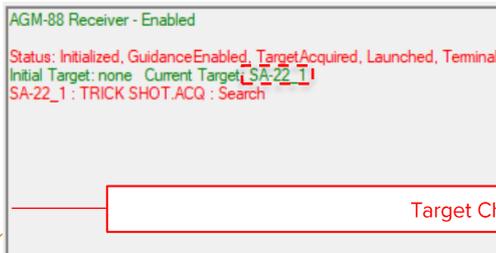
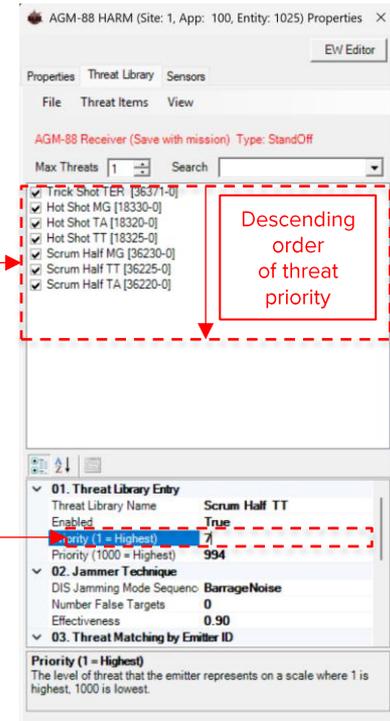
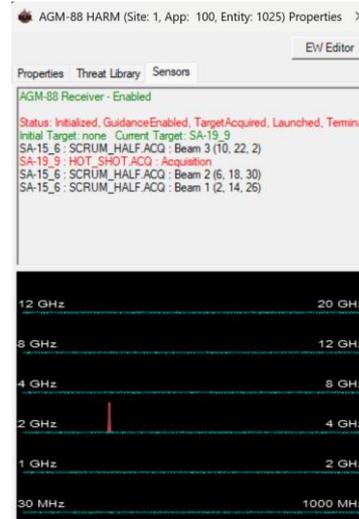


# ADVANCED WEAPONS AND EQUIPMENT

## Anti Radiation Missiles – Threat Priority

When creating custom threat list

- Priority is shown in descending order
- The missile will engage highest priority
  - RMB on Missile in flight to open properties
  - Emissions and Current Target in [Sensors] tab
  - Can edit threat library in flight if required



Target Changes dependent on the highest priority emission detected



# ADVANCED WEAPONS AND EQUIPMENT

## AIM-120 AMRAAM General Parameters

- AMRAAM command – extra fields in properties
  - Written at UNCLASS level
  - For other parties to take code and adapt
    - Guides to predicted collision point
    - Will search an uncertainty volume
    - Once acquired shift to track mode
- Typical Edits:
  - CCM – Home on jam, based on datalink settings
  - Datalink:
    - These are the parameters that determine if it is going to get jammed
    - How frequently it updates when in datalink guidance
  - PRF Ranges – High and Medium (Cheap-shot and Pitbull)
  - Track Quality – Before firing

| Properties                   | Sensors               | Properties                   | Sensors               |
|------------------------------|-----------------------|------------------------------|-----------------------|
| <b>Active State</b>          | Active State          | <b>Active State</b>          | Active State          |
| Waypoints Enabled            | False                 | Waypoints Enabled            | False                 |
| Aerodynamic Model            | AIM-120 AMRAAM        | Aerodynamic Model            | AIM-120 AMRAAM        |
| Attack Profile               | Loft                  | Attack Profile               | Loft                  |
| Range Direct Trigger         | 10.0 nm               | Range Direct Trigger         | 10.0 nm               |
| <b>Behaviors</b>             |                       | <b>Behaviors</b>             |                       |
| Inertial Guidance Period     | 0 s                   | Inertial Guidance Period     | 0 s                   |
| Max Reciprocal Bearing       | 90°                   | Max Reciprocal Bearing       | 90°                   |
| <b>CCM</b>                   |                       | <b>CCM</b>                   |                       |
| Home on Jam                  | False                 | Home on Jam                  | True                  |
| <b>Datalink</b>              |                       | <b>Datalink</b>              |                       |
| Update Rate                  | 5 Hz                  | Update Rate                  | 2 Hz                  |
| Datalink Status              | OK                    | Datalink Status              | OK                    |
| Datalink Frequency           | 1 MHz                 | Datalink Frequency           | 1 MHz                 |
| Bandwidth                    | 0.001 MHz             | Bandwidth                    | 0.001 MHz             |
| <b>ID</b>                    |                       | <b>ID</b>                    |                       |
| Ownership Name               | F-35C_1               | Ownership Name               | F-35C_1               |
| Equipment Name               | AIM-120 AMRAAM        | Equipment Name               | AIM-120 AMRAAM        |
| Weapon Instance ID           | 1113                  | Weapon Instance ID           | 1118                  |
| <b>Impact Parameters</b>     |                       | <b>Impact Parameters</b>     |                       |
| Vertical Angle (degrees)     |                       | Vertical Angle (degrees)     |                       |
| Course (degrees magnetic)    |                       | Course (degrees magnetic)    |                       |
| <b>Location</b>              |                       | <b>Location</b>              |                       |
| Height Offset                | -1.08 ft              | Height Offset                | -1.08 ft              |
| Length Offset                | 1.12 ft               | Length Offset                | 1.12 ft               |
| Width Offset                 | -3.12 ft              | Width Offset                 | 3.12 ft               |
| <b>Modeling</b>              |                       | <b>Modeling</b>              |                       |
| Capability                   | Weapon                | Capability                   | Weapon                |
| Refresh Time                 | 0.10 s                | Refresh Time                 | 0.10 s                |
| Assigned Commands            | AMRAAM Weapon Command | Assigned Commands            | AMRAAM Weapon Command |
| <b>PRF Ranges</b>            |                       | <b>PRF Ranges</b>            |                       |
| MPRF Active Range            | 5.8 nm                | MPRF Active Range            | 6.8 nm                |
| HPRF Active Range            | 14.8 nm               | HPRF Active Range            | 10.8 nm               |
| <b>Target Location</b>       |                       | <b>Target Location</b>       |                       |
| Target Location              |                       | Target Location              |                       |
| Target Object (DPI)          |                       | Target Object (DPI)          |                       |
| Target Elevation             |                       | Target Elevation             |                       |
| Time on Target (Planned)     |                       | Time on Target (Planned)     |                       |
| Time on Target               |                       | Time on Target               |                       |
| Time to Target               | 00:00:00              | Time to Target               | 00:00:00              |
| Use Target Location          | False                 | Use Target Location          | False                 |
| <b>Weapon</b>                |                       | <b>Weapon</b>                |                       |
| Callsign                     |                       | Callsign                     |                       |
| DIS type                     | Type: 2.1,225,1.2,3,0 | DIS type                     | Type: 2.1,225,1.2,3,0 |
| Datalink                     | none                  | Datalink                     | none                  |
| Fuse                         |                       | Fuse                         |                       |
| WEZ Name                     | AIM-120 AMRAAM        | WEZ Name                     | AIM-120 AMRAAM        |
| Munitions Count              | 1                     | Munitions Count              | 1                     |
| Salvo/Reload Time            | 8.00 s                | Salvo/Reload Time            | 8.00 s                |
| Max Range                    | 57.0 nm               | Max Range                    | 57.0 nm               |
| Inertial Guidance Duration   | 0 sec                 | Inertial Guidance Duration   | 0 sec                 |
| Terminal Guidance Activation | 12.0 nm               | Terminal Guidance Activation | 12.0 nm               |
| Lock-On After Launch         | False                 | Lock-On After Launch         | False                 |
| Weapon As Sensor             | False                 | Weapon As Sensor             | False                 |
| Track #                      | 0                     | Track #                      | 0                     |
| Minimum Track Quality        | 75                    | Minimum Track Quality        | 75                    |

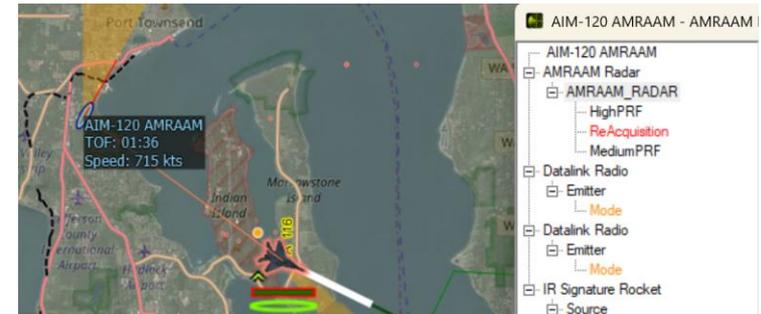
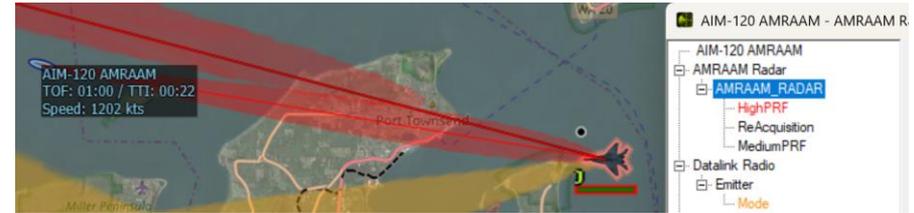
# ADVANCED WEAPONS AND EQUIPMENT

## AIM-120 AMRAAM – Mode Changes

- High PRF
- Medium PRF
- Reacquisition

### PRF Ranges

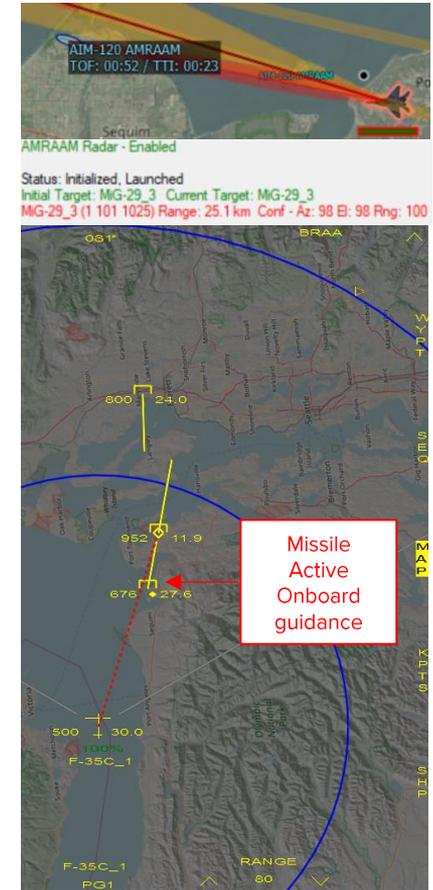
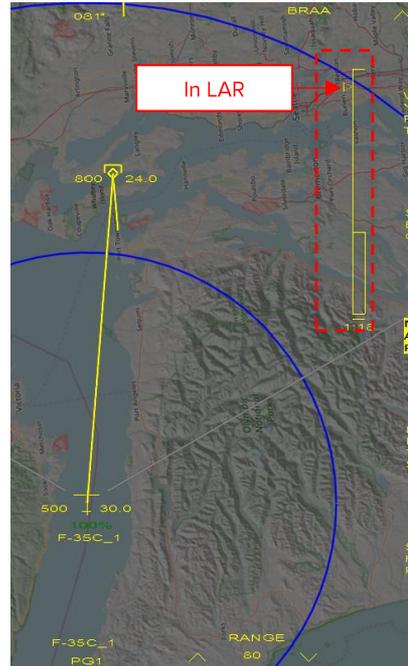
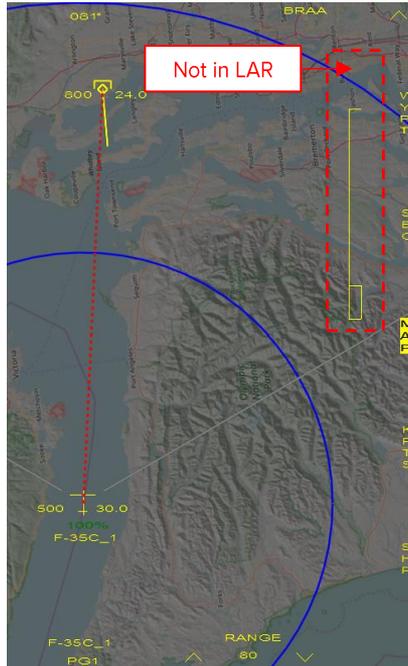
|                   |         |
|-------------------|---------|
| MPRF Active Range | 5.8 nm  |
| HPRF Active Range | 14.8 nm |



# ADVANCED WEAPONS AND EQUIPMENT

## AIM-120 AAMRAM

- TAC Display LAR indications
- Currently designed for human in loop (constructive on the roadmap)



# ADVANCED WEAPONS AND EQUIPMENT

## Ground Radar Control Area (GRCA)

- GRCA command added to aircraft with ground scanning radar
- Constrains scan to a small user defined area
- Can create a route for the aircraft to follow
- Or user can create their own route

### Adding a GRCA:

- (1) Access Via RMB click on enabled platform (e.g. JSTARS)
- (2) Tick or untick Create Route  as required and enter parameters for route if using
- (3) [Add GRCA from Map] - Draw GRCA rectangle on map
- (4) Set tolerance of alignment to GRCA in the ground scanning radar (e.g. APY-7) properties from 'Weapons & Equipment'

The screenshot shows the 'Create Ground Radar Coverage Areas' window. At the top, a 'Route Properties' section is highlighted with a red dashed box and contains a '2' in a yellow circle. It includes a checked 'Create Route' checkbox, radio buttons for 'Offset Left' and 'Offset Right', an 'Offset Distance' field set to '75 nm', and an 'Altitude (MSL)' field set to '30000 ft'. Below this, an 'Add GRCA from Map' button is highlighted with a red dashed box and contains a '3' in a yellow circle. A table below the button lists the GRCA details:

| Name  | Latitude        | Longitude        | Major Axis (NM) | Minor Axis (NM) | Major Axis (deg true) |
|-------|-----------------|------------------|-----------------|-----------------|-----------------------|
| GRCA1 | N 47° 54' 1.47" | W 121° 44' 2.54" | 54.49           | 44.01           | 027°                  |

The main map area shows a terrain view with a yellow line representing a route and a red dashed rectangle representing the GRCA. A context menu is open over the map, with 'Mission Parameters Tool' highlighted and a '4' in a yellow circle next to it. The 'APY-7 Properties' window is also open, showing the 'GRCA' tab. The 'GRCA Properties' section is highlighted with a red dashed box and contains a '4' in a yellow circle. It lists 'Active Range' as '75 nm' and 'Alignment Tolerance' as '10°'.

# ADVANCED WEAPONS AND EQUIPMENT

## Programming Weapon Impact Parameters

- Weapons like JDAM, SDB, JASSM, JSOW allow programmable impact parameters
  - Final attack heading – course
  - Impact angle
- Programmable from weapons form (and via TAC Display)
  - Can be used with UFCD device
  - Or Keyboard

### Program Impact Parameters

- (1) [Edit] Weapon Properties from Weapons & Equipment Form
- (2) [Properties] Tab
- (3) Enter impact angle in 'Vertical Angle (degrees)'
- (4) Enter final attack heading in 'Course (degrees magnetic)'

These can also be entered in TAC display manually

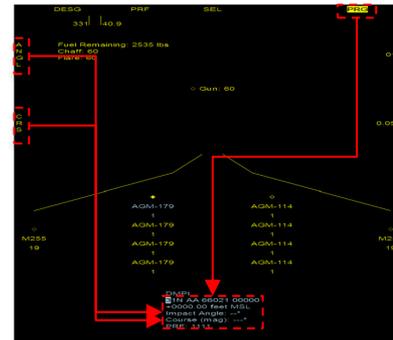
#### NOTE – IMPACT PARAMETERS FOR HUMAN IN THE LOOP OPS

Weapon impact parameters were originally added for human-in-the-loop use cases where the user determines the release point. Constructive automatic weapon releases within LAR are in the future roadmap.

| Weapon          | Location      | Qty  | Auto / Enabled | Selected Weapon                     | Edit                                | Shoot                               |
|-----------------|---------------|------|----------------|-------------------------------------|-------------------------------------|-------------------------------------|
| RGM-109E (TLAM) | (Entity 2259) | Mast | 1              | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

| GBU-39/A/B (Site: 1, App: 100, Entity: 1014) Properties |                     |
|---|---------------------|
| Waypoints Enabled                                       | True                |
| Aerodynamic Model                                       | GBU-39              |
| Attack Profile  | Direct              |
| Range Direct Trigger                                    | N/A                 |
| <b>Behaviors</b>  |                     |
| Inertial Guidance Period                                | 0 s                 |
| Max Reciprocal Bearing                                  | 90°                 |
| <b>CCM</b>  |                     |
| Home on Jam   | False               |
| <b>ID</b>   |                     |
| Owship Name   | F-35B_1             |
| Equipment Name  | GBU-39/A/B          |
| Weapon Instance ID                                      | 3448                |
| <b>Impact Parameters</b>                                |                     |
| Vertical Angle (degrees)                                | 30°                 |
| Course (degrees magnetic)                               | 330°                |
| <b>Location</b>   |                     |
| Height Offset   | 14.00 ft            |
| Length Offset   | 0.00 ft             |
| Width Offset  | 0.00 ft             |
| <b>Modeling</b>   |                     |
| Capability  | Weapon              |
| Refresh Time  | 0.10 s              |
| Assigned Commands                                       | GPS Weapon Command  |
| <b>Target Location</b>                                  |                     |
| Target Location   | 10T EU 18748 07442  |
| Target Object (DPI)                                     |                     |
| Target Elevation  | 418 ft              |
| Time on Target (Planned)                                |                     |
| Time on Target  | 12:31:21 08/01/2024 |
| Time to Target  | 00:00:51            |
| Use Target Location                                     | False               |



# ADVANCED WEAPONS AND EQUIPMENT

**Student Exercise** (Link to Online Solution Video Not Yet Available)

1. () Make a New MACE Mission
2. () Add 3 x different autonomous tactical enemy air defense sites within 10nm of each other (e.g. SA-22, SA-15, SA-19)
3. () Add 1 x Submarine or Surface Ship carrying TLAM
4. () Add 1 x EA-18 carrying 3 Anti Radiation Missiles (e.g. AGM-88 HARM) in a loiter racetrack facing the threats but outside of engagement range
5. () Add a temporary TLAM platform near the intended TLAM launch platform and use MARC to plan a route to a target
6. () Add the route to the temporary platform and export it as CRD before deleting the temporary platform
7. () Program target position into one of the TLAMs on the ship/submarine
8. () Import the CRD route to the TLAM waypoints
9. () Select an appropriate planned TOT (about 3 min after mission start) and ensure the TLAM is auto/enabled
10. () Program 1 x ARM on the EA-18 – Pre-brief attack, building from mission threats in threat library, re-order the threats by giving each a different priority, then Save the threat library from that ARM, untick all but the emitters on the desired target
11. () Program 1 x ARM on the EA-18 – Flex attack (no target position), load the previously saved weapons library and ensure all threats are selected, delete one threat from the list
12. () On the final ARM – change the properties to enable the missile to be a sensor
13. () Add 1 x F-35 with at least 2 x AIM-120 AMRAAM and a Mig-29 as a target just outside AMRAAM range – have them facing each other and assign the Mig-29 as the F-35 Target
14. () On one of the AIM-120 missiles change the High and Low PRF ranges
15. () Start the mission – Open the TAC Display and top-lock to the F-35 – observe the LAR changes as range closes – launch the AIM-120s manually at the Mig-29 when in range

# ADVANCED WEAPONS AND EQUIPMENT

**Student Exercise** (Link to Online Solution Video Not Yet Available) Cont

16. () Observe the ranges at which each AIM-120 goes active and High and low PRF (Layer manager and RMB on missiles in flight – sensor display)
17. () Observe the TLAM launch on time (automatically) to make the planned TOT – use layer manager to display weapon TTI
18. () Manually fire each of the EA-18 HARM missiles in the order: Pre-planned, Flex, Direct
19. () Confirm in platform properties that the EA-18 aircraft tracks include those from the ARM that was made ‘Weapon as sensor’

# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## Learning objective:

- To be able to use the MACE aircraft tactical display plugin for aircrew human in the loop functions

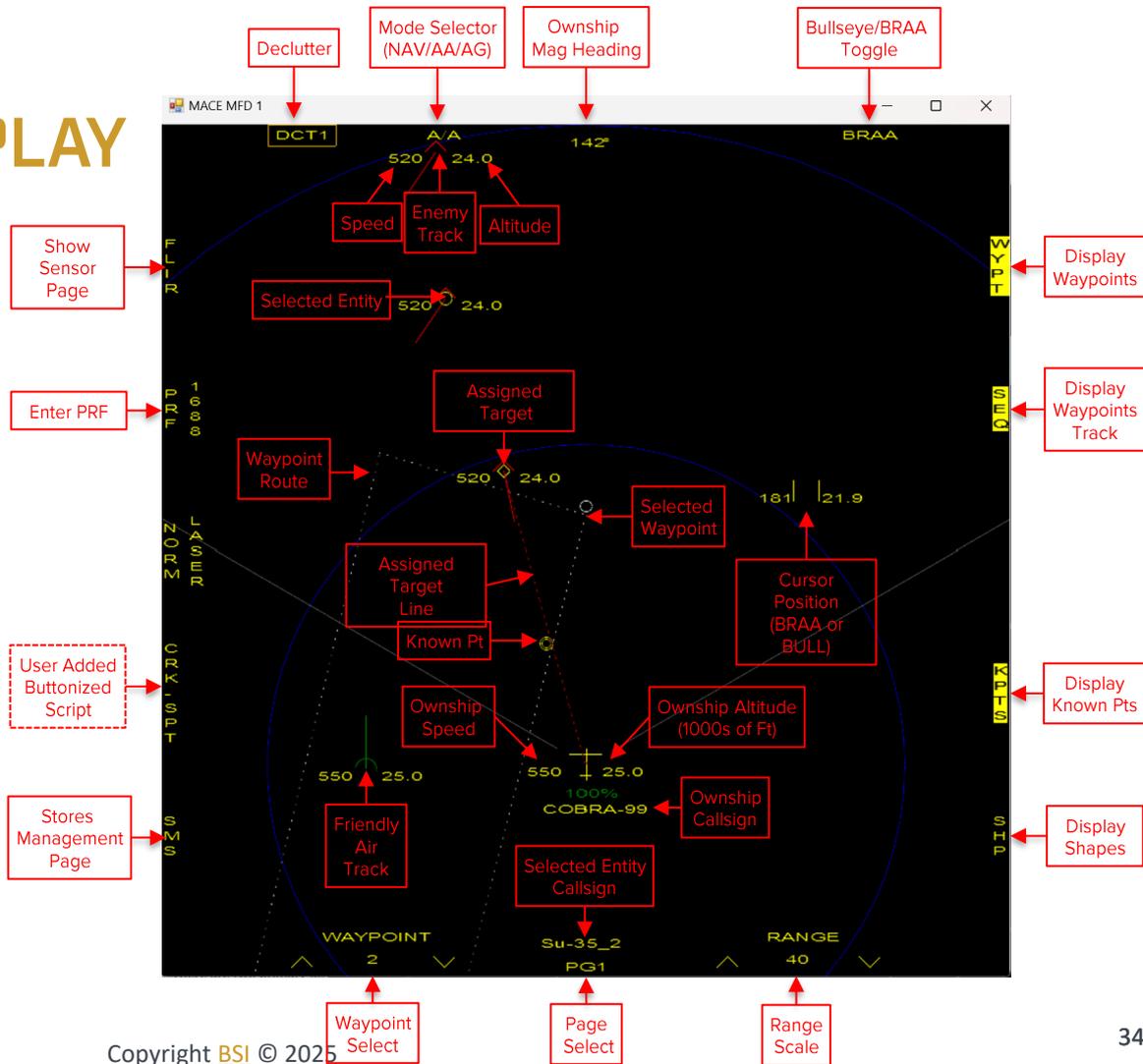
## Enabling objectives:

- Know how to open the TAC display
- Know the main page symbology and what the MFD bezel buttons do
- Know how to control the MFD Cursor
- Know how to add moving map files for the main page display
- Know how to program weapon parameters in the SMS page
- Know how to NDI stream from ARMOR to the TAC display and activate the feed
- Know how to enter and leave SCAN-RAID mode to discriminate between targets in close proximity
- Understand how to use the MFD for air-to-air engagement
- Know how to assign buttonized scripts with the TAC Display

# MACE AIRCRAFT MULTIFUNCTION DISPLAY

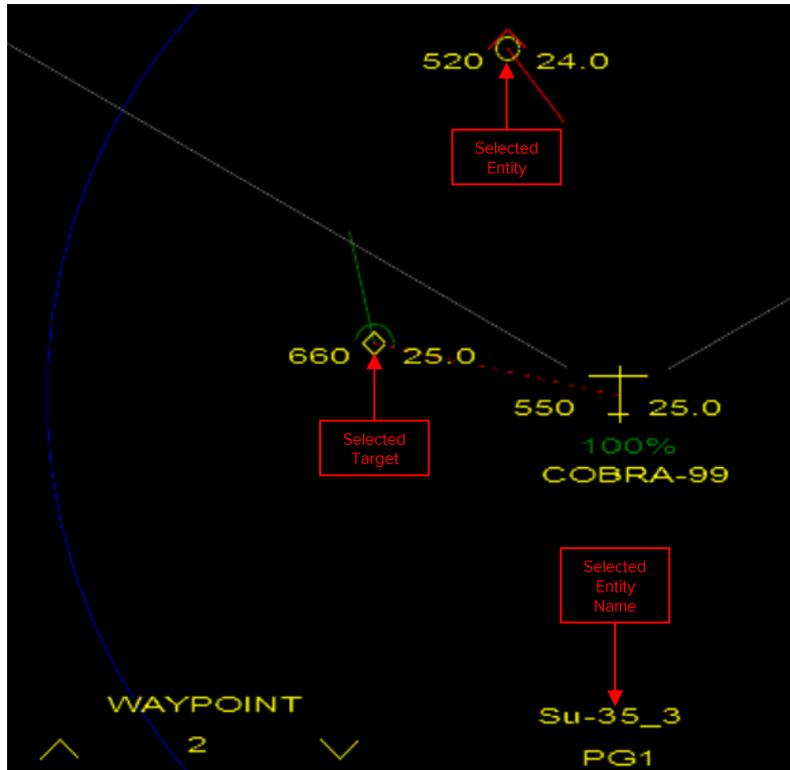
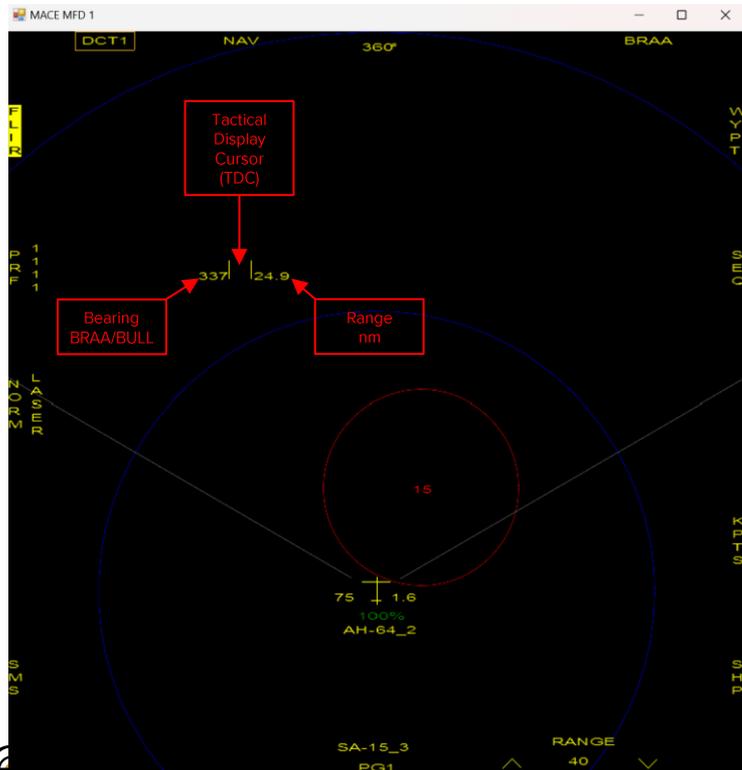
## MFD – Main Page Overview

- Top Lock like any other display
- 2 Modes
  - MACE Mode – Displays All Truth
  - Radar Mode – Displays Tracks Populated by onboard radar
- POD Control
  - [FLIR] must be selected to use joystick to control pod
- Joystick Control – Use HOTAS Alt Config
  - System Settings>Joystick
  - Thrustmaster\_with\_Tactical\_Display.xml
- Mouse Control
  - RMB on display to open Settings>TDC
  - TDC follows mouse cursor –
    - Range and Bearing
    - BRAA or BULL (Dependent on Mode)
  - Right Click on Target Track to Assign As Target



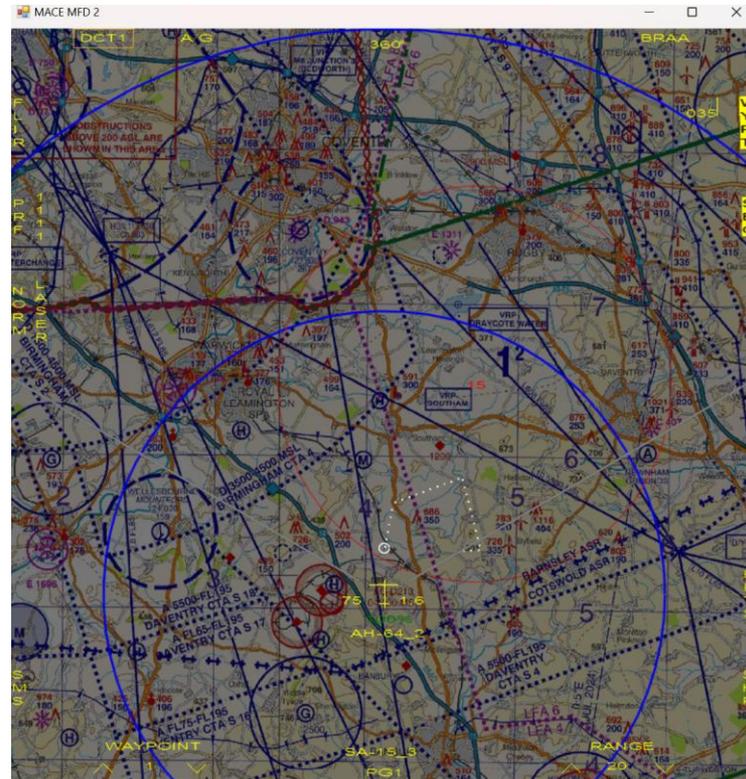
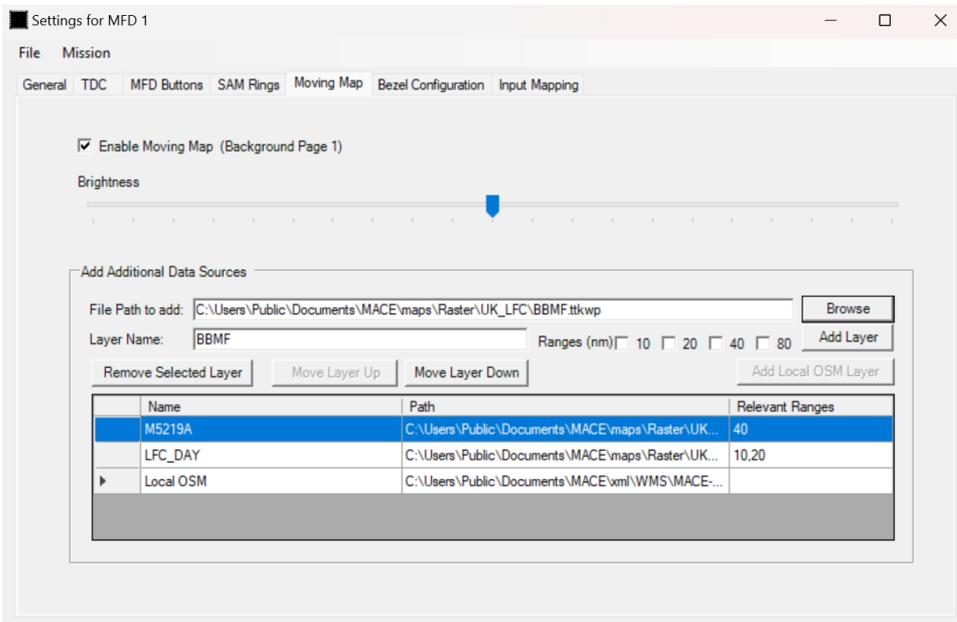
# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## Tactical Display Cursor (TDC)



# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## MFD - Moving Maps



# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## MFD - Stores Management Page

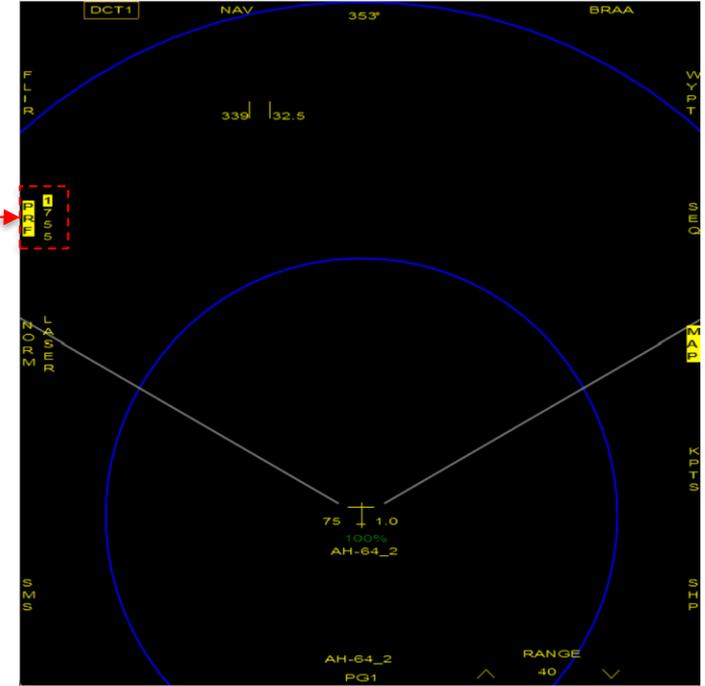
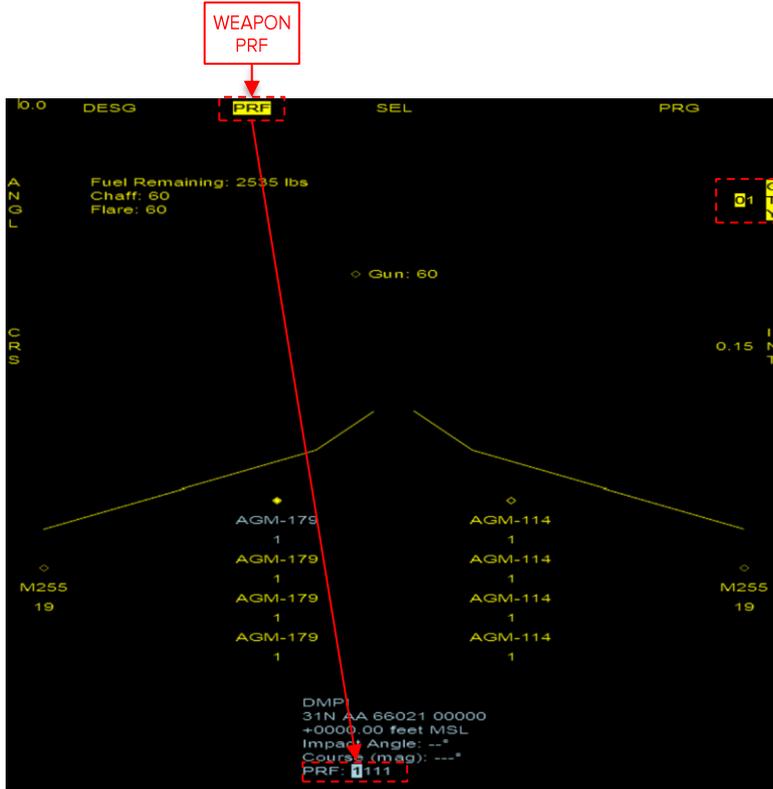
- Press [SEL] to cycle through weapons
- Only weapons on hardpoints displayed
- Use
  - CSE – to program FAH on applicable weapons
  - ANGL – to program impact angle on applicable weapons
  - PRG – to program coordinates and elevation into applicable weapons
  - PRF – to program PRF into applicable weapons
- Use with Keyboard or UFCD (DSC Device)



# MACE AIRCRAFT MULTIFUNCTION DISPLAY

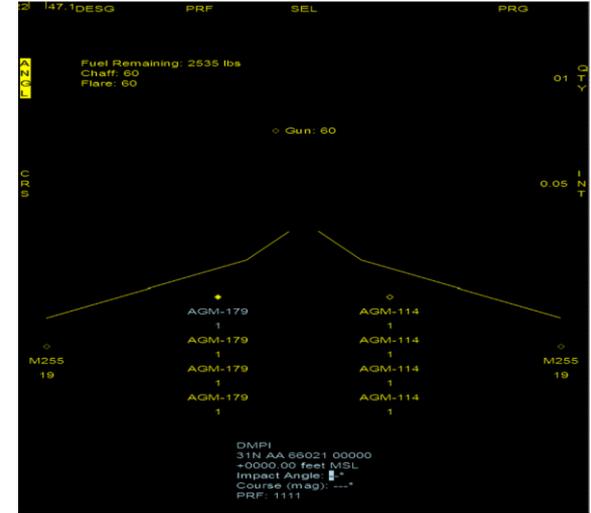
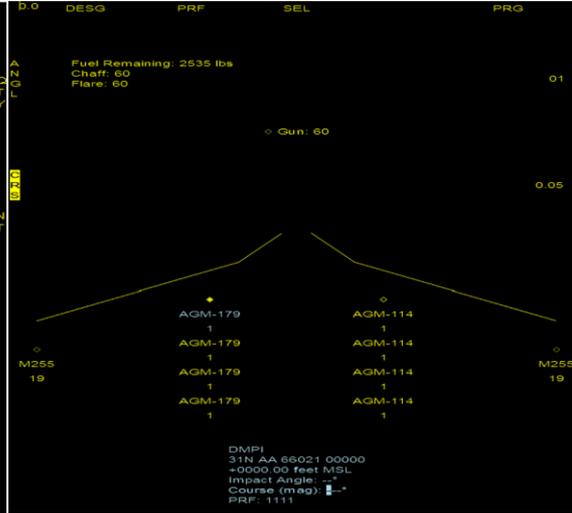
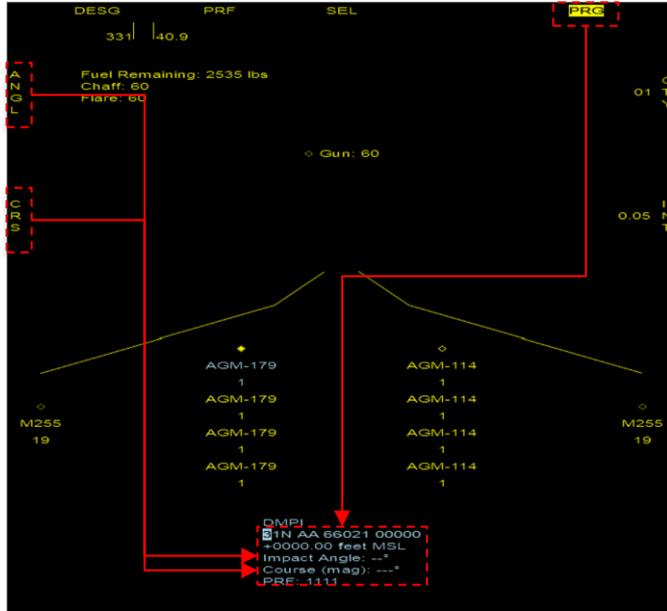
## MFD - Programmable Weapons

- Weapon must be on a hardpoint



# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## MFD - Programmable Weapons

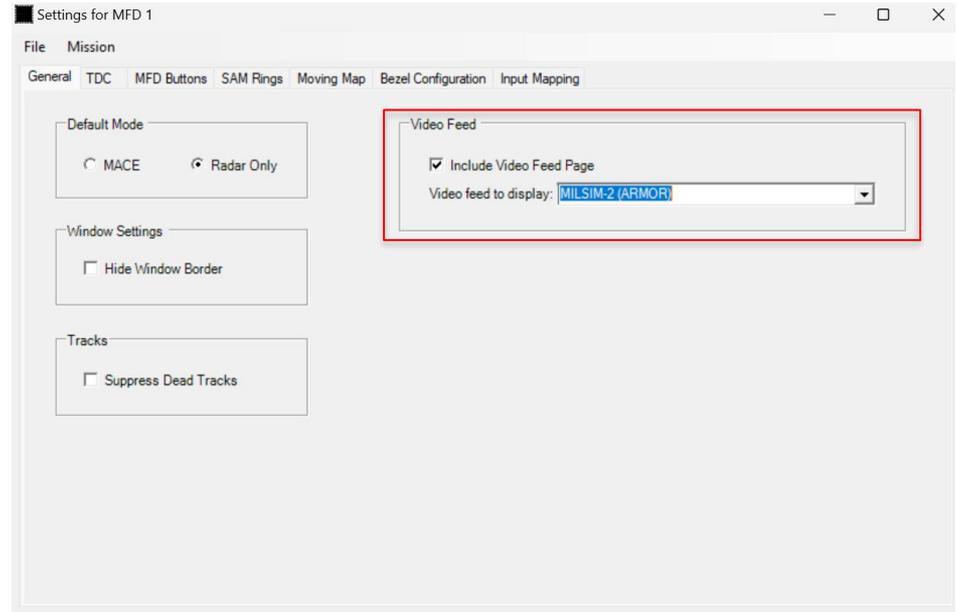


- [PRG]
  - Press 'd' to cycle formats (DD.DD / DD MM.MM / DD MM SS.SS / MGRS
  - In Lat/Long press N/S or E/W to change
  - Elevation – press 'f' or 'm' to change between ft and m
  - Elevation – press 'h' to change between MSL and HAE

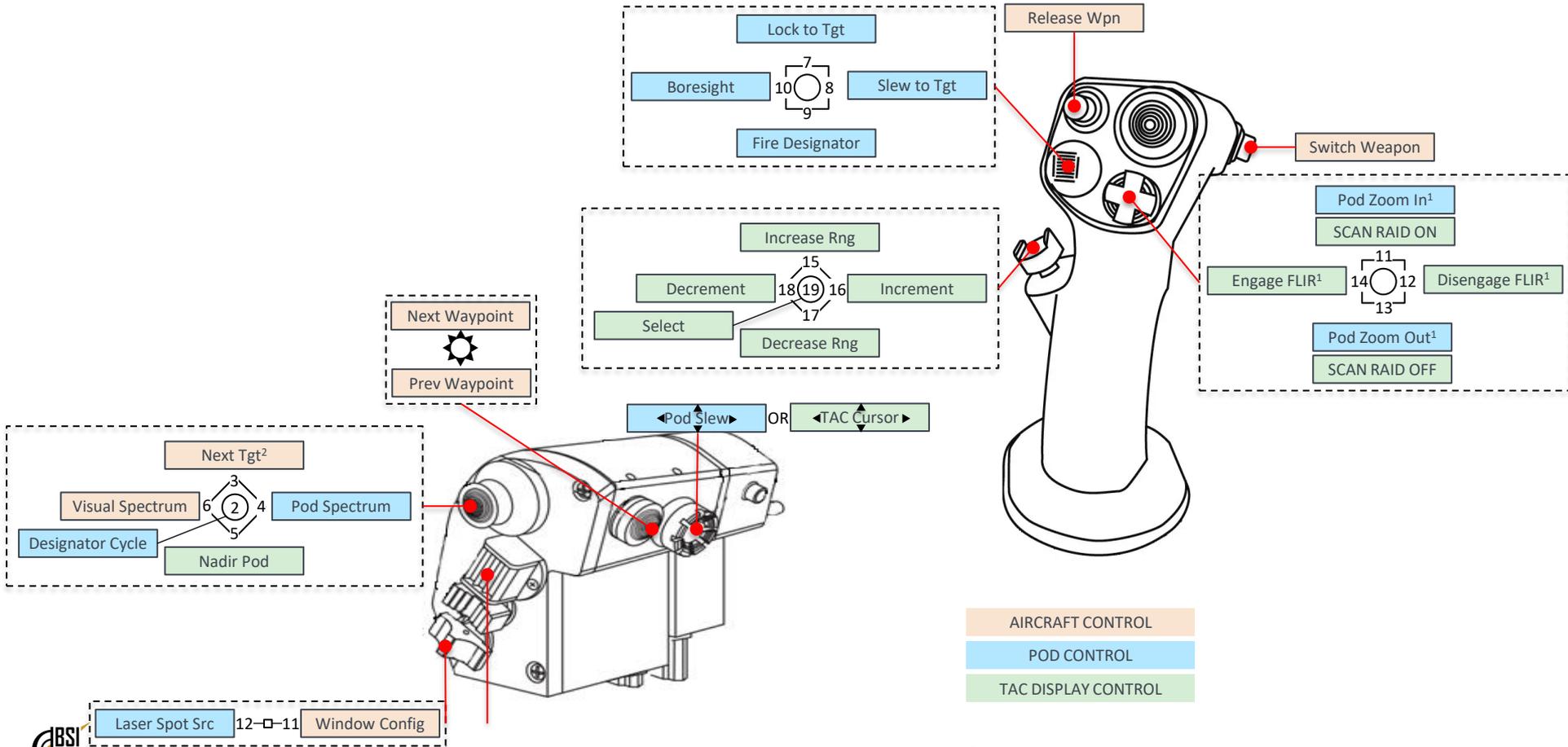
# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## MFD - FLIR/Sensor View Page

- Needs to be enabled in MFD Settings
- Needs to be enabled in ARMOR



# MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL



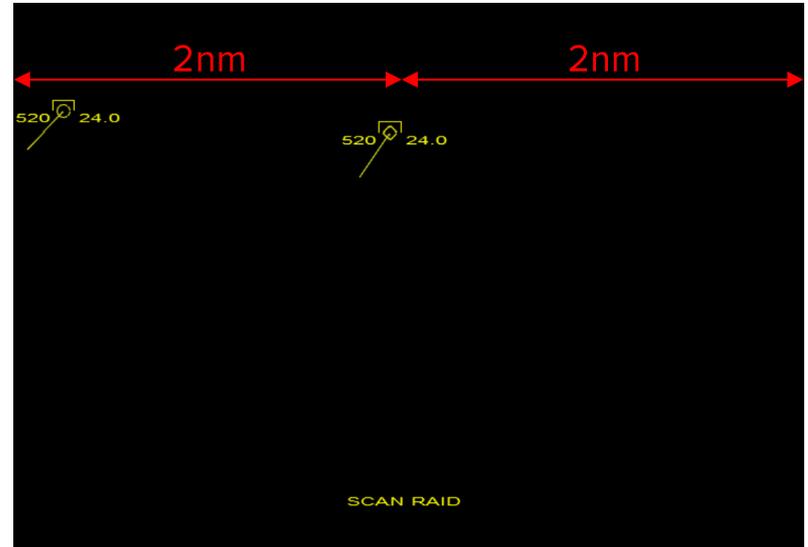
Note 1: if using Tactical-Display plugin to enable zoom on the pod FLIR must be engaged

Note 2: Next Target is disabled when using Tactical Display

# ADVANCED WEAPONS AND EQUIPMENT

## MFD - SCAN RAID MODE

- Only if a target is selected
- Zooms the display to a scale 2nm either side of target
- Allows selection of targets that are close together

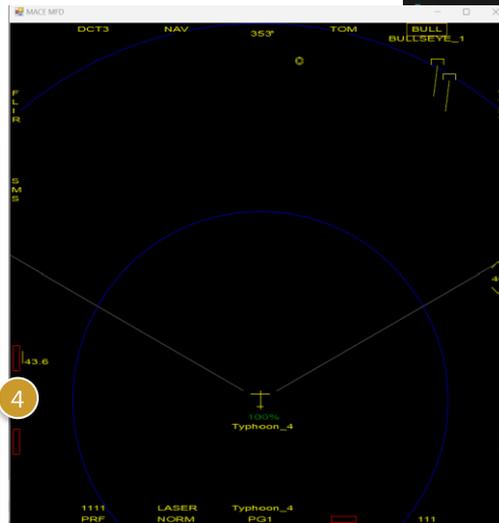
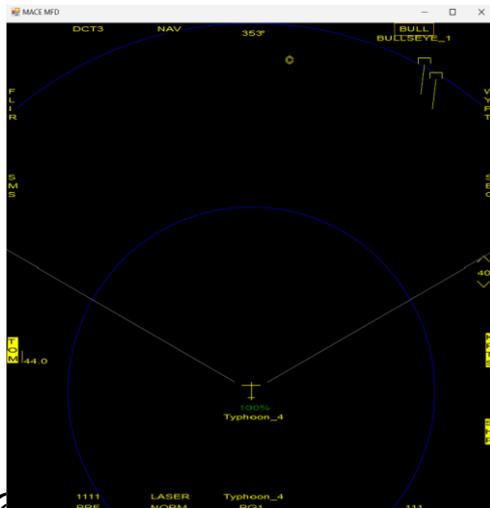




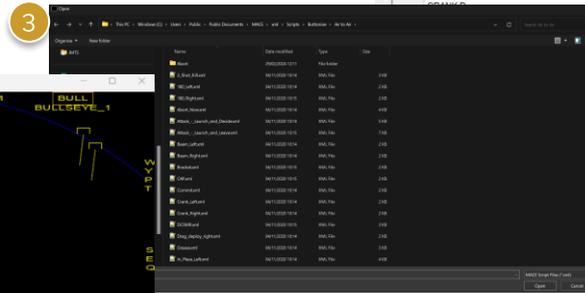
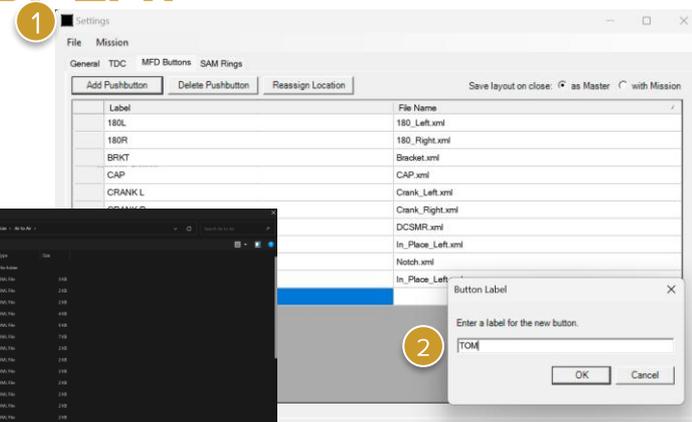
# MACE AIRCRAFT MULTIFUNCTION DISPLAY

## MFD - Assigning Buttons To The Display

- Assign Any Buttonized Script to TAC display
  - (1) RMB settings>MFD Buttons
  - (2) [Add Push Button] – Name it (something short!)
  - (3) Choose a buttonized script
  - (4) Choose a location on MFD
  - (5) Choose how button is saved



5 Save layout on close:  as Master  with Mission



# MACE AIRCRAFT TACTICAL DISPLAY

**Student Exercise** (Link to Online Solution Video Not Yet Available)

1. Make a New MACE Mission
2. Open MFD Settings and add at least the BSI Map layer to the moving map at some ranges
3. Add 2 x Friendly Fighter Aircraft in Line Abreast Formation
4. Use Group Add to add a VIC presentation of 3 groups of 3 Enemy Fighter Aircraft about 50nm away
5. Ensure both groups are facing each other and the friendly leader has some waypoints
6. Place a known point and name it BULL-01
7. (Optional) Draw a MACE shape between the 2 groups (e.g. a circle or a polygon)
8. Save the mission and start then pause it
9. Select the lead friendly fighter aircraft, Top-Lock to it, open 1 TAC Display
10. Access the MFD settings and enable the mouse cursor and switch to radar only mode
11. Ensure FLIR is unselected and switch the display to A/A mode
12. Change the reference for the cursor from BRAA to Bullseye
13. Display the waypoints, waypoint sequence, known points
14. Add a buttonized script to perform a 'crank' to the display at a blank button location
15. Run the mission on
16. Change the range scale up to see the oncoming targets
17. Select a target



# MACE AIRCRAFT TACTICAL DISPLAY

**Student Exercise** (Link to Online Solution Video Not Yet Available)

18. Access the weapons page and select a weapon for engaging the target (ideally an active or semi active missile)
19. Engage the target when in range and use the crank button
20. In ARMOR start the NDI Stream for the targeting pod
21. In the MFD configure the targeting pod stream – verify selecting FLIR in MFD

# IADS BUILDER

## Learning objective:

- To be able to use the IADS Builder plugin to create an air defence system hierarchy of multiple air and land-based air defence

## Enabling objectives:

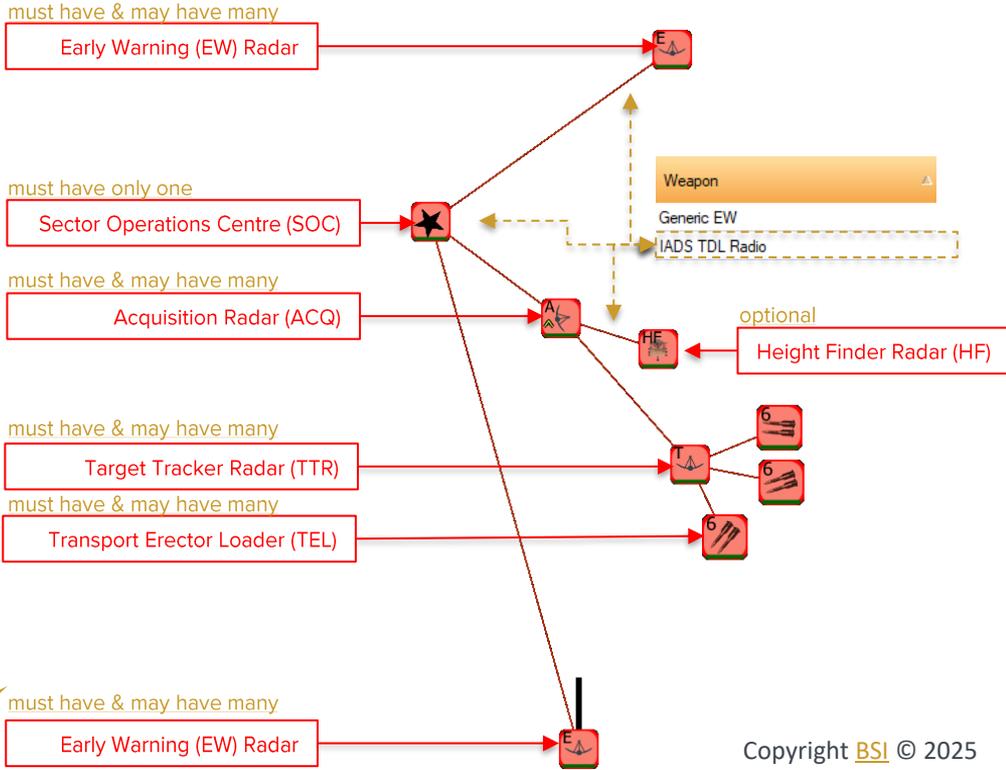
- Recap the standard MACE IADS rules and understand the IADS Builder plugin supersedes
- Know how to add control nodes (peers) and subordinate units to the engagement hierarchy
- Know how to create control sectors and define their roles and parameters for engagement
- Know how to set permitted IFF codes and where to set on individual platforms
- Know how to assign air defence platforms to different control sectors
- Understand the engagement hierarchy process of target allocation and execution

# IADS BUILDER

## MACE Default IADS and Autonomous SAM rules

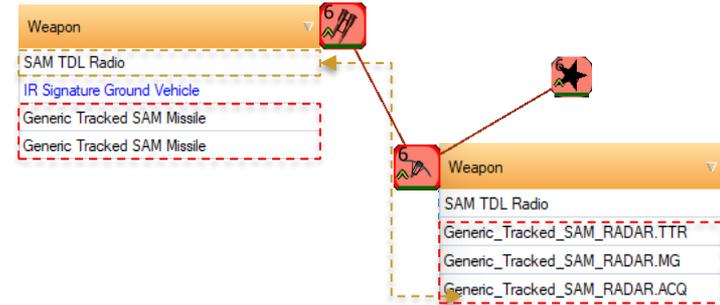
### INTEGRATED AIR DEFENCE SYSTEM (IADS)

IADS platforms require **IADS TDL Radio**



### AGGREGATED AUTONOMOUS SITE

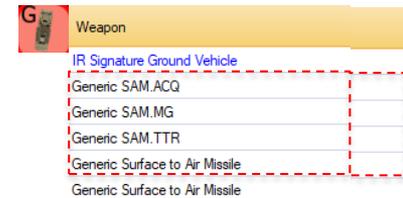
Separate platforms require **SAM TDL Radio**



| Category                            | Count     |
|-------------------------------------|-----------|
| Aircraft                            | 336       |
| Vehicles/Land                       | 406       |
| Humans                              | 138       |
| Animals                             | 11        |
| Ground (Mines)                      | 9         |
| Surface (Water)                     | 116       |
| Subsurface (Water)                  | 7         |
| Space                               | 8         |
| Airfield Operations                 | 8         |
| C3I Buildings                       | 10        |
| AAA                                 | 44        |
| <b>Autonomous SAM</b>               | <b>67</b> |
| IADS Command Post (CPSOC)           | 40        |
| IADS SAM                            | 29        |
| IADS Early Warning (EW)             | 35        |
| IADS Height Finding (HF)            | 6         |
| IADS Acquisition (ACQ)              | 32        |
| IADS Target Tracking / Fire Control | 58        |
| IADS Launcher / TEL                 | 53        |

### AUTONOMOUS PLATFORM

Single platforms do not require TDL



must have & may have many

Early Warning (EW) Radar

# IADS BUILDER

## What The IADS Builder Plugin Does

- Allows users to add mixed IADS and Autonomous SAM/AAA platforms to mission and control as one system
- Allows restraint of engagement to defined 3D Airspace Sectors
- Allows restraint of engagement to parameters:
  - Min speeds
  - Altitude bands
  - IFF codes
- Allocates firing assets based on priority and parameters defined in sectors
- Applies a 'C2 Tasking' command to air defence aircraft in hierarchy
- Suspends 'Generic Engagement' command on all platforms in hierarchy until execution – then 'unleashed'

The screenshot displays the IADS Builder interface. The top portion is a map showing a geographical area with several engagement sectors defined by blue lines and labeled in red boxes: FEZ, JEZ, and MEZ. A yellow line indicates a flight path or boundary, with points labeled 'Victoria', 'Seattle', and 'Olympia'. A blue box labeled 'MD' is in the top left corner. Below the map is the 'Engagement Hierarchy' panel, which is divided into two main sections: a tree view on the left and a detailed view on the right.

**Engagement Hierarchy**

Edit Add View

- ★ SOC\_1
  - SA20CP\_13
  - ✖ MG\_29\_24
  - ✖ MG\_29\_25
  - ✖ MG\_29\_26
  - SA-19\_3
  - SA-15\_2
  - SA-22\_5
  - CrSREW\_4
  - ★ SA-15\_1
- ⊟ C2
  - ✖ MG\_29\_25
  - ✖ MG\_29\_26
  - ✖ MG\_29\_24

**★ SOC\_1**

**Commands: Sector Based IADS**

[Edit Sectors](#)

**Engagements:**

- Target F-15E\_27 assigned to SA20CP\_13; Status: Executing
- Target F-16CD\_30 assigned to SA-19\_3; Status: Executing
- Target F-16CD\_31 assigned to SA-19\_3; Status: Executing
- Target F-15E\_28 assigned to SA20CP\_13; Status: Executing

**Target Tracks:**

**F-15E\_28**

Az (True): 297°El: -1°Rng (nm): 23.8

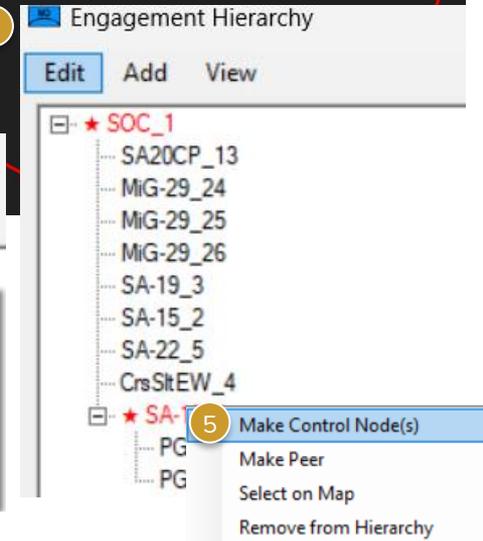
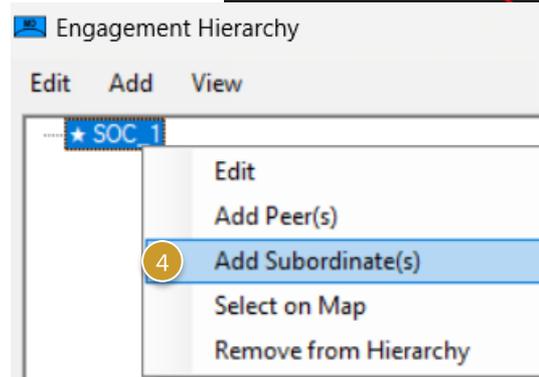
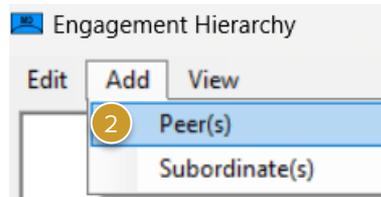
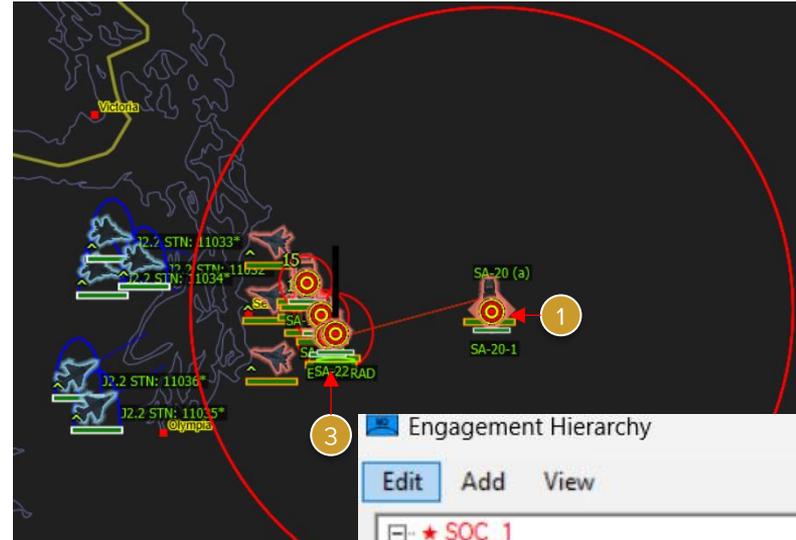
Trk Confidence: 66% (s/n 12.1 dB)Trk Priority: 42.1

Primary Trk Source: MiG-29\_26 / SlotBack.ACQ

# IADS BUILDER

## Mission Setup

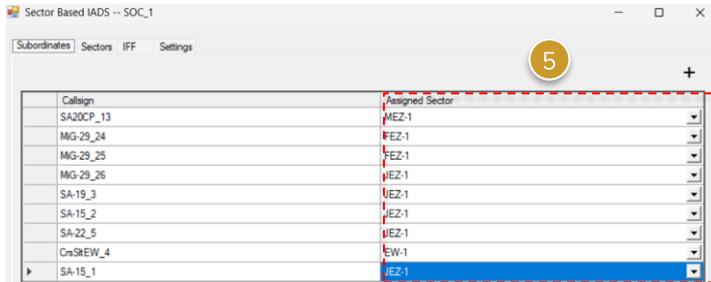
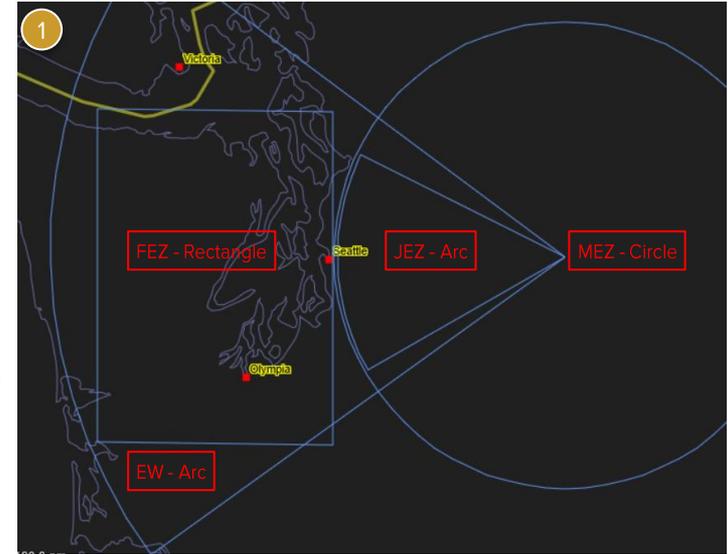
- Add Air defence sites to mission
  - Any air defence platforms – IADS or Autonomous SAMS, AAA, Fighter Aircraft
  - Add additional C2 nodes if required (e.g. SOCs) to create desired hierarchy
- IADS Builder – Setup Hierarchy 
- Add Peers and subordinates:
  - (1) Select on MACE map and add in plugin form
  - (2) 1st Peer (CP or SOC) from Top-menu
  - (3) Select (multiple if required) on MACE Map
  - (4) RMB on parent node – Add Subordinates(s)
- Select subordinates as ‘Control Nodes’ if required



# IADS BUILDER

## Mission Setup

- Add sectors for each **control node**
  - (1) Circle, Arc – from control node
  - (1) Polygon, rectangle – anywhere on mission area
  - (2) Name the sectors (Name them sensibly so you know which is which!)
  - (3) (Optional) Setup Altitude and Speed Boundaries per sector
- (4) Assign Sector Engagement Type to Each and Priority
  - FEZ, JEZ, MEZ, EW (Constrain Sensors?)
- (5) Assign sectors to subordinates



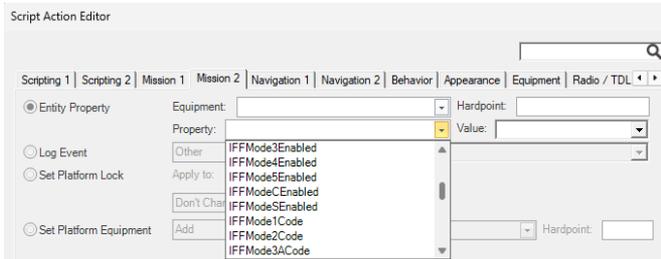
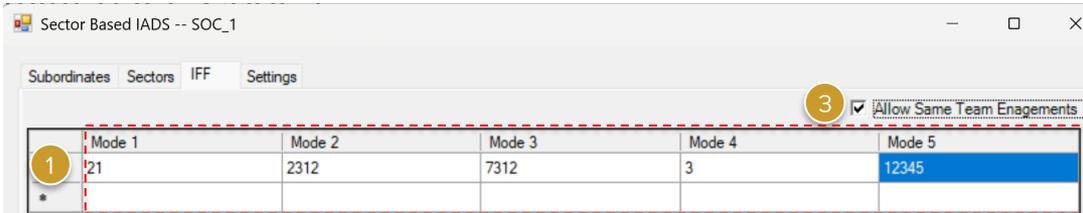
| Name  | Priority | Constrain Sensors                   | Engagement Type | Lower Altitude (ft MSL) | Upper Altitude (ft MSL) | Velocity Threshold (kts) |
|-------|----------|-------------------------------------|-----------------|-------------------------|-------------------------|--------------------------|
| FEZ-1 | Low      | <input type="checkbox"/>            | JEZ             | 20000 ft                | 50000 ft                | 0 kts                    |
| JEZ-1 | Low      | <input type="checkbox"/>            | EW              | 0 ft                    | 20000 ft                | 0 kts                    |
| EW-1  | Low      | <input checked="" type="checkbox"/> | EW              | 0 ft                    | 0 ft                    | 0 kts                    |
| MEZ-1 | Low      | <input type="checkbox"/>            | JEZ             | 0 ft                    | 0 ft                    | 0 kts                    |

A screenshot of the engagement type configuration table. A red dashed box highlights the table, and a yellow circle with the number '4' is in the top center. A yellow circle with the number '3' is in the top right corner of the table area. The table has columns for Name, Priority, Constrain Sensors, Engagement Type, Lower Altitude (ft MSL), Upper Altitude (ft MSL), and Velocity Threshold (kts). The 'EW-1' row is highlighted in blue.

# IADS BUILDER

## Mission Setup - IFF

- (Optional) Permitted IFF Codes - Platforms with matching codes will be allowed through IADS
- (1) Mode 1 to 5 – type in each field; create as many lines as required
- (2) Assign individual platform codes in **PLATFORM PROPERTIES** → **IFF**
- (3) [x] **Allow same team engagement** (Optional)
- Codes can be changed by script action too!



| 2 IFF               |   |
|---------------------|---|
| Aircraft Address    | 0   |
| Aircraft ID         | <input type="radio"/> Undefined<br><input type="radio"/> Flight Number<br><input type="radio"/> Tail Number |
| Aircraft ID Type    |   |
| IFF Mode 1 Code     | 00  |
| IFF Mode 1 Enabled  | <input type="checkbox"/> IFF Mode 1 Enabled   |
| IFF Mode 2 Code     | 0000  |
| IFF Mode 2 Enabled  | <input type="checkbox"/> IFF Mode 2 Enabled   |
| IFF Mode 3 Code     | 0000  |
| IFF Mode 3 Enabled  | <input type="checkbox"/> IFF Mode 3 Enabled   |
| IFF Mode 4 Code     | 0   |
| IFF Mode 4 Enabled  | <input type="checkbox"/> IFF Mode 4 Enabled   |
| IFF Mode 5 Enabled  | <input type="checkbox"/> IFF Mode 5 Enabled   |
| IFF Mode 5 PIN      | 00000   |
| IFF Mode C Altitude | 0   |
| IFF Mode C Enabled  | <input type="checkbox"/> IFF Mode C Enabled   |
| IFF Mode S Enabled  | <input type="checkbox"/> IFF Mode S Enabled   |

# IADS BUILDER

## Mission Execution

- Generic Engagement Command – Suspended By Engagement Hierarchy Plugin
- Monitor Engagements in Engagement Hierarchy Plugin UI

### ★ SOC\_1

Commands: Sector Based IADS

[Edit Sectors](#)

#### Engagements:

Target F-15E\_27 assigned to SA20CP\_13; Status: Executing  
Target F-16CD\_30 assigned to SA-19\_3; Status: Executing

The screenshot shows the 'Engagement Hierarchy' window with a tree view. The 'SOC\_1' node is expanded, showing a list of sectors including SA20CP\_13, MiG-29\_24, MiG-29\_25, MiG-29\_26, SA-19\_3, SA-15\_2, SA-22\_5, CrsSHEW\_4, and SA-15\_1. The SA-15\_1 node is further expanded to show PGZ95AAA\_16 and PGZ95AAA\_17. Below the hierarchy, the details for 'MiG-29\_24' are displayed. The details include: 'MiG-29\_24: 1 x MiG-29', Health: 100%, DIS Type: 1, 2, 222, 1, 2, 5, 0, DIS ID: Site: 1, App: 68, Entity: 1024, CIGI Type: 16108, CIGI ID: 1029, Location: 47.92500, -122.41253, Speed: 500 kts, Indicated Airspeed: 500 kts, Alt: 24000 ft MSL / 23707 ft AGL, Heading: 285.1 (true) / 269.9 (mag), Target: None, Commands: MACE.Generic.Platform.Engagement, State: Suspended, and Target Tracks: F-15E\_27, F-15E\_28, and F-15E\_29. The F-15E\_27 track details are: Az (True): 242°, El: -12°, Rng (nm): 18.4, Trk Confidence: 95% (s/n 47.6 dB), Trk Priority: 40.4, Primary Trk Source: MiG-29\_25 / SlotBack.ACQ. The F-15E\_28 track details are: Az (True): 267°, El: -8°, Rng (nm): 24.5, Trk Confidence: 97% (s/n 42.7 dB), Trk Priority: 40.2, Primary Trk Source: MiG-29\_24 / SlotBack.ACQ. The F-15E\_29 track details are: Az (True): 246°, El: -7°, Rng (nm): 29.9, Trk Confidence: 97% (s/n 43.5 dB), Trk Priority: 35.7, Primary Trk Source: MiG-29\_25 / SlotBack.ACQ. A red dashed box highlights the 'SOC\_1' node in the hierarchy, the 'State: Suspended' text, and the 'Target Tracks' section.



# IADS BUILDER

**Student Exercise** (Link to Online Solution Video Not Yet Available)

1. () Place an autonomous strategic SAM (e.g. SA-20) and within its engagement range place 3 tactical SAMs (e.g. SA-15, SA-22)
2. () Place 2 AAA systems near to one of the tactical SAMs inside its engagement range
3. () Add a sector operations center
4. () Add 3 x Enemy Fighters (e.g. Mig-29) in Loiters on the edge of the strategic SAM engagement Area
5. () Between the tactical SAMs and the strategic SAM place an IADS EW radar
6. () Add 6 x Friendly Fighters (e.g. F-16) in 3 groups of 2: 2 at 30kft, 2 at 500ft, 2 at 10kft – on the edge of range of the fighters or SAM facing the threats from different directions (e.g. NW, W, SW)
7. () Open the Engagement Hierarchy plugin and add the SOC as the first 'Peer'
8. () Select All of the other SAMs (not AAA) and add them as subordinates to the SOC
9. () Promote the tactical SAM near the AAA to become a control node
10. () Add the 2 x AAAs as subordinates of the newly promoted SAM
11. () Edit Sectors for the SOC
12. () Make a rectangular FEZ sector beyond the Strat SAM range near the enemy fighters 5kft to 50kft
13. () Make a roughly 60 Arc JEZ from the SOC 0 to 20kft
14. () Make a large circle MEZ from the SOC that extends out to just beyond the TAC SAMs 2kft to 50kft
15. () Make a roughly 90 degree Arc EW sector far out beyond the Strat SAM engagement range and
16. () Edit the sectors of the promoted TAC SAM control node - Make a polygon JEZ around the AAA
17. () Assign the MEZ to the Strat Sam; the JEZ to all tactical SAMS, the FEZ to fighters, the polygon JEZ to AAA, the EW Arc to the EW radar
18. () Start the mission and observe the engagements



# INTRODUCTION TO DIS NETWORKING

## Learning objective:

- Understand the basics of how the elements of DIS based simulation communicate with each other

## Enabling objectives

- Understand basic networking, addressing, ports and transmission types
- Know how to set a static IP Address in Windows
- Understand the purpose and implications of the DIS Identifiers
- Know that duplication of DIS identifiers can result in total system disruption
- Know how to configure essential DIS Settings in multiple MACEs for networked missions
- Understand the principle of Master Timekeeper
- Understand the additional DIS settings that can be set
- Understand the purpose and implications of the DIS enumerations
- Know how to control external entities
- Know how to perform a 'MACE to MACE Transfer'

# INTRODUCTION TO DIS NETWORKING

- PCs are networked together to provide the overall capability
  - Data must be sent between different applications and computers
  - This includes entity state data, radio traffic, DACAS messages, etc.
- IP Addresses
  - Each Network Interface Controller (NIC) is assigned a unique IP address (e.g. 192.168.1.101)
  - A PC may have one or more NICs, but for this course we will consider a PC to have only one NIC and IP address
  - NICs are configured to self-assign **static** IP addresses, so they always have the same IP address
- Data Transmission
  - Unicast directs traffic to a single IP address (e.g. 192.168.1.102)
  - Broadcast directs traffic to every IP address within the subnet (e.g. 192.168.1.255)
  - Loopback directs traffic back to the same PC, using a special loopback address (127.0.0.1) – used in some visual systems
  - Multicast is not used

# INTRODUCTION TO DIS NETWORKING

## IP Address

### Find /Change IP Address:

- (1) [Win + R] Run “ncpa.cpl”
- (2) Right Click on the network adapter > Properties
- (3) Double Click Internet Protocol Version 4 (TCP/IPv4)
- (4) Read or overtype a new IP Address
- (4) Set subnet mask to 255.255.255.0

### Check IP Address and Ping:

- Open the command prompt
- Type ‘ipconfig’ to verify the IP address
- (5) Type ‘ping ’ and then the IP address you want to verify communication with E.g. ping 192.168.1.1

```
Command Prompt

Media State . . . . . : Media disconnected
Connection-specific DNS Suffix . . . . . :
Wireless LAN adapter WiFi:

Connection-specific DNS Suffix . . . . . :
Link-local IPv6 Address . . . . . : fe80::69cc:9430:2932:566a%20
IPv4 Address. . . . . : 192.168.0.18
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.0.1

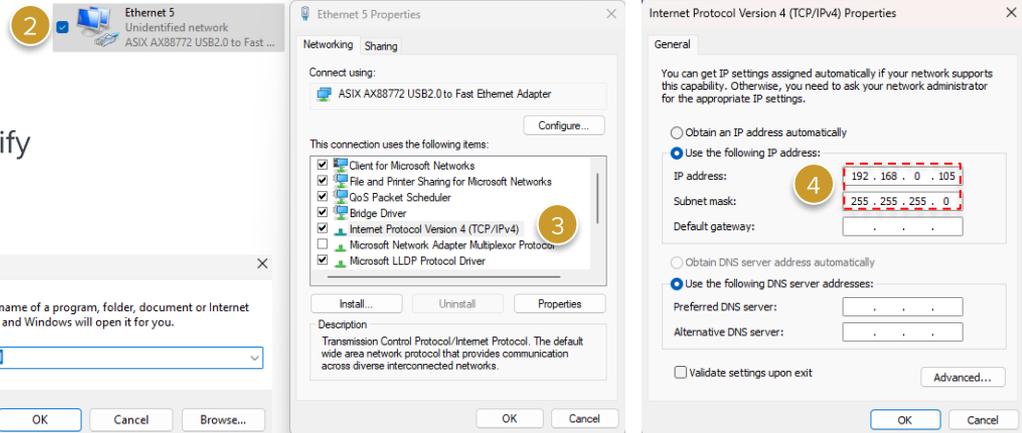
Ethernet adapter Bluetooth Network Connection:

C:\Users\Tom Ball>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:
Reply from 192.168.1.1: bytes=32 time=2ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=140ms TTL=64
Reply from 192.168.1.1: bytes=32 time=4ms TTL=64

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 140ms, Average = 36ms

C:\Users\Tom Ball>
```



### NOTE - TWO NETWORK ADAPTERS

If you have 2 network adapters make the IP address range significantly different

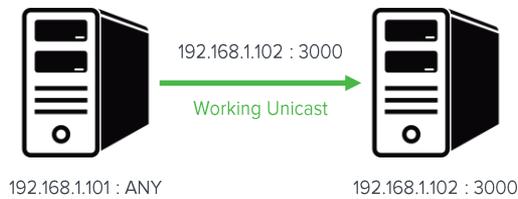
Eg 192.168.1.115 vs 10.1.0.115

If the network IP addresses fall in the same subnet issues occur

# INTRODUCTION TO DIS NETWORKING

## Network Ports

- Multiple applications may run on the same PC, but they may need to exchange different data
- In addition to specifying an IP address, applications must specify a destination port (e.g. port 3000)
- An application listening on the specified port and running on the PC with the specified IP address will receive the data
- Applications can sometimes specify a port to transmit from, but typically only the destination port matters



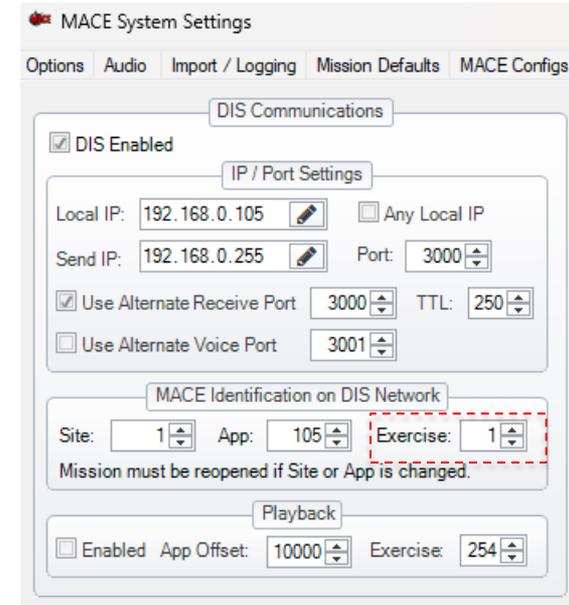
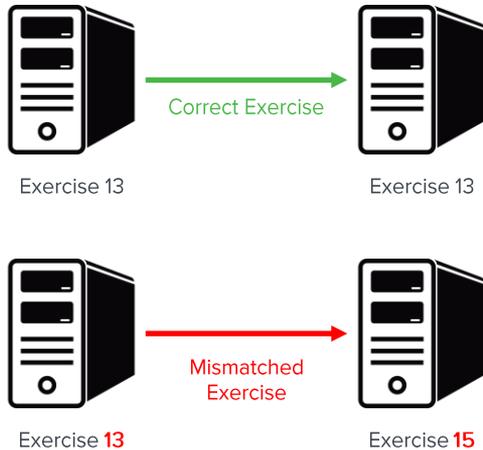
# INTRODUCTION TO DIS NETWORKING

- Most data is exchanged over the network using Distributed Interactive Simulation (DIS)
  - DIS is a simulation protocol: essentially a specific packet structure for sending data
- There are many different types of DIS messages, known as Protocol Data Units (PDUs)
  - Entity State PDUs carry data about the physical state (position, orientation, damage state) of DIS entities
  - Simulated radio data and DACAS messages are sent via Signal PDU
  - Scenario start and stop messages are sent via respective Start and Stop DIS PDUs
- DIS Transmission
  - Often broadcast, as data is often needed by many or all other DIS clients
  - Sometimes unicast or even loopback, this can save network bandwidth
  - Typically uses port 3000

# INTRODUCTION TO DIS NETWORKING

## Exercise ID

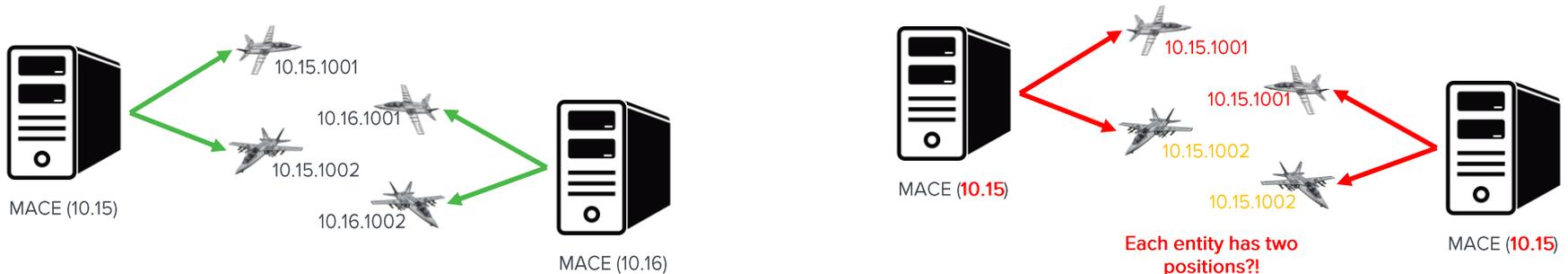
- DIS traffic includes a field for Exercise ID (e.g. 13)
- Programs using DIS usually only pay attention to DIS traffic matching the expected Exercise ID
- The Exercise ID field allows multiple simulations to run on the same network, but this is not used in iCASS
- Exercise ID must match across the system, but does **NOT** need to be updated for different scenarios



# INTRODUCTION TO DIS NETWORKING

## DIS Identifiers (WHICH IS IT?)

- Unique DIS identifiers are comprised of three parts: Site / App / Entity
- Each DIS entity has a unique DIS identifier (e.g. Site 10, App 15, Entity 1001, displayed as 10.15.1001)
- Programs that generate DIS entities must have a unique Site and Application combination
- Programs that generate DIS entities generally increment the Entity number for each new entity that they create
- For example, the first entity from MACE (10.15) might be 10.15.1001, the second would be 10.15.1002
- With multiple DIS entity generators (MACE), if the Site-Application is not unique then then duplicate entity identifiers will appear, resulting in undefined behaviour.
- In VRSG systems, VRSG (the IG) does not generate entities, but each VRSG uses a Site-App-Entity identifier (e.g. 1.2.101) as a way of distinguishing visual channels



Each entity has two positions?!

MACE Identification on DIS Network

|          |          |             |
|----------|----------|-------------|
| Site: 10 | App: 105 | Exercise: 1 |
|----------|----------|-------------|

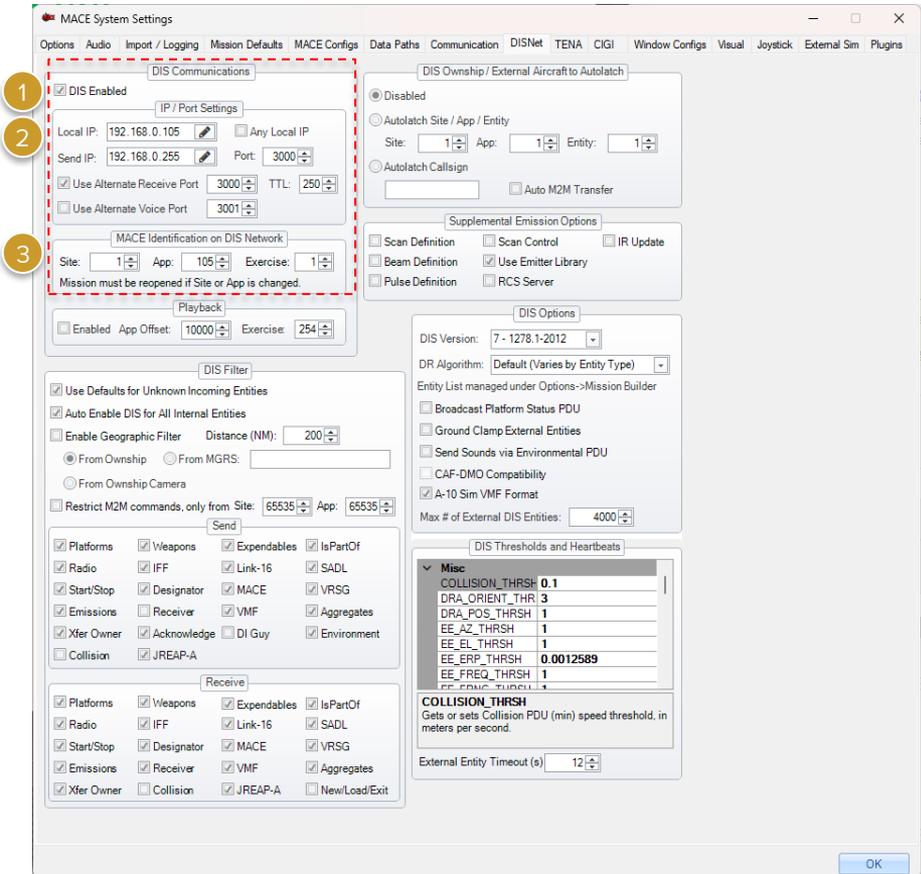
Mission must be reopened if Site or App is changed.

NR-77: 1 x Generic Utility Health: 100%  
Helo  
DIS Type: 1, 2, 0, 21, 0, 0, 0  
DIS ID: Site: 1, App: 100, Entity: 1241

# INTRODUCTION TO DIS NETWORKING

## MACE DIS Settings

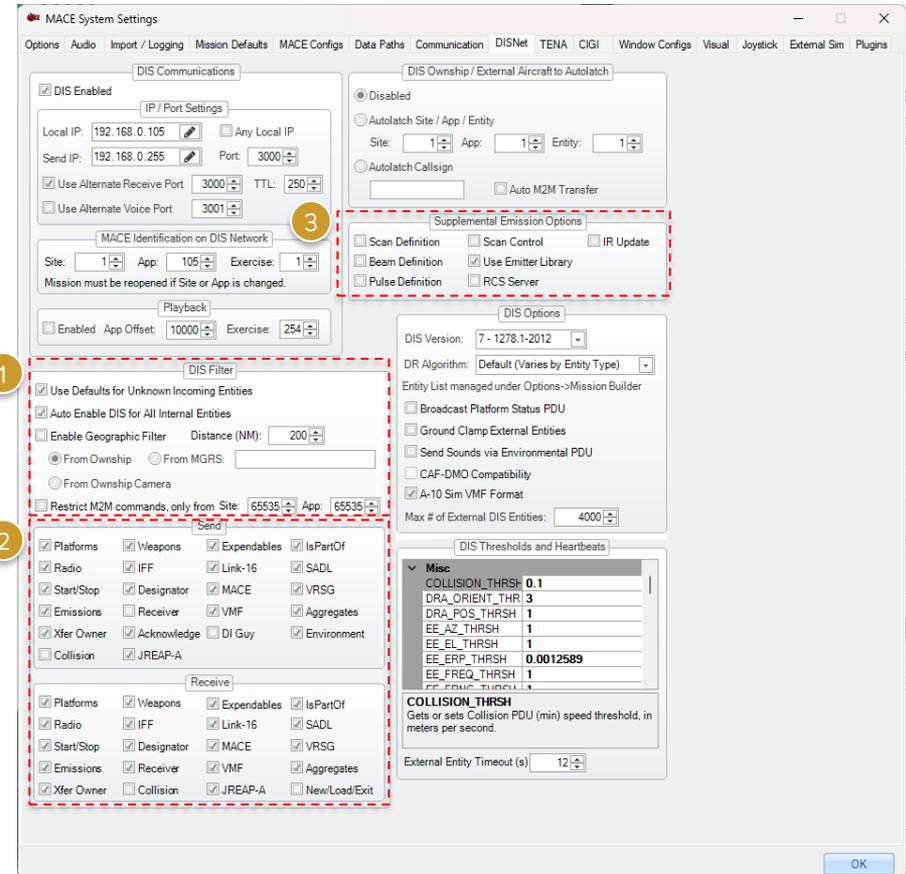
- (1) Enable DIS
- (2) IP/Port Settings
  - Local IP
    - As set statically in Windows Ethernet Adapter Settings
  - Send IP
    - As per local IP – last 3 digits '.255'
  - Port
    - 3000 (standard DIS Port)
- (3) MACE Identification on DIS Network
  - Site
    - Must be different from other MACEs
  - App
    - Good practice to set as last 3 of Local IP address
  - Exercise
    - Must be the same as other MACEs



# INTRODUCTION TO DIS NETWORKING

## Less Frequently used DIS Settings

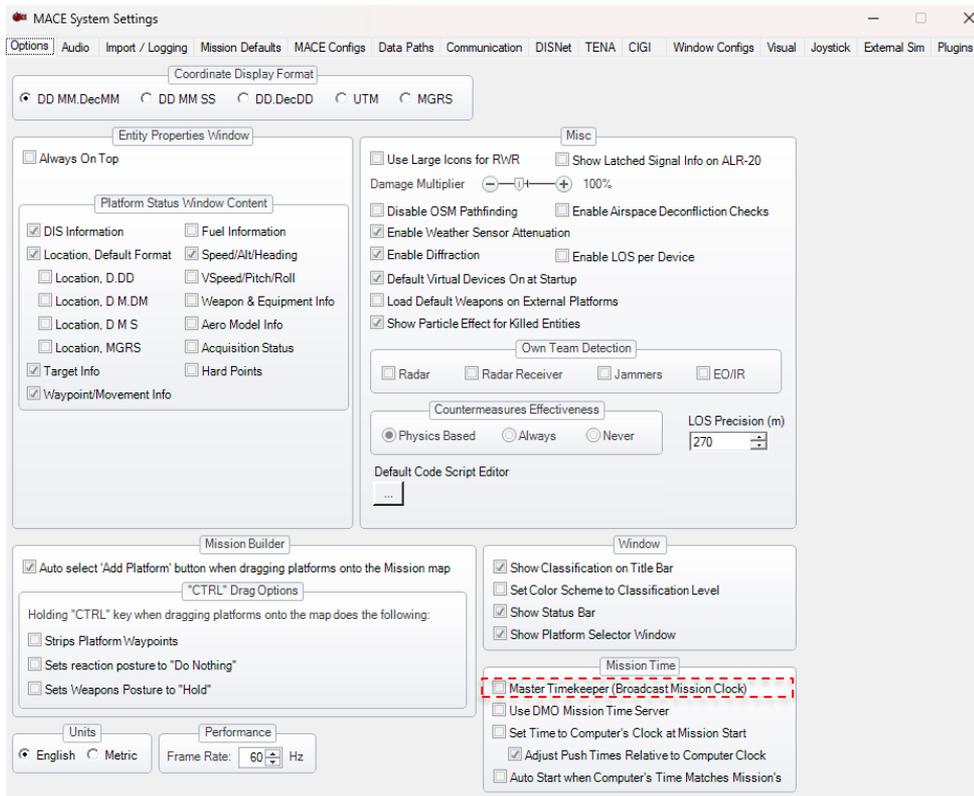
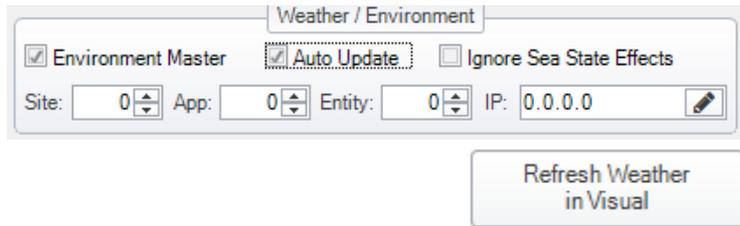
- (1) DIS Filter
  - If on a large exercise with 10000s entities
  - Can filter around a point of ownership
- (2) Send / Receive
  - Can set specific PDUs
- (3) Supplemental Emission Options
  - Additional PDUs specific for sending EW signals between DIS applications (e.g. DSC)



# INTRODUCTION TO DIS NETWORKING

## MACE Options

- Master Timekeeper
  - Only one MACE can be the timekeeper
  - Else time will alternate – competing
- Master Environment
  - Auto Update
  - Refresh Weather



# INTRODUCTION TO DIS NETWORKING

## DIS Enumerations (WHAT IS IT?)

- The 3D model associated with a particular entity is defined by a 7-part DIS enumeration
- The 7 parts are: Kind, Domain, Country, Category, Subcategory, Specific and Extra
- DIS-based programs like MACE and VRSG use XML or model-map files to map enumerations to 3D models
- It is important for programs to make sure that their model-map files match, or the resulting 3D models will not match
- VRSG displays a beach ball if it does not recognize the DIS enumeration



1 2 225 2 4 3 0 Vehicle A-10C.US.grey.hpy

DIS Enumeration

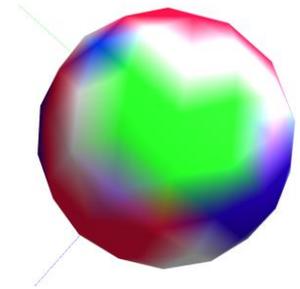
Corresponding 3D Model



1 2 225 2 4 3 0 animal-camel-001.hpy

DIS Enumeration

Different 3D Model!!



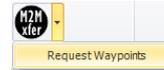
If MACE tries to use a DIS enumeration that VRSG does not recognize, VRSG displays a beach ball!

```
NR-77: 1 x Generic Utility Health: 100%  
Helo  
[DIS Type: 1, 2, 0, 21, 0, 0, 0]  
[DIS ID: Site: 1, App: 100, Entity: 1241]
```

# INTRODUCTION TO DIS NETWORKING

## External Entities and Transfers

- External Entities are Marked with an 'X' in the platform icon
- You can control external entities to a degree
  - Headings, Speeds, Targets, Intent ....
  - You can request an entity's waypoints from the other MACE and Move them
- For full control (joystick) the entity must be transferred between MACEs



# INTRODUCTION TO DIS NETWORKING

**Student Exercise** - Link to Online Solution Video Not Yet Available

1. Check the IP Address on your PC using the windows method
2. Use the command prompt to check the IP address and verify that you can ping other IP addresses on the network
3. Set up a MACE DIS network using on Exercise 1 – each MACE with a different site number
4. Check you can load a mission with aircraft on one mace and view the entities on the other MACEs as external entities
5. Add entities on each MACE
6. On the other MACEs check the external entity properties to see from which Site and App they originate from
7. Experiment with Geographic DIS filter from a geographic point and from ownship – then reset
8. Request an external entity's waypoints and change it's path – move it from intent and back into intent
9. Conduct a MACE to MACE transfer of an Air entity to another MACE and back

# MACE - LINK 16 NETWORKING

## Learning objective:

- To know how to create configure and execute a Link-16 mission in MACE

## Enabling objectives

- Know how to setup overall L-16 system settings for track numbers and automatic WICLOS
- Understand how MACE adds datalink radios based on properties selection or TDL form selections
- Know how to configure specific entity TDL settings via the TDL form
- Know how to manually create J3 tracks
- Know how to analyse the L-16 network signal strength and enable propagation
- Know how to task L-16 platforms with missions using J-12 messages
- Know how to task networked enabled weapons via J-11 messages
- Understand how MACE simulates adversary TDL
- Understand how MACE can connect via JREAP-C to real L-16 network
- Not covering K series messages

# MACE - LINK 16 NETWORKING

## Supported Messages

- J2 PPLI: J2.0, J2.2, J2.3, J2.4, J2.5, J2.6
- J3 Surveillance Track: J3.0, J3.1, J3.2, J3.3, J3.4, J3.5, J3.6, J3.7
- J7.0 Drop Track
- J11 Network Enabled Weapons: J11.0, J11.1
- J12.0 Mission
- J12.4 Controlling Unit
- J12.6 Target Sorting
- J13.2 System Status
- J28.2 Text Message
- J31.7 Padding
- K01.1 Chat
- K02.27 Close Air Support Request
- K02.28 Battle Damage Assessment
- K02.31 Mission Request Rejection
- K02.32 Close Air Support Request Acceptance
- K02.33 Mission Assignment
- K02.34 Aircraft On Station
- K02.35 Depart Initial Point
- K02.57 Aircraft Attack Position and Target Designation
- K02.58 CAS Aircraft Final Attack Control
- K02.59 Aircraft Attack Position and Target Designation Request
- K04.1 Observation Report
- K04.17 Tactical Image Transfer Message
- K05.1 Position Report

J2 – Here I am

J3 – Here is someone I found!

J12 – Do this thing

J11 – Network Enabled Weapon Command

# MACE - LINK 16 NETWORKING

## Setup - Basics

- If networking only between MACEs

- (1) Select J-Series Version
- (2) Select Auto-grouping distance (m)
- (3) Choose defaults
  - **Propagation Modelling** – more accurate but with many links can affect performance
  - **Auto Wilco** – for commands sent by other platforms (constructive control) – (5) Needs to be set in Mission Settings!
    - Mission
    - Controlling Unit Change
    - Aircraft Attack Position
  - **Dead reckoning** – if link lost or track lost
- (4) Track numbering – J2 start number



## MISSION SETTINGS → Datalinks: Link-16

The screenshot shows the 'MACE System Settings' interface with several sections highlighted by red dashed boxes and numbered callouts:

- 1**: 'Link-16' section containing 'Set Simulation Indicator' checkbox, 'J-Series Version' dropdown (MIL-STD-6016F), and 'VMF' section with 'K-Header Version' (MIL-STD-2045-47001C) and 'K-Series Version' (MIL-STD-6017A) dropdowns.
- 2**: 'J3 Track Auto Grouping' section with 'Air Tracks (m): 6,000.00' and 'Ground Tracks (m): 1,000.00' spinners.
- 3**: 'Mission Defaults' section with checkboxes for 'Enable TDL Network Signal Propagation Modeling', 'Automatically Wilco Incoming J12.0 Messages', 'Automatically Wilco Incoming J12.4 Messages', 'Automatically Reply To Incoming K02.59 Messages', and 'Suppress J3 Track Dead Reckoning'. A link 'Open TDL Mission Settings' is also present.
- 4**: 'TDL J2 Start Source Track #' spinner set to 10000 and 'Default TDL J3 Start Track #' spinner set to AB000.
- 5**: 'Settings' section with 'Next TDL J2 Source Track #' spinner (11746) and checkboxes for 'Automatically Wilco Incoming J12.0 Messages', 'Automatically Wilco Incoming J12.4 Messages', and 'Automatically Reply To Incoming K02.59 Messages'. A link 'Data Link System Settings' is also present.

Other visible settings include 'Drop Track Time (s): 120', 'Recover Track Time (s): 120', 'Guard Channel: 7', 'Channel Hopping: 7', 'Needline: 165', and 'Needline Type: 7 - Multi Source'.

### NOTE – HOW MACE BROADCASTS AND RECEIVES J & K SERIES MESSAGES

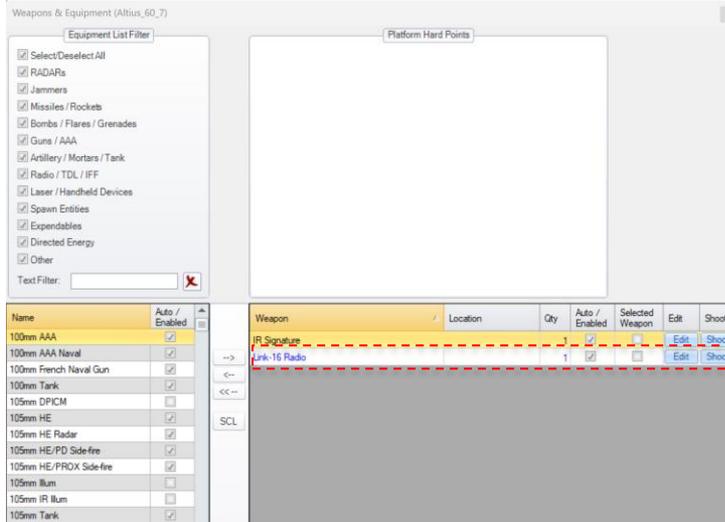
- MACE supports several versions of J and K series messages; select the version in **System Settings>Datalinks**
- J-Series messages can be transmitted from a simulated Link-16, SADL, or JREAP-A network
- MACE entities will automatically send accompanying DIS Transmitter PDUs for the appropriate Tactical Data Link network when the messages are enabled

# MACE - LINK 16 NETWORKING

## MACE Platform Equipment

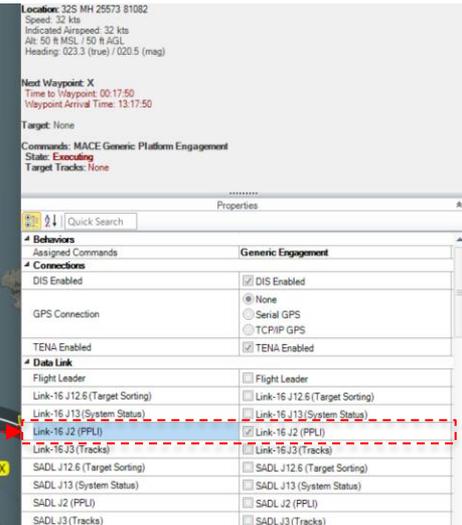
- To be part of L-16 must have L-16 Tactical Datalink Radio in equipment
- Automatically added if L-16 tracks selected in Platform Properties

### PLATFORM WEAPONS AND EQUIPMENT



Ticking J2 automatically adds L-16 radio

### PLATFORM PROPERTIES → Data Link



# MACE - LINK 16 NETWORKING

## Setup – Entity Specific Settings

Each entity (with L-16 Radio equipped):

- Has a specific TDL Form – [CTRL+D]
- Settings
  - Change Track Number for J2 – also on properties form (octets 00000 to 77777)
  - Change Track Blocks for J3s (2 alphanumeric characters plus 3 numeric octets)
  - Enable J2, J3, J12.6, J-13 – as per platform properties form
  - Set NPGs – leave as default unless competent!
- Can be set by ATO/Op Task Link (Import ATO first!)

## PLATFORM DATA LINK SETTINGS → Settings

| Type     | TN    | Entity   | Location           | Identity | Send                                |
|----------|-------|----------|--------------------|----------|-------------------------------------|
| J3.2 Air | 30000 | MiG-15_4 | 32T NL 04431 56055 | Hostile  | <input checked="" type="checkbox"/> |

## PLATFORM PROPERTIES → Data Link

| Data Link                      | Flight Leader  |
|--------------------------------|--|
| Link-16 J12.6 (Target Sorting) | <input checked="" type="checkbox"/> Link-16 J12.6 (Target Sorting) |
| Link-16 J13 (System Status)    | <input type="checkbox"/> Link-16 J13 (System Status)               |
| Link-16 J2 (PPLI)              | <input checked="" type="checkbox"/> Link-16 J2 (PPLI)              |
| Link-16 J3 (Tracks)            | <input checked="" type="checkbox"/> Link-16 J3 (Tracks)            |
| SADL J12.6 (Target Sorting)    | <input type="checkbox"/> SADL J12.6 (Target Sorting)               |
| SADL J13 (System Status)       | <input type="checkbox"/> SADL J13 (System Status)                  |
| SADL J2 (PPLI)                 | <input type="checkbox"/> SADL J2 (PPLI)                            |
| SADL J3 (Tracks)               | <input type="checkbox"/> SADL J3 (Tracks)                          |
| TDL Source Track # (J2)        | 1,221  |

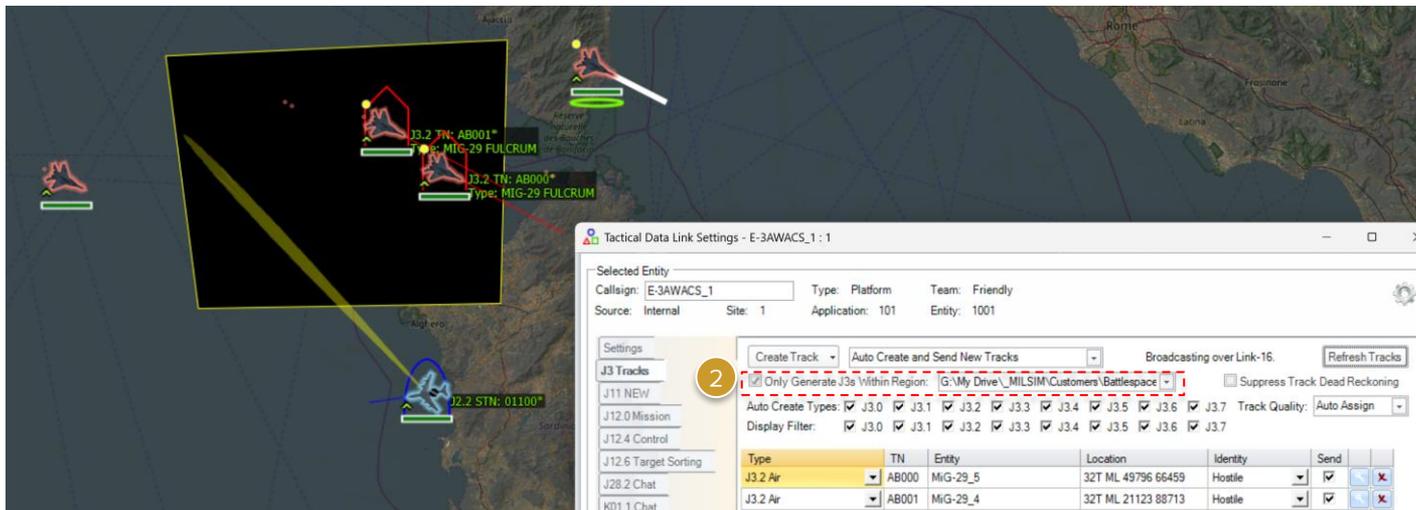
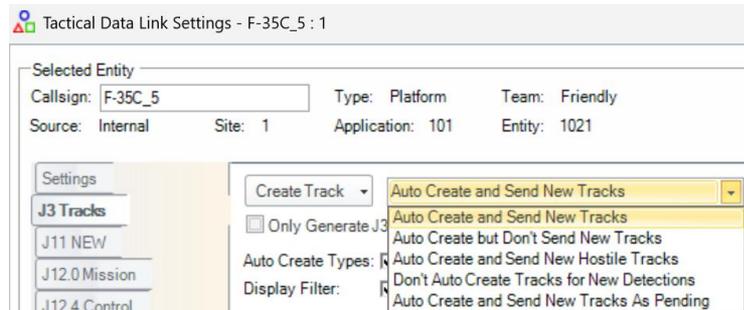


# MACE - LINK 16 NETWORKING

## Setup – Track Creation

Each entity (equipped with L16 radio):

- Has a specific TDL Form – [CTRL+D]
- (1) Can create and/or send J3 tracks automatically
  - Or Manual! Especially useful if connected to REAL L-16 network!
- (2) Limit track creation to a region - .shp file

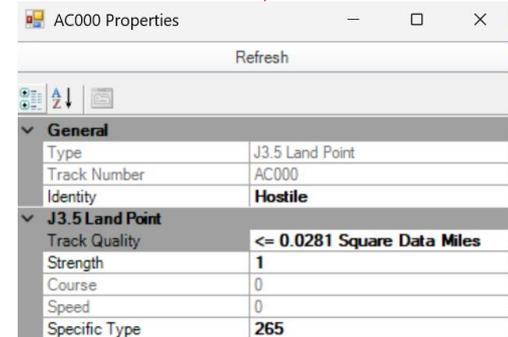
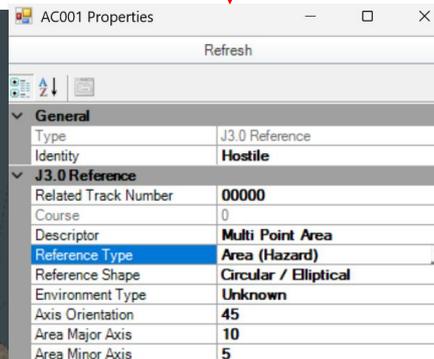
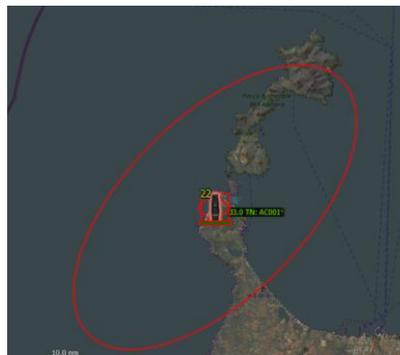
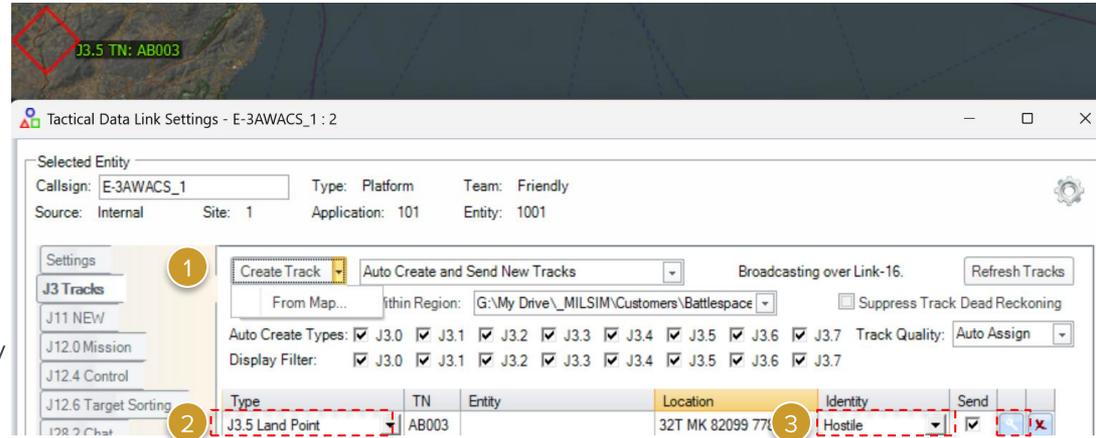


# MACE - LINK 16 NETWORKING

## Manual Track Creation

Each entity TDL Form:

- Allows user to create manual tracks
  - (1) From map
  - (2) Change Type
  - (3) Change Identity (e.g. pending to hostile)
  - (4) Change other properties based on type – e.g. track quality
- J3.0 Reference Points – Properties include:
  - Identity
  - Shape
  - Type
  - Environment
  - Axis
  - Area



# MACE - LINK 16 NETWORKING

## Track Sharing

Tracks are shared with other entities on L-16 Network (in same NPG)

- ALL tracks are visible in **MISSION SETTINGS** → **Data links: Entities**
- Tracks generated by specific entities visible by 'Selected Entity' or use **CTRL+D** on selected entity on Map (or context menu)

The screenshot shows the 'MACE Mission Settings' window with the 'Data Link' tab selected. The 'Selected Entity' section is empty. The 'J3 Tracks' table is visible, showing a list of tracks with columns for Type, TN, Source, Entity, Location, Identity, and Send. The track 'MiG-29\_5' is highlighted in blue.

| Type     | TN    | Source     | Entity     | Location            | Identity | Send |
|----------|-------|------------|------------|---------------------|----------|------|
| J3.2 Air | AB002 | DDG-112_2  | MiG-29_7   | 32T MK 51628 806... | Hostile  | ✓    |
| J3.2 Air | AB003 | E-3AWACS_9 | MiG-29_8   | 32T MK 51411 803... | Hostile  | ✓    |
| J3.2 Air | AB004 | DDG-112_2  | USArlnr_13 | 32T MN 78379 084... | Suspect  | ✓    |
| J3.2 Air | AB005 | E-3AWACS_9 | MiG-29_5   | 32T NK 23533 808... | Hostile  | ✓    |
| J3.2 Air | 00000 | F-35C_11   | USArlnr_13 | 32T MN 75887 087... | Suspect  | ✓    |
| J3.2 Air | AB000 | DDG-112_2  | MiG-29_6   | 32T NL 48258 02686  | Hostile  | ✓    |
| J3.2 Air | AB001 | DDG-112_2  | MiG-29_5   | 32T NK 23666 767... | Hostile  | ✓    |

The screenshot shows the details for the track 'F-35C\_12'. The track is currently 'Executing'.

**Location:** 32T MM 58877 16324  
**Speed:** 500 kts  
**Indicated Airspeed:** 500 kts  
**Alt:** 30000 ft MSL / 30000 ft AGL  
**Heading:** 172.9 (true) / 169.7 (mag)

**Next Waypoint:** X (not in intent)  
**Loiter Time:** Indefinite

**Target:** BMP-3\_2 (BMP-3)  
**Bearing (deg):** 175.4 (true) / 172.1 (mag)  
**Range:** 51.9 (nm) / 96027.1 (m)

**Commands:** MACE Generic Platform Engagement  
**State:** Executing  
**Target Tracks:**

- USArlnr\_13**  
Az (True): 2° El: 0° Rng (nm): 50.9  
Trk Confidence: 89% (s/n 0.0 dB) Trk Priority: 0.0  
Primary Trk Source: DDG-112\_2 / SPS-67
- MiG-29\_5**  
Az (True): 156° El: -1° Rng (nm): 72.6  
Trk Confidence: 97% (s/n 6.5 dB) Trk Priority: 0.0  
Primary Trk Source: DDG-112\_2 / SPY-1D
- MiG-29\_8**  
Az (True): 192° El: -1° Rng (nm): 83.8  
Trk Confidence: 93% (s/n 0.0 dB) Trk Priority: 0.0  
Primary Trk Source: F-35C\_11 / APG-81
- MiG-29\_7**  
Az (True): 192° El: -1° Rng (nm): 84.1  
Trk Confidence: 93% (s/n 0.0 dB) Trk Priority: 0.0  
Primary Trk Source: F-35C\_11 / APG-81
- MiG-29\_6**  
Az (True): 150° El: -1° Rng (nm): 92.9  
Trk Confidence: 97% (s/n 3.5 dB) Trk Priority: 0.0  
Primary Trk Source: DDG-112\_2 / SPY-1D

# MACE - LINK 16 NETWORKING

## Network Link Analysis – Signal Strength and Propagation

### MISSION SETTINGS → Data links: Networks

- All Data-Link network nodes visible
- Select from ‘Available Networks’ – Link-16
- Select ‘Entity on Network’
- Check in ‘Network Connections’ signal strength with other entities from selected ‘Entity on network’
- Enable Network Propagation

Mission TDL Form also allows:

- Equipping of any entity with L16
- Same functions of individual TDL form for any entity
- See ALL tracks and their origin

The screenshot displays the 'MACE Mission Settings' interface. The 'Data Link' tab is active, showing 'Enable Network Propagation Modeling' checked. The 'Available Networks' dropdown is set to 'Link-16 / NET:0.0 (1131, 240000, FH, CPSM, 0, JTIDS/MIDS, Other, 0)'. The 'Entities on the Network' table lists various radio entities, with 'DDG-112\_2 (1 101 1014)' highlighted. The 'Network Connections for DDG-112\_2 (1 101 1014)' table shows connections to other entities like E-3AWACS\_9, EBJSTARS\_10, F-35C\_11, F-35C\_12, and RGM-109E (TLAM) with a signal strength of 100.0%.

| Name                         | Equipment           |
|------------------------------|---------------------|
| DDG-112_2 (1 101 1014)       | Link-16 Radio       |
| E-3AWACS_9 (1 101 1009)      | Link-16 Radio       |
| EBJSTARS_10 (1 101 1010)     | Link-16 Radio       |
| F-35C_11 (1 101 1011)        | Link-16 Radio       |
| F-35C_12 (1 101 1012)        | Link-16 Radio       |
| RGM-109E (TLAM) (1 101 1155) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1156) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1157) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1158) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1159) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1160) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1161) | Link-16 Radio (Off) |
| RGM-109E (TLAM) (1 101 1162) | Link-16 Radio (Off) |

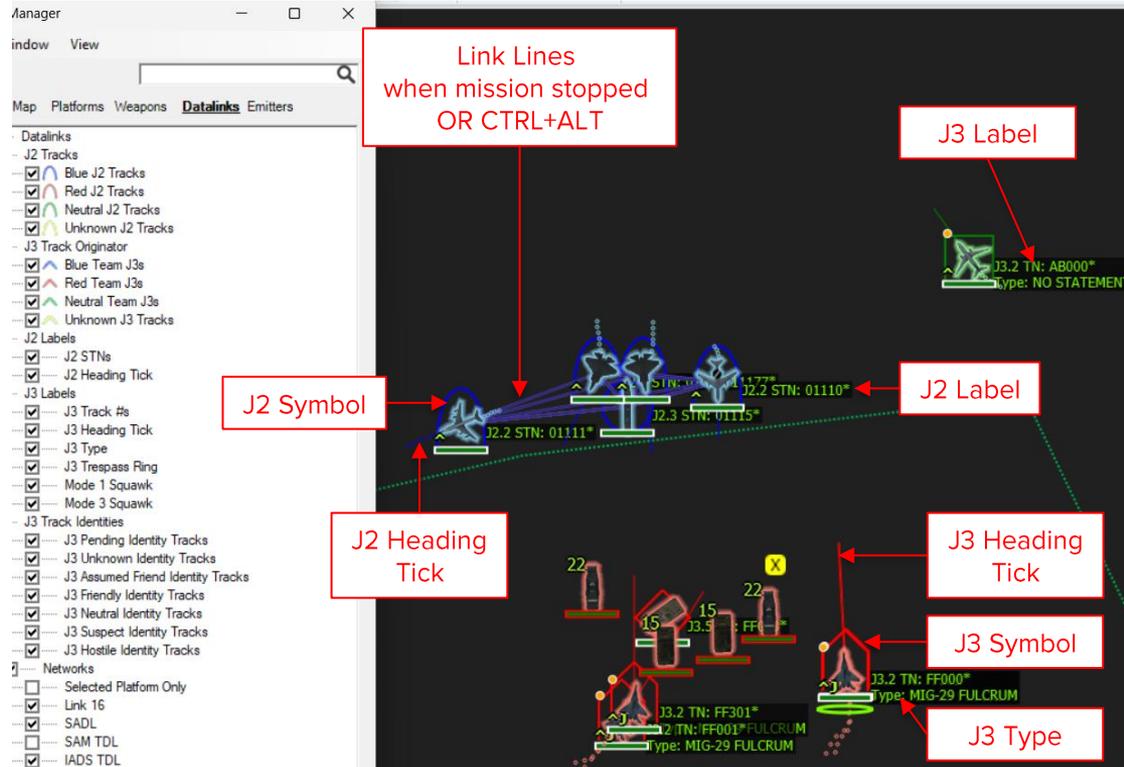
| Entity Name                  | Equipment     | Connection Type | Alternate Type | Relationship | Signal Strength |
|------------------------------|---------------|-----------------|----------------|--------------|-----------------|
| E-3AWACS_9 (1 101 1009)      | Link-16 Radio | RF              | N/A            | Peer         | 100.0%          |
| EBJSTARS_10 (1 101 1010)     | Link-16 Radio | RF              | N/A            | Peer         | 100.0%          |
| F-35C_11 (1 101 1011)        | Link-16 Radio | RF              | N/A            | Peer         | 100.0%          |
| F-35C_12 (1 101 1012)        | Link-16 Radio | RF              | N/A            | Peer         | 100.0%          |
| RGM-109E (TLAM) (1 101 1155) | Link-16 Radio | RF              | N/A            | Peer         | Radio Off       |



# MACE - LINK 16 NETWORKING

## MACE Overlays

- **LAYER MANAGER** → DataLinks
- Links visible when mission stopped (or press CTRL+ALT)
- J2 PPLI and J3 Track Symbols via team and domain
- J2 and J3 Labels
- Target Pairing Lines



# MACE - LINK 16 NETWORKING

## L16 Missions (J12) – Platform Engage Via Link

- Send J12 Mission Messages to other platforms
- Auto Wilco or User Wilco (settings)

### Types of J-12 and Wilco Results:

| Mission Type   | Addressee Actions on WILCO   |
|--|--|
| <b>7 - Break Engagement</b><br><b>42 - Cease Attack</b>                  | Weapons Hold; Enter Intent (if in move to target mode)               |
| <b>20 - Close Air Support</b><br><b>41 – Attack</b><br><b>5 – Engage</b> | Target Set to Senders Target Location; Weapons Tight; Move To Target |
| <b>25 - Weapons Free</b>   | Weapons Free   |
| <b>26 - Weapons Tight</b>  | Weapons Tight  |
| <b>63 - Cease Mission</b>  | Enter Intent (if in delta mode)                                      |



# MACE - LINK 16 NETWORKING

## L16 Missions (J12) – Platform Engage Via Link

- Send J12 Mission Messages to other platforms
  - Choose mission type, target and recipient → [SEND]
  - Auto WILCO Enabled = mission starts automatically (e.g. move to target, weapons tight)
  - Auto WILCO Disabled = requires user WILCO on TDL Form (CTRL+D)
  - Details – shows what recipient is to do as MACE Actions

The screenshot displays the MACE interface for configuring a J12 mission. On the left, a map shows a mission track from a sender to a target. The target is labeled 'J3.2 TN: AB004\* Type: MIG-29 FULCRUM'. The sender is labeled 'J2.2 STN: 01100\*'. A red line indicates the mission path.

The main interface shows the following configuration:

- Message: 5 - Engage
- Target: MiG-29\_2
- Recipient: F-35C\_6
- TN: 01105

Buttons for 'Send' and 'Details' are visible. Below the configuration is a table of 'Incoming J12.0 Missions':

| Sender            | Recipient      | Message | Details | WILCO | CANTCO | HAVECO | Status  |
|-------------------|----------------|---------|---------|-------|--------|--------|---------|
| E-3A/WACS_1 (...) | F-35C_6 (1105) | Engage  |         |       |        |        | WILCO ✖ |

An 'Engage' dialog box is open, providing details for the mission:

Engage  
Orders the destruction of an air target.  
Sets target to: MiG-29\_2  
Sets weapons posture to: Tight  
Sets maneuvering state to: Move To Target (except for surface ships against aircraft)  
Objective Track Number: AB002

Buttons for 'OK' and 'Delete All' are also visible.

# MACE - LINK 16 NETWORKING

## L16 Missions (J12) – Platform Ground Attack

- Use J12.41 (Attack) or J12.20 (Close Air Support)
- Pre-fills and clears CAS-9-Line

The screenshot displays the MACE Link 16 networking interface, divided into several panels:

- Tactical Data Link Settings (E-3AWACS\_1 - 2):** Shows the selected entity (E-3AWACS\_1), type (Platform), team (Friendly), and site (1). The message is set to "41 - Attack" with a target of "32T NL 04738 35347". The recipient is "F-35C\_1" with a TN of "01104".
- Mission Configuration (9-Line (Close Air Support) (1)):** Shows four assets (Asset 1-4) configured for ground attack. Each asset is set to "Same Final Attack Heading All Aircraft" and "Insert Into Existing Route". The assets are configured with "FAH: 360", "PRF: 1111", and "Aircraft Self-Designates".
- Attack Dialog:** A small dialog box titled "Attack" with the text: "Clears aircraft to attack target. Sets target to: 32T NL 04741 35350. Requested Egress Heading: 270 deg. Will execute via 9-line due to run-in heading, egress, or TOT." with an "OK" button.
- 3D Map View:** Shows a top-down view of a terrain map with a blue flight path and target locations. A red diamond marker indicates a target at "33.5 TN: AC000" and a yellow circle marker indicates another target at "32.2 STN: 01104".



# MACE - LINK 16 NETWORKING

## Adversary TDL

- Similar to L-16 for red force
- J3 exchange happens automatically (no J3 enable)
- Relay (is disabled by default)
  - Allows mesh networking (like L-16)
  - Enable via **Weapons & Equipment Properties Form**

# MACE - LINK 16 NETWORKING

## Setup **SYSTEM SETTINGS** → **Datalinks: Link-16**

- If networking outside of MACE
  - MACE can be TCP Server, TCP Client, or communicate via UDP.
  - MACE can relay J-Series messages that were received over DIS to JREAP-C – or vice versa
    - Via Entitles – MACE will try to match with MACE platform PPLI and Track Number; if correlated will broadcast as if from the MACE platform itself
- Else →
  - Via L16 – sends as originating from general MACE instance not platform – acts as a simple L16 gateway
  - Via SADL – as above but for SADL

The screenshot shows the 'MACE System Settings' window with the 'Data Paths' tab selected. The 'General' section displays 'Detected IP Addresses: 127.0.0.1, 192.168.1.246' with a 'Refresh' button. The 'JREAP-C' section includes checkboxes for 'Relay DIS to JREAP-C' (unchecked), 'Relay JREAP-C to DIS via: Entities, Link-16, SADL, JREAP-A' (all unchecked), and 'Include NPG #' (unchecked). The 'Sender ID' is set to 100. The 'TCP Server' section has an 'Enable' checkbox (unchecked) and 'Port: 8888'. The 'TCP Client' section has an 'Enable' checkbox (unchecked), 'Port: 8888', and 'Server IP: 127.0.0.1'. The 'UDP' section has 'Send' and 'Receive' checkboxes (both unchecked), 'Port: 8888', and 'Send IP: 127.255.255.255'. A red dashed box highlights the JREAP-C, TCP Server, TCP Client, and UDP sections.

# MACE - LINK 16 NETWORKING

## Student Exercise (Solution Video Not Yet Available)

1. Create a new mission
2. Add the following blue forces: 1 x Arleigh Burke, Above it: 2 x F-35, further north: 1 x E-3, 1 x RC-135
3. Add a civilian aircraft on a circular route near the area
4. Add the following Red forces: 3 x Mig-29 (2 in a close formation, the other elsewhere), 2 x APC (BMPs) following waypoints, 2-3 x Tactical SAMs (SA22 or 15)
5. Change system or Mission network settings to NOT Auto-Wilco, enable network propagation
6. Use the layer manager to display the L-16 links and J2 and J3 tracks and labels
7. Import or draw a shape – place at least one of the red aircraft outside the shape in a loiter
8. Open the datalink form on the E-3 and constrain its automatic track creation to the shape, also make its track numbers from EW000 to EW777
9. Open the datalink form on each F-35 and change Track Ident to FF000 to FF300 and FF301 to FF600 respectively – ensuring J3s are enabled
10. Start the mission and observe the auto-track creation – use the track numbers annotation (layer manager) to determine track source – and grouped tracks
11. Open datalink form on Arleigh burke and E-3 to see which tracks they created
12. Open platform properties on one of the F-35s and verify in the status window the tracks and their origins
13. Open the Mission Settings Datalink tab to see all track and their origin
14. Open the Mission Settings Network tab confirm network propagation enabled – check the signal strength between the E-3 and other blue platforms
15. Add a platform that does not have Link-16 (e.g. AH-64) and use platform properties to enable J2 – check weapons and equipment to verify L16 radio has been added – verify that the J-3 track with origin changes to a J2 STN
16. Open datalink form on the E-3 and use J-12 to instruct one of the F-35s to engage one of the MIG-29s
17. Open datalink form on the F-35 and WILCO the mission and confirm the aircraft is moving to target and weapons tight
18. Use the datalink form to cease the mission for the F-35
19. On any platform Add a manual track from the map



# MACE - LINK 16 NETWORKING

## Student Exercise Cont

20. Create a manual track (as if observed by SOF unit) for one of the SAM sites that has no track or another enemy ground unit
21. Use J12 message to have a platform engage the SAM site
22. Fire a TLAM from the submarine and task it to destroy an enemy SAM using J-11 message



# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## Learning objective:

- To be able to create and configure a new platform and add existing equipment to it

## Enabling objectives

- Understand the object configuration hierarchy
- Understand the layout of the MOCT and the MACE XML File structure
- Understand the principal of duplication and customization
- Know how to use filters and search to find platforms in the MOCT
- Understand requirement for correct SISO identification in DIS mission
- Know where to find SISO information
- Know how to duplicate a platform or equipment
- Know how to set DIS Enumeration for a platform or equipment
- Understand how changing platform attributes and icon data affects display in MACE
- Know how to set movement characteristics for platforms
- Understand the underlying models linked to platforms
- Know how to set models for platforms (Constructive Aero, Joystick Aero, RCS etc)
- Know how to set physical characteristics for platforms
- Know how to set visual (IG) models for platforms
- Understand Eyepoints and Articulation settings for platforms
- Know how to add existing equipment to a platform
- Know how to add a hard point to a platform
- Know how to add assign platform equipment to a hardpoint
- Know how to save a platform
- Understand where User data is saved
- Understand the requirement to export model maps

# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## Platform

- Vehicle
- Lifeform

## Hardpoints

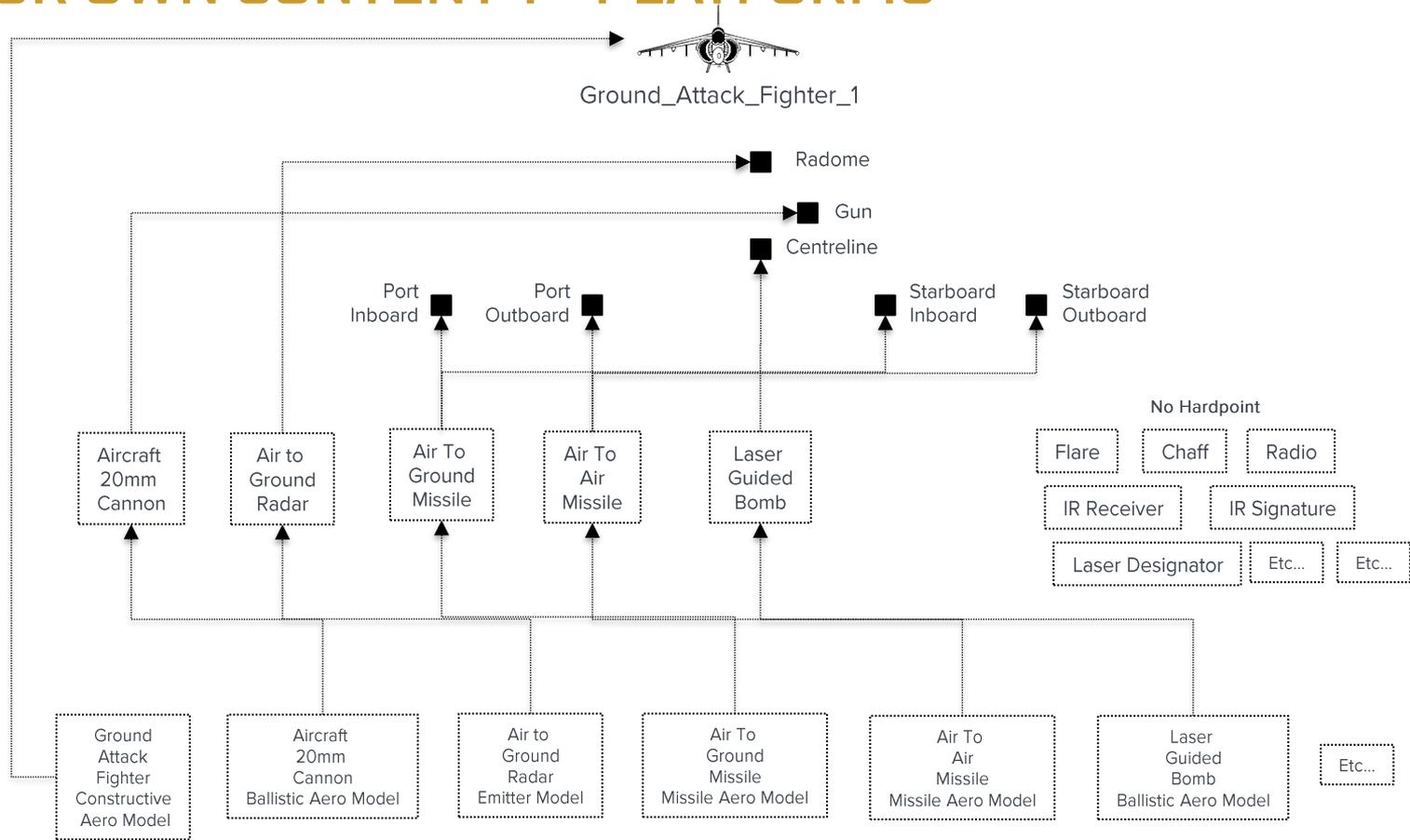
- 3D Position on platform
- Can have parents and children
- Az Pitch Roll limits
- Pairable with sensors
- Equipment may or may not be attached to a hard point

## Equipment

- Weapons
- Sensors
- Expendables
- Devices
- Signatures

## Models

- Ballistic
- Missile
- Fixed Wing Flight
- Rotary Wing Flight
- Emitters
- Threat Libraries





# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## XML File Structure

This PC > OS (C:) > Users > Public > Public Documents > MACE > xml > MissionObjectsConfiguration >

| Name                        | Date modified    | Type        | Size |
|-----------------------------|------------------|-------------|------|
| AToToMACEEntityConfigs      | 22/03/2023 09:58 | File folder |      |
| AToToMACEEquipmentConfigs   | 22/03/2023 09:58 | File folder |      |
| BallisticAeroConfigs        | 22/03/2023 09:58 | File folder |      |
| EMAeroConfigs               | 22/03/2023 09:58 | File folder |      |
| Emitters                    | 12/01/2023 13:28 | File folder |      |
| EntityGroupTemplateConfigs  | 22/03/2023 09:58 | File folder |      |
| EquipmentConfigs            | 22/03/2023 09:58 | File folder |      |
| FFMAeroConfigs              | 22/03/2023 09:58 | File folder |      |
| HeadsUpDisplayConfigs       | 22/03/2023 09:58 | File folder |      |
| HelicopterAeroConfigs       | 22/03/2023 09:58 | File folder |      |
| HydrodynamicConfigs         | 22/03/2023 09:58 | File folder |      |
| JSBSimAeroConfigs           | 22/03/2023 09:58 | File folder |      |
| KnownPlaceConfigs           | 22/03/2023 09:58 | File folder |      |
| MissileAeroConfigs          | 22/03/2023 09:58 | File folder |      |
| PlatformConfigs             | 22/03/2023 09:58 | File folder |      |
| ScriptActionTemplateConfigs | 22/03/2023 09:59 | File folder |      |
| SiteConfigs                 | 04/01/2023 13:41 | File folder |      |
| ThreatLibraries             | 22/03/2023 09:59 | File folder |      |
| UnifiedWeaponAeroConfigs    | 04/01/2023 13:41 | File folder |      |
| WeaponEngagementZoneConfigs | 22/03/2023 09:59 | File folder |      |

OS (C:) > Users > Public > Public Documents > MACE > xml > MissionObjectsConfiguration > PlatformConfigs >

| Name                           | Date modified    | Type                | Size  |
|--------------------------------|------------------|---------------------|-------|
| Cultural-VRSG                  | 22/03/2023 09:59 | File folder         |       |
| UserData                       | 23/03/2023 14:06 | File folder         |       |
| SiteModel                      | 04/11/2020 11:13 | Microsoft Edge H... | 11 KB |
| ca-52_Alligator_(Custom)       | 04/11/2020 11:13 | Microsoft Edge H... | 11 KB |
| Market_Incident_(Arabic)_Sound | 04/11/2020 11:14 | Microsoft Edge H... | 11 KB |
| Mine                           | 04/11/2020 11:14 | Microsoft Edge H... | 11 KB |
| Windsock                       | 04/11/2020 11:14 | Microsoft Edge H... | 11 KB |
| Bouncing_Betty                 | 04/11/2020 11:14 | Microsoft Edge H... | 11 KB |
| Bicycle                        | 07/11/2020 18:07 | Microsoft Edge H... | 13 KB |
| Airdrop_Bundle_CDS             | 30/11/2020 18:14 | Microsoft Edge H... | 13 KB |
| Aiming_Post                    | 06/02/2021 00:00 | Microsoft Edge H... | 10 KB |
| SA-11_9T229_Transloader        | 11/02/2021 00:00 | Microsoft Edge H... | 11 KB |

OS (C:) > Users > Public > Public Documents > MACE > xml > MissionObjectsConfiguration > PlatformConfigs > UserData

| Name       | Date modified    | Type                | Size  |
|------------|------------------|---------------------|-------|
| Super_SA-8 | 23/03/2023 14:06 | Microsoft Edge H... | 28 KB |

### NOTE - MACE CHOOSES USER DATA

User data overrides MACE installed data – so if there are 2 xmls of the same name one in user data folder and one in normal config folder MACE will use the User Data xml



# MAKING YOUR OWN CONTENT 1 - PLATFORMS

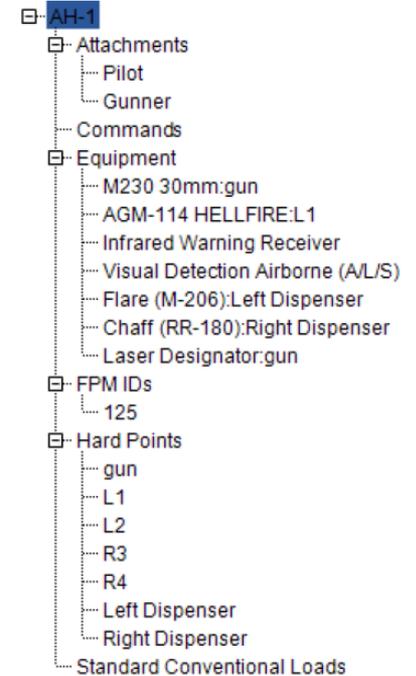
## Platform Sub-Items

- **ATTACHMENTS**
  - 3D position **offset** on platform on which **another platform** can be attached
  - How ‘attaching platforms’ should **approach** the platform and where they should **detach**
  - **Articulated parts** that should move during the attachment
- **HARD POINTS**
  - 3D position on platform on which **equipment** can be attached
  - **Orientation** of the hardpoint
  - **Slew Rate** and **Slew Limits**
  - **Control and Tracking Indexes**
    - If multiple hard points have the same control index, then the salvo/reload time is shared between those hard points.
    - Tracking Index - which weapon should use which tracking RADAR
- **EQUIPMENT**
  - List of **equipment attached to platform** (and on which hardpoint – if applicable)
- **COMMANDS**
  - Code that modifies platform behaviour (e.g. Weapon engagement by datalink)
  - **FPM (Flight Performance Model) ID**
    - Single integer value that uniquely identifies the Platform

Motion of Hard Point Slaved To Loaded Emitter

Motion Defaults to Assigned Target

Commands Parent Hard Point Position



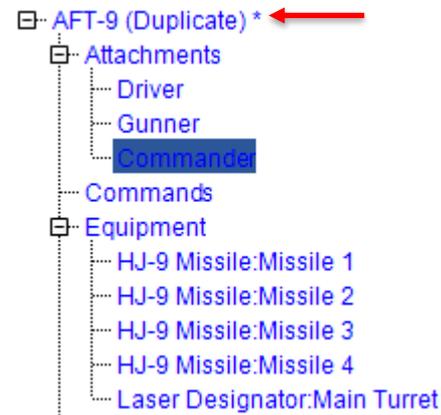


# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## Saving and Testing



- Save each XML
  - Close each tab after saving so you know you have saved
- Close the MOCT
- Restart MACE
  - If you have made minor changes – you can drag XMLS from folders into a running MACE
  - To be totally sure – restart MACE
- Refresh Platforms in Missions
  - If you have changed a platform XML and it is already in a mission
  - Select the platforms of that type in the mission (SHIFT + DBL LMB)
  - Select the changed platform in mission builder
  - Use the 'Delta Triangle' to replace the platforms (with themselves!)



### NOTE – NO SAVE REMINDERS

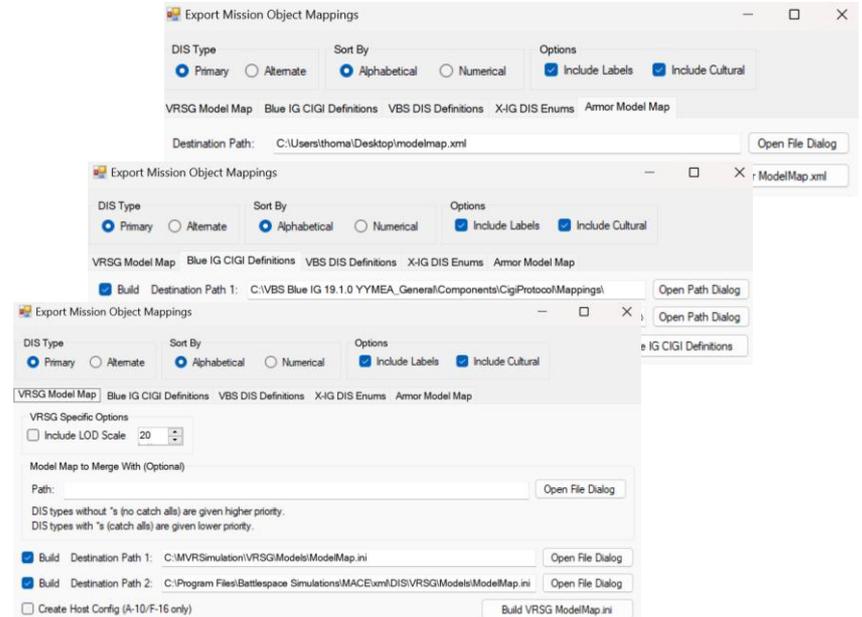
Don't forget to Save each XML (Tab in MOCT) as it's very easy to miss unsaved and close without saving – there is no prompt for unsaved data on closing



# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## Export for Image Generators

- IGs need to map entity types to 3D models
- Usually have their own format of ‘mapping file’
- MOCT can generate
  - AMROR
  - VRSG
  - VBS Blue IG
- Place the file in the correct folder for the IG
  - ARMOR - C:\Program Files\Battlespace Simulations\ARMOR



# MAKING YOUR OWN CONTENT 1 - PLATFORMS

## Student Exercise (Solution Video Not Yet Available)

1. Find an SA8 SAM in the MOCT by using domain, team, and name filters
2. Duplicate and rename the SAM system Super\_SA-8
3. (Optional) Check the SISO documentation to make the new SAM a correct DIS enumeration for a country of your choice
4. Check role attribute is correct
5. Pick a different mission builder category or leave as default to role
6. Check / Choose a new constructive aerodynamic engine and joystick engine for movement from another vehicle
7. Add more default waypoints and change the colour of the platform's waypoints
8. Check the other parameters and save
9. Verify there is a file named Super\_SA-8.xml in the correct MACE mission object config folder
10. In the Super\_SA-8 Equipment on the existing hardpoints add 2 more additional missiles one on each launcher hardpoint
11. In the Super\_SA-8 Equipment add a generic EW radar
12. Save your platform config and load MACE to look at the new platform
13. Add the platform to your mission with fixed wing fighter at 5000ft MSL with a route that takes it inside the engagement zone with foam weapon mode enabled for the mission
14. Open the Super\_SA-8 Weapons and Equipment and note the addition of the generic EW radar and the extra missiles
15. Use platform properties and Edit the EW radar from the weapons and equipment properties and observe the sensor display to see the EW radar tracking the target before it's entry into the MEZ

# MAKING YOUR OWN CONTENT 2

## Learning objective:

- To be able to create and configure new equipment and associated models

## Enabling objectives

- Understand the underlying models linked to equipment
- Know how to set models for equipment (Ballistic Aero, Missile Aero, RCS, WEZ etc)
- Know how to set capabilities for weapons equipment (min / max ranges etc)
- Understand how the relationship between capabilities and WEZ for missiles
- Understand how guidance type is linked to Associated Equipment
- Know how to set effects for equipment
- Know how to use the missile aero visualization tool to assess success with different types of engagement parameters
- Know how to edit missile aero model parameters
- Know how to generate a new missile WEZ from a missile aero model
- Know how to link new Aero models and WEZ to equipment
- Know how to add an existing 'associated device' to equipment

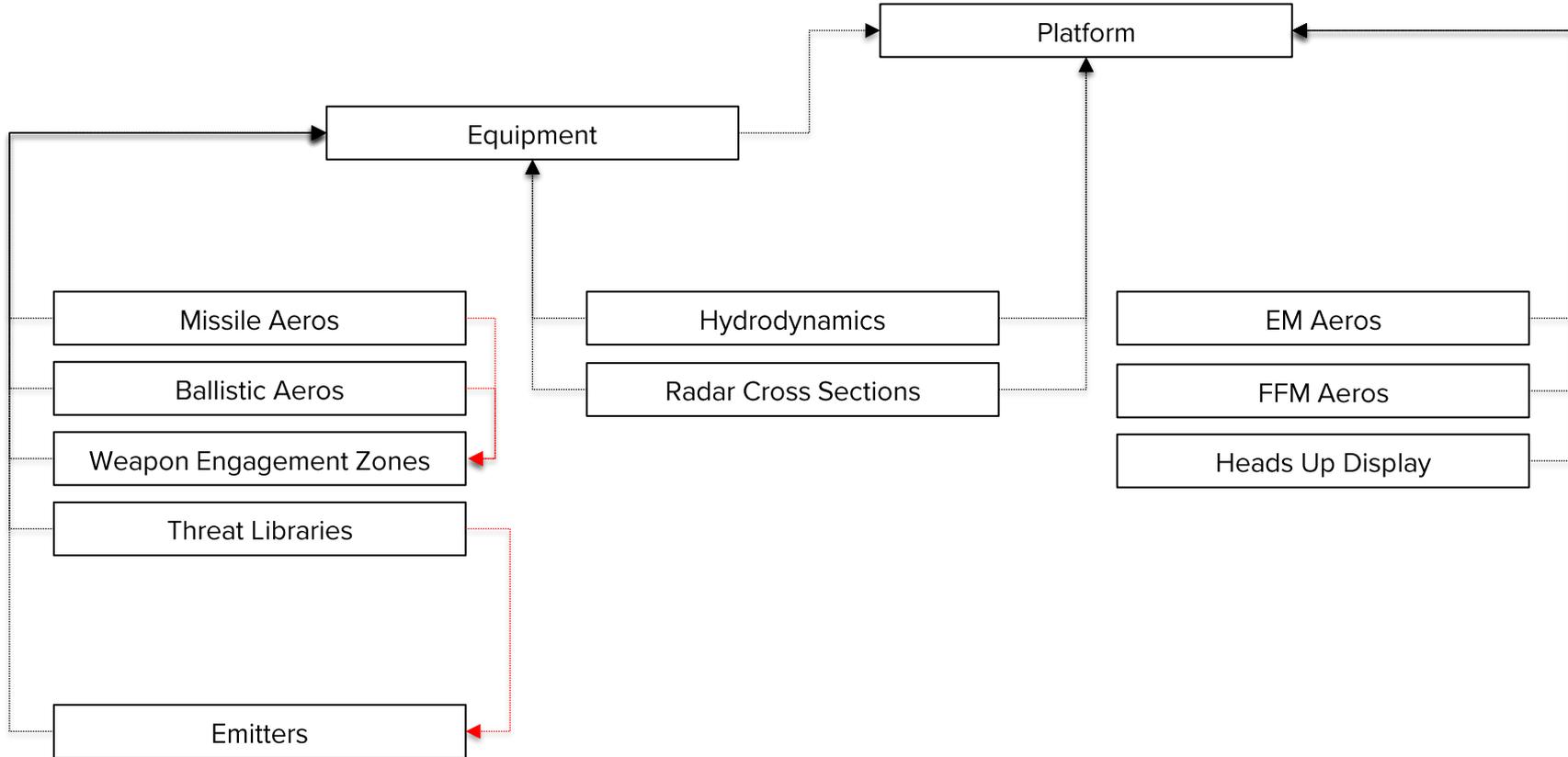
# MAKING YOUR OWN CONTENT 2

PLATFORM

EQUIPMENT

MODELS

EMITTERS



# MAKING YOUR OWN CONTENT 2

## Equipment XML

- Like Platform: 01 – ID / 02 – Description / 03 – Mission Builder / 04 – Icon /05 – Network etc
- **06 – ATTRIBUTES** (most important aspects)
  - Function Type is critical to how MACE handles the equipment
  - Category – where it appears in weapons and equipment form
- **09 – CAPABILITIES** (most important aspects)
  - Threat Library – Jammers, ARMs, RWR
  - Weapon Engagement Zone – calculated from missile/ballistic aero
  - Max / Min Ranges – for MACE Map info and optimisation – WEZ Trumps this
  - Min Target Solution Confidence – before able to fire
  - Power – is only for Laser and IR designators (for others it is in emitter editor)
  - Max ToF – before miss/disappear
  - Launch Azimuth – for off boresight launching
  - Terminal guidance activation range – when it goes
  - Lock on After Launch – no target solution required at launch
  - Salvo interval – how long between each launch
  - Fire and forget – no post launch guidance required
  - Guidance type – weapons only (some depreciated in lieu of emitters) match to be safe
  - Engage with Data link – can be tasked by offboard sensors
- **08 – MOVEMENT**
  - Aero Model
- **12 – EFFECTS** (most important aspects)
  - UV Detect range – range at which MWR can detect
  - Blast Radius
  - Blast Effectiveness – Use weapon damage effect table to verify
- **13 – SUBMUNITIONS**
  - Number, Angle, Velocity, Type (another bit of equipment)

### **NOTE – WEAPON DAMAGE EFFECTS**

The amount of damage a weapon causes is based on the target's radius, target's armor, weapon's blast radius, weapon's blast effect, and the distance from the weapon to the target at detonation.



# MAKING YOUR OWN CONTENT 2

## Missile Aero Model Parameters and Visualisation

Missile Aero Parameters

| Classification  | 1 = Unclassified | Classification  | 1 = Unclassified |
|---|------------------|---|------------------|
| <b>Misc</b>   |                  | <b>Misc</b>   |                  |
| Is Ground Launched  | True             | Is Ground Launched  | True             |
| Targets Ground  | False            | Targets Ground  | False            |
| Dry Weight In Pounds (min=0, max=1000000, inc=10)                                   | 54.385           | Dry Weight In Pounds (min=0, max=1000000, inc=10)                                   | 20.0000          |
| Fuel Weight In Pounds (min=0, max=1000000, inc=10)                                  | 320.7000         | Fuel Weight In Pounds (min=0, max=1000000, inc=10)                                  | 450.0000         |
| Maximum Fuel Weight In Pounds (min=0, max=1000000, inc=10)                          | 320.7000         | Maximum Fuel Weight In Pounds (min=0, max=1000000, inc=10)                          | 450.0000         |
| Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)              | 0.3728           | Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)              | 0.2000           |
| Subsonic Drag Coefficient (min=0, max=1000000, inc=0.1)                             | 0.5500           | Subsonic Drag Coefficient (min=0, max=1000000, inc=0.1)                             | 0.3000           |
| Supersonic Drag Coefficient (min=0, max=1000000, inc=0.1)                           | 0.6000           | Supersonic Drag Coefficient (min=0, max=1000000, inc=0.1)                           | 0.4500           |
| Parachute Drag Coefficient (min=0, max=1000000, inc=0.1)                            | 0.0000           | Parachute Drag Coefficient (min=0, max=1000000, inc=0.1)                            | 0.0000           |
| Parachute Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)    | 0.0000           | Parachute Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)    | 0.0000           |
| Drogue Drag Coefficient (min=0, max=1000000, inc=0.1)                               | 0.0000           | Drogue Drag Coefficient (min=0, max=1000000, inc=0.1)                               | 0.0000           |
| Drogue Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)       | 0.0000           | Drogue Drag Reference Area In Feet <sup>2</sup> (min=0, max=1000000, inc=0.1)       | 0.0000           |
| Parachute Release Altitude Above Ground Level In Feet (min=0, max=1000000, inc=100) | 0.0              | Parachute Release Altitude Above Ground Level In Feet (min=0, max=1000000, inc=100) | 0.0000           |
| Parachute Release Duration In Seconds (min=0, max=100000, inc=1)                    | 0.00             | Parachute Release Duration In Seconds (min=0, max=100000, inc=1)                    | 0.00             |
| Parachute Illumination  | False            | Parachute Illumination  | False            |
| Illumination Duration In Seconds (min=0, max=1000000, inc=1)                        | 0.0              | Illumination Duration In Seconds (min=0, max=1000000, inc=1)                        | 0.0              |
| Muzzle Velocity In Feet Per Second (min=0, max=1000000, inc=1)                      | 0.0000           | Muzzle Velocity In Feet Per Second (min=0, max=1000000, inc=1)                      | 0.0000           |
| Duration On Rail In Seconds (min=0, max=10000, inc=1)                               | 0.100            | Duration On Rail In Seconds (min=0, max=10000, inc=1)                               | 0.100            |
| Booster Start Delay In Seconds (min=0, max=10000, inc=1)                            | 0.000            | Booster Start Delay In Seconds (min=0, max=10000, inc=1)                            | 0.000            |
| Booster Duration In Seconds (min=0, max=10000, inc=1)                               | 2.000            | Booster Duration In Seconds (min=0, max=10000, inc=1)                               | 4.000            |
| Booster Impulse In Seconds (min=0, max=100000, inc=1)                               | 25.0             | Booster Impulse In Seconds (min=0, max=100000, inc=1)                               | 20.0             |
| Booster Mass Flow Rate In Slugs Per Second (min=0, max=100000, inc=1)               | 1.747300         | Booster Mass Flow Rate In Slugs Per Second (min=0, max=100000, inc=1)               | 1.747300         |
| Sustainer Duration In Seconds (min=0, max=10000, inc=1)                             | 25.000           | Sustainer Duration In Seconds (min=0, max=10000, inc=1)                             | 50.0000          |
| Sustainer Impulse In Seconds (min=0, max=100000, inc=1)                             | 150              | Sustainer Impulse In Seconds (min=0, max=100000, inc=1)                             | 200              |
| Sustainer Mass Flow Rate In Slugs Per Second (min=0, max=100000, inc=1)             | 0.250000         | Sustainer Mass Flow Rate In Slugs Per Second (min=0, max=100000, inc=1)             | 0.500000         |
| Control System Delay Feet A G L (min=0, max=10000, inc=0.1)                         | 0.000            | Control System Delay Feet A G L (min=0, max=10000, inc=0.1)                         | 0.000            |
| Control System Delay In Seconds (min=0, max=10000, inc=0.1)                         | 1.100            | Control System Delay In Seconds (min=0, max=10000, inc=0.1)                         | 0.000            |
| Seeker Azimuth Limit In Degrees (min=0, max=180, inc=1)                             | 10.000           | Seeker Azimuth Limit In Degrees (min=0, max=180, inc=1)                             | 10.000           |
| Seeker Pitch Limit In Degrees (min=0, max=180, inc=1)                               | 10.000           | Seeker Pitch Limit In Degrees (min=0, max=180, inc=1)                               | 10.000           |
| Range Factor Lift Dive In Degrees Per Nautical Mile (min=0, max=100000, inc=1)      | 1.00000          | Range Factor Lift Dive In Degrees Per Nautical Mile (min=0, max=100000, inc=1)      | 1.00000          |
| Range Direct Trigger In Nautical Miles (min=0, max=100000, inc=1)                   | 10.0000          | Range Direct Trigger In Nautical Miles (min=0, max=100000, inc=1)                   | 10.0000          |
| Altitude Limit Lift In Feet (min=0, max=1000000, inc=1000)                          | 60.000.00        | Altitude Limit Lift In Feet (min=0, max=1000000, inc=1000)                          | 60.000.00        |
| Altitude Limit Lift Relative To Target Altitude                                     | False            | Altitude Limit Lift Relative To Target Altitude                                     | False            |
| Altitude Limit Dive In Feet (min=0, max=1000000, inc=1000)                          | 10.000.00        | Altitude Limit Dive In Feet (min=0, max=1000000, inc=1000)                          | False            |
| Minimum Speed In Mach (min=0, max=1000, inc=0.1)                                    | 0.7500           | Minimum Speed In Mach (min=0, max=1000, inc=0.1)                                    | 0.7500           |
| Maximum G Turn Rate In Gs (min=0, max=1000, inc=0.1)                                | 30.000           | Maximum G Turn Rate In Gs (min=0, max=1000, inc=0.1)                                | 30.000           |
| Attack Profile  | Direct           | Attack Profile  | Direct           |
| G Bias Angle_deg (min=0, max=90, inc=1)   | 0.000            | G Bias Angle_deg (min=0, max=90, inc=1)   | 0.000            |
| G Bias Load Factor In Gs (min=0, max=1000, inc=1)                                   | 0.000            | G Bias Load Factor In Gs (min=0, max=1000, inc=1)                                   | 0.000            |
| Is Lottering Capable  | False            | Is Lottering Capable  | False            |
| Lotter Speed In Knots (min=0, max=1000, inc=10)                                     | 0.00             | Lotter Speed In Knots (min=0, max=1000, inc=10)                                     | 0.00             |
| Lotter Minimum Altitude A G L In Feet (min=0, max=1000000, inc=1000)                | 0.00             | Lotter Minimum Altitude A G L In Feet (min=0, max=1000000, inc=1000)                | 0.00             |
| Lotter Maximum Altitude A G L In Feet (min=0, max=1000000, inc=1000)                | 0.00             | Lotter Maximum Altitude A G L In Feet (min=0, max=1000000, inc=1000)                | 0.00             |
| Impact Probability Of Error   | 0.00             | Impact Probability Of Error   | 0.00             |

Missile Aero Visualisation Tool Flyouts

The screenshot displays the WEZ Builder interface, which is used for configuring and visualizing missile models. The interface is divided into several sections:

- Parameters:** A list of parameters on the left side, including 'Name', 'Type', 'Is Ground Launched', 'Targets Ground', 'Dry Weight', 'Fuel Weight', 'Maximum Fuel Weight', 'Drag Reference Area', 'Subsonic Drag Coefficient', 'Supersonic Drag Coefficient', 'Parachute Drag Coefficient', 'Parachute Drag Reference Area', 'Drogue Drag Coefficient', 'Drogue Drag Reference Area', 'Parachute Release Altitude', 'Parachute Release Duration', 'Parachute Illumination', 'Illumination Duration', 'Muzzle Velocity', 'Duration On Rail', 'Booster Start Delay', 'Booster Duration', 'Booster Impulse', 'Booster Mass Flow Rate', 'Sustainer Duration', 'Sustainer Impulse', 'Sustainer Mass Flow Rate', 'Control System Delay', 'Seeker Azimuth Limit', 'Seeker Pitch Limit', 'Range Factor Lift Dive', 'Range Direct Trigger', 'Altitude Limit Lift', 'Altitude Limit Lift Relative To Target Altitude', 'Altitude Limit Dive', 'Minimum Speed', 'Maximum G Turn Rate', 'Attack Profile', 'G Bias Angle', 'G Bias Load Factor', 'Is Lottering Capable', 'Lotter Speed', 'Lotter Minimum Altitude A G L', 'Lotter Maximum Altitude A G L', and 'Impact Probability Of Error'. Each parameter has a corresponding value field.
- Flight Profile - Distance vs Altitude:** A graph showing the missile's trajectory. The x-axis represents distance (0 to 40 km) and the y-axis represents altitude (0 to 20 km). The profile shows a launch phase, a boost phase, a sustainer phase, and a terminal phase.
- Flight Profile - Overhead:** A graph showing the missile's path from an overhead perspective. The x-axis represents distance (0 to 40 km) and the y-axis represents altitude (0 to 20 km). The path is shown as a series of connected points.
- WEZ Builder Controls:** A panel on the right side of the interface containing various controls and settings, including 'Name', 'Type', 'Is Ground Launched', 'Targets Ground', 'Dry Weight', 'Fuel Weight', 'Maximum Fuel Weight', 'Drag Reference Area', 'Subsonic Drag Coefficient', 'Supersonic Drag Coefficient', 'Parachute Drag Coefficient', 'Parachute Drag Reference Area', 'Drogue Drag Coefficient', 'Drogue Drag Reference Area', 'Parachute Release Altitude', 'Parachute Release Duration', 'Parachute Illumination', 'Illumination Duration', 'Muzzle Velocity', 'Duration On Rail', 'Booster Start Delay', 'Booster Duration', 'Booster Impulse', 'Booster Mass Flow Rate', 'Sustainer Duration', 'Sustainer Impulse', 'Sustainer Mass Flow Rate', 'Control System Delay', 'Seeker Azimuth Limit', 'Seeker Pitch Limit', 'Range Factor Lift Dive', 'Range Direct Trigger', 'Altitude Limit Lift', 'Altitude Limit Lift Relative To Target Altitude', 'Altitude Limit Dive', 'Minimum Speed', 'Maximum G Turn Rate', 'Attack Profile', 'G Bias Angle', 'G Bias Load Factor', 'Is Lottering Capable', 'Lotter Speed', 'Lotter Minimum Altitude A G L', 'Lotter Maximum Altitude A G L', and 'Impact Probability Of Error'. Each parameter has a corresponding value field.

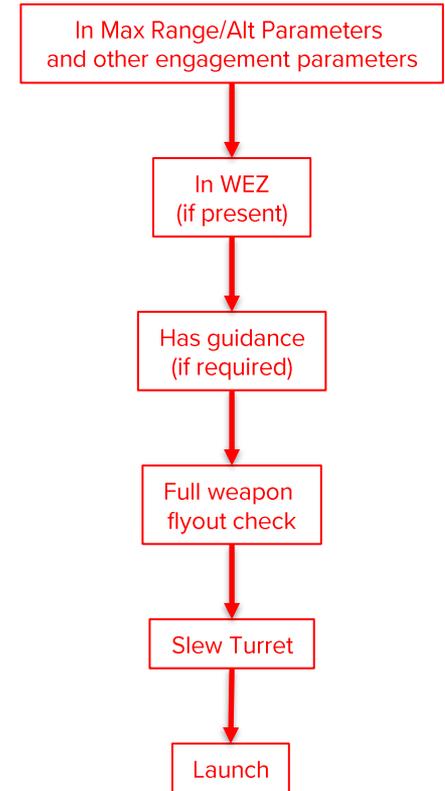
WEZ Builder



# MAKING YOUR OWN CONTENT 2

## Logic to launch

- Check macro engagement parameters
  - Equipment XML values
- Check WEZ (if present)
  - Specified by equipment XML
  - Built from Aero model
- Check Guidance
  - Associated Devices
- Weapon flyout check
  - Aero Model
- Slew turret
  - Platform Model – hardpoints
- Launch
- Continued guidance vs CMs / Manoeuvres etc
  - Hit



# MAKING YOUR OWN CONTENT 2

**Student Exercise** - Link to Online Solution Video Not Yet Available

1. Make a better performing SA-8 Missile Equipment by duplicating the current SA-8 Missile and renaming it Super\_SA-8\_Missile
2. Give the missile a closer minimum range, a longer maximum range and a better blast effectiveness
3. Check that it's guidance is listed as Beam-Riding SACLOS
4. Save the equipment
5. Now return to the Super\_SA-8 Platform and delete all of the old SA-8 missiles and equip 4 of the Super SA-8 Missiles on each of the 'Launcher' hard points
6. Duplicate the SA-8 Missile aero model and rename Super\_SA-8 Missile
7. Use the missile Aero Visualization to see if there would be a successful engagement for a target at 15000ft 500kts 15nm
8. In the Aero Model, Change the: Dry weight to 20, Fuel and max weights to 450, Drag Ref area = 0.2, Subsonic Coeff = 0.2, Supersonic Coeff = 0.4, Booster duration = 4.0, Sustainer Duration = 50, Sustainer Impulse 200, Max G turn rate = 30
9. Use the missile Aero Visualization to see if there would be a successful engagement for a target at 15000ft 500kts 15nm
10. Make a new WEZ for the Super SA8 missile using the Missile Aero Visualization tool
11. Change the WEZ on the Super SA-8 Equipment to use the new Super SA-8 WEZ
12. Change the Super SA-8 Equipment to use the new Super SA-8 Equipment aero model
13. Ensure all the new configs are saved
14. Open MACE and test the new platform in a mission with the Super SA-8 vs a platform
15. Use the weapons analysis window to see how the missile tracks the aircraft / flares
16. Now open the Super SA-8 Missile Equipment in the MOCT and add a Generic IR Tracker to it
17. Repeat the MACE test and see that the IR tracker is also used to track the aircraft
18. Once a missile has launched use the weapons analysis window to freeze platforms and weapons then switch off the Radars on the SA-8, unfreeze and see if the IR guidance takes over



# MAKING YOUR OWN CONTENT 3: EMITTERS

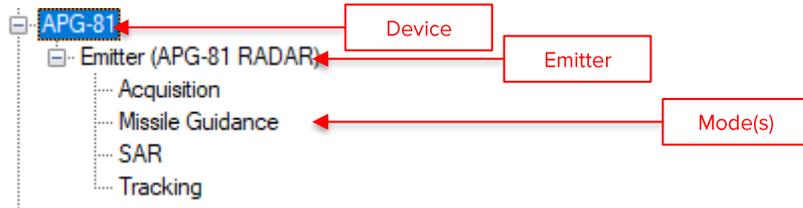
## Learning objective:

- To be able to configure emitters and add them as associated devices to equipment

## Enabling objectives

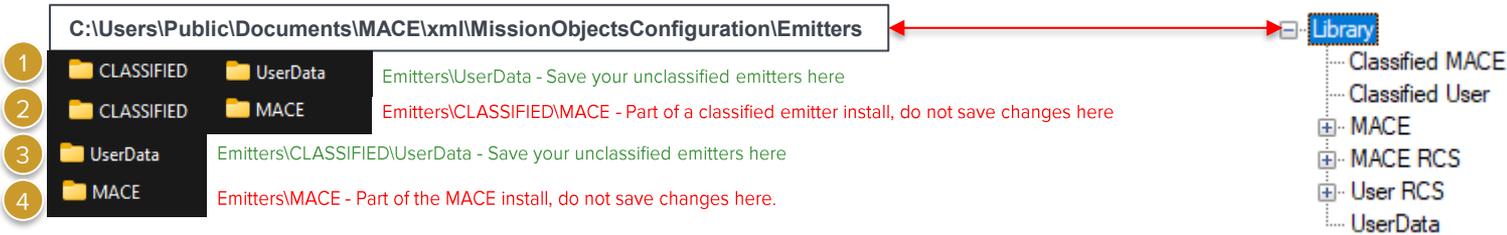
- Know how to open the Emitter editor and create a duplicate emitter as user data
- Understand that guidance / illuminator parameters must match missile seeker parameters
- Know how to configure an emitter's parameters and roles
- Know how to save a new emitter to user data
- Understand how equipment role must match the emitter type
- Know how to change equipment roles
- Understand how to automatically create an equipment xml that has the emitter as its associated device
- Know how to configure from platform to equipment to associated device as suite of items that interoperate correctly

# MAKING YOUR OWN CONTENT 3: EMITTERS



- EW Editor is available offline (MOCT) and at runtime
- Some information only available at runtime
- Live data from the Signal Generator Engine

Order of evaluation

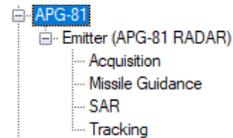


# MAKING YOUR OWN CONTENT 3: EMITTERS

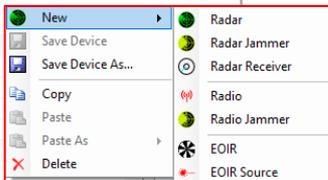
## General Pattern To Edit a New Emitter

- Create a duplicate emitter in the MOCT-Emitter Editor
- Create an associated piece of equipment by closing the editor
- Use a MACE Mission and Analysis Tools to configure
  - Equip the emitter equipment to a platform
  - Use MRT on the platform – Radar Propagation vs correct RCS or complex RCS platform (As Target)
    - Assess Power
    - Receiver Sensitivity
    - Frequency
    - Beam Width
  - Use Beam Viewer with ARMOR
    - Check coverage
    - Scan pattern
  - Save over the emitter file

# MAKING YOUR OWN CONTENT 3: EMITTERS



|  |  |
|--|--|
| <b>Classification</b>                        | Unclassified   |
| Classification                               |  |
| Data Source                                  |  |
| <b>ID</b>                                    |  |
| Ownship Name                                 |  |
| Device ID                                    | 131072   |
| Device Name                                  | <b>APG-81</b>  |
| Device Type                                  | Radar  |
| <b>Antenna</b>                               |  |
| Height Offset                                | 0.00 ft  |
| Length Offset                                | 0.00 ft  |
| Width Offset                                 | 0.00 ft  |
| Boresight (Azimuth)                          | 0°   |
| Boresight (Elevation)                        | 0°   |
| <b>Antenna Limits - Set by the Hardpoint</b> |  |
| Antenna Mount Limits                         | Azimuth_Elevation  |
| Antenna Center (Azimuth)                     | 0°   |
| Antenna Center (Elevation)                   | 0°   |
| Antenna Range (Azimuth)                      | 0.0°   |
| Antenna Range (Elevation)                    | 0.0°   |
| <b>Beam Limits</b>                           |  |
| Beam Steering Limits                         | Azimuth_Elevation  |
| Beam Range (Azimuth)                         | 240°   |
| Beam Range (Elevation)                       | 90°  |
| <b>Descriptors</b>                           |  |
| ESA  | True   |
| Hardpoint                                    | radome   |
| Max Targets                                  | 4  |
| <b>Modeling</b>                              |  |
| Max. Range                                   | 162.0 nm   |
| Min. Range                                   | 0.0 nm   |
| Min. Signal                                  | -174.0 dBm   |
| Minimum RCS                                  | 0.400 sqm  |
| Target Space                                 | False  |
| Target Air                                   | True   |
| Target Land                                  | True   |
| Target Surface                               | True   |
| Target Sub-surface                           | False  |
| Server                                       | True   |
| Own Team Detection                           | True   |
| <b>Position</b>                              |  |
| Device Location                              | Latitude: 0° 0' 0.00" N Longitude: 0° 0' 0.00" E Altitude: 0 |



Evaluated First  
Before any modes  
are tested

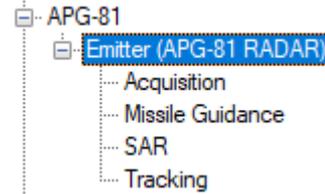
- General information about a device
- Some of info is populated at runtime such as:
  - DIS ID , Ownship name, Position etc.
- Some info is set in Selection of Type of Device
  - Device Type, Device ID

- **Device ID** - ID of this device. This is the same as the DIS emitter or radio ID.
- **Device Name** - Text name of this device.
- **Device Type** - Selected when the device is created, can't be changed
- **Boresight** – angle relative to the entity (determined at runtime)
- **Offsets** – from entity geometric centre (set by hardpoint)
- **Antenna Mount Limits** - Motion limits for the antenna mount (not the antenna)
- **Antenna Centre** - The centre of the antenna mount motion relative to entity
- **Antenna Range** - Range of antenna mount motion in azimuth degrees about centre
- **Beam Steering** - The axis of motion limits for an electronically steered beam
- **Beam Range** - The range of motion of the beam from boresight
- **Max. Range** - The maximum effective range for device. Hard limit for optimisation
- **Min. Signal** - The minimum detectable signal power in dBm
- **Target Air / Land / Surface / Subsurface** – can be tracked by this sensor
- **Device Location** – Determined at runtime
- **ESA** – If True is an electronically scanned array (see note)
- **Max Targets** – The maximum number of track-able targets at any one time.

## NOTE – ESA - (Electronically Scanned Array, includes PESA and AESA radars)

- One TTR beam is used per target.
- Each beam has its parameters modified to best track that target.
- ESA scheme emitters have ESA = True in the device descriptors
- and reserve ModeGroup IDs starting from 100, for target tracking modes.

# MAKING YOUR OWN CONTENT 3: EMITTERS



Show Targets    Current Mission Time: 0

| ID               |               |
|------------------|---------------|
| DIS Emitter Name | 1974          |
| Emitter Function | Multifunction |
| Emitter Name     | APG-81 RADAR  |
| Emitter Variant  | 0             |
| Vendor ID        | MACE          |

**DIS Emitter Name**  
Specifies the DIS Emitter Name Enumeration (as specified in Section 8 of the EBV-DOC). This value needs to be non-zer...

| Mode | Time | Dwell | Repeat | Target | Azimuth | Elevation | Ignore Az. Track         | Ignore El. Track         |
|------|------|-------|--------|--------|---------|-----------|--------------------------|--------------------------|
| *    | ▼    |       |        | ▼      |         |           | <input type="checkbox"/> | <input type="checkbox"/> |

- **DIS Emitter Name** – Must not be 0, as per SISO documents
- **Emitter Function** - DIS emitter function per CAF DMO / SISO
- **Emitter Name** - Text name of this device
- **Emitter Variant** - Variation of the Emitter Type (0 is the default) valid range is 0 to 9

All Determined at Runtime:

- **Show Targets checkbox** – At runtime shows targets that are detected in box below
- **Scan Control Table** - Table of mode switches that are being made by a simulation at runtime
  - Mode – Mode radiating according to the entries in the row.
  - Time – Time of execution relative to this table's start in seconds.
  - Dwell – Time the scan control is active for, in seconds.
  - Repeat – The time delay before this scan control executes again, in seconds.
  - Target – The id of an entity to be tracked by this mode or none if not tracking
  - Azimuth / Elev – Offset in degrees the mode scan is centered on
  - Ignore Az. Track – If tracking, will ignore the azimuth of the target and use the one entered
  - Ignore El. Track - If tracking, will ignore the elevation of the target and use the one entered

# MAKING YOUR OWN CONTENT 3: EMITTERS



- Each emitter can contain 1 or more modes
- Each mode contains one:
  - Pulse table
  - Beam shape definition
  - Scan pattern
- Mode data includes specific mode properties

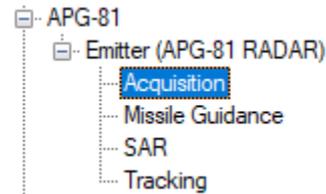
## NOTE – IR MODE NAMES

- “Plume”, “Exhaust”, or “Engine” – The temperature is changed with engine power and for “plume” on an aircraft, with the afterburner (speed > MACH 1).
- “Surface” – The temperature is changed with the sun and weather for ground platforms, and with speed for aircraft.

| Mode Data               |                            | Pulse Data                  |  | Beam Shape |  | Scan Pattern |  |
|-------------------------|----------------------------|-----------------------------|--|------------|--|--------------|--|
| Calculate Receiver Data |                            |                             |  |            |  |              |  |
| <b>ID</b>               | Beam Function              | <b>Acquisition</b>          |  |            |  |              |  |
|                         | Beam Parameter Index       | 5001                        |  |            |  |              |  |
|                         | Mode Group                 | 1                           |  |            |  |              |  |
|                         | Mode ID                    | 1                           |  |            |  |              |  |
|                         | Mode Name                  | <b>Acquisition</b>          |  |            |  |              |  |
| <b>Descriptors</b>      | RequireTrackToAutoEnable   | False                       |  |            |  |              |  |
|                         | ScanData                   | ScanWrapperRandomSector,Sta |  |            |  |              |  |
| <b>Power</b>            | Average Power              | <b>0.0007 kW</b>            |  |            |  |              |  |
|                         | ERP                        | <b>83.3579 dBm</b>          |  |            |  |              |  |
|                         | Peak Power                 | <b>0.0300 kW</b>            |  |            |  |              |  |
| <b>Scan Control</b>     | Max Target Tracks          | <b>Unlimited</b>            |  |            |  |              |  |
|                         | Repeat Sequence Period     | <b>0</b>                    |  |            |  |              |  |
|                         | Scan Center Azimuth        | <b>0°</b>                   |  |            |  |              |  |
|                         | Scan Center Elevation      | <b>0°</b>                   |  |            |  |              |  |
|                         | Scan Offset Azimuth        | <b>0°</b>                   |  |            |  |              |  |
|                         | Scan Offset Elevation      | <b>0°</b>                   |  |            |  |              |  |
|                         | Scan Parameters            | <b>Undefined</b>            |  |            |  |              |  |
| <b>State</b>            | Transmitting               | <b>False</b>                |  |            |  |              |  |
| <b>Antenna</b>          | Receiver Antenna Gain      | <b>30.00 dB</b>             |  |            |  |              |  |
| <b>Receiver</b>         | Bandwidth                  | <b>50.0 kHz</b>             |  |            |  |              |  |
|                         | Pulse Compression Gain     | <b>46.00 dB</b>             |  |            |  |              |  |
|                         | Noise Figure               | 3.00 dB                     |  |            |  |              |  |
|                         | Required SNR               | 4.00 dB                     |  |            |  |              |  |
|                         | Receiver Loss              | 3.00 dB                     |  |            |  |              |  |
|                         | Temperature                | 290.0 °K                    |  |            |  |              |  |
| <b>Sensitivity</b>      | Sensitivity                | <b>-162.99 dBm</b>          |  |            |  |              |  |
|                         | Ambient Noise              | None                        |  |            |  |              |  |
|                         | Range Max                  | 99.5 nm (75.2)              |  |            |  |              |  |
| <b>Simulation</b>       | Detection Quality          | Az: 99% E: 99% Rg: 100%     |  |            |  |              |  |
|                         | Total Detection Quality    | 99%                         |  |            |  |              |  |
|                         | Range Resolution           | 0 ft                        |  |            |  |              |  |
|                         | Clutter Rejection          | <b>False</b>                |  |            |  |              |  |
| <b>Velocity Filter</b>  | MTI / Doppler Speed        | <b>10.0 knots</b>           |  |            |  |              |  |
|                         | Enable MTI / Doppler Speed | <b>True</b>                 |  |            |  |              |  |

- Beam Function** - DIS beam function per CAF DMO SISO – must be correct for AI in MACE
  - Beam Parameter Index** - DIS Beam Parameter Index. With DIS Emitter Name identifies the type. Valid range is between 5000-5099.
  - Mode Group** - All modes that have the same ModeGroup number will not transmit simultaneously
    - Group numbers starting at 100 are reserved ESA - First mode will be duplicated and assigned to an individual target
  - Mode ID** - Unique ID of this mode
  - Mode Name** - Text name of this mode (IR modes have special meaning see note)
  - RequireTrackToAutoEnable** – Suppresses emitters with beam function “Acquisition” from turning on until a target track is sent via an external source (such as an IADS)
  - Average Power** - The average power of the transmitter in this mode
  - ERP** - Effective Radiated Power of this beam
  - Peak Power** - The peak power of the transmitter in this mode
  - Repeat Sequence Period** - The time before the scan control table repeats (determined at runtime)
  - Scan Centre** - The scan centre in degrees (Az/Elev) (determined at runtime)
  - Scan Offset** - The scan centre relative to the ownship (determined at runtime)
  - Transmitting** - True if this beam is active and transmitting
- “Calculate Receiver Data” automatically calculates values in the receiver data
- Gain / bandwidth / noise SNR / Temp / Loss** – Set as required for emulation of real system
  - Pulse Compression Gain** - directly affects the range precision used by the simulation
  - Range Max / Detection Quality / Range Resolution** – Calculated
  - MTI / Doppler Speed** – Min speed (VMG) at which targets can be detected

# MAKING YOUR OWN CONTENT 3: EMITTERS



- Pulse data for each mode = rows of pulse-words that contain
  - Time
  - PRI
  - Count
  - Pulse segments that have: Frequency + Phase + Amplitude values
- User may define as many pulse segments as desired in as many pulse-words as needed (supporting jitter & stagger)
- Pulse sequence table – rows of pulse words in sequential order that repeat (after count is reached)

Add additional segments to the pulse

Delete the selected segment in the pulse

Mode Data **Pulse Data** Beam Shape Scan Pattern

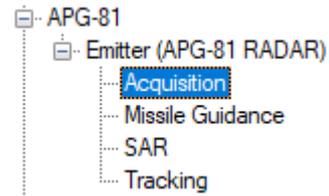
Pulse ( FMOP )

|                    |               |        |  |
|--------------------|---------------|--------|--|
| Pulse Segment      |               | 1 of 2 |  |
| Frequency          | 11000.000 MHz |        |  |
| Phase              | 0°            |        |  |
| Amplitude (0 to 1) | 1.00          |        |  |

Interpolate:  Freq.  Phase  Amp.  
 CW  Quantum Illuminator  
 Coherency: 100.0% Calculated PCG: 46.8 dB

|   | Time (μs) | Frequency (MHz) | Pulse Width (μs) | PRI (μs) | PRF (Hz) | Amplitude | Count |
|---|-----------|-----------------|------------------|----------|----------|-----------|-------|
| ▶ | 0         | 13000           | 12               | 500      | 2000     | 1         | 1     |

\*  Add Row  
 Delete Selected Row(s)



# MAKING YOUR OWN CONTENT 3: EMITTERS

- Allows beam editing for each cross section of a beam

Click and drag to add additional lobes  
**LMB = Gaussian**  
**RMB = Square**

Delete Custom Lobes

Expand or contract shape by modifying main lobe

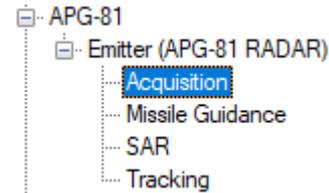
Change polarization

Attenuate side lobes (dB)

Scale with mouse scroll wheel in graphic area

Dropdown mathematical functions that define the shape





# MAKING YOUR OWN CONTENT 3: EMITTERS

- Defines how the beam moves over time
- Any scan pattern can be simulated including overlaid scan patterns (i.e. secondary motion).
- Vector elements in: azimuth elevation, time, duration, and speed
- User definable or choose from pre-defined patterns and modify

**Graphical display of scan**

**Pre-set Scans that can be applied and modified**

**Time (s) beam executes for**

**Speed of scan graphic**

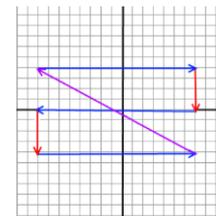
**Elapsed time from beginning of the table**

**Starting elevation and azimuth**

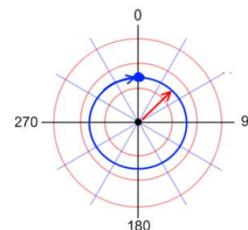
**The rate °/s the beam will move vertically or horizontally**

**Secondary Motion**

| Time              | Azimuth        | Elevation | Azimuth Rate | Elevation Rate | Duration          | Amplitude |
|-------------------|----------------|-----------|--------------|----------------|-------------------|-----------|
| 0                 | 50.50000000... | 45        | 0            | -630           | 0.142857142857... | 1         |
| 0.142857142857... | 37.20000000... | 45        | 0            | -630           | 0.142857142857... | 1         |
| 0.285714285714... | 16.30000000... | 45        | 0            | -630           | 0.142857142857... | 1         |
| 0.428571428571... | 44.80000000... | 45        | 0            | -630           | 0.142857142857... | 1         |



**Spherical Scan**  
 Beam travel in direction of arrows where blue has a horizontal rate only and red has a vertical rate only



**Polar Scan**  
 Beams travel will be in the direction of the arrows where the blue line indicates the rotation rate and the red line indicates the radius.



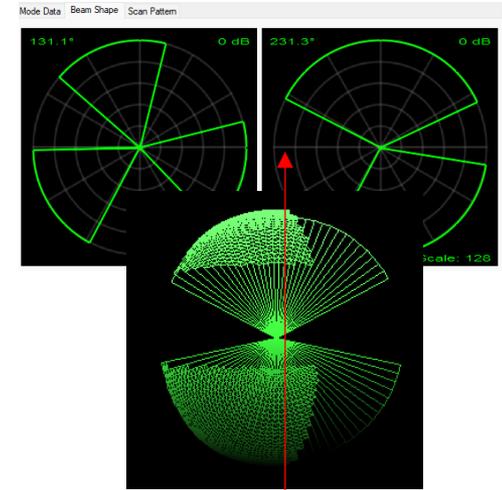
# MAKING YOUR OWN CONTENT 3: EMITTERS

## Emitters With Multiple Antennae – Approach

- Think what you are trying to achieve – simulation is a model!
- The Platform Track-Processor merges all tracks from all sources
- Recommendation for multi-antennae:
  - Make 1 emitter
  - Mount on different hard-points – e.g. SPY-1D on Arleigh Burke
    - OR
  - Make 1 Emitter – modify beam shape (e.g. RWR) to take into account receiver directions
    - OR
- Unless necessary we do not recommend
  - Create multiple receiver modes for single emitter – unless simulating failures
    - In real receivers the other antennae usually compensate – this would require SGE Script to do the same
  - Results in multitude of beams from 1 emitter – unmanageable
  - No real advantage over duplication and mounting on hardpoints



Duplicate Emitter  
Different Hardpoints



Modify Receiver  
Beam Shape

# MAKING YOUR OWN CONTENT 3: EMITTERS

## Jammers: Explanation of Operation

- Jammer's receivers - properties
  - Like RWR jammers receive signals
  - Check **threat library** to see if signal is included
- Jammer's transmitters
  - Have power settings that are applied to all threats
    - Average Power, Peak Power vs Pulse data (freq)
  - Pulse settings automatically controlled based on received signal
    - Frequency
    - Pulse segments / Bandwidth – continuous wave
  - Jammers automatically activate transmitters (modes)
    - If received signal is in **threat library**
    - If there is an **available antenna (mode)**
    - Based on **priority of threat received** – may steal from another lower pri threat

### Emitter → Device Properties

Show Targets    Current Mission Time 61652.3

Fwd I UEU Target: LAND\_ROLL.ACQ (High Feed) Tech: Noise 100% effective  
 AR I UEU Target: LAND\_ROLL.ACQ (High Feed) Tech: Noise 8000% effective  
 Fwd III UEU Target: LAND\_ROLL.ACQ (High Feed) Tech: Noise 8000% effective

### Emitter → Mode Properties: Mode Data

| Mode Data            |                     |
|----------------------|---------------------|
| ID                   |                     |
| Beam Function        | Jamming             |
| Beam Parameter Index | 5001                |
| Mode Group           | 1                   |
| Mode ID              | 1                   |
| Mode Name            | Fwd I UEU           |
| Descriptors          |                     |
| RequiredSNRSwering2  | 0                   |
| ScanData             | ScanWzappedFixedAog |
| Power                |                     |
| Average Power        | 6.8000 kW           |
| ERP                  | 88.3251 dBm         |
| Peak Power           | 6.8000 kW           |

Power parameters for each antenna ('mode')

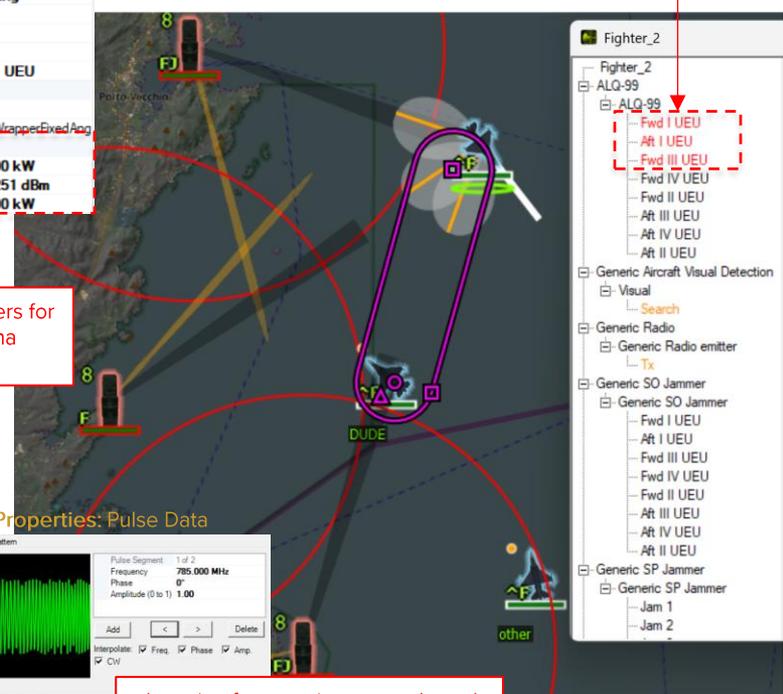
### Emitter → Mode Properties: Pulse Data

| Pulse Data         |  |
|--------------------|--|
| Pulse Segment      | 1 of 2   |
| Frequency          | 785.000 MHz  |
| Phase              | 0°   |
| Amplitude (0 to 1) | 1.00   |
| Interpolate        | <input checked="" type="checkbox"/> Freq <input checked="" type="checkbox"/> Phase <input checked="" type="checkbox"/> Amp |
|                    | <input checked="" type="checkbox"/> Cvt  |

Frequency (MHz)    Length of Modulator

Jamming frequencies auto selected based on received frequency

One antenna ('mode') allocated to each threat



# MAKING YOUR OWN CONTENT 3: EMITTERS

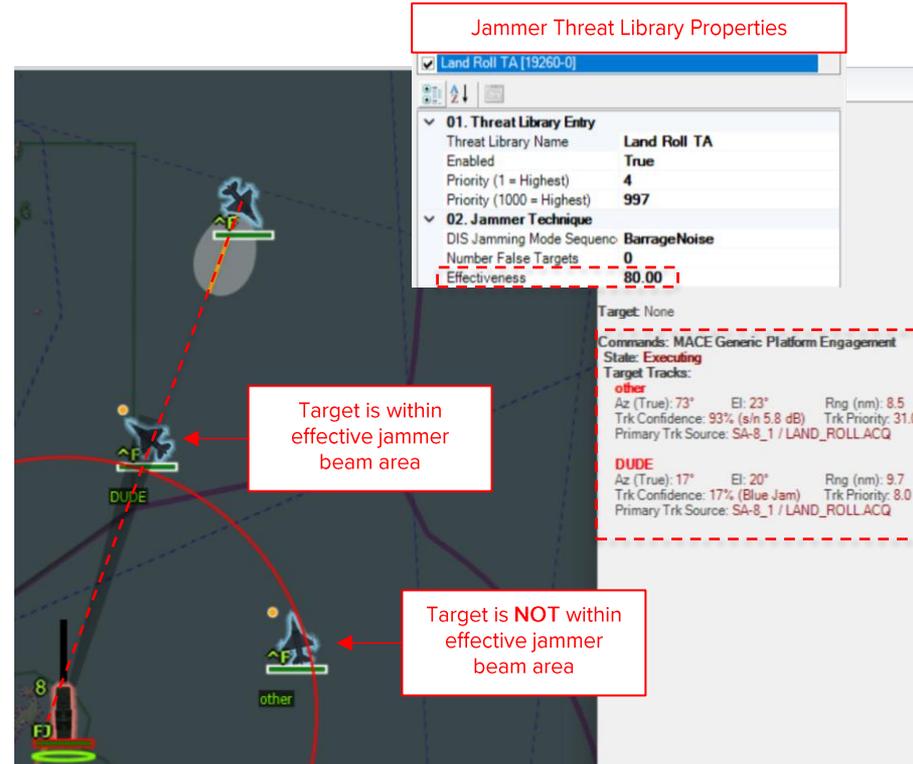
## General Explanation of Operation – Does jamming occur?

- Based only on Jammer to Signal (J:S) ratio at receiver of jamming
  - If J:S ratio  $>1$  – jamming is applied
  - Jamming is applied at the ‘technique effectiveness’ specified in threat library
  - It is on/off no in-between no, tapering of effectiveness
    - if J:S  $>1$  total effectiveness value applied
    - Track confidence minus technique effectiveness = New track confidence value

### Example:

Search radar receiving jamming at J:S ratio  $>1$

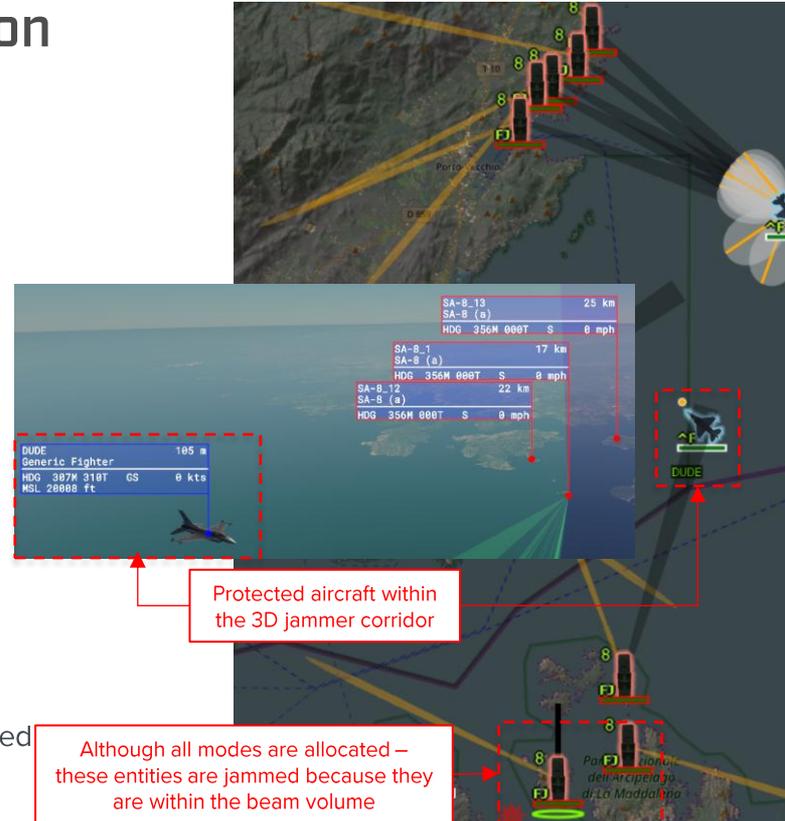
- Jammer could be effective
- If target entity is **within effective beam shape** of the jammer
- Jammer technique effectiveness of 0.8 applied
- Track confidence will drop by 80%



# MAKING YOUR OWN CONTENT 3: EMITTERS

## Types of Jammers and Their General Operation

- Self Protection Jammers
  - Usually deceiving a single high priority incoming radar for a short time
  - Time enough for aircraft to manoeuvre and dispense countermeasures
  - To get out of the beam volume
  - They are not a Klingon Cloaking device
- Standoff Jammers
  - Usually producing noise against multiple radars simultaneously
  - Attempting to prevent search and acquisition of targets in the first place
- Datalink Jammers (Later)
  - Are radios
  - **Jammers use beams** and if the target or 'protected aircraft' is not within the beam – they will not be effective
  - Careful planning of position of (standoff jammers) vs ingressing aircraft is required if jamming is to be effective
  - The beams – directed at a threat may overspill and overlap depending on the shape
    - May jam more than one entity if it has the same radar parameters as the target entity



# MAKING YOUR OWN CONTENT 3: EMITTERS

## Threat Library

Jammers, ARMs, RWR all use threat library

### Threat Library Editing

- Any equipment that detects threat emissions has Threat Library
- Threat libraries can be loaded and saved (1)
- Can be built from the threats in the mission (MACE 2025)
- And edited and saved for future use
  - Add New Threat – By Name or by parametric (4)
  - Delete Threats (1)
- Change Priority for engagement (3)
- Threat items can be included/excluded from the library by checking/unchecking in threat list (5)
- E.g. Uncheck ALL and check 1 only to target a specific system

AGM-88 HARM (Site: 1, App: 100, Entity: 1025) Properties EW Editor

Properties Threat Library Sensors

File Threat Items View

AGM-88 Receiver (From file) Type: StandOff

Max Threats 1 Search

- Chair Back ILL [11010-0]
- Fox Fire ILL [18330-0]
- EA-12 TELAR ILL [26795-0]
- Slot Back ILL [29400-0]
- Braight Flush ILL [33600-0]
- Fan Song B/FF MG [15255-0]
- Fan Song C/E MG [15240-0]
- Gin Sting MG [16925-0]
- Gun Dish (Z9U-234) [17070-0]
- Hot Shot MG [18330-0]
- Land Roll MG [19215-0]
- Low Blow MG [19950-0]

Load Library

Save Library

Add Threat Item

Delete Threat Item

Check All

Uncheck All

AGM-88 HARM (Site: 1, App: 100, Entity: 1036) Properties EW Editor

Properties Threat Library Sensors

File Threat Items View

AGM-88

Add new threat item

Delete selected threat item(s)

Max Tr

Build from threats in mission

- Trick Shot TER [36371-0]
- Hot Shot MG [18330-0]
- Scrum Half TT [36225-0]
- Hot Shot TA [18320-0]
- Hot Shot TT [18325-0]
- Scrum Half MG [35230-0]
- Scrum Half TA [36220-0]

01. Threat Library Entry

Threat Library Name Toms New Threat

Enabled True

Priority (1 = Highest) 15

Priority (1000 = Highest) 986

02. Jammer Technique

DIS Jamming Mode Sequence Noise

Number False Targets 0

Effectiveness 1.00

03. Threat Matching by Emitter ID

DIS Numeric Name 0

DIS Emitter Name None

DIS Beam Parameter None

04. Threat Matching by Parameter (optional)

Use Parameter Matching False

Upper Frequency Limit 2333.000 MHz

Lower Frequency Limit 1595.000 MHz

Upper PRI Limit 23.0 µs

Lower PRI Limit 45.0 µs

Upper PVI Limit 22.0 µs

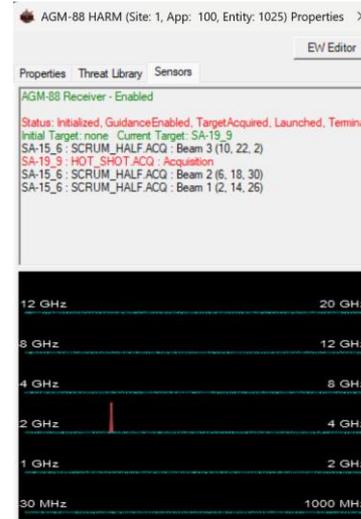
Lower PVI Limit 241.0 µs

# MAKING YOUR OWN CONTENT 3: EMITTERS

## Threat Priority

When creating custom threat list

- Priority is shown in descending order
- The equipment will engage/jam highest priority



AGM-88 HARM (Site: 1, App: 100, Entity: 1025) Properties EW Editor

AGM-88 Receiver (Save with mission) Type: StandOff

Max Threats 1 Search

- ✓ Trick Shot IER [36371-0]
- ✓ Hot Shot MG [18330-0]
- ✓ Hot Shot TA [18320-0]
- ✓ Hot Shot TT [18325-0]
- ✓ Scrum Half MG [36230-0]
- ✓ Scrum Half TT [36225-0]
- ✓ Scrum Half TA [36220-0]

01. Threat Library Entry  
Threat Library Name Scrum Half TT  
Enabled True  
Priority (1 = Highest) 7  
Priority (1000 = Highest) 994

02. Jammer Technique  
DIS Jamming Mode Sequo BarrageNoise  
Number False Targets 0  
Effectiveness 0.90

03. Threat Matching by Emitter ID

Priority (1 = Highest)  
The level of threat that the emitter represents on a scale where 1 is highest, 1000 is lowest.

AGM-88 Receiver - Enabled  
Status: Initialized, GuidanceEnabled, TargetAcquired, Launched, Terminal  
Initial Target: none Current Target: SA-22\_1  
SA-22\_1 : TRICK SHOT.ACQ : Search

AGM-88 Receiver - Enabled  
Status: Initialized, GuidanceEnabled, TargetAcquired, Launched, Terminal  
Initial Target: none Current Target: SA-15\_6  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 3 (10, 22, 2)  
SA-19\_9 : HOT\_SHOT.ACQ : Acquisition  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 2 (6, 18, 30)  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 1 (2, 14, 26)  
SA-22\_1 : TRICK SHOT.ACQ : Search

AGM-88 Receiver - Enabled  
Status: Initialized, GuidanceEnabled, TargetAcquired, Launched, Terminal  
Initial Target: none Current Target: SA-19\_9  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 3 (10, 22, 2)  
SA-19\_9 : HOT\_SHOT.ACQ : Acquisition  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 2 (6, 18, 30)  
SA-15\_6 : SCRUM\_HALF.ACQ : Beam 1 (2, 14, 26)  
SA-22\_1 : TRICK SHOT.ACQ : Search

Target Changes dependent on the highest priority emission detected



# MAKING YOUR OWN CONTENT 3: EMITTERS

## Comm/Datalink Jamming

- Comms is bi-directional Who are we jamming?
  - E.g. Drone or Operator
    - Who receives the signal?
    - Control Signal = Drone; VDL Signal = Operator
- Comms Jammers are Radio Type device
- Changes UI in Weapons & Equipment Form
  - Can pre-emptively jam on a frequency
  - Can be activated from script too!
  - Can re-actively jam between a min and max frequency
- Emitter Editor – Device Level Looks different
- Mode Levels are the same as other jammers
  - Beams can be Omni or directional
  - Select Beam Antenna Pattern = TRUE in Device level settings
- NO Threat Library – only min and max frequencies

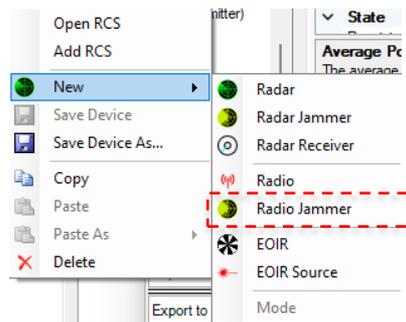
### MACE Script Action – Pre-emptive Jamming

Shoot regardless if equipped.  Don't self-designate.  Shoot all configured.

Control Emitter Control:  State:  Target:

Emitter:  Function:  Alt Mode:

Frequency:



### Emitter Editor - Device

|                   |                      |                     |
|-------------------|----------------------|---------------------|
| ID                | DIS Emitter Name     | 30                  |
| Emitter Function  | Emitter Name         | Data Transmission   |
| Emitter Variant   | Emitter Variant      | Datalink Jammer emi |
| 0                 |                      | 0                   |
| Cryptography      | Crypto Key           | 0                   |
|                   | Crypto System        | Other               |
| Descriptors       | ELNOTFunction        | EW                  |
|                   | emitterModeCode      | AA                  |
| Modulation        | Frequency Hop        | False               |
|                   | Major Modulation     | Amplitude           |
|                   | Modulation Detail    | Other               |
|                   | Modulation System    | Other               |
|                   | Pseudo Noise         | False               |
|                   | Time Hop             | False               |
| Radio             | Category             | Data                |
|                   | Frequency            | 2200.000000 MHz     |
|                   | Input Source         | DataJammer          |
|                   | Max Frequency        | 2400.000000 MHz     |
|                   | Min Frequency        | 30.000000 MHz       |
| Radio Antenna     | Beam Antenna Pattern | True                |
|                   | Beam Azimuth Width   | 0.0°                |
|                   | Beam Elevation Width | 0.0°                |
|                   | Polarization Angle   | 0.0°                |
|                   | Polarization Type    | None                |
|                   | Relative Azimuth     | 0.0°                |
|                   | Relative Elevation   | 0.0°                |
| Radio Receiver    | Bandwidth            | 25.000 kHz          |
|                   | Dynamic Range        | 80.0 dB             |
|                   | Enable Receive       | True                |
|                   | Sensitivity          | -90.0 dBm           |
| Radio Transmitter | Enable Transmit      | True                |
|                   | Power                | 100.0 watts         |

### MACE Weapons & Equipment Form

Generic Comms Jammer Properties

Quick Search Emitter Editor

ID

Radio ID 2

Ownership LEER\_1

Equipment Name Generic Comms Jammer

Communications Jamming

Category Data

Input Source DataJammer

Transmitter Power 50.000 watts

Modulation Amplitude

Bandwidth 10.000 kHz

Minimum Frequency 0.001 MHz

Maximum Frequency 1000000.000 MHz

Manual Jammed Frequency 2400.000 MHz

Preemptive Jamming  True

Modulation

Frequency Hop  False

Pseudo Noise  False

Time Hop  False

Major Modulation Amplitude

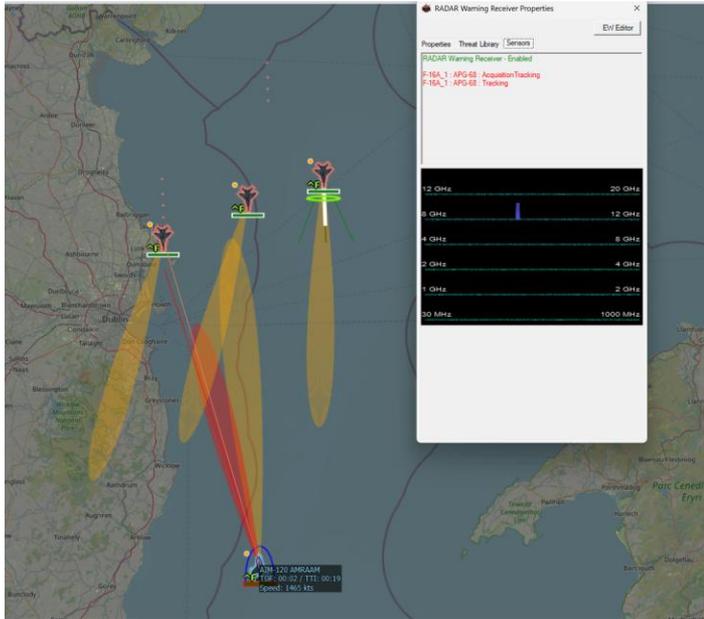
Modulation Detail AM

Modulation System Generic



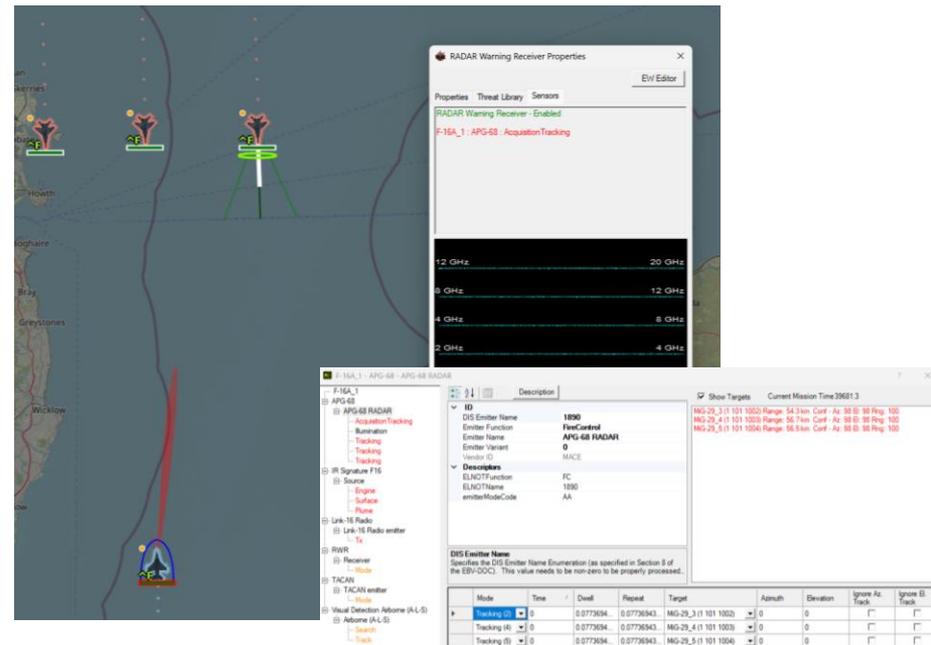
# MAKING YOUR OWN CONTENT 3: EMITTERS

## Electronic Scanned Array + Low Probability of Intercept



### BEFORE

- Single beam fixed power
- Alternates between targets
- Targets aware of Tracking



### AFTER ESA With LPI

- Multiple beams variable power
- Simultaneous (1 x Track mode per target)
- Targets not aware of Tracking





# MAKING YOUR OWN CONTENT 3: EMITTERS

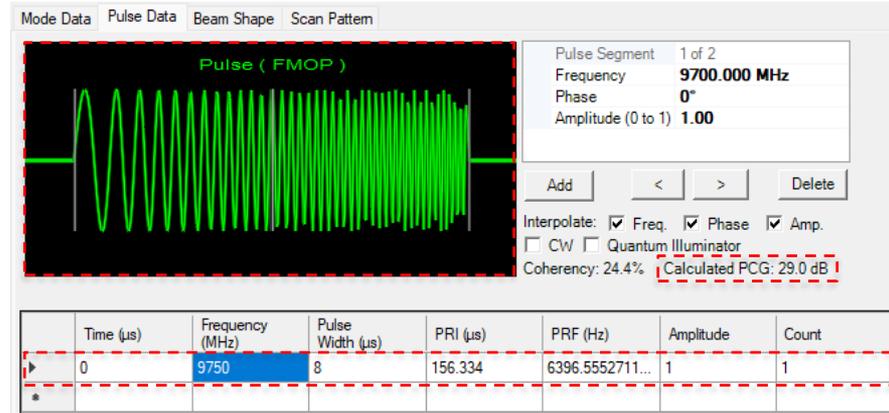
## Electronic Scanned Array – Key Steps

### PULSE DATA LEVEL

- **Single Pulse** – LPI script controls single pulse PRI and power automatically
- **2 Segment Pulse** – Pulse compression sensitivity for LPI
  - Note **PCG** value for receiver properties
- Large enough pulse width for compression gain

### MODE LEVEL - RECEIVER

- Match Pulse Compression Gain from Pulse Edit: **PCG**
- **Bandwidth:** Set **bandwidth to 0**, tab out to recalculate
- Edit Noise, SNR, Loss to make higher receiver sensitivity value



|                        |              |
|------------------------|--------------|
| ▼ <b>Antenna</b>       |              |
| Receiver Antenna Gain  | 38.00 dB     |
| ▼ <b>Receiver</b>      |              |
| Bandwidth              | 125.0 kHz    |
| Pulse Compression Gain | 24.00 dB     |
| Noise Figure           | 3.00 dB      |
| Required SNR           | 3.00 dB      |
| Receiver Loss          | 3.00 dB      |
| Temperature            | 290.0 °K     |
| ▼ <b>Sensitivity</b>   |              |
| Sensitivity            | -138.01 dBm  |
| Ambient Noise          | None         |
| Range Max              | 3.2 nm (3.1) |

# MAKING YOUR OWN CONTENT 3: EMITTERS

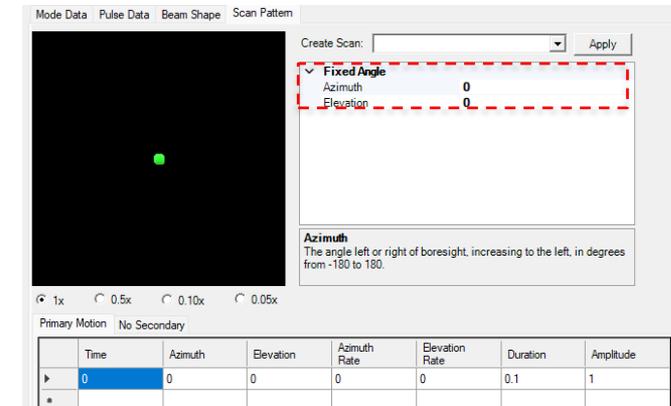
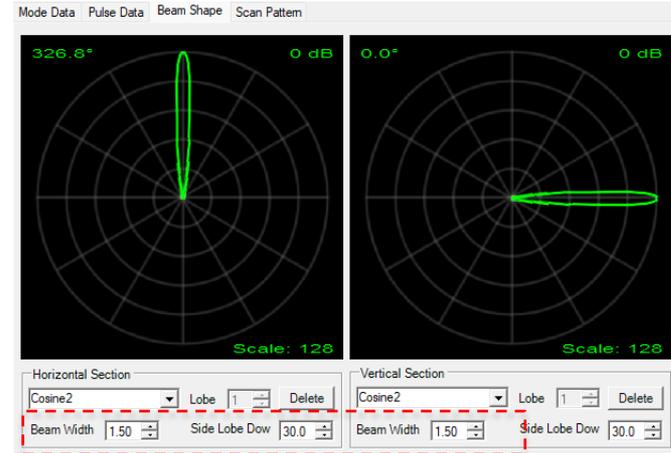
## Electronic Scanned Array – Key Steps

### BEAM SHAPE

- Narrow Beam: best for LPI (e.g. 1.5°)

### BEAM SCAN

- Fixed: No scan required – individual beams automatically created and controlled for each target



# MAKING YOUR OWN CONTENT 3: EMITTERS

**Student Exercise** (Link to Online Solution Video Not Yet Available)

1. Duplicate the Super SA-8 Platform and rename as Semi-Active Super SA-8
2. Remove the radars from the Semi-Active Super SA-8 platform
3. Add the following radars to the platform: (1) Generic SAM.ACQ (2) Generic SAM.TTR (3) Generic SAM.MG – save the platform
4. Duplicate the Super SA-8 Missile Equipment and change its name to Semi-Active Super SA-8 Missile and change the guidance type to semiactive radar – save the equipment config
5. In the associated equipment of the semi-Active Super SA-8 Missile leave the IR sensor in place
6. Open the Emitter editor Copy the SA-5 Radar Seeker to the User Data Area and rename it to Semi-Active Super SA-8 Missile Seeker
7. Open the Semi-Active Super SA-8 Missile Seeker Emitter underneath the device and change the DIS emitter name to something that is not taken – a check is made when the emitter editor is closed
8. Open the Semi-Active Super SA-8 Missile Seeker Emitter mode and ensure the beam function is tracking – change the min and max frequency to 7000 Mhz
9. In the emitter editor copy the Generic SAM.MG radar to the user data area and rename it to Semi-Active Super SA-8 MG
10. Open the Semi-Active Super SA-8 MG Radar Emitter underneath the device and change the DIS emitter name to something that is not taken – a check is made when the emitter editor is closed
11. Open the Semi-Active Super SA-8 MG Radar Emitter mode and ensure the beam function is 'guidance' – change the frequency of the pulse 7000 Mhz to match the missile seeker
12. Close the emitter editor – find in the list of equipment to be created the 'Semi-Active Super SA-8 MG Radar' and tick it to create the associated piece of equipment that we can equip the Semi-Active SA-8 platform with

# MAKING YOUR OWN CONTENT 3: EMITTERS

**Student Exercise Cont** - Link to Online Solution Video Not Yet Available

13. Open the Semi-Active Super SA-8 Missile Equipment item and add the associated device Semi-Active Super SA-8 Missile Seeker – also ensure 09. Capabilities Auto Fire is set to True
14. Open the Semi-Active Super SA-8 platform and remove the Generic SAM.MG radar and replace it with Semi-Active Super SA-8 MG Radar
15. Replace the missiles with Semi-Active Super SA-8 Missiles
16. Test your new platform missiles and emitters in a MACE mission with one Semi-Active Super SA-8 Platform and one FW Fighter Aircraft
17. Use the Weapons analysis tool to view the guidance indications from both the IR seeker and the new semi active seeker
18. Now use the Emitter Editor to make a copy of the Generic SP Jammer – and name it ‘My SP Jammer’ and change the DIS Emitter Name to something not used
19. On each Jamming Mode (Jam 1 to 4) change the average power to 2KW – note the ERP and Peak power change
20. Save the new jammer (RMB) - Close the EW Editor and Tick the new jammer in the list of equipment to be created
21. Find the new equipment in the equipment section of the MOCT and see which threat library it is using
22. Make a new threat library for My SP Jammer and add the Semi-Active Super SA-8 MG Radar to it
23. In your MACE test mission replace the SP jammer on the Generic fighter with your new jammer and watch the indications as it flies through the MEZ

# ARMOR XR

## Learning objective:

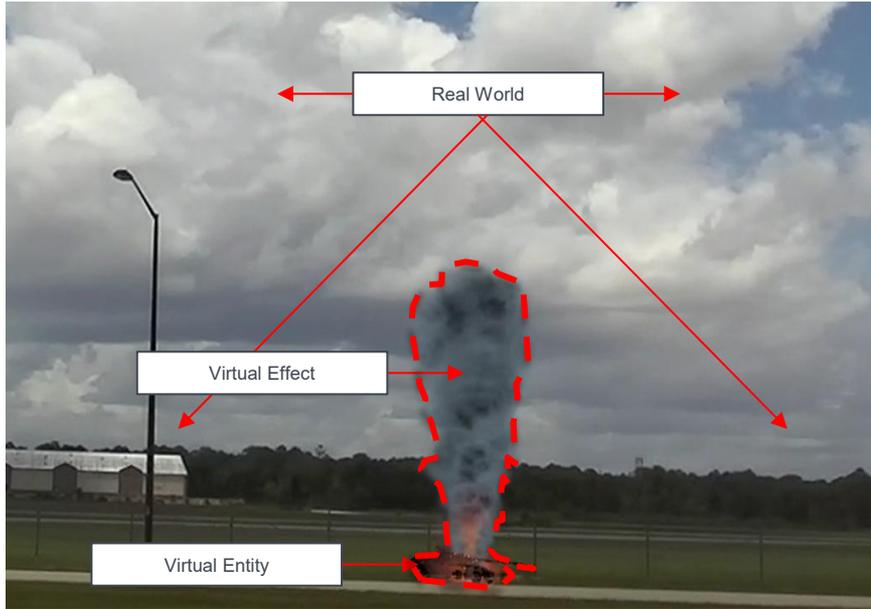
- To be able to configure and use ARMOR with XR devices

## Enabling objectives

- Understand the different XR modes in ARMOR
- Understand the different view scaling in ARMOR
- Know how to enter and exit the different ARMOR XR and viewpoint scale modes
- Know how to setup the table-top view
- Know how to use the in-XR hand controller menus in ARMOR
- (Optional) Know how to setup and troubleshoot XR Devices using Steam VR and ARMOR
- (Optional) Know how to setup and troubleshoot XR Devices using Varjo Base and ARMOR

# ARMOR - XR

## Mixed Reality



# ARMOR – XR

## XR Headsets (Using Steam VR)

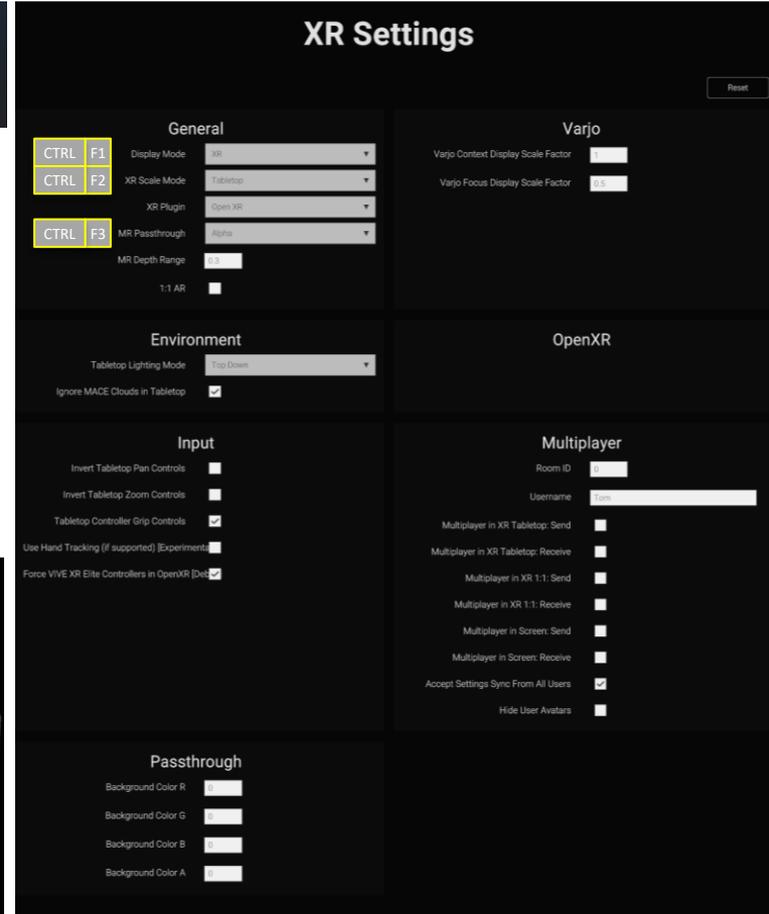
- Install & Configure Steam VR
- Install & Configure Headset Software (e.g. Vive business Streaming)
- Run ARMOR
- XR Mode Changes in ARMOR
  - CTRL + F1 – to change to XR
  - CTRL + F2 – to change between 1:1 and Tabletop Mode
  - CTRL + F3 – to change between MR/VR & Passthrough modes
- Controlling Overlays
  - All ARMOR Keyboard Shortcuts work
  - Some can be accessed using menus on VR Hand-controllers – Trigger to select
  - ARMOR Works with Stream-Decks
    - C:\Program Files\Battlespace Simulations\ARMOR\ARMOR\_Data\StreamingAssets\StreamDeck



Steam-Deck ARMOR Config

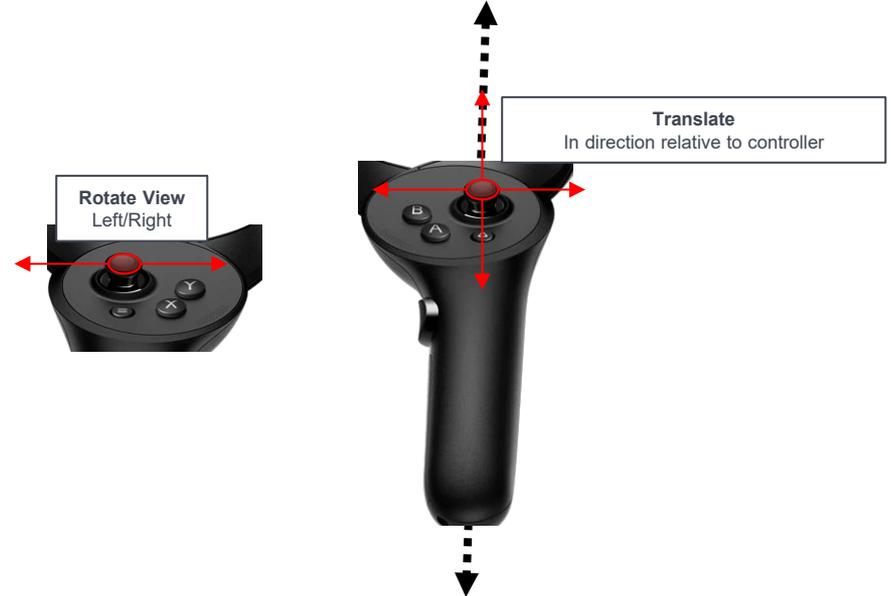
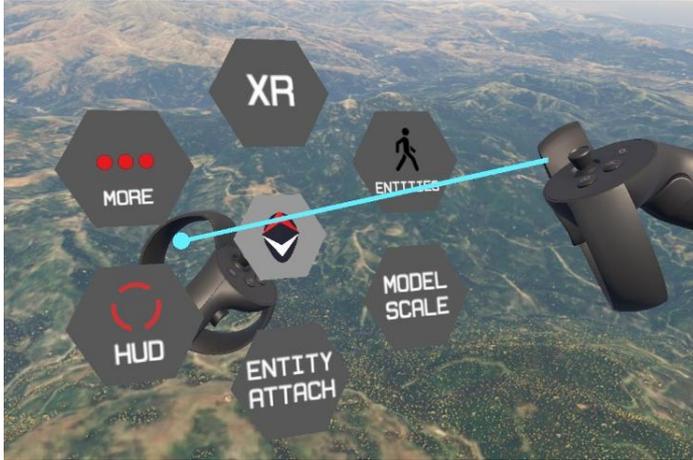


VR Controller Interface in ARMOR  
Copyright BSI © 2025



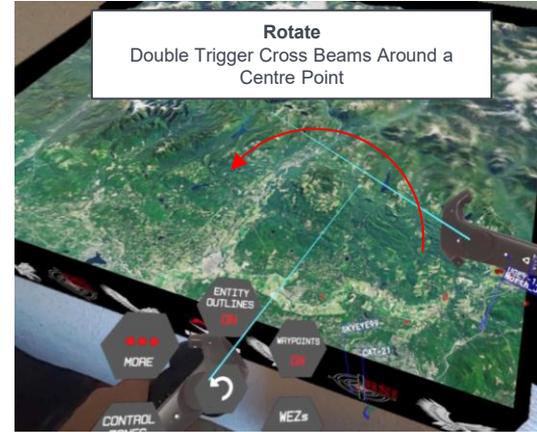
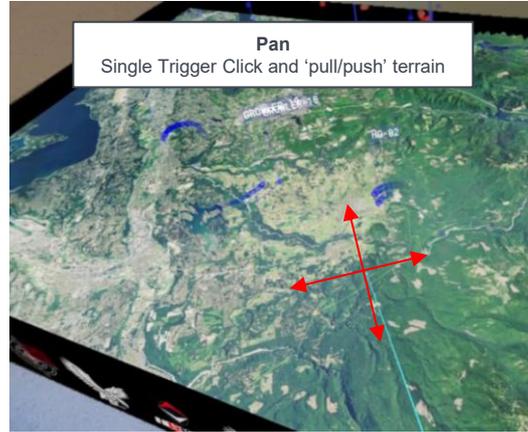
# ARMOR - XR

## XR - Hand Controller Menu



# ARMOR - XR

## Tabletop Controls



# ARMOR XR

## Student Exercise (Link to Online Solution Video)

1. Setup your headset of choice with ARMOR
2. Open your headset's application (e.g. Steam VR or Varjo Base) and ensure the headset and controllers are operating correctly
3. Open the Tutorial 3 Mission in MACE and ARMOR
4. Activate the beam viewer in MACE and ARMOR
5. Top lock to the north eastern aircraft Thunder 02
6. Enter XR mode in ARMOR
7. Look around in the cockpit
8. Detach from the aircraft using the in-XR hand controller menu
9. Switch from 1:1 to table top scale using the in-XR hand controller menu
10. Configure a new position, width, and elevation for the table top
11. Use the in-XR hand controller menus to activate trails and entity labels and missile engagement zones
12. Move the table top to view the engagement of the aircraft by the North Eastern IADS platforms
13. (if supported by your headset) Switch to MR pass through mode while in table top
14. Revert back to screen mode in ARMOR

# ARMOR TERRAIN EDITING

## Learning objective:

- To be able to manage and edit ARMOR terrains

## Enabling objectives

- Understand how terrain edits can be stored and managed
- Know how to open existing terrain edits
- Know how to start a new terrain edit
- Know how to add, move, rotate, delete objects and nodes
- Understand how to organise content in groups and subgroups
- Know how to move groups and objects within the hierarchy
- Understand how to mix MACE cultural platforms with ARMOR terrain Edits for destructible elements

# ARMOR TERRAIN EDITING

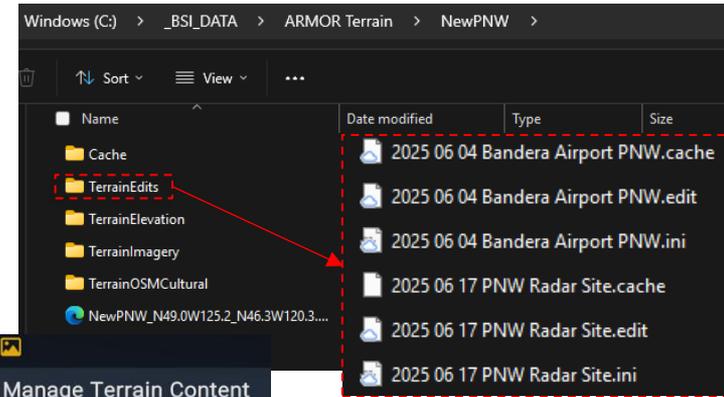
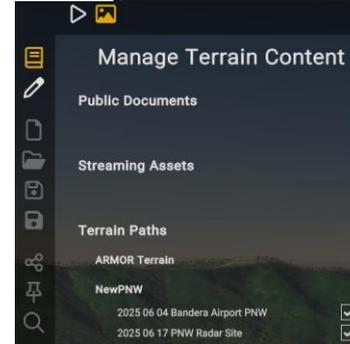
## Terrain Editor Intro and Managing Content

- Allows users to edit the procedurally produced terrain – postproduction
- Integrated into ARMOR and always available from the OSI [Tab] menu



### Managing Terrain Edits: 3 Locations to store edits

- **Terrain Paths** – suitable for most users who want to distribute the edits with the terrains – **Use this one!** - Unless good reason not to
- **Public Documents** – suitable for single users
- **Steaming Assets** – suitable for BSI to provide edits with installer



### NOTE – TERRAIN EDIT FILES

There are 3 Files that form a complete terrain edit:

- **.edit** file contains edits and is changed as the user makes the edits in the editor
- **.cache** file is the binary optimized version of the **.edit** file - gets regenerated when there is a difference between it and **.edit** file.
- **.ini** file reflects whether the edit is 'enabled' in ARMOR or not

When copying, be sure to copy all 3 files to one of the valid locations listed above. **Do not have the same edits in different locations.**

# ARMOR TERRAIN EDITING

## Terrain Edit Management

Display / Hide Edit in ARMOR

Selected Terrain Edit Name

Selected Terrain Edit Description

Terrain Edits Listing

Delete Selected Terrain Edit

Open Selected Terrain Edit

Thumbnail of Terrain Edit

ARMOR

Manage Terrain Content

Public Documents

Tom's PNW Edits

PNW\_1

PNW\_2

Streaming Assets

Terrain Paths

Sardinia\_Corsica

Sanso

Finland Islands

PNW

PNW3

Info

PNW\_1

A few Edits just for me

Groups: 4

Objects: 11

Fences: 2

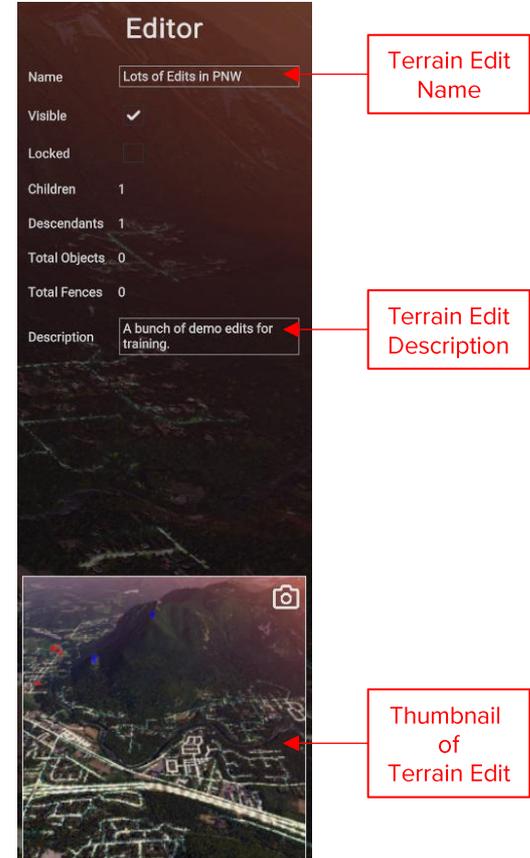
Biomes: 2

+47.65532, -121.92002 424 ft MSL 345°M 01 Aug 2024 12:30:00

# ARMOR TERRAIN EDITING

## Start a New Terrain Edit

- Select Edit Mode 
- Select New 
- On right hand side 'Editor'
  - Name Terrain
  - Add Description
  - (Later) Add Thumbnail
- Save  
  - **Terrain Paths** – suitable for most users
  - Or Documents or ARMOR assets
  - Name appears on left when saved



# ARMOR TERRAIN EDITING

## Groups

- Organize your content
- Allow easy duplication

### Add a Group:

- Select 'root' (Terrain name)
  - [+] bottom left
  - Name on Top Right 'Editor'
  - Tip:** Group Like things for easy duplication e.g. Fuel Dump, Storage area, Baracks

The screenshot displays the Armor Terrain Editor interface. The central view shows a 3D terrain with a river and several wooden crates. On the left, the 'Hierarchy' panel shows a tree structure with categories like 'Base', 'Objects (4)', 'Surrounds', 'Biomes (1)', 'VCP', 'Objects (2)', 'New Group', 'Objects', 'Fences', 'Biomes', 'Buildings', and 'Terrains'. On the right, the 'Editor' panel shows settings for the selected group, including 'Name' (New Group), 'Visible' (checked), 'Locked', 'Children' (0), 'Descendants' (0), 'Total Objects' (0), and 'Total Fences' (0). Annotations with red boxes and arrows point to various elements: 'Terrain Edit Name' points to the 'Lots of Edits in PN' header; 'Change Selected Group or Terrain Name' points to the 'Name' field; 'Selected Group' points to the 'New Group' entry; 'Group Hierarchy' points to the 'Terrains' category; 'Delete Selected Group' points to the trash icon; 'Add New Group' points to the plus icon; and 'Clone Group' points to the copy icon. A smaller inset at the bottom right shows a different state of the Hierarchy and Editor panels, with 'PNW Test' as the root and 'First Group of Like Stuff' selected.

# ARMOR TERRAIN EDITING

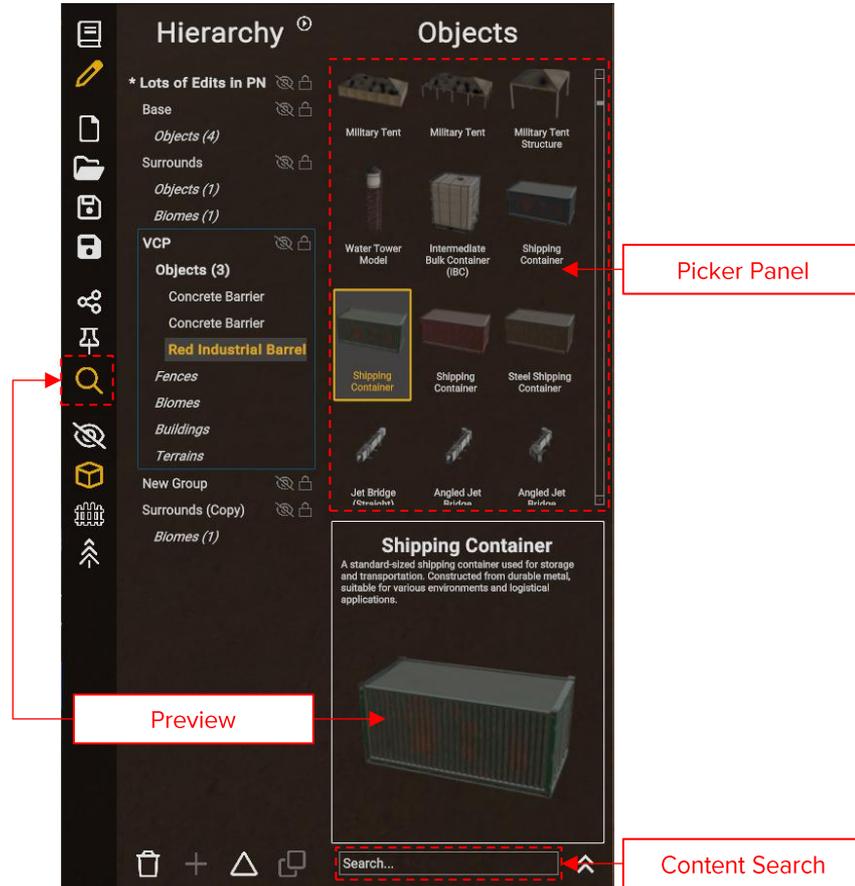
## Adding Items Within Groups

- **Make a sensible group for items** – try to be logical:
  - Similar type
  - Particular or similar locations
- **Each group contains item categories**
  - **Objects** – Point based (Drag and drop, then add more of type)
  - **Fences** – Node based (Drag and drop, then add more nodes)
  - **Biomes** – Node based (Drag and drop, then add more nodes)
  - **Terrains & Buildings not available yet**
- Use the picker panel to drag and drop into ARMOR
- Preview if required

### TIP – ORDER OF PLACEMENT

It can be easier to do things in the order: 1. Biome 2. Fences 3. Objects

Mapping out an area with the biome, dividing it up with fence type, placing objects within.

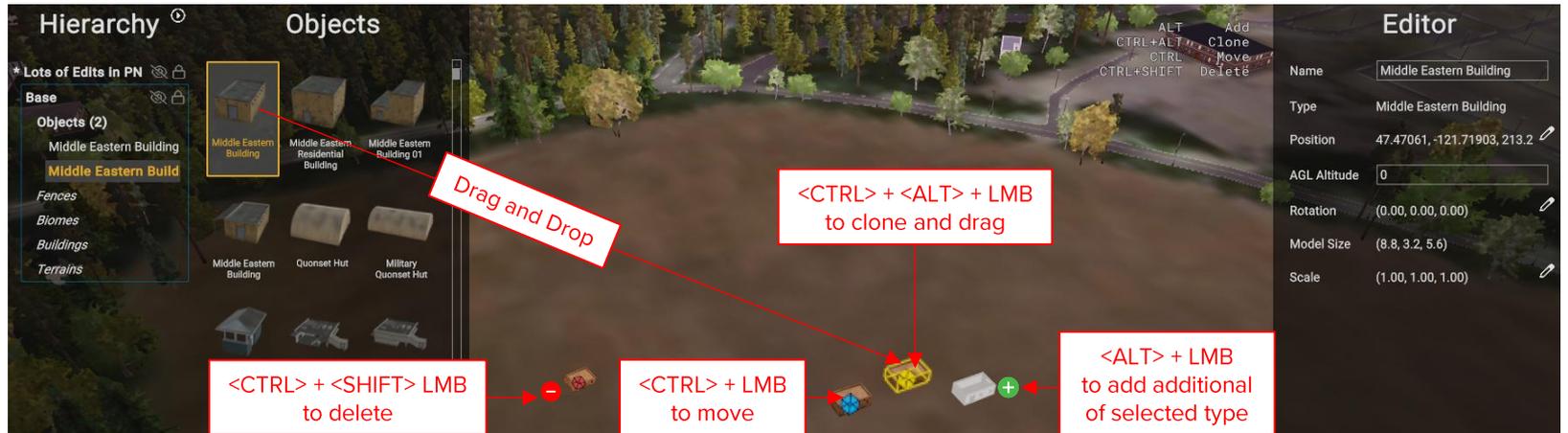
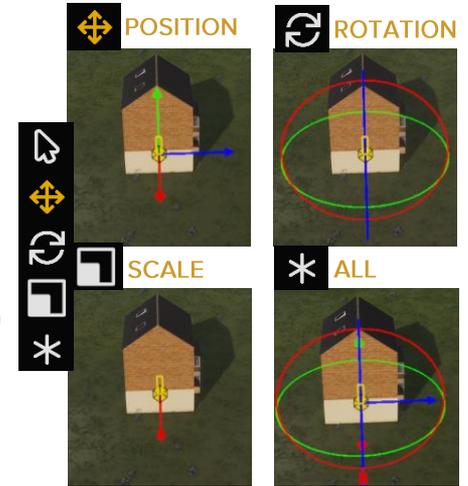


# ARMOR TERRAIN EDITING

## Dragging Dropping, Adding More, Cloning

- Once a drag and drop is done use mouse + modifier keys:
  - [CTRL] + LMB on the 'Object Handle' to refine the placement (only on-terrain)
  - [ALT] + LMB to add more of type or more nodes
  - [CTRL] + [ALT] + LMB on the 'Object Handle' to clone and drag to new location
  - [CTRL] + [SHIFT] + LMB on 'Object Handle' to delete
  - [CTRL] + Mouse Wheel rotates object (only in azimuth)

OR  
THE  
GIZMOS  
(Top Right)



# ARMOR TERRAIN EDITING

## Nodes

- Used for fences and biomes
- Nodes can be:
  - Moved
  - Named
  - Deleted
  - Reversed
- The entire 'node object' can be moved and rotated by using:
  - The 'Center Point Object Handle'



### TIP – ADDING A NODE AT THE BEGINNING

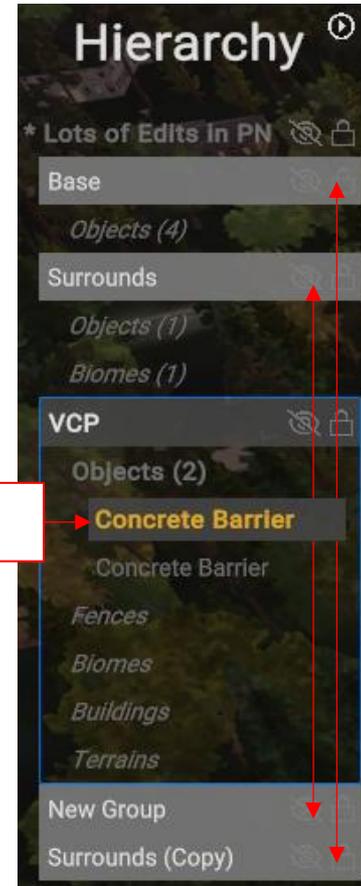
If you need a node at the beginning of the nodes: reverse the nodes so the begging becomes the end; add more nodes; then reverse the order again



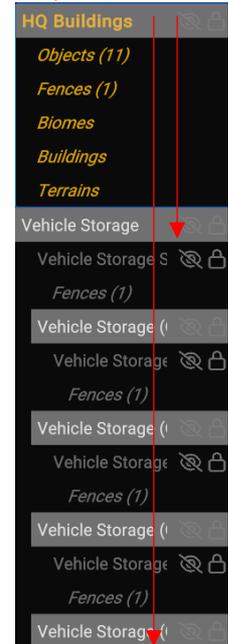
# ARMOR TERRAIN EDITING

## Groups and Moving Between

- Organize your content
- Allow easy duplication
- Groups can contain groups (Subgroups) e.g.
  - Top Group: Base
    - Subgroup: Base Surrounds
      - Subgroup: Guard Towers
        - Content
      - Subgroup: Lighting
        - Content
    - Subgroup: Entry
      - Subgroup: Barriers and Buildings
        - Content
      - Subgroup: Lights
        - Content- Groups **cannot contain** Edits AND Subgroups
- Content AND Groups – can be dragged into different groups



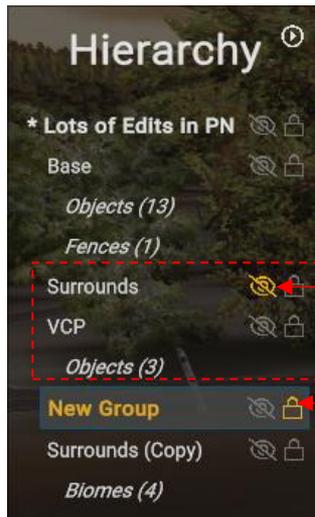
Drag a group to another group



# ARMOR TERRAIN EDITING

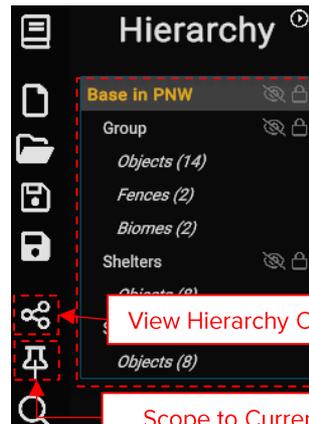
## Helping Stay on Top of Complex Hierarchy

- Lots of items in hierarchy can be overwhelming
  - Use the padlock to hide the group contents in the hierarchy 
  - Use the eyeball to hide on the ARMOR terrain 
  - Use view hierarchy only to see none of the content listed 
  - Scope to current to hide all except the group you have selected 



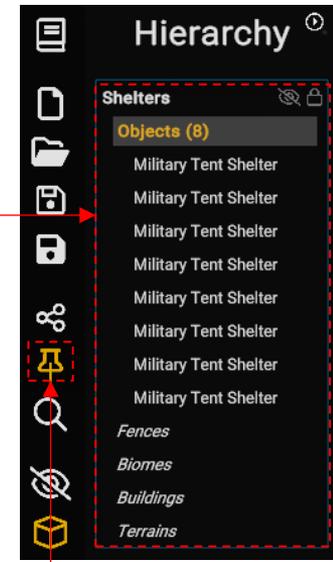
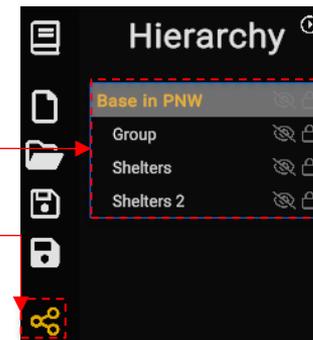
Visible/editable in hierarchy but not visible on ARMOR terrain

Not visible/editable in hierarchy visible on ARMOR terrain



View Hierarchy Only

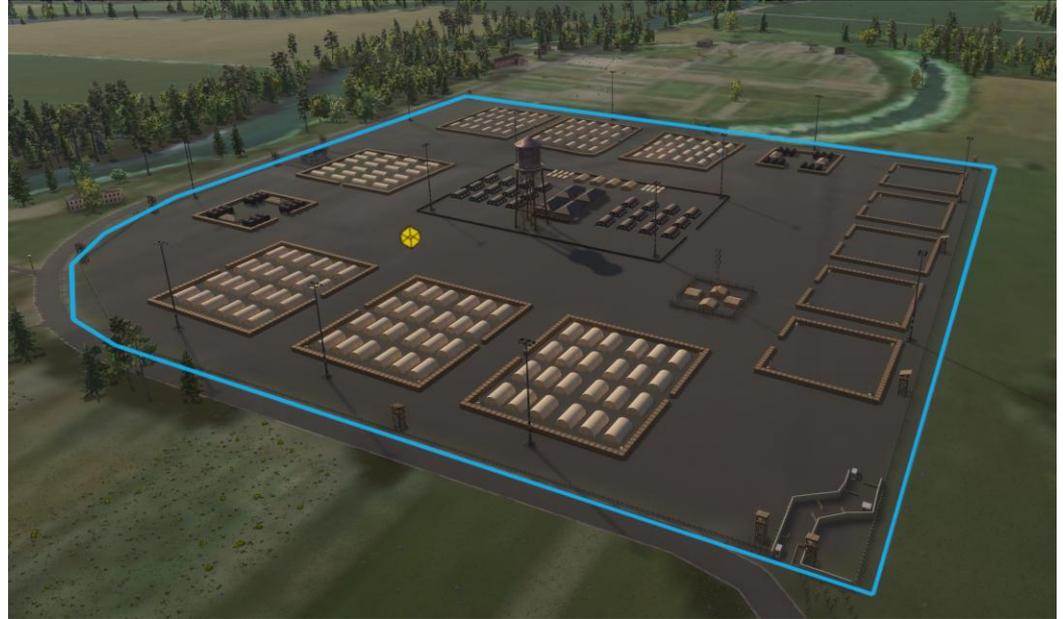
Scope to Current



# ARMOR TERRAIN EDITING

Student Exercise (Link to Online Solution Video)

1. Build a supply base (perhaps like the figure here) including
2. Biome over-ride to create a good surface
3. Fencing
4. A Guard post entry
5. Lighting
6. Buildings or temporary accommodation in some form of array that is cloned and used elsewhere
7. Walls / fencing that is grouped and used elsewhere



# ALL THE SHORTCUTS

A collection of all the shortcut slides and decodes

### MISSION EDITING - GROUP - MAP TOOLS

- Properties
- CTRL + [Mouse Icon] Display Name & Summary Data
- CTRL + [Mouse Icon] Move Object
- SHIFT + [Mouse Icon] Group Select
- CTRL + Del Delete Selected
- ALT + Del Delete Unselected
- CTRL + 1 to 9 Store Group
- ALT + 1 to 9 Recall Group
- CTRL + Z Toggle Zoom Tool
- CTRL + W Reverse Waypoints
- CTRL + F Cycle Coordinate Format
- CTRL + K Toggle Platform Roof Clamping
- CTRL + G Reload Pathfinding Grid
- CTRL + S Save Mission

### DOT - RADAR RECEIVED

- YELLOW** Search Radar
- AMBER** Acquisition Radar
- BLACK** Engagement Radar

### SHORT - JAMMING VECTORS

- YELLOW** Search Radar
- AMBER** Acquisition Radar
- RED** Tracking Radar

### LONG - LINES

- GREEN** Camera Line
- BLUE** Formation Line
- RED** Target Line
- BROWN** Track Line
- DARK BLUE** Data Link

### LETTERS - ACTIONS

- A** Entity in Delta mode
- A** Entity has attached entities
- F** Entity movement frozen
- N** Entity being navigation-jammed
- I** Entity invulnerable
- J** Entity being sensor-jammed
- L** Entity is landing
- G** Airborne entity is on the ground
- 9** Entity is assigned to a 9-Line
- 5** Entity is assigned to a 5-Line
- 0** Entity has not 'pushed yet'
- X** External entity
- C** Entity has concealment

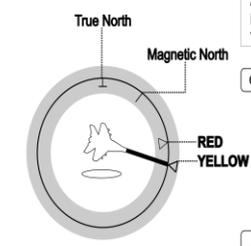
- Displays Locked to Platform
- Camera Locked to Platform

### OUTLINE - ENGAGEMENT

- CLEAR** Weapons Hold
- AMBER** Weapons Tight
- RED** Weapons Free
- YELLOW** Suppression

### VECTOR - MANEUVER STATE

- BLACK** Following waypoints
- WHITE** Delta mode
- RED** Moving to target
- PINK** Running Away
- ORANGE** Taking Cover
- CYAN** Rallying to point
- GREEN** Random walk
- YELLOW** Joystick Controlled



CTRL + T Display Platform Control Tapes

ALT + [Mouse Icon] Move Triangles

### DATA & VISUALIZATIONS

- ALT + T Toggle Tracks display
- ALT + W Toggle WEZ display
- ALT + E Open Event Log
- ALT + M Open Message Window
- CTRL + ALT Display Range Rings / Data Links / Masks / Impacts



### VISUALIZATIONS & OVERLAYS

- LABELS**
  - L Labels Markers On / Off
  - SHIFT L Cycle Labels Team
  - CTRL L Cycle Labels Filter
  - ALT L Cycle Compact / Full Labels
- TRAILS**
  - T Trails On / Off
  - SHIFT T Cycle Trails Team
  - CTRL T Cycle Trails Filter
- COMPASS**
  - C Compass On / Off
  - SHIFT C Mag / True Heading
  - CTRL C Mils / Degrees Heading
  - ALT C Mission Clock: On / Off
- POSITION**
  - V Camera Position On / Off
  - SHIFT V m / ft Altitude
  - CTRL V Cycle Coordinate Format
  - ALT V amsl / agl Altitude
- WAYPOINTS**
  - Y Waypoints: On / Off
  - SHIFT Y Waypoint Label Mode
  - CTRL Y Cycle Waypoint Entity
- OTHER**
  - B MACE Beams On / Off
  - G Designators On / Off
  - G Threat Domes On / Off
  - K Airspace On / Off
  - D Entity Outlines On / Off
  - U Control Zones On / Off
  - N WEZs On / Off
  - H HUD On / Off

### XR

- CTRL + F1 Toggle Screen / XR Mode
- CTRL + F2 Toggle 1:1 / Tabletop Scale
- CTRL + F3 Cycle MR / VR Modes

### CAMERA VIEWS

- SPACEBAR Attach to Ownship

### OWNSHIP ATTACHED VIEWS

- 1st Person
- Trail
- Trail Fixed Horizon
- Orbit
- North Up
- Heading Up
- Target
- Equipment
- Sensor
- Picture in Picture
- Munition Camera
- Cycle Through Saved Viewpoints

### CAMERA MOVEMENT

- Forward: W
- Back: S
- Left: A
- Right: D
- XR Left: Q
- XR Right: E
- Up: R
- Down: F
- Pan Camera: [Mouse Icon]
- Movement Speed: [Mouse Icon]
- Fast Move: SHIFT
- Slow Move: CTRL

### CAMERA APPEARANCE

#### SPECTRUM & POLARITY

- Z Primary Camera Spectrum
- X Primary Camera Polarity
- SHIFT Z Sensor Camera Spectrum
- SHIFT X Sensor Camera Polarity

#### IR GAIN

- CTRL PgUp PgDn IR Manual Bottom Limit Up / Down
- ALT PgUp PgDn IR Manual Top Limit Up / Down
- CTRL End IR Auto Temperature Range

### SETTINGS & CAPTURE

- Esc Main Menu
- F1 Help
- F2 Audio On / Off
- TAB On Screen Interface
- ALT ENTER Full Screen / Window
- CTRL Pause Freeze Entity Motion
- CTRL Home Screen Capture
- SHIFT Home Video Capture

### SCALE

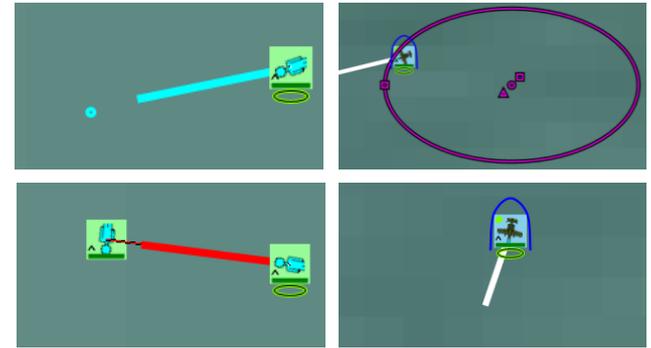
- + - Adjust Model Scale
- ALT + - Adjust Waypoint Scale
- CTRL + - Adjust HUD Scale



# MACE BASIC MISSION BUILDING

## Intent and delta

- Intent – Black Vector Line
  - Platform follows waypoints
  - Return to intent
    - Button on ENTITY CONTROLS Tab 
    - RMB on platform vector line 
    - Button on ENTITY CONTROL FORM 
- Delta (Not Black)
  - Platform does not follow waypoints
  - Tell by vector color **OR** intent state drop down



|  |                                 |   |
|--|---------------------------------|---|
|   | In Intent (follows Waypoints)   |    |
|   | Delta (not following waypoints) |    |
|   | Rallying                        |    |
|   | Moving to Target                |    |
|   | Running Away                    |    |
|   | Taking Cover                    |    |
|   | Random Walk                     |    |
|  | Joystick Controlled             |   |
|  | In formation                    |  |

# SPACE NAVIGATOR CONTROLS



Trails

Waypoints

Spectrum (Short)  
Polarity (Long)

Toggle Attach (Short)  
Attach Mode (Long)

Labels (Short)  
Outlines (Long)

Beams

On Screen Interface

WEZs

Control Zones

Threat Domes

Designators

Spectrum (Short)  
Polarity (Long)

Airspaces

Toggle Attach (Short)  
Attach Mode (Long)

Pan fwd/back  
<W> <S>



Tilt fwd/back



Pan left/right  
<A> <D>



Pan up/down  
<R> <F>



Rotate left/right

