

BSI UNIVERSITY



ARMOR

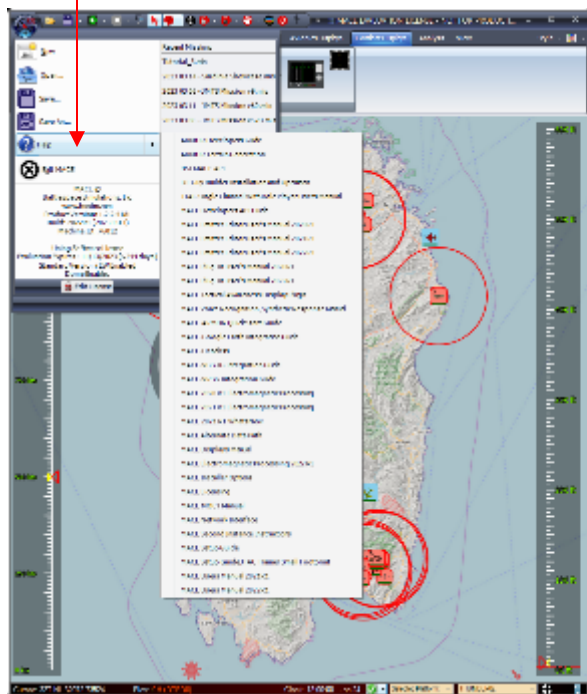


SOURCES OF HELP

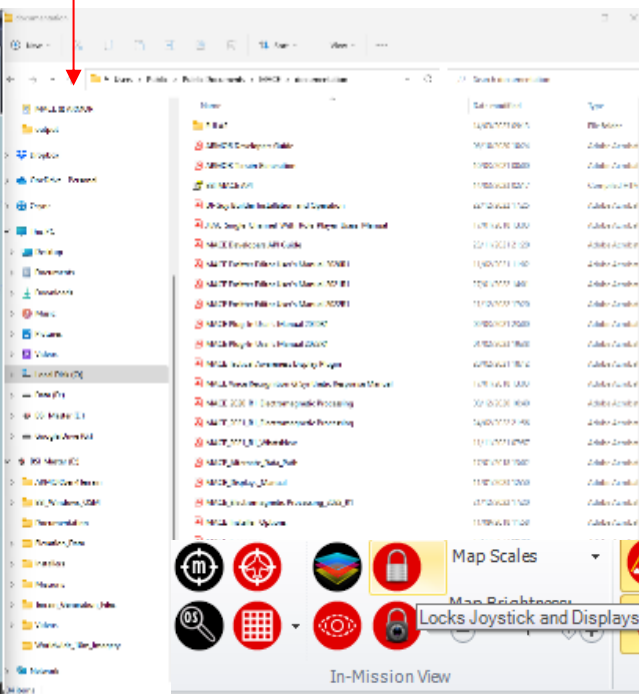
<https://www.youtube.com/@BattlespaceSims/>



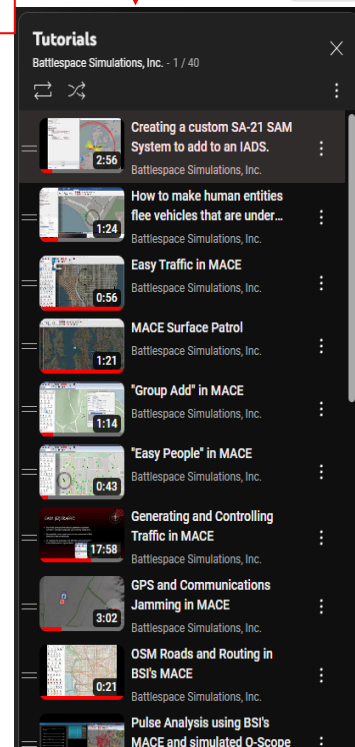
BSI-Quick Menu → Help



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



Tool Tips



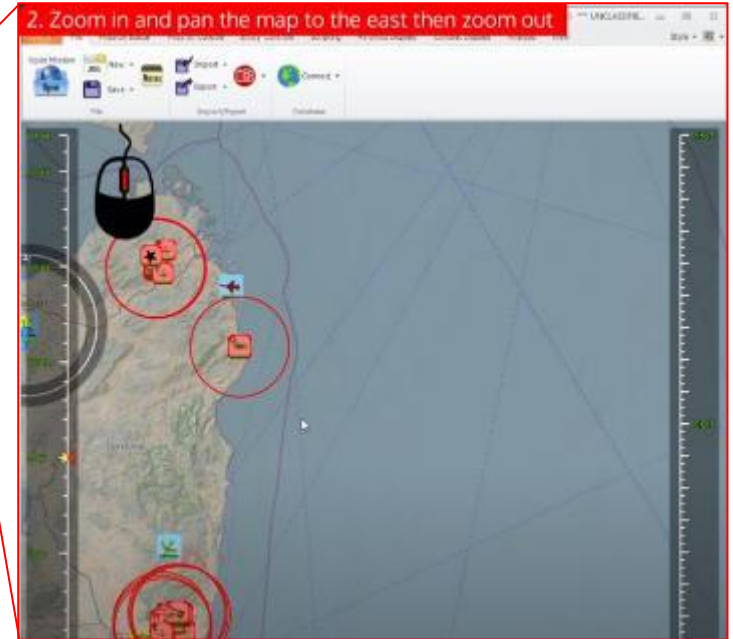
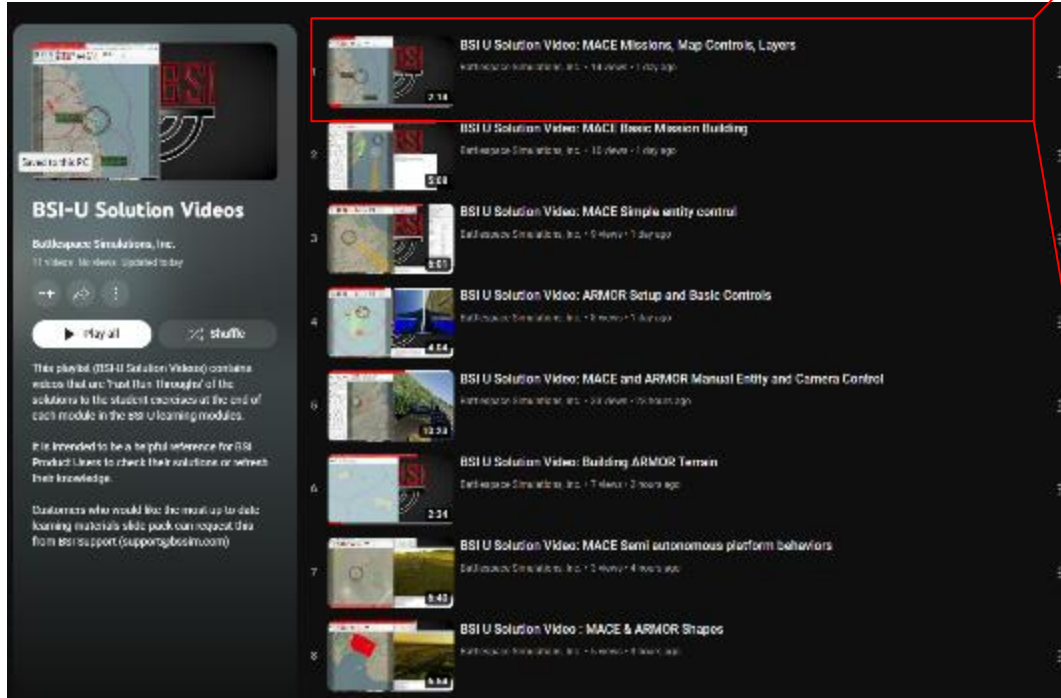
Exercise Solutions:
Email Support:

support@bssim.com
Student Exercises Solutions Videos



SOURCES OF HELP

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



[Student Exercises Solutions Videos](#)

MACE INITIAL SETUP

Learning objective:

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

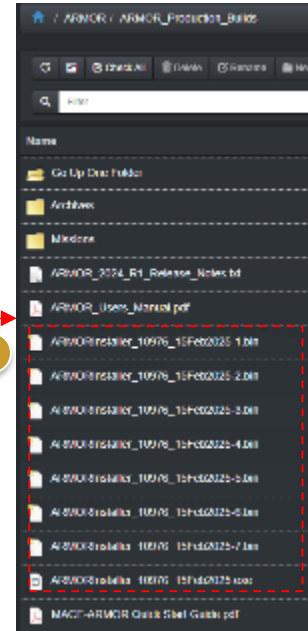
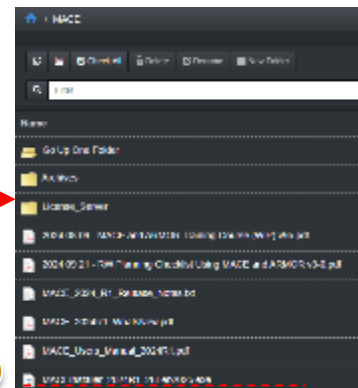
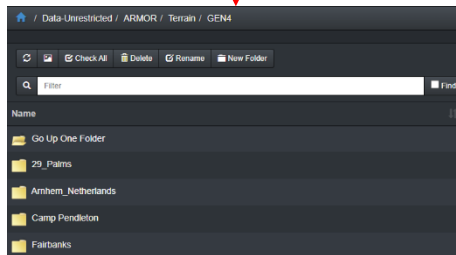
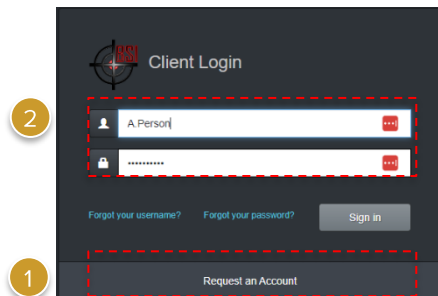
Enabling objectives

- 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)



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
- (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

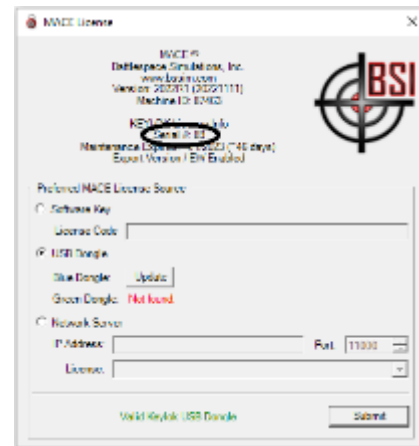
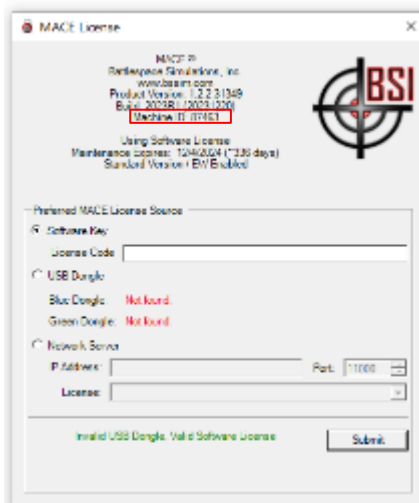
Updating a USB dongle

- 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 Directory Search Configuration			
MACE Data Type	Directory Search Order		
	Dir Num	Directory Name	Items Found
CADRG Map Data			
Hi-Res Imagery Data	1	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\ne_50m_populated_places_simple.shp	1
	2	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\physical\ne_10m_coastline.shp	1
Vector Map Data	3	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\ne_10m_admin_0_countries.shp	1
	4	C:\Users\Public\Documents\MACE\maps\Vector\Worldwide\cultural\ne_10m_admin_0_boundary_lines_land.shp	1
Elevation Data			

Data Paths: Elevation Data (Required)

MACE System Settings						
Options	Audio	Import / Logging	Mission Defaults	MACE Configs	Data Paths	Communication
DISNet	TENA	CIGI	Window Configs	Visual	Joystick	Extern
MACE Data Directory Search Configuration						
MACE Data Type	Priority	Type	Status	Configure	Clear Cache	Reload
CADRG Map Data	1	ARMOR	Found 0 terrain tiles.	Configure	Clear Cache	Reload
	2	CDB	No tiles loaded.	Configure	Clear Cache	Reload
Hi-Res Imagery Data	3	VRSG	No paths configured.	Configure	Clear Cache	Reload
	4	DTED	No elevation found.	Configure	Clear Cache	Reload
Vector Map Data	5	SRTM	No elevation found.	Configure	Clear Cache	Reload
Elevation Data						

- (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

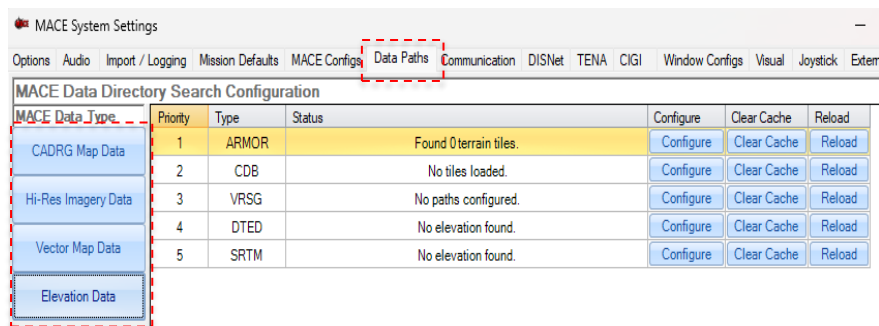
NOTE – STATIC GIS DATA

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)

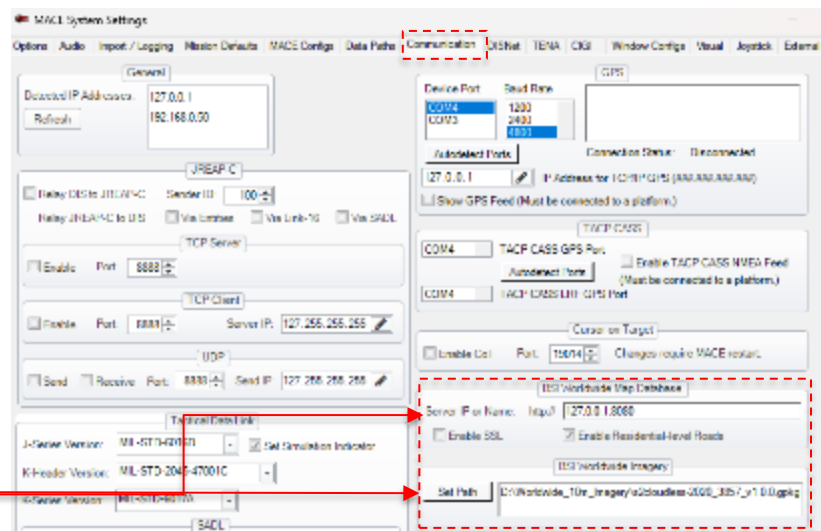


The screenshot shows the 'MACE System Settings' window with the 'Data Paths' tab selected. The 'MACE Data Directory Search Configuration' table is visible, listing various data types and their status.

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	VRS	No paths configured.	Configure	Clear Cache	Reload
Elevation Data	4	DTED	No elevation found.	Configure	Clear Cache	Reload
	5	SRTM	No elevation found.	Configure	Clear Cache	Reload

Static Data
<Data Paths>

Streaming Data
<Communication>



The screenshot shows the 'MACE System Settings' window with the 'Communication' tab selected. The 'General' section is visible, showing detected IP addresses and network settings.

Detected IP Addresses: 127.0.0.1, 192.168.0.0

Device Port: COM4, COM3, COM1

Send Rate: 1200, 2400, 1000

Autoselect Ports: [X] 127.0.0.1, [X] 192.168.0.0

Connection Status: Disconnected

IP Address for 127.0.0.1 (LAN/AN/LAN/LAN): [X] Show GPS Feed (Must be connected to a platform.)

TCP/UDP Settings: [X] Enable, Port: 8882, Server IP: 127.255.255.255

UDP Settings: [X] Send, [X] Receive, Port: 8883, Send IP: 127.255.255.255

ES Worldwide Map Database: [X] Enable SSL, [X] Enable Residential-level Roads

ES Worldwide Imagery: [X] Set Path: C:\Worldwide_10m_imagery\2d\download-2500_300_1_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

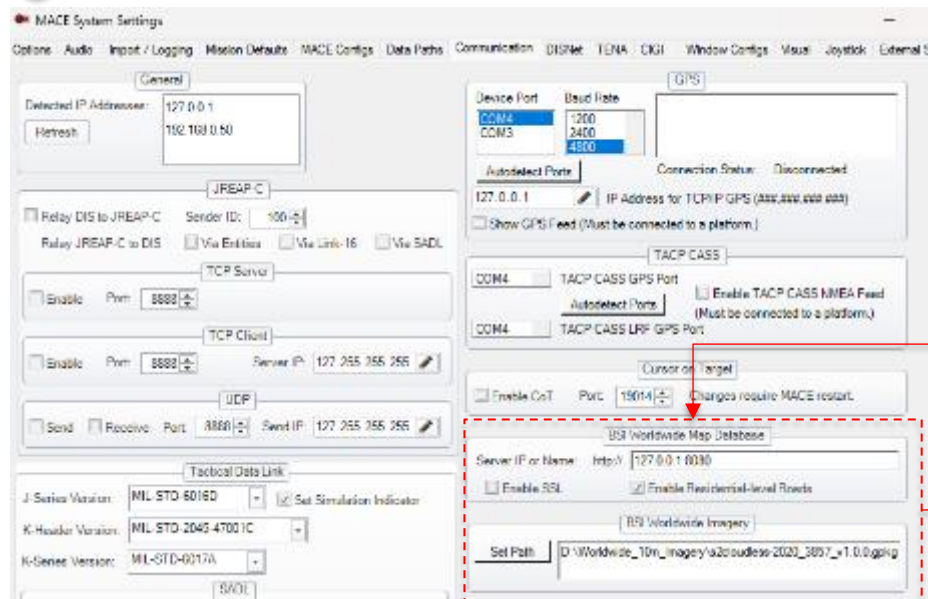
MACE INITIAL SETUP

Getting Required Data in MACE – Steaming Data

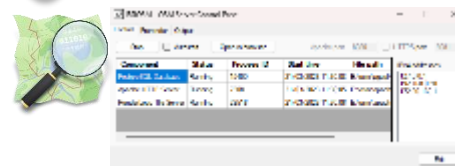
1 VIEW → System Settings



2 Communication: BSI Worldwide Map Database / Imagery



3 BSI Open Street Maps Server



4 FILE → Connect: BSI Sources



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

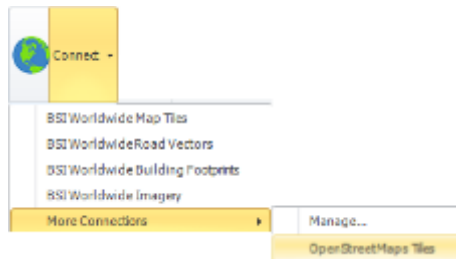
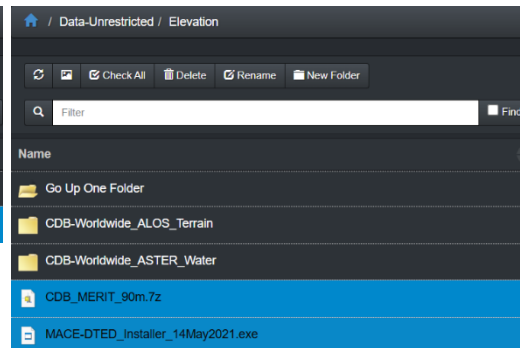
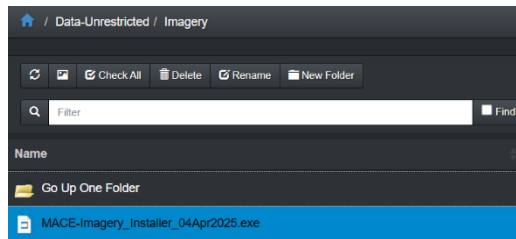
No GIS Drive – Sample and Online Data Only

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

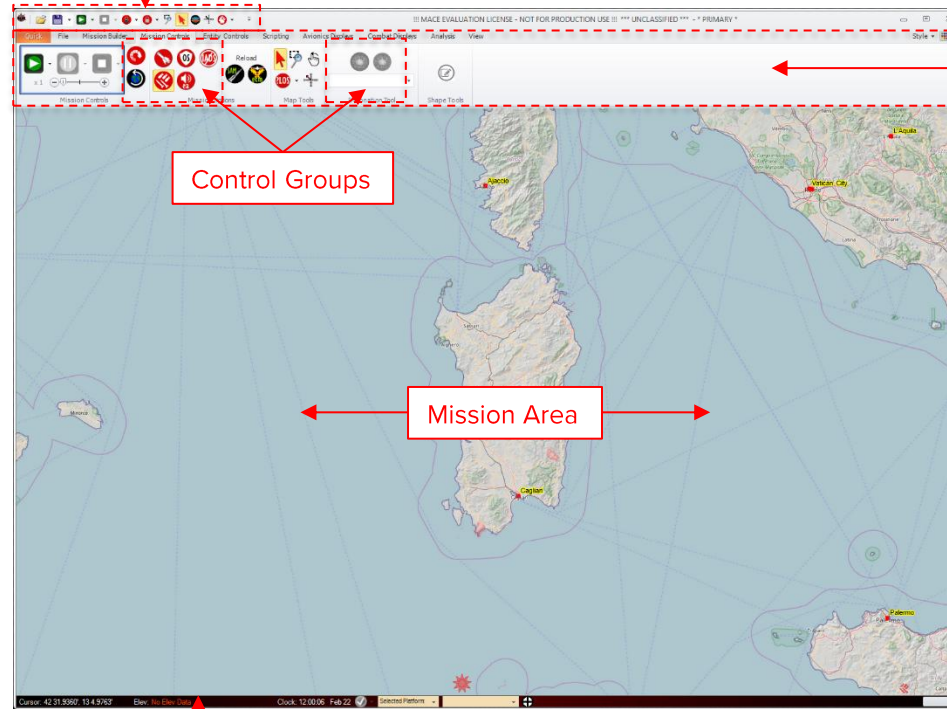
- Understand the components of the MACE GUI
- Understand how to use and customise the Quick Access Toolbar
- Overview of the different grouped functions of the Top Ribbon Navigation Bar
- Understand the appearance and function relationship of the different types of buttons
- Understand the purpose of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

MACE OVERVIEW

MACE Workflow



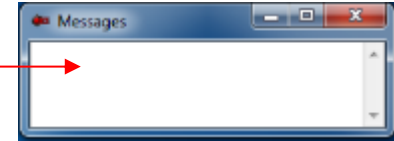
Quick Access Tool Bar



Control Groups

Main Tool Bar

Message Window



Mission Area

Status Bar

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

Data

Build

Execute & Control

Analysis

File

Mission Builder

Mission Controls

Entity Controls

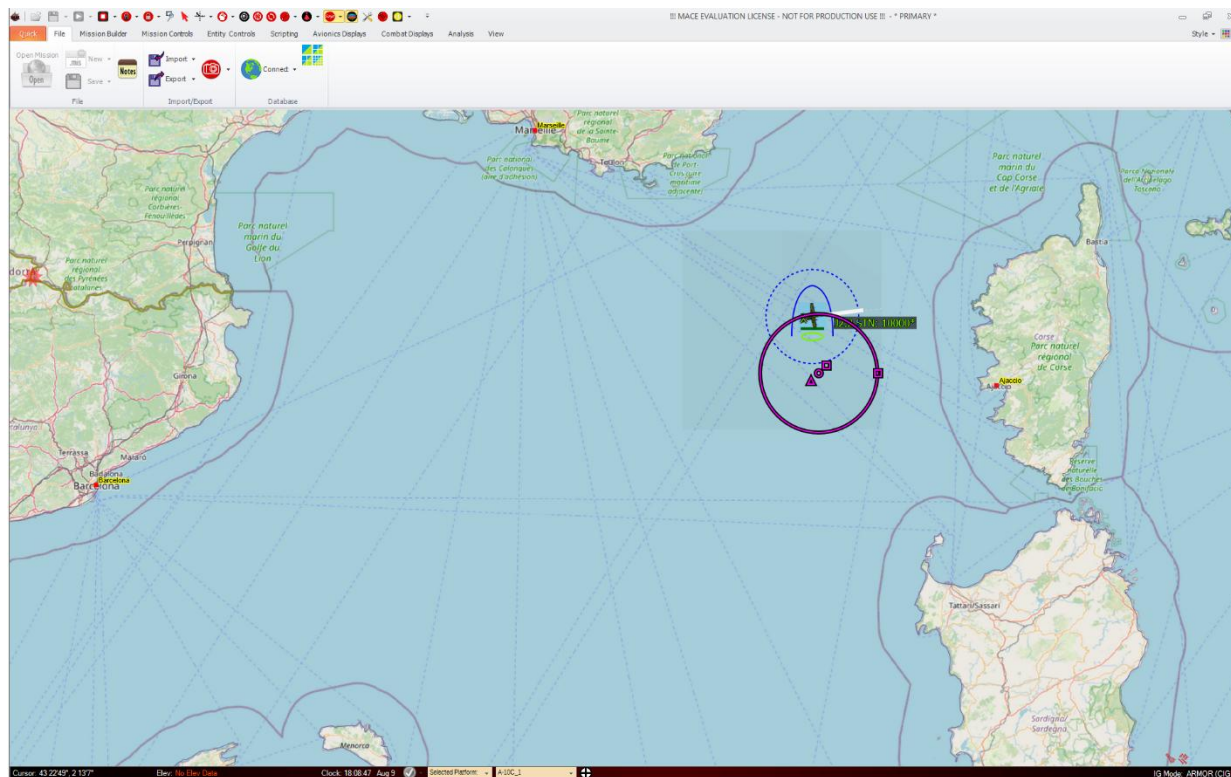
Scripting

Avionics Displays

Combat Displays

Analysis

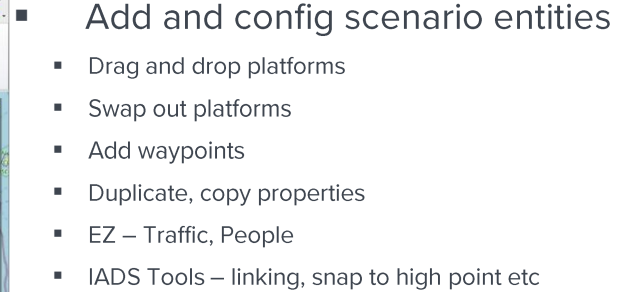
View



Sets the canvas for the scenario

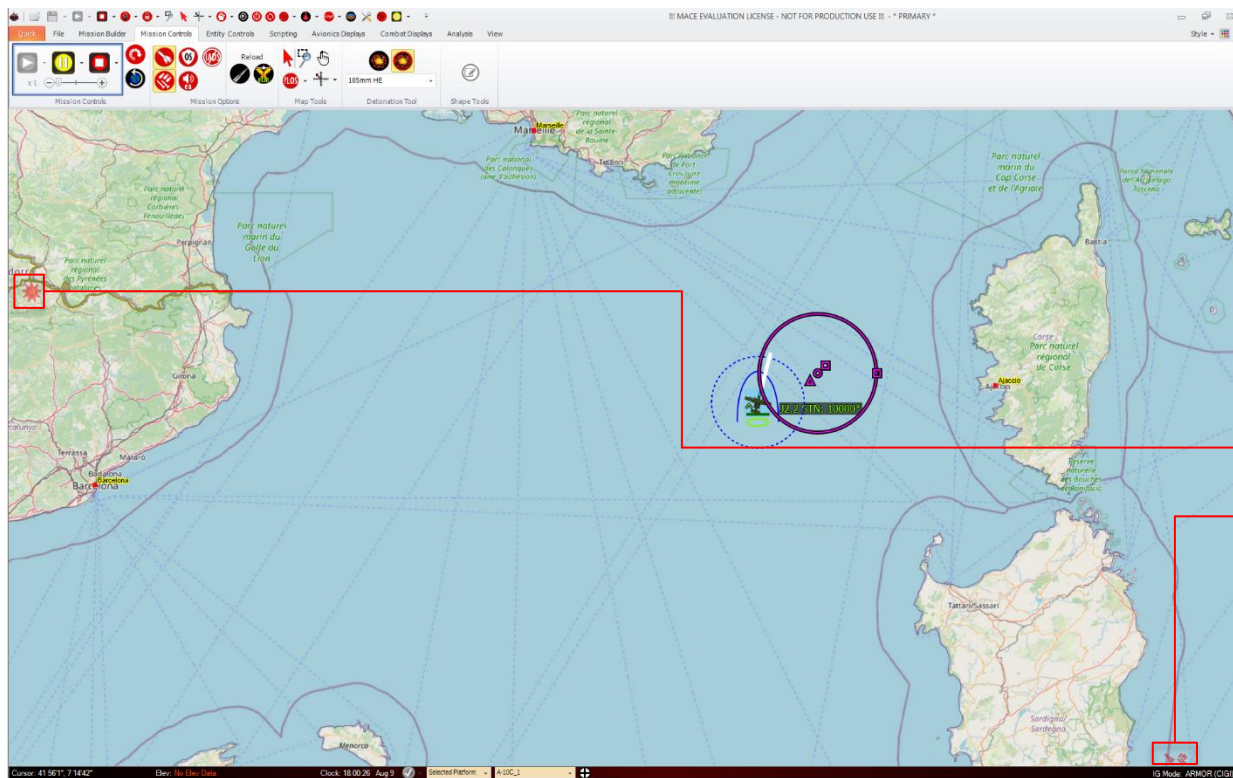
- Open previous missions
- Clear scenario for new mission
- Save missions
- Import Mil Data – ACO/ATO, Shapes, Routes etc
- Import MACE specific – Partial Missions, Scripts etc
- Connect to Streaming Data – OSM, Imagery
- Export data for use in other scenarios
- Export data for use in Mil Systems

MACE Workflow – Mission Builder Tab



MACE OVERVIEW

MACE Workflow – Mission Controls Tab



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



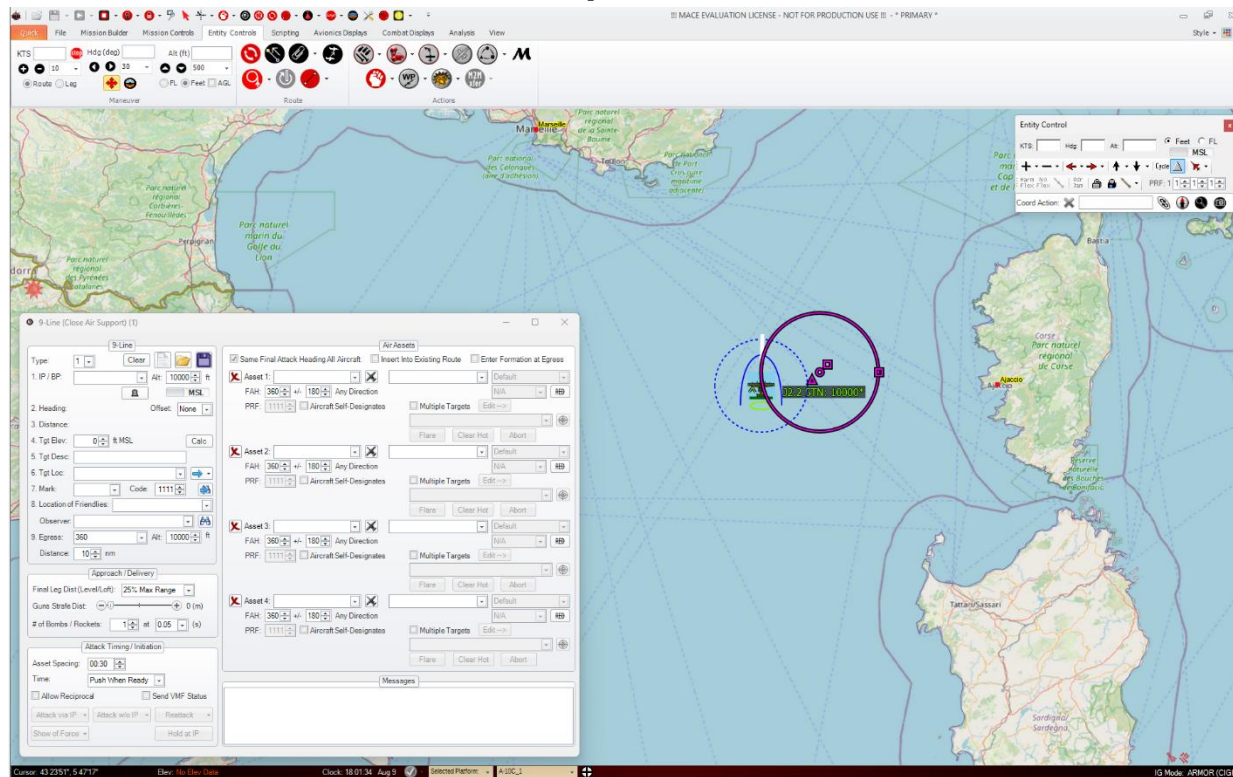
→ Unlimited Ammo

↓ Foam Weapons

↓ Ownship
Invulnerable

MACE OVERVIEW

MACE Workflow – Entity Controls Tab

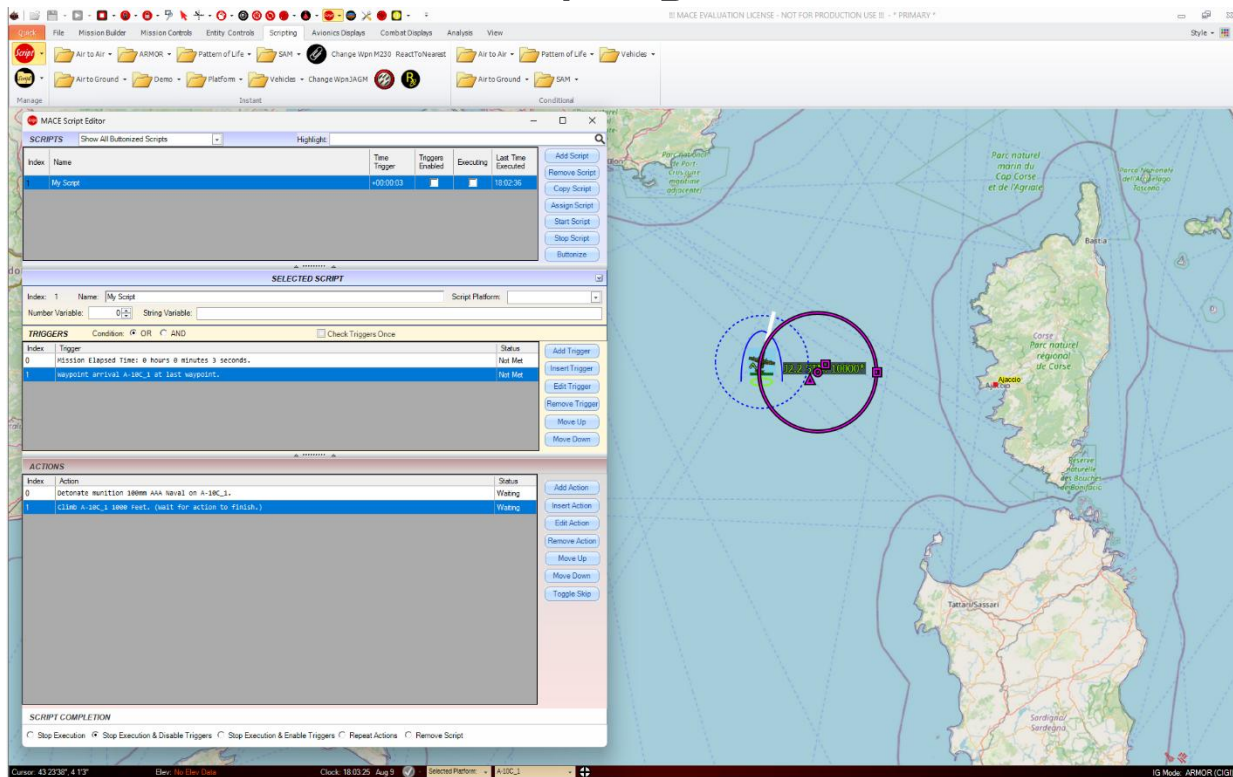


Entity specific control

- 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

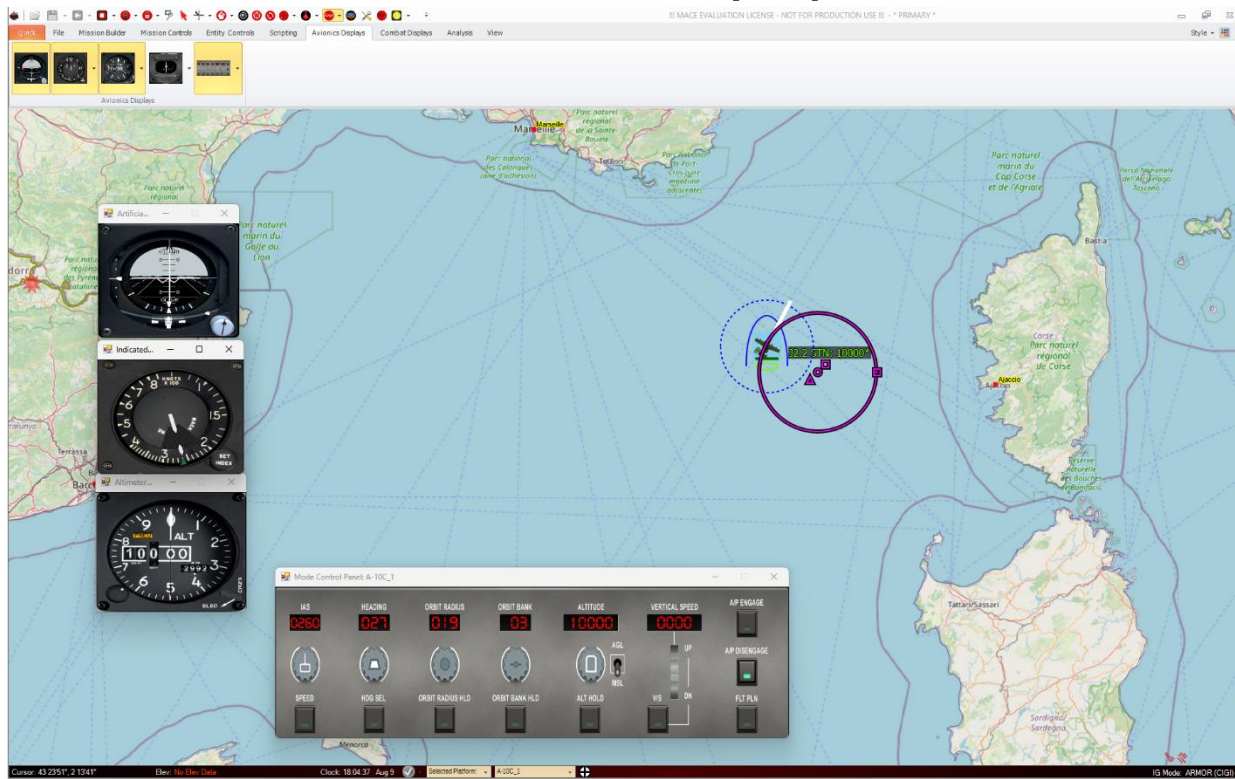


Conditional, autonomous / semi-autonomous actions

- 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



Cockpit avionic instruments

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

MACE OVERVIEW

MACE Workflow – Combat Displays Tab

Data

Build

Execute & Control

Analysis

File

Mission Builder

Mission Controls

Entity Controls

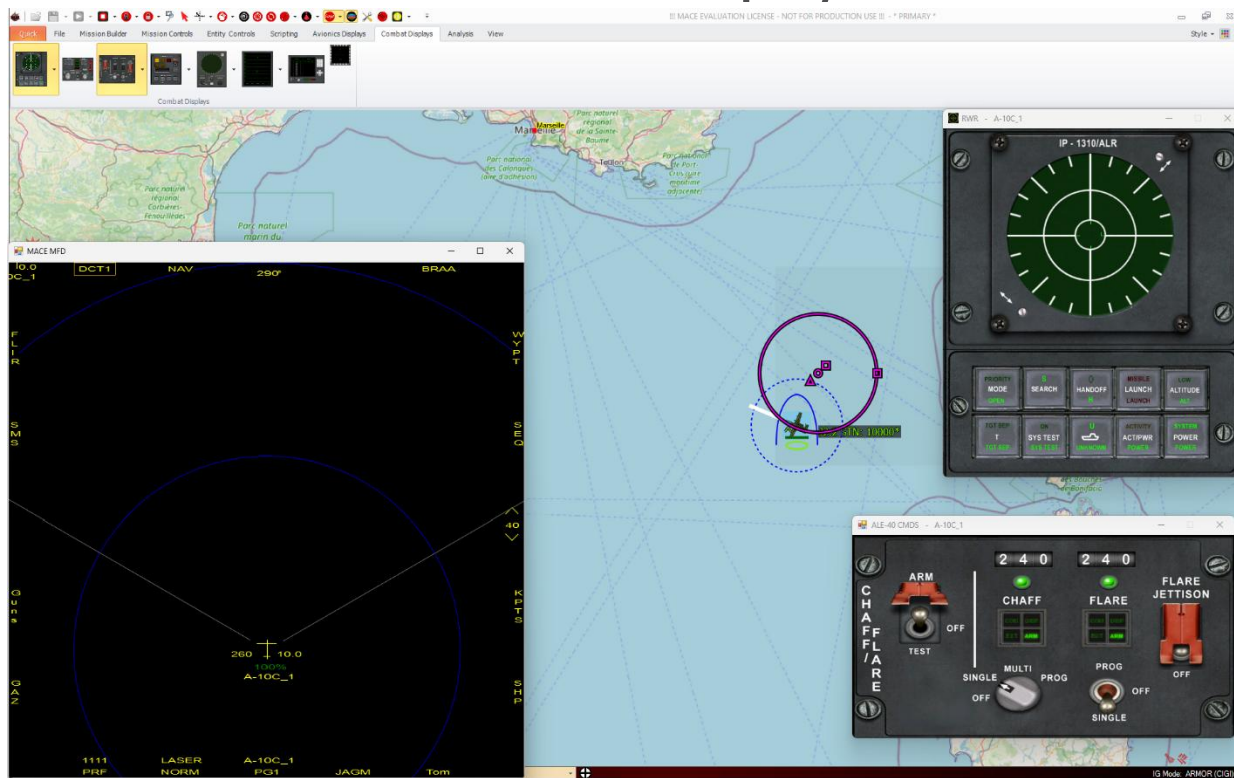
Scripting

Avionics Displays

Combat Displays

Analysis

View



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

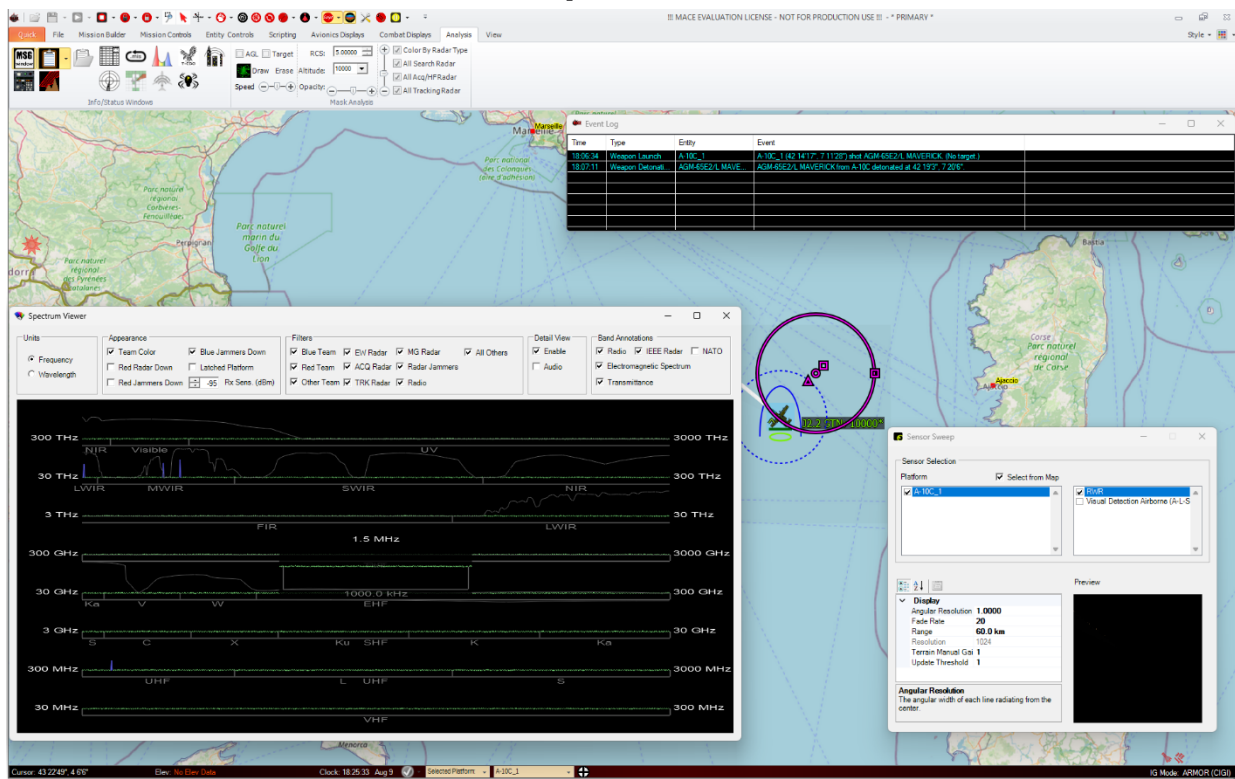
Data

Build

Execute & Control

Analysis

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



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

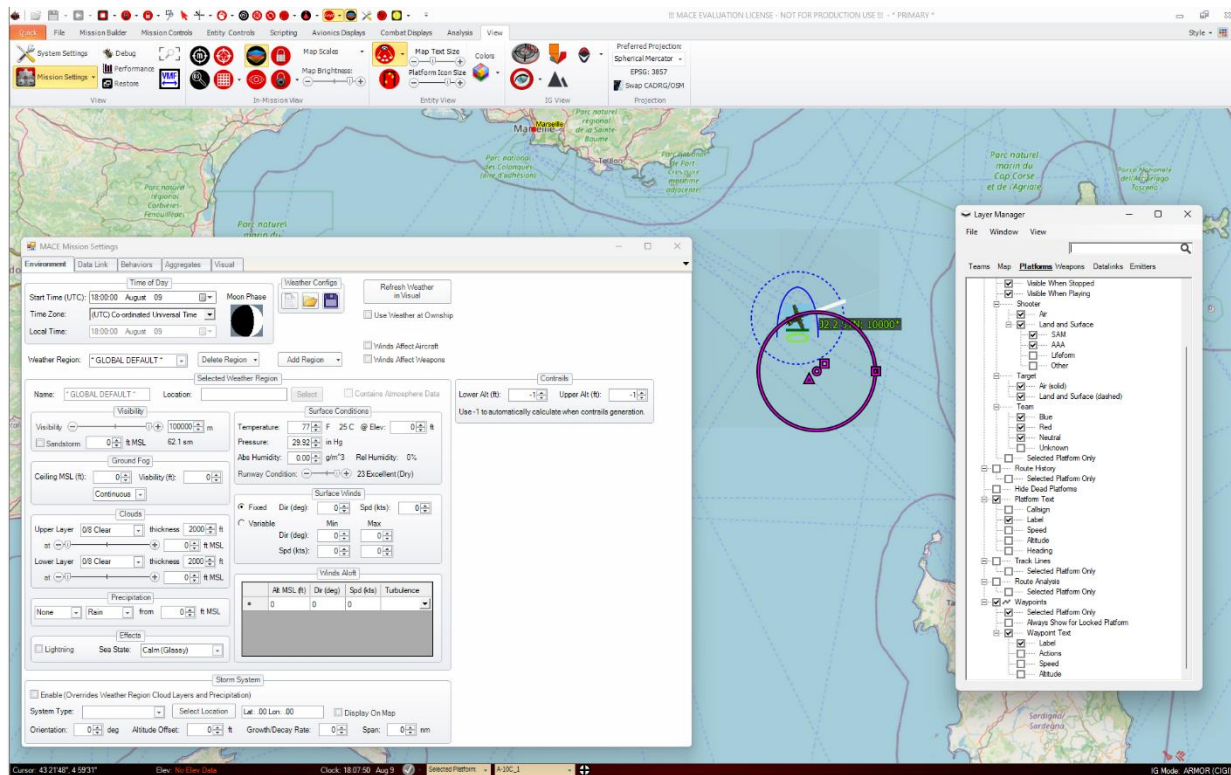
Scripting

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 and 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

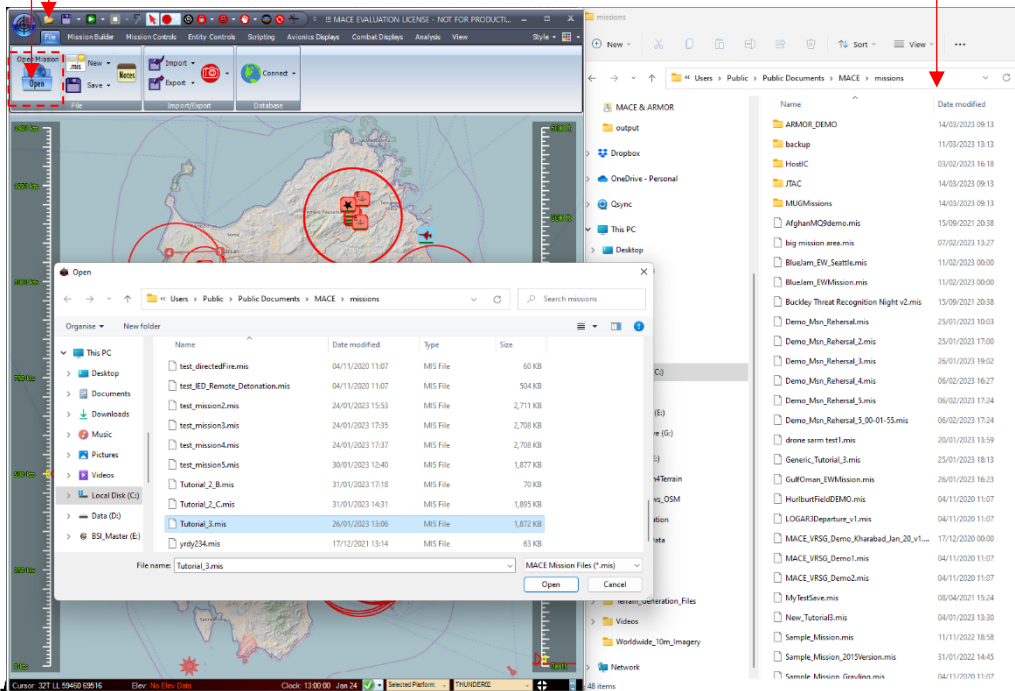
MACE MISSIONS, MAP CONTROLS, LAYERS

Load A Mission

FILE → File → Open Mission “Tutorial_3.mis”

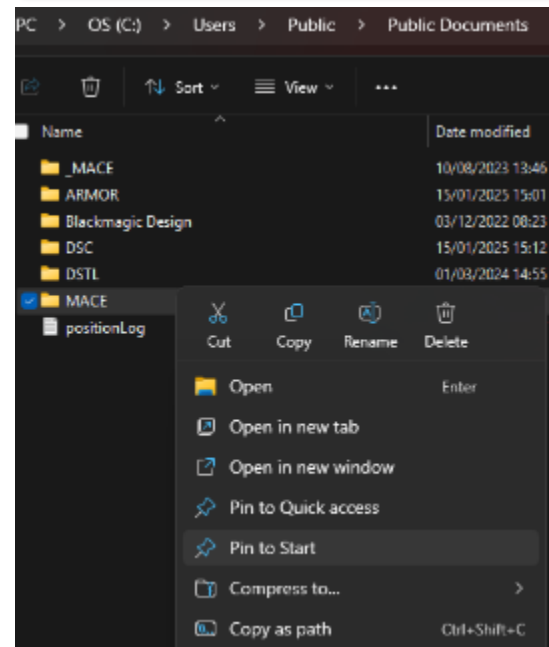
Open Mission

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



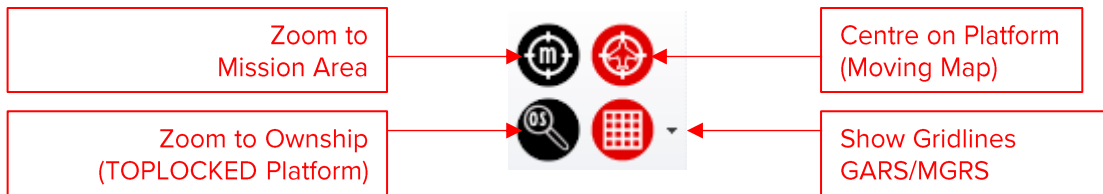
TIP – PIN THE MACE DIRECTORY

‘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



SHORTCUTS

CTRL + F

CTRL + F5 to F8

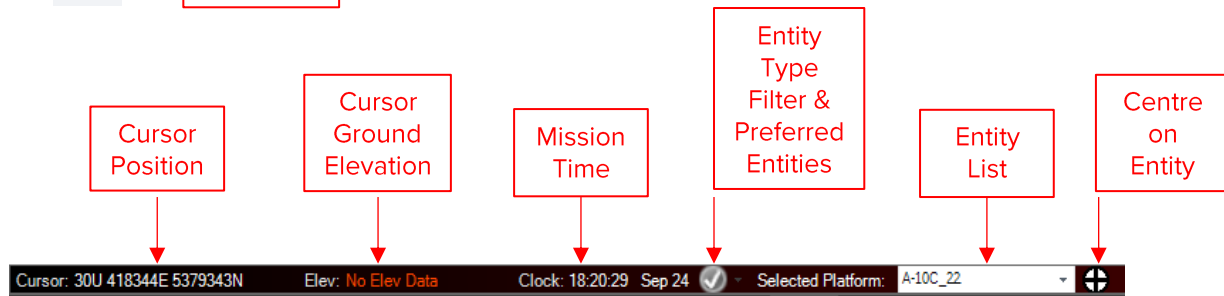
ALT + F5 to F8

LMB = Left Mouse Button
RMB = Right Mouse Button

Change coordinate type

Save a zoom level

Zoom to saved zoom level





MACE MISSIONS, MAP CONTROLS, LAYERS

The Overlay Manager

Layer Manager

File Window View

Teams

- ☒ Blue Team
- ☐ Only If Detected
- ☒ Red Team
- ☐ Only If Detected
- ☒ Neutral Team
- ☐ Unknown Team
- ☐ Only Draw Detected Entities

Map

- ☒ 102 Tile View
- ☒ Sentinel 2 Worldwide Imagery
- ☒ Vector Images Only
- ☒ Map Tiles
- ☒ Road Vectors
- ☒ Full Planet Building Vectors
- ☐ Radar Images
- ☐ MACE CADRG
- ☐ Full Earth
- ☐ 10-sec Imagery
- ☐ 10m or Better Only
- ☒ WMS
- ☐ IADS Layer
- ☐ Navigation Points
- ☐ NAVWIDS
- ☐ Obscuradna
- ☐ Radar
- ☐ EW Radar
- ☐ Aox Radar
- ☐ TTR
- ☐ Selected Platform Only

Platforms

- ☐ Camera Line
- ☐ Latched Platform Only
- ☐ Priority Target Line
- ☐ Priority Target Line
- ☐ MAM/IMA
- ☐ Unlatched Stage
- ☒ Visible When Stopped
- ☒ Visible When Playing
- ☐ Shooter
- ☐ Air
- ☐ Land and Surface
- ☐ SAM
- ☐ NAA
- ☐ Lifeline
- ☐ Other
- ☐ Target
- ☐ Air (solid)
- ☐ Land and Surface (solid)
- ☐ Team
- ☐ Blue
- ☐ Red
- ☐ Neutral
- ☐ Unknown
- ☐ Selected Platform Only
- ☐ Route - History
- ☐ Selected Platform Only
- ☐ Risk: Dual Platform
- ☐ Platform Text
- ☐ Label
- ☐ Speed
- ☐ Altitude
- ☐ Heading
- ☐ Collision
- ☐ Track Lines
- ☐ Selected Platform Only
- ☐ Route Analysis
- ☐ Selected Platform Only
- ☐ Waypoints
- ☐ Selected Platform Only
- ☐ Always Shown For Locked Platform
- ☐ Waypoint Text
- ☐ Label
- ☐ Actions
- ☐ Speed
- ☐ Altitude

Weapons

- ☒ Weapon Text
- ☐ Type
- ☐ Speed
- ☐ Altitude
- ☐ Guidance
- ☐ Time of Flight
- ☐ Engagement Zones
- ☐ Assumed Target Only
- ☐ Target Line

Datalinks

- ☒ Datalink
- ☒ 20 Tracks
- ☒ Blue J2 Tracks
- ☒ Red J2 Tracks
- ☒ Neutral J2 Tracks
- ☒ Unknown J2 Tracks
- ☒ 20 Track Originator
- ☒ Blue Team J3a
- ☒ Red Team J3a
- ☒ Neutral Team J3a
- ☒ Unknown J3 Tracks
- ☒ 42 Labels
- ☒ 42 STNs
- ☒ 42 Heading Tick
- ☒ 42 Labels
- ☒ 43 Track Alt
- ☒ 43 Heading Tick
- ☒ 43 Type
- ☒ 43 Thrust/Fuel Ring
- ☒ Made 1 Square
- ☒ Made 3 Square
- ☒ 43 Track Identities
- ☒ 43 Pending Identity Tracks
- ☒ 43 Unknown Identity Tracks
- ☒ 43 Assumed Friend Identity Tracks
- ☒ 43 Friendly Identity Tracks
- ☒ 43 Neutral Identity Tracks
- ☒ 43 Suspect Identity Tracks
- ☒ 43 Hostile Identity Tracks
- ☐ Network
- ☐ Selected Platform Only
- ☐ LAR: IS
- ☐ SAOL
- ☐ SAOL: TOL
- ☐ IAU: TOL
- ☐ Network: TOL
- ☐ 1125 TOL: Sol
- ☐ KS: LURM

Entities

- ☒ Entities
- ☒ Detection Rings
- ☒ EW
- ☒ ACG
- ☐ Domain
- ☐ Air
- ☐ Land
- ☐ Surface
- ☐ Weapons
- ☐ Datalink
- ☐ Jammer
- ☐ Jammer Corridor
- ☐ Radio
- ☐ Infrared
- ☐ Radar Receiver Beam
- ☐ ICDN Receiver Beam
- ☐ Selected Platform Only
- ☐ Radar
- ☐ Search
- ☐ Acquisition
- ☐ Target Tracking
- ☐ Missile Guidance

Tracks

2.2 STN 10790°

Jammer Corridor

Detection Rings

Engagement Range

Weapon Text

TOF: 0907 / TTD: 0910
Speed: 1005 kts
Altitude: 3064 ft msl
3014 ft AGL

Platform Text

THUNDER
Headings: 129° T / 126° M
Speed: 480 kts
Altitude: 500 ft MSL
500 ft AGL

Engagement Zones

Waypoints

Speed: 140 kts
Altitude: 300 ft AGL

Networks

Imagery

Open Street Maps

Vector Images

Masks

Radio/IR/Receiver

Radar

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

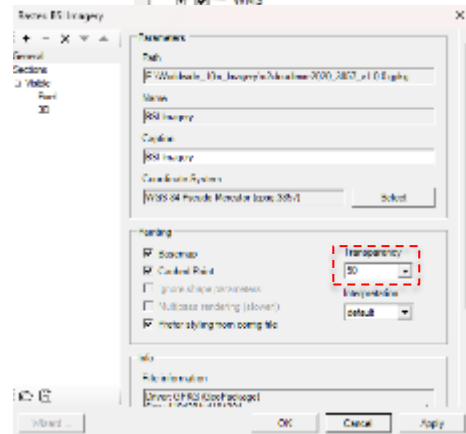
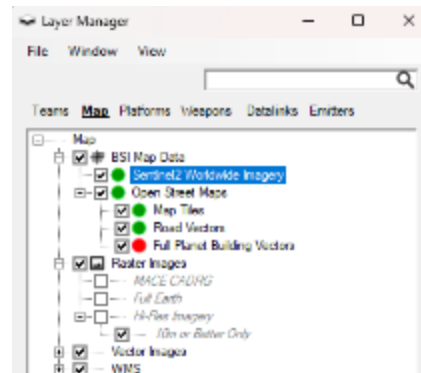
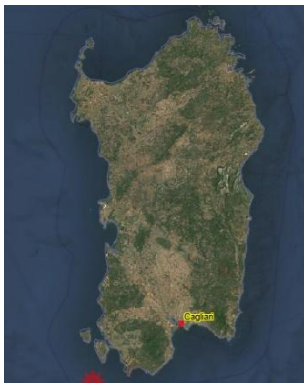
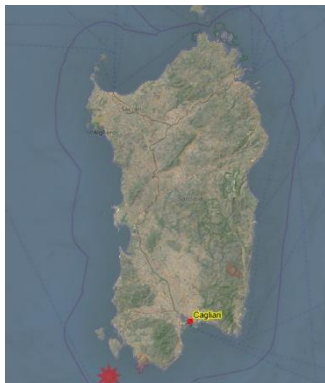
MACE MISSIONS, MAP CONTROLS, LAYERS

Layer Manager Intro

■ MAP

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

VIEW → In-Mission View → Layer Manager



- 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 BASIC MISSION BUILDING

Learning objective:

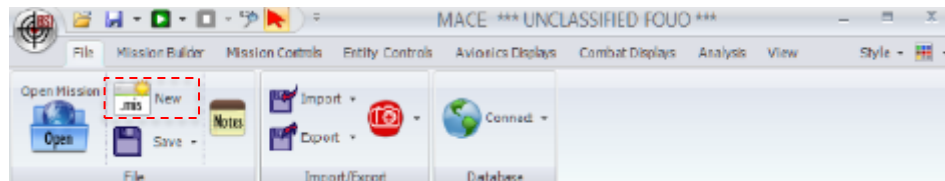
- Understand how to choose, place, move and delete entities, and how to see the properties of entities in MACE

Enabling objectives

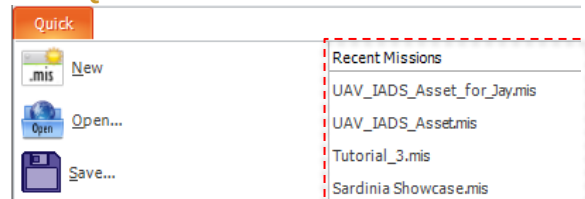
- Know how to Save, Run, Clear, and Load missions
- Know how to add platforms
- Know how to filter and search the mission builder list
- Know how to change platforms
- Know how to add platform waypoints
- Know how to Move Platforms and Waypoints
- Understand Intent
- Know how to select and move multiple 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 BASIC MISSION BUILDING

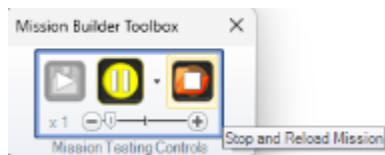
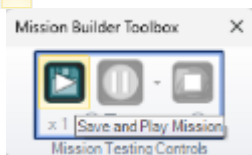
- New vs Global New – Mission Clear-out
- Save
 - Clean – Mission not started
 - Dirty – Mission in progress (includes time stamp)
- Quick Open from BSI/Quick Menu
- Scenario Editing Workflow:
 - OPEN → EDIT → SAVE → PLAY → STOP → RELOAD (BEFORE EDITING)
 - Use 'Recent Missions'
 - Or use mission builder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



BSI / QUICK MENU



MISSION BUILDER → Mission Builder Toolbox



SHORTCUTS

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

MACE BASIC MISSION BUILDING

Add/Move/Select/Change

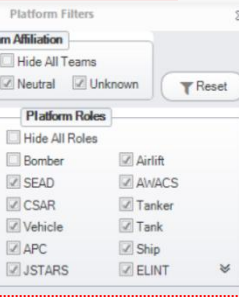
Search By Category

- RMB Minimise All

Filter By Type



Filter By Team / Role



Search By Name

Select and click

[ALT] + Drag and drop to add a group

Drag and drop

Click to swap existing for selected

ADD:

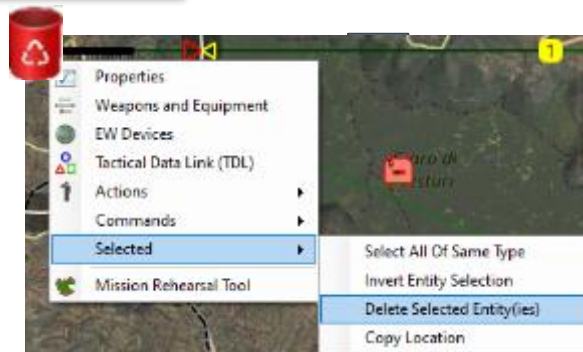
- Drag and Drop
- OR
- Select and Click
- RMB after finished adding

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)

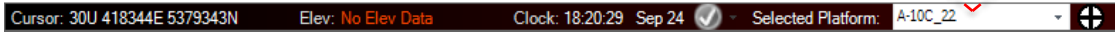


MACE BASIC MISSION BUILDING

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 single clicked-on Item OR
move group selected to LMB clicked Point
Multi Select (Drag or Click)

SHIFT + LMB

CTRL + DELETE

ALT + DELETE

CTRL + 1 to 9

ALT + 1 to 9

CTRL + W

CTRL + R

Delete Selected

Delete ALL BUT Selected

Create a Group

Recall a Group

Reverse Selected Platform Waypoints

Resurrect ALL

ALT + A

ALT + G

Select ALL AIR

Select ALL GROUND



MACE BASIC MISSION BUILDING

Add/Move/Select/Change Waypoints

Waypoint Add
(Stateful)

Context Menu Add

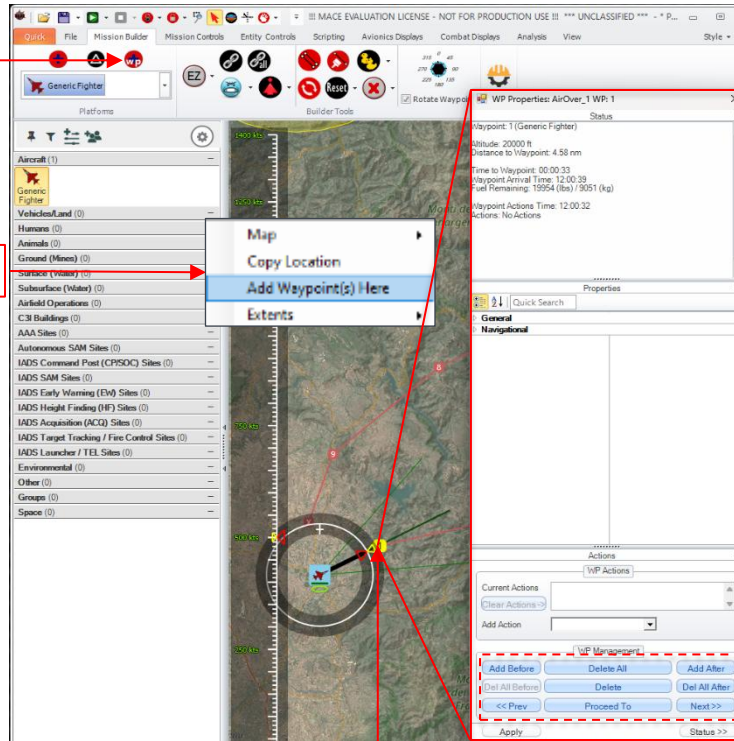
Waypoint Properties Window

- 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

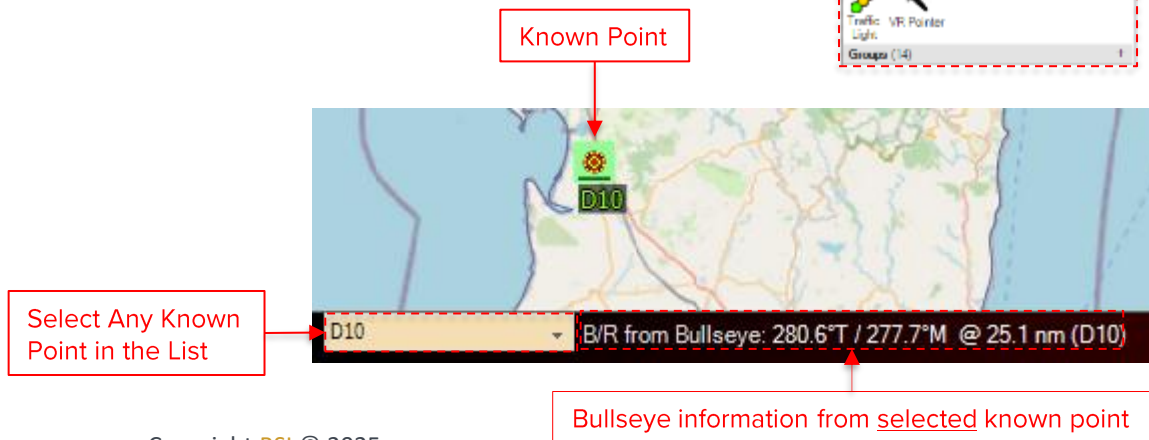
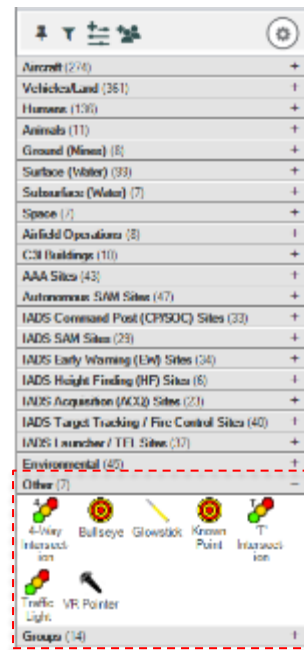
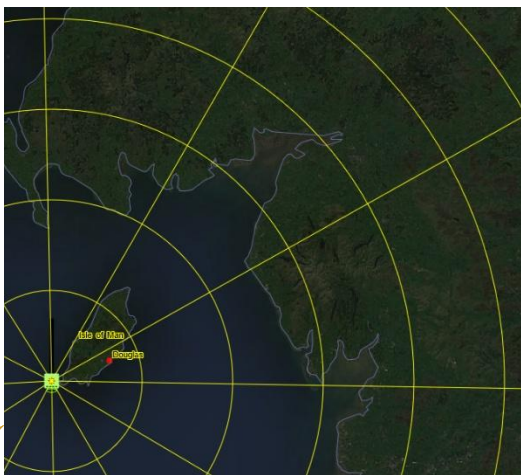
RMB on waypoint
To open properties



MACE BASIC MISSION BUILDING

Known Points and Bullseye

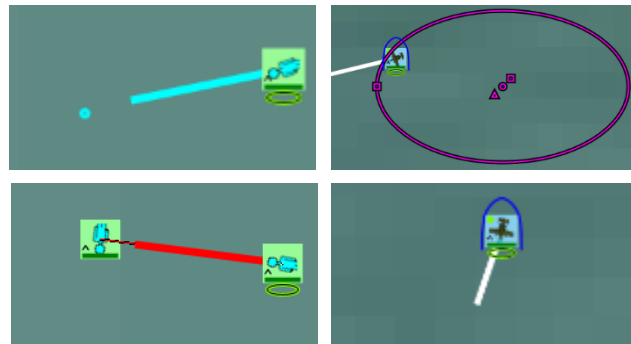
- Known Point – An invisible platform, useful for:
 - Reference points for attacks (9-Lines, Call for Fire)
 - Landing zones
 - Bullseyes
 - Trigger points in scripts e.g. proximity triggers



MACE BASIC MISSION BUILDING

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 BASIC MISSION BUILDING

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 ownship – 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

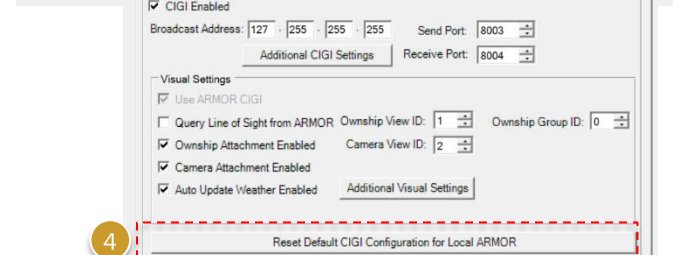
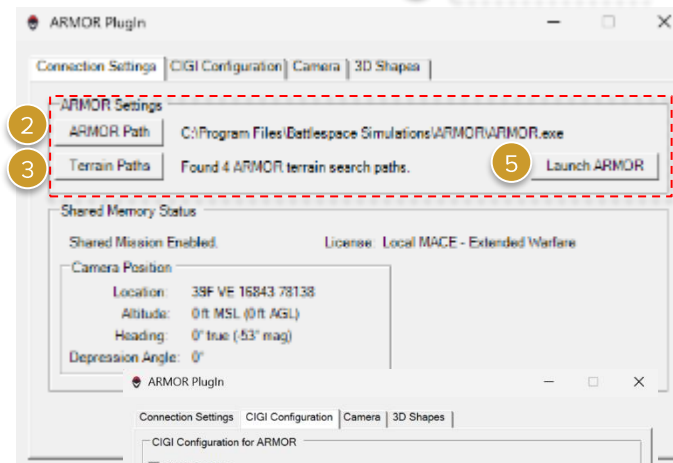
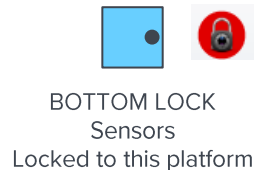
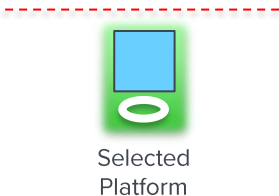
ARMOR SETUP AND BASIC CONTROLS

1st 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)





O – OUTLINES M – THREAT DOMES N – WEZs L – LABELS Y – WAYPOINTS U – CTRL ZONES T – TRAILS B – BEAMS C – COMPASS V – POSITION



CAMERA ATTACHMENT VIEWS 1 – FIRST PERSON 2 – TRAIL 3 – FIXED HORIZON 4 – ORBIT 5 – NORTH UP 6 – HEADING UP 7 – TARGET 9 – SENSOR 0 – PIP

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

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

Z Main Spectrum shift Z Sensor Spectrum
X Main Polarity shift X Sensor Polarity



insert home page up
del end Page down

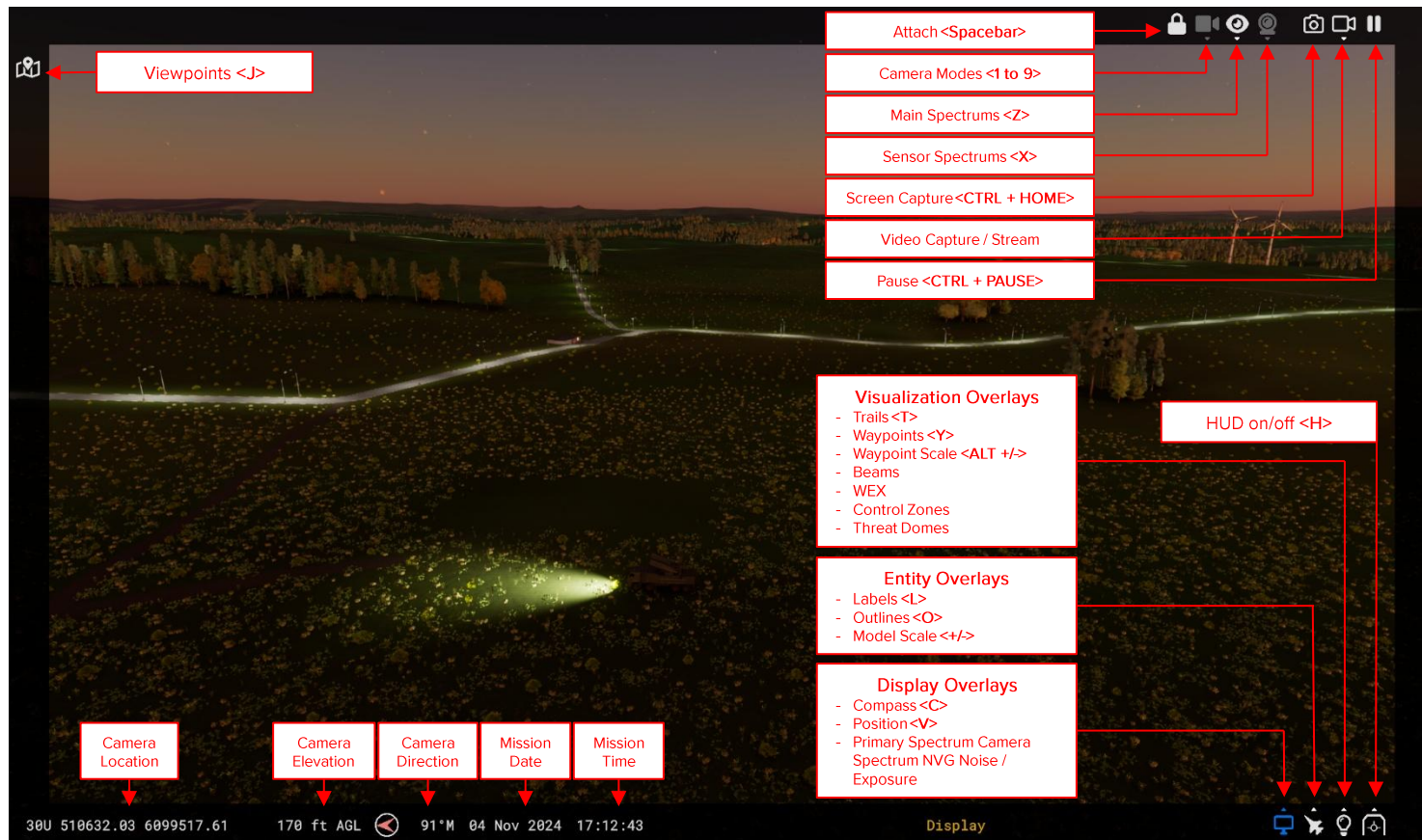
ctrl page up page down IR Manual Temp Lower limit up/down
alt page up page down IR Manual Temp Upper limit up/down
ctrl end IR Auto temperature range

shift L Label Team Filter
ctrl L Label Type Filter
alt L Label Compact / Large



ARMOR SETUP AND BASIC CONTROLS

On-Screen-Interface



ARMOR SETUP AND BASIC CONTROLS

Labels

The screenshot displays the ARMOR interface with several entity labels overlaid on a 3D terrain map. A control panel in the top-left corner shows keyboard shortcuts for filtering and toggling views. Red callout boxes with arrows point to specific parts of the labels to explain their meaning.

Control Panel:

- Shift + L: Label Team Filter
- Ctrl + L: Label Type Filter
- Alt + L: Compact / Detailed

Entity Labels and Callouts:

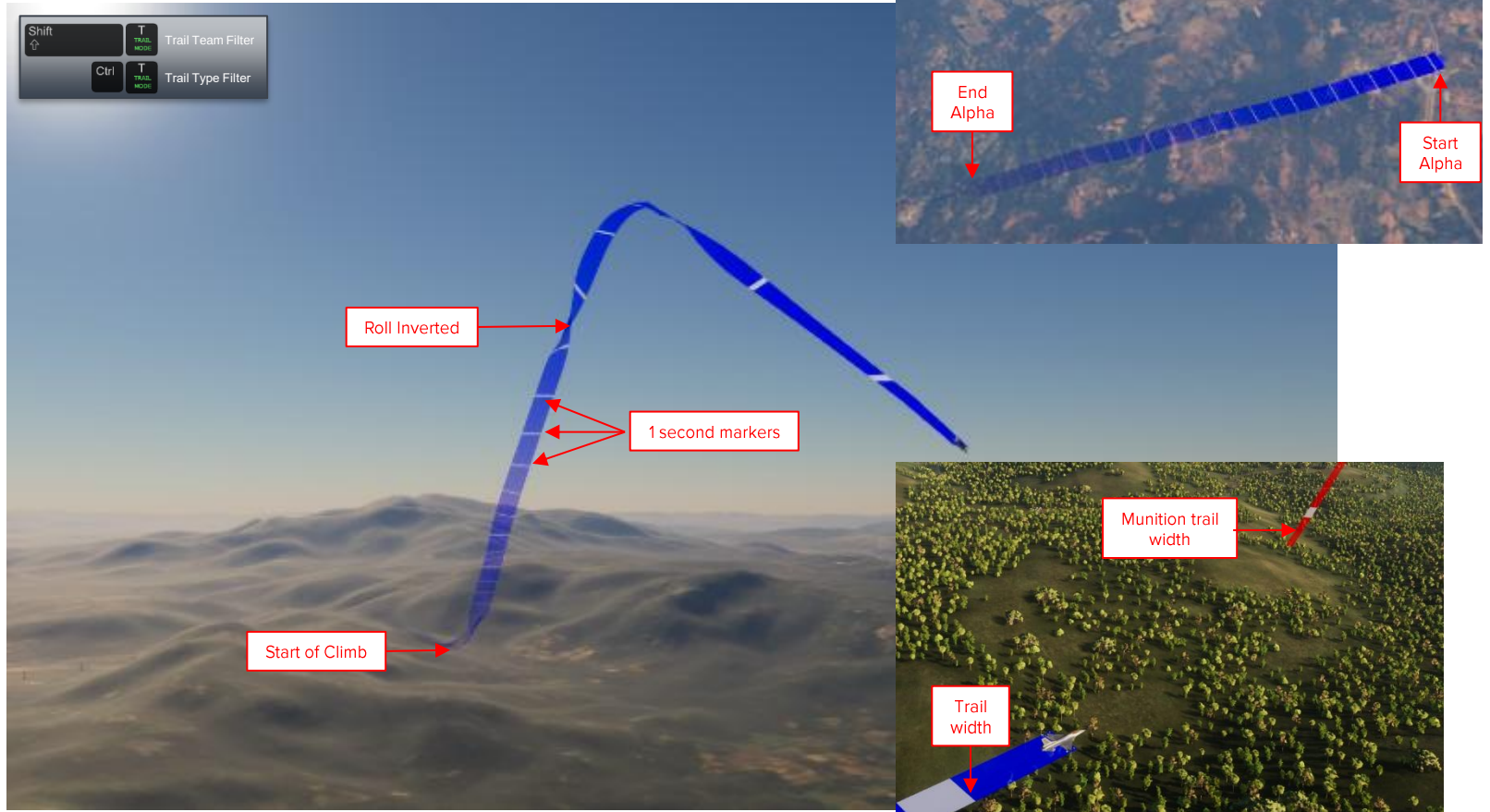
- Callsign:** Points to the top line of a label (e.g., SAM_2).
- Distance From Camera:** Points to the distance value (e.g., 133 km).
- Type:** Points to the entity type (e.g., Generic SAM).
- Jammed (by Blue):** Points to a blue highlight on the label (e.g., NW_Auto_AA).
- Heading Mag / True:** Points to the heading information (e.g., HDG 087M 090T).
- Altitude / Height:** Points to the altitude/height value (e.g., 177 km).
- Speed:** Points to the speed value (e.g., 0 mph).
- Entity Position:** Points to the location of the entity on the map.
- Dead Entity:** Points to a label with a red background (e.g., BMP-3_2).
- # Of Attached Entities:** Points to the count of attached entities (e.g., +4 ATTACHED).

Entity Data Examples:

- SAM_2:** Generic SAM, 133 km, HDG 087M 090T S 0 mph
- NW_Auto_AA:** Generic AAA, 19 km, HDG 357M 000T S 0 mph
- THUNDERB2:** Generic Fighter, 26 km, HDG 175M 170T IAS 500 kts, AGL 403 ft
- NW_Auto_SA:** Generic SAM, 4.6 km, HDG 006M 009T S 0 mph
- TEL_43:** Generic_TEL, 177 km, HDG 043M 046T S 0 mph
- TEL_44:** Generic_TEL, 177 km, HDG 271M 274T S 0 mph
- TEL_45:** Generic_TEL, 178 km, HDG 054M 050T S 0 mph
- TEL_42:** Generic_TEL, 176 km, HDG 296M 299T S 0 mph
- TT_41:** Generic TT Radar, 177 km, HDG 357M 000T
- B00ART01:** Generic Bomber, 160 km, HDG 265M 260T IAS 392 kts, MSL 8483 ft
- BMP-3_2:** BMP-3, 2.7 km, HDG 357M 000T S 0 mph, +4 ATTACHED

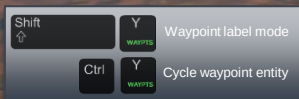
ARMOR SETUP AND BASIC CONTROLS

Trails



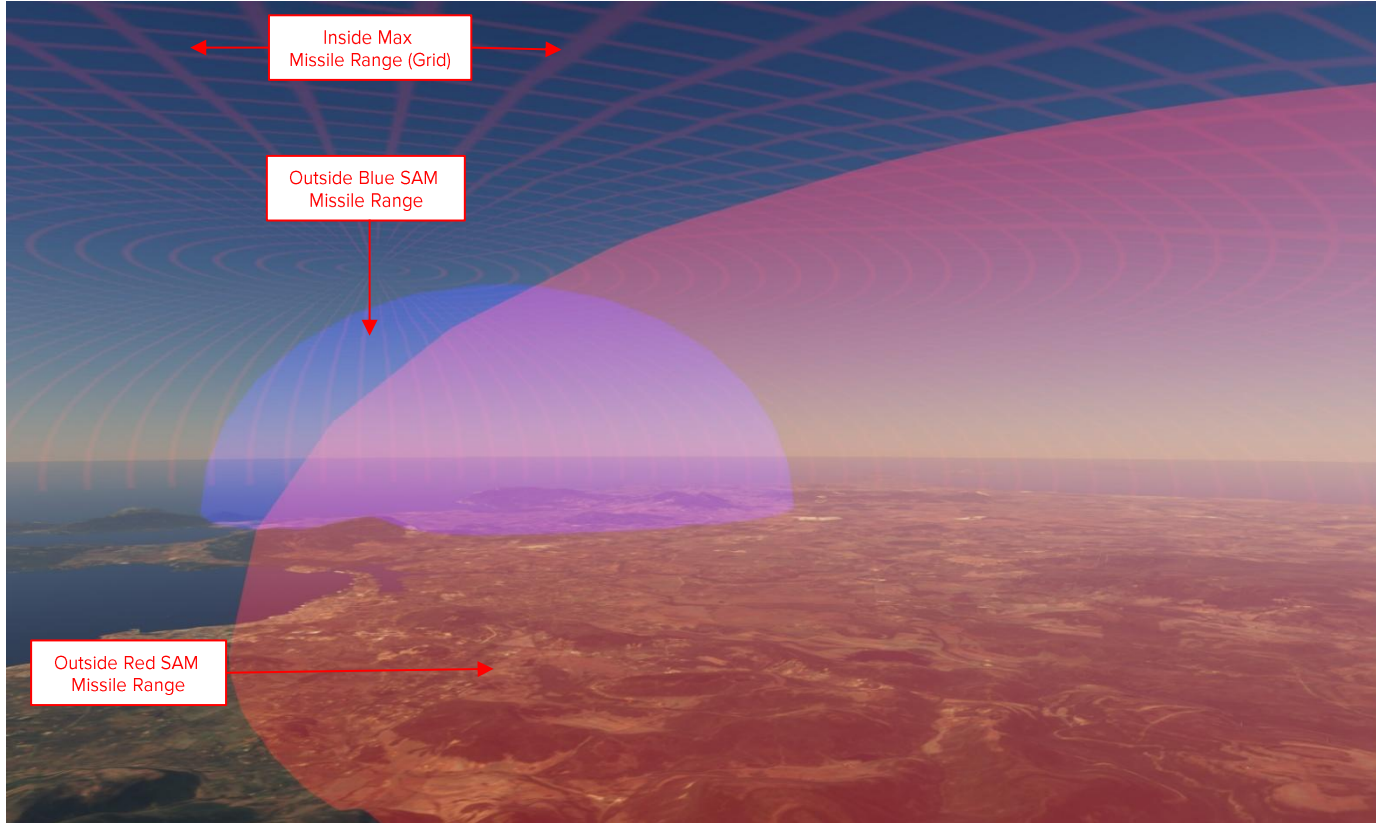
ARMOR SETUP AND BASIC CONTROLS

Waypoints



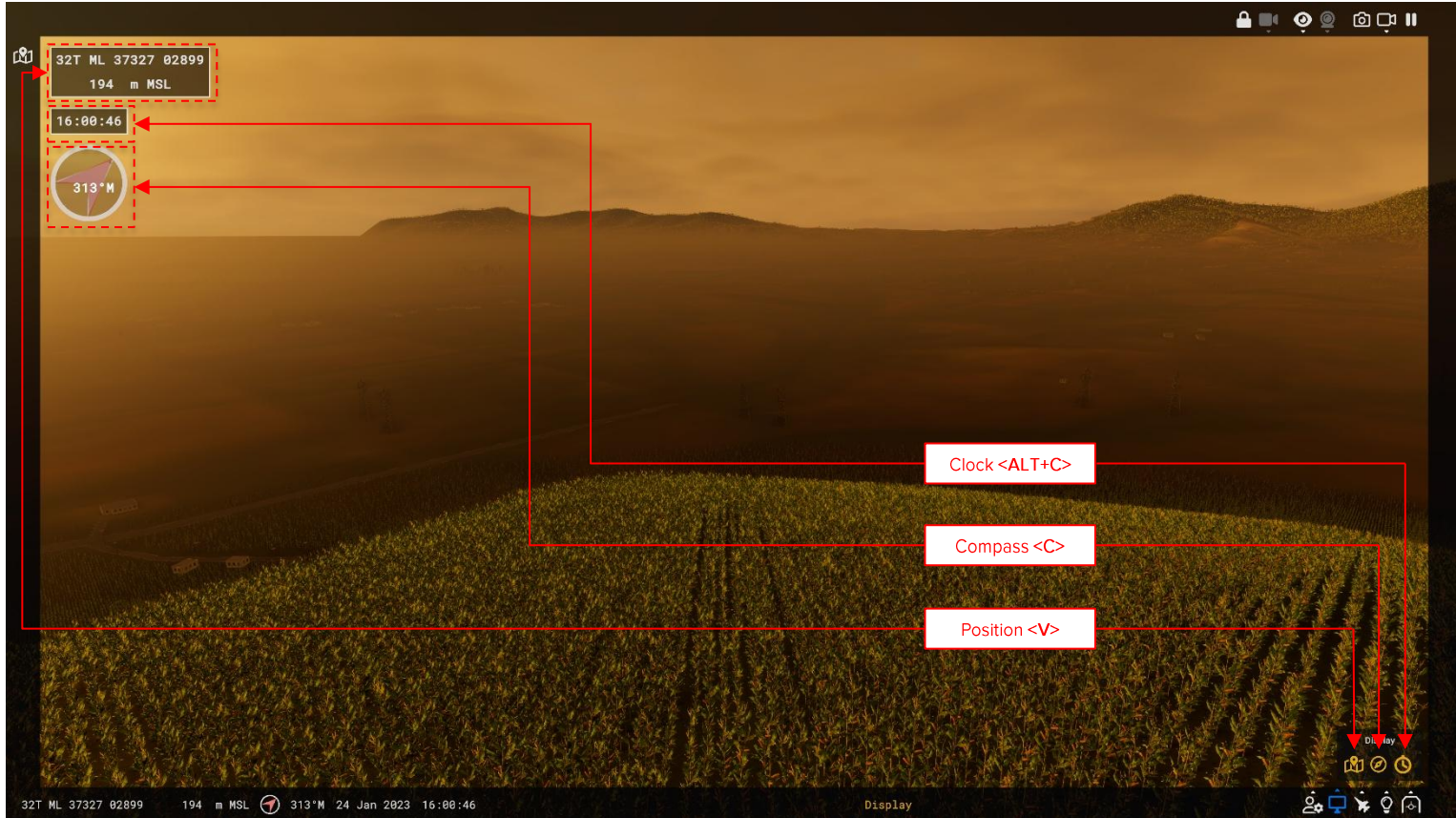
ARMOR SETUP AND BASIC CONTROLS

Missile Max Range Domes



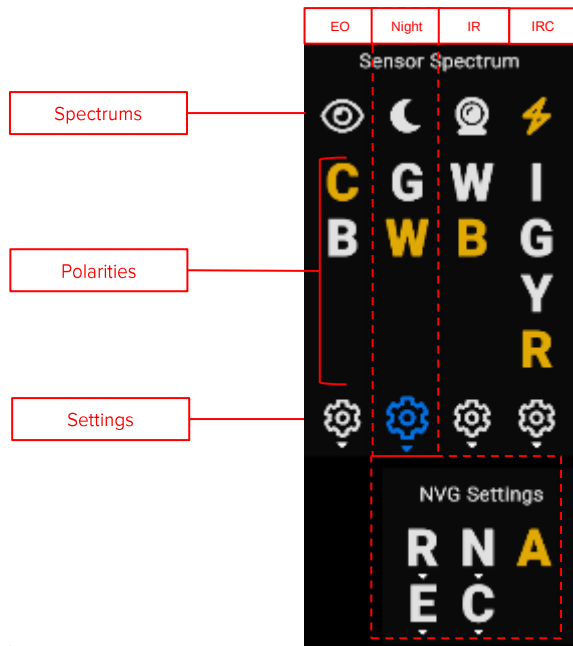
ARMOR SETUP AND BASIC CONTROLS

Display – Compass, position, time

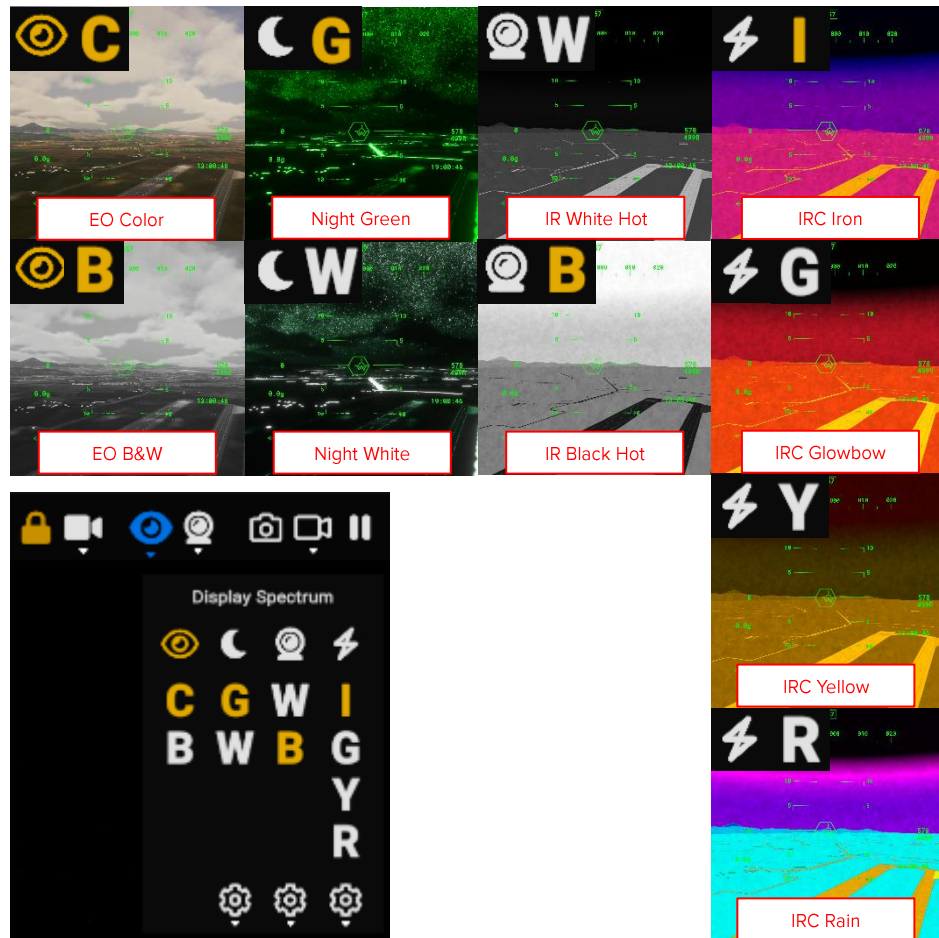


ARMOR SETUP AND BASIC CONTROLS

Spectrums & Polarities



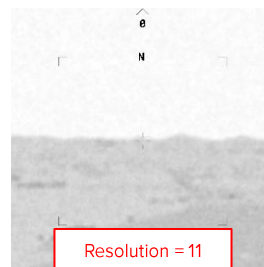
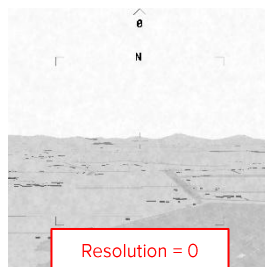
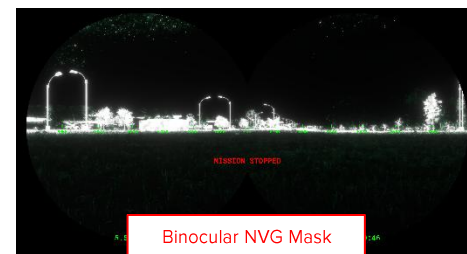
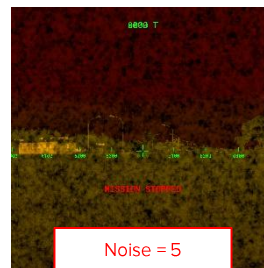
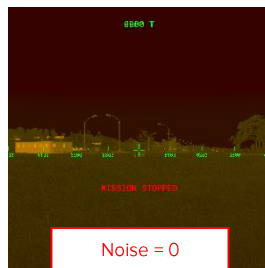
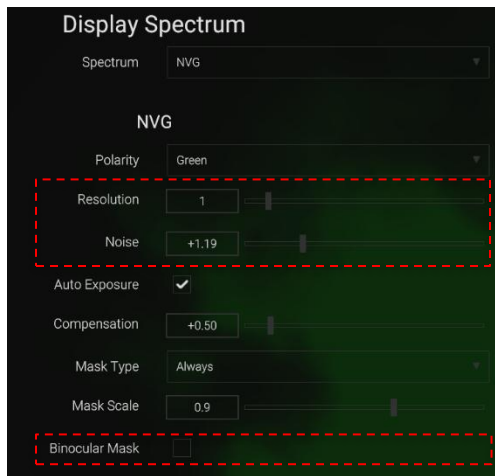
- 4 Spectrums
- Polarities in columns under each spectrum
- Settings at the bottom of each column



ARMOR SETUP AND BASIC CONTROLS

Common spectrum and polarity settings

- ARMOR Preferences
 - Display / Sensor Spectrum
 - Resolution
 - Noise
 - Mask Type
 - Always / Lifeform / Attached / Never



ARMOR SETUP AND BASIC CONTROLS

Sensor Picture in Picture



ARMOR SETUP AND BASIC CONTROLS

Viewpoints

The screenshot displays the ARMOR software interface. On the left, a 'Viewpoints' menu is open, listing various locations. A red dashed box highlights the menu area. Below the menu, a 'Viewpoint Name Entry' field is shown with a text input. To the right of the menu, a 3D landscape view is displayed, showing a green field with trees and a distant town. The interface includes several control buttons and a status bar at the bottom.

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

Viewpoints List:

- Cyprus
- Sardinia
- Scotland
- Seattle
- vancouver
- Portugal
- VP1
- IADSL
- IADSL2
- Brighton1
- Alpsport Callan
- sam site
- WARTS Route Eval
- Viewpoint
- AAA
- north sardinia

Viewpoint Details:

- Latitude: 40.30963
- Longitude: 8.594745
- Altitude: 349.8229
- Heading: 148.7736
- Pitch: -24.05593

Status Bar:

32T MK 57916 62175 1,144 ft MSL 2645 1 16 Feb 2023 15:40:00

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

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



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
- 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

MACE SIMPLE ENTITY CONTROL

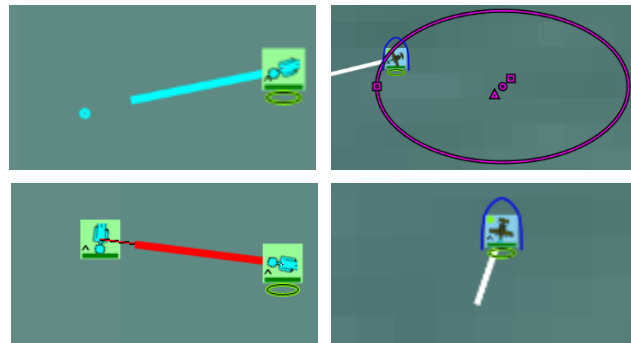
Intent and delta

- 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 interface includes 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 +/- buttons in the speed/heading/altitude fields.
- WP CYCLE**: Cycle button
- INTENT**: Intent button
- PRF**: PRF button
- Coord Action**: Coord Action dropdown menu
- Orbit Location**: Orbit Location button
- Attack Location**: Attack Location button
- Centre Map**: Centre Map button
- Camera Slew to Location**: Camera Slew to Location button



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

The Entity Control Tapes interface includes the following controls and 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
- YELLOW = INSTANT**: Yellow tape indicator
- RED = TARGET VALUE**: Red tape indicator
- MSL**: Mean Sea Level indicator



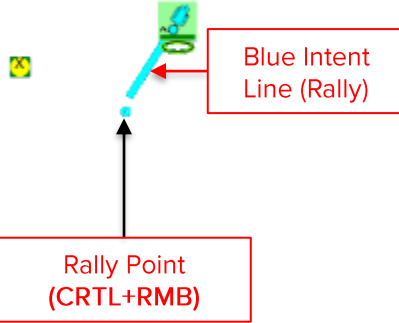
MACE SIMPLE ENTITY CONTROL



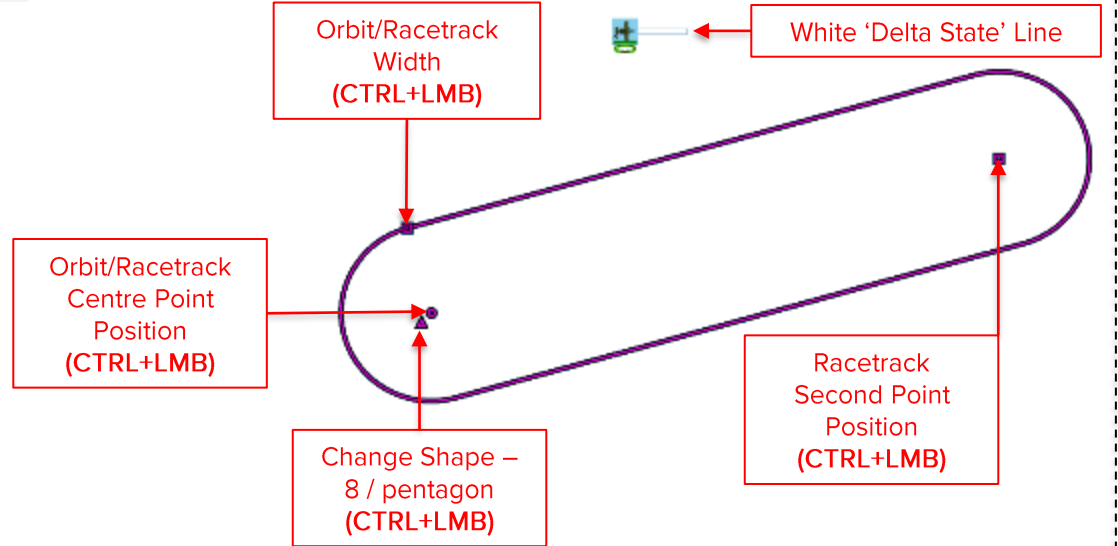
RETURN TO INTENT



GROUND PLATFORM (CTRL+RMB) RALLY



AIRCRAFT PLATFORM DELTA (CTRL+ RMB) ORBIT



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

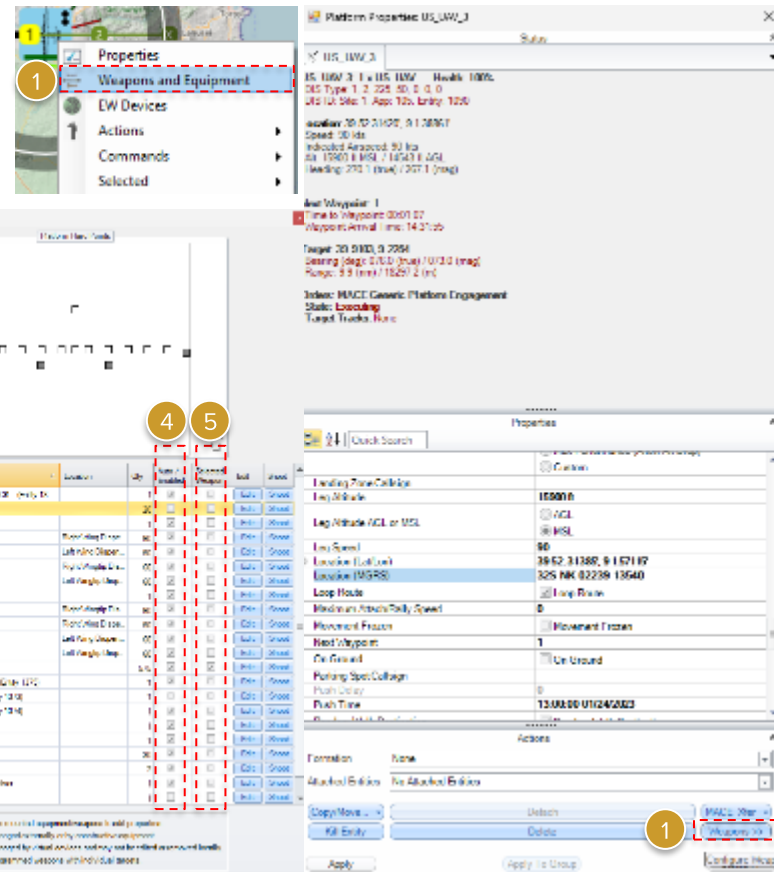
- [-->] Add 1 x Weapon
- [<--] Remove 1 x Weapon
- [<--<] Remove ALL weapons

(4) Change Quantity of Weapons

(5) Enable/Disable Auto

- Allows constructive (semi automatic) use weapons/ equipment

[SCL]– save weapons load outs and restore them



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  Weapons 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

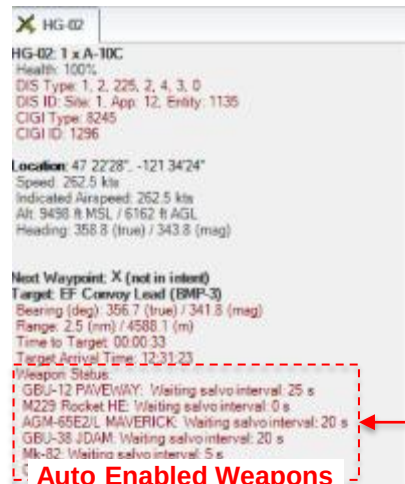
Weapon Release



Target & Attack



Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
IR Signature		1	☒	☐	Edit
Generic Air RADAR		1	☒	☐	Edit
Generic Air to Air Missile		1	☒	☐	Edit
Generic Air to Air Missile		1	☒	☐	Edit
Generic Air to Ground Missile		1	☒	☐	Edit
Generic Air to Ground Missile		1	☒	☐	Edit
Generic Aircraft Bullet		400	☒	☐	Edit
Generic Aircraft Visual Detection		1	☒	☐	Edit
Generic ARM		1	☒	☒	Edit



Auto Enabled Weapons

MACE SIMPLE ENTITY CONTROL

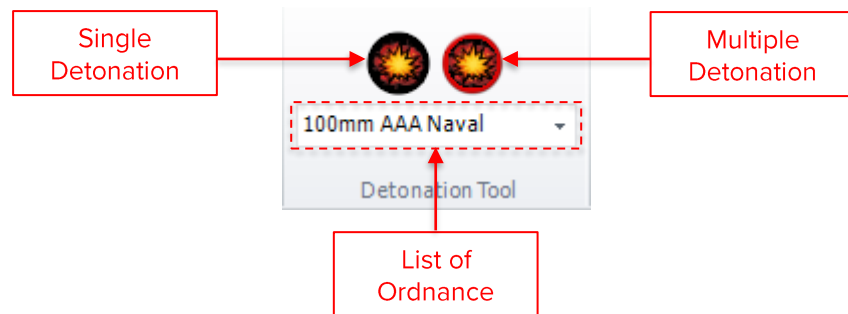
Detonation Tool and Resurrection

- Detonation Tool
 - Pick from list any ordnance
- Resurrection
 - Individually from **Platform Properties**
 - Raise ALL the Dead: **CTRL+R**

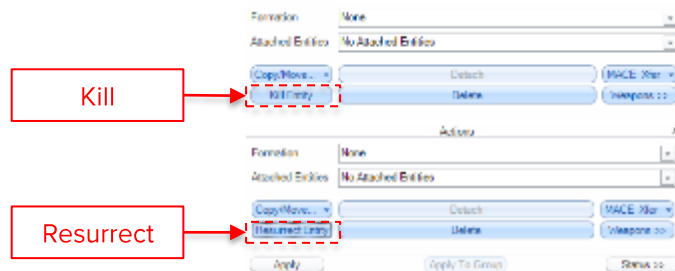
SHORTCUTS
CTRL + R

Resurrect all dead entities

Mission Controls: Detonation Tool



Platform Properties



MACE ENTITY ICONS

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:

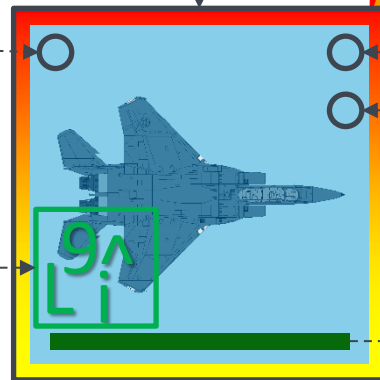
-  Sensor line and swathe
-  Attached to entity (formation)
-  Target line
-  Track Line

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

DAY 1 - REVISION (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 manoeuver 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



BUILDING ARMOR TERRAIN

Learning objective:

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

Enabling objectives

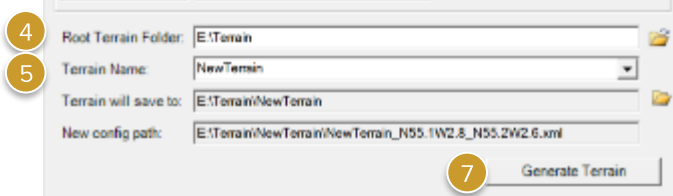
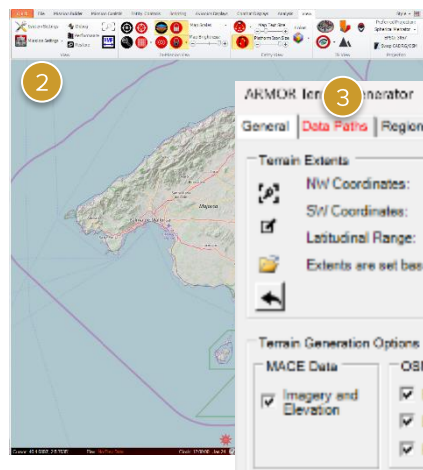
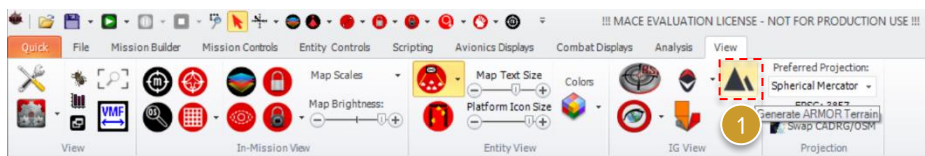
- Understand how to correctly set the data paths in the MACE-ARMOR Terrain building plugin
- Understand the functions of the different terrain data sources
- Know how to build a terrain in the correct directory
- Understand the ARMOR terrain caching process

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

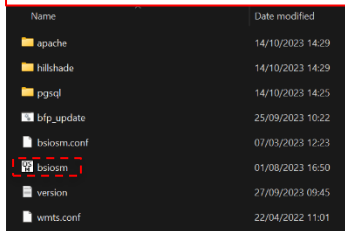


BUILDING ARMOR TERRAIN

Worldwide Mapping

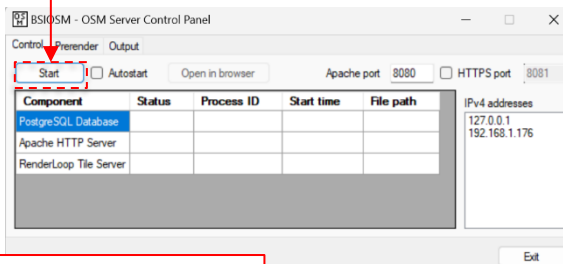
1

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



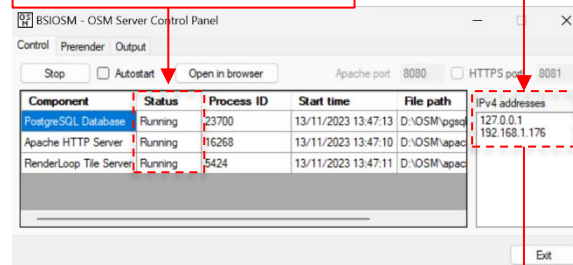
2

Start the OSM Applications



3

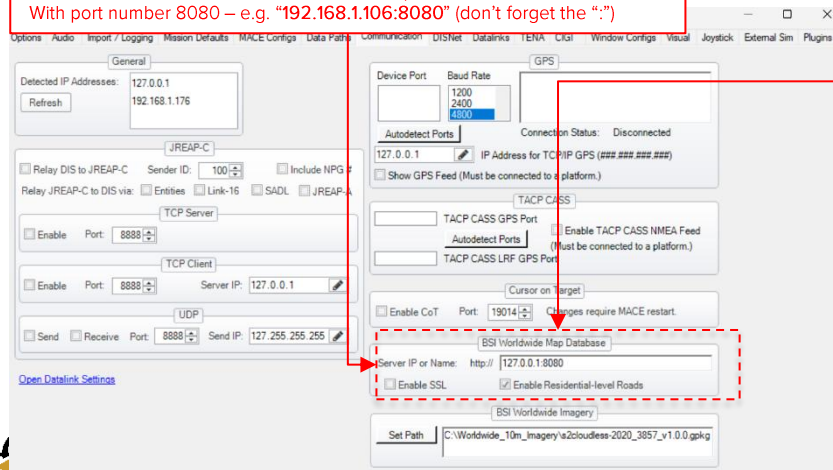
Verify the applications are running
Note: the IPv4 Address



4

MACE>Visual>System Settings>Communication

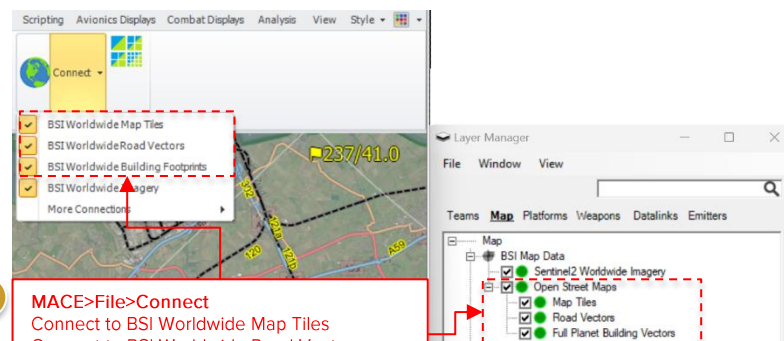
Put the IPv4 Address in the BSI Worldwide Map Database Field
With port number 8080 – e.g. "192.168.1.106:8080" (don't forget the ":")



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

ARMOR Terrain Generator

General | **Data Paths** | Regions | Tile Downloader

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

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

Set path

Water polygons data path (required for coastlines generation)

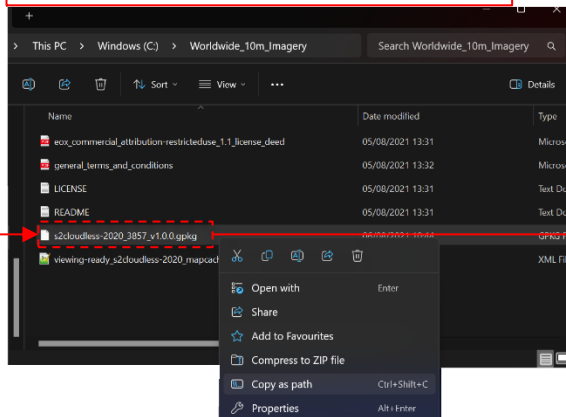
Set path

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

Set path

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

MACE System Settings

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

General

Detected IP Addresses: 127.0.0.1, 192.168.1.176

Relay DIS to JREAP-C: ☐ Sender ID: 100 Include NPG: ☐ Relay JREAP-C to DIS via: ☐ Entities: ☐ Link-16: ☐ SACL: ☐ JREAP-A: ☐ TCP Server: ☐

Device Port: 1200, 2400, 8080

Autodetect Ports: ☐ Connection Status: Disconnected

127.0.0.1 IP Address for TCP/IP GPS (set #00 #00 #00)

Show GPS Feed (Must be connected to a platform): ☐

TACP CASS: ☐ TACP CASS GPS Port: Enable TACP CASS NMEA Feed: ☐

Technical Data Link

J-Series Version: MIL-STD-6016F Set Simulation Indicator: ☒ K-Header Version: MIL-STD-2045-47001C

Server IP or Name: http://127.0.0.1:8080 Enable SSL: ☐ Enable Residential-level Roads: ☒

Set Path

SACL

Default Division ID: Guard Channel: 7 Channel Hopping: 7

Gateway Key: 6 Air Key: 6 Ground Key: F

Headline: 165 Headline Type: 7 - Multi Source

Time Out: 120 Auto-Group: ☐

Drop Track Time (s): 120 Air Tracks (m): 6,000.00

3

MACE>File>Connect
Connect to BSI Worldwide Imagery

Connect

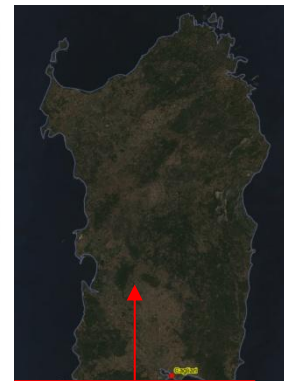
BSI Worldwide Map Tiles

BSI Worldwide Road Vectors

☒ BSI Worldwide Imagery

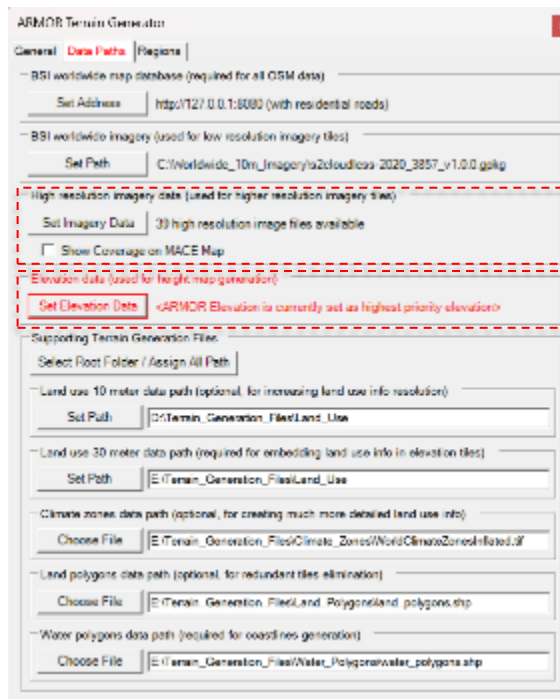
4

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 GSM data)

Set Address [http://127.0.0.1:8080 \(with residential roads\)](http://127.0.0.1:8080 (with residential roads))

BSI worldwide imagery (used for low resolution imagery tiles)

Set Path C:\Worldwide_10m_Imagery\azcloudless-2020_3857_v1.0.0.gpkg

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

Set Imagery Data 30 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 E:\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

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

Choose File E:\Terrain_Generation_Files\Climax_Zones\WorldClimaxZonesHatched.tif

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

Choose File E:\Terrain_Generation_Files\Land_Polygons\land_polygons.shp

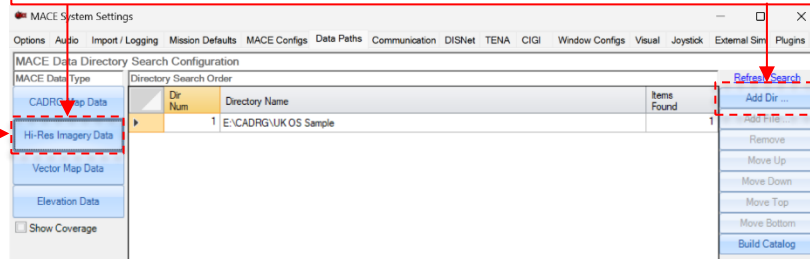
Water polygons data path (required for coardest generation)

Choose File E:\Terrain_Generation_Files\Water_Polygons\water_polygons.shp

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 Directory Search Order

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

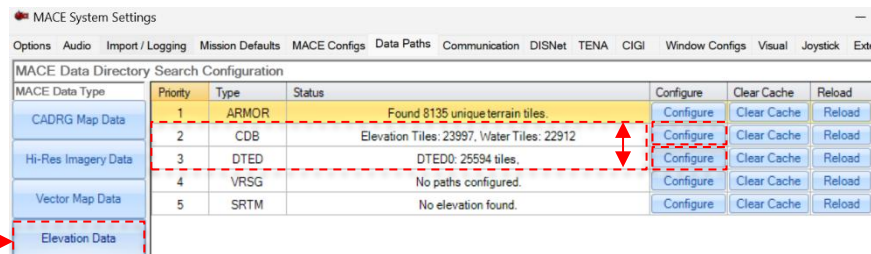
Show Coverage

Buttons: Refresh Search, 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
Elevation Data	4	VRS	No paths configured.	Configure	Clear Cache	Reload
	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 CGM data)

Set Address

BSI worldwide imagery (used for low resolution imagery files)

Set Path

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

Set Imagery Data

☐ Show Coverage on NACE 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 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)

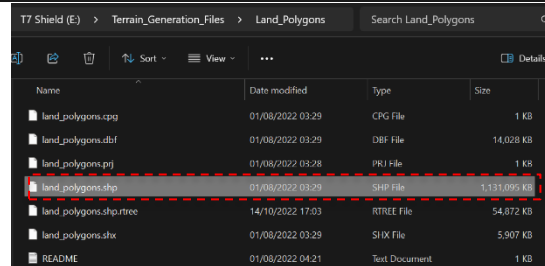
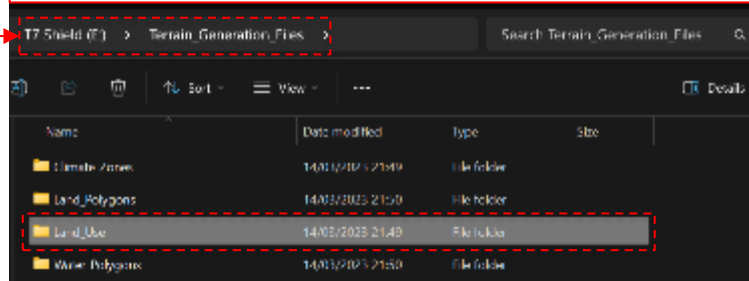
Choose File

Water polygons data path (required for coastlines generation)

Choose File

1

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

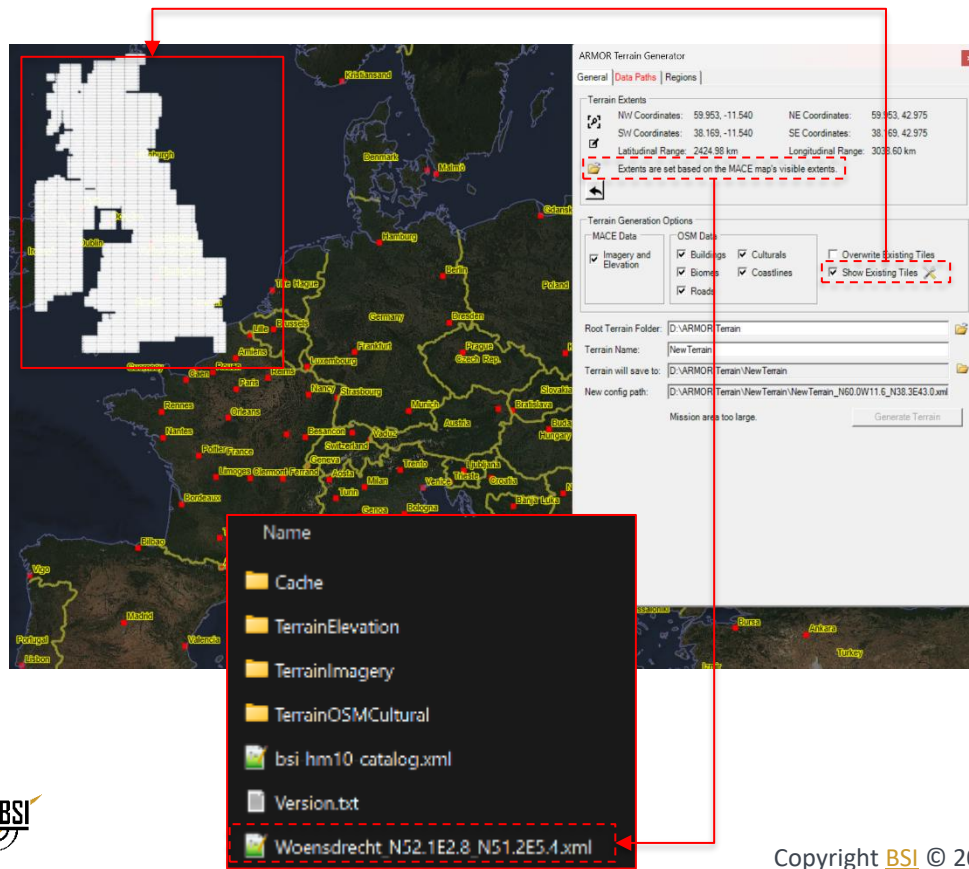


2

OR Select each directory individually

BUILDING ARMOR TERRAIN

Select Terrain Build Area



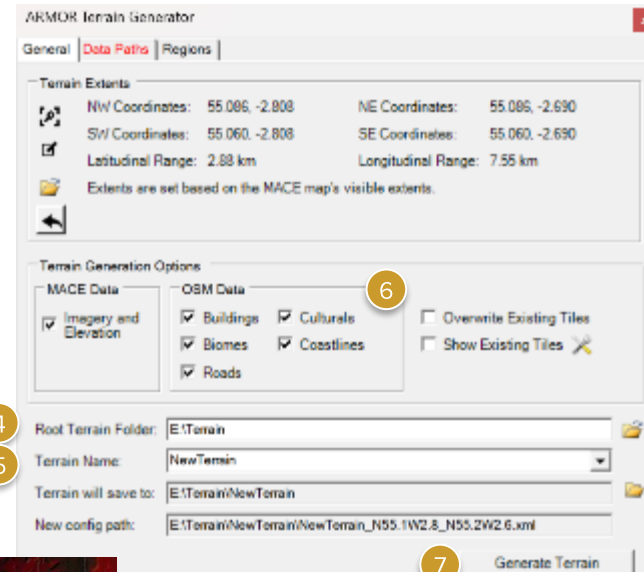
- ARMOR Terrain
- Sardinia
- Pacific Northwest
- A N Other Terrain
- A N Other Terrain 2

- 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 & ARMOR MANUAL ENTITY & CAMERA CONTROL

Learning objective:

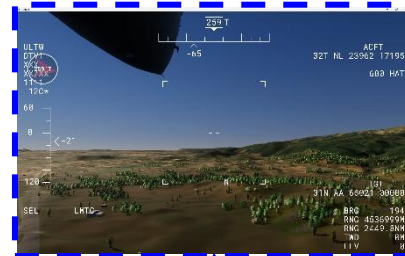
- Understand how MACE own-ship views controls are configured and manifest in control within ARMOR

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

Ownship/Sensor – Top/Bottom Lock

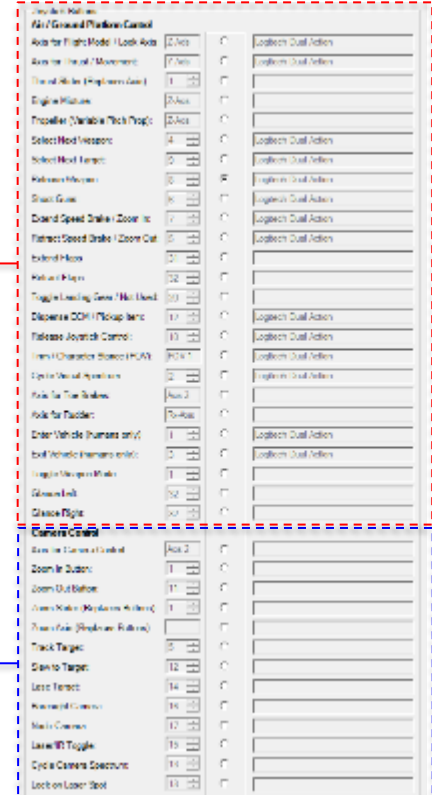
- TOP LOCK**
Visuals & Displays
(Ownship)
Locked to this platform



BOTTOM LOCK
Sensors / Camera
Locked to this platform

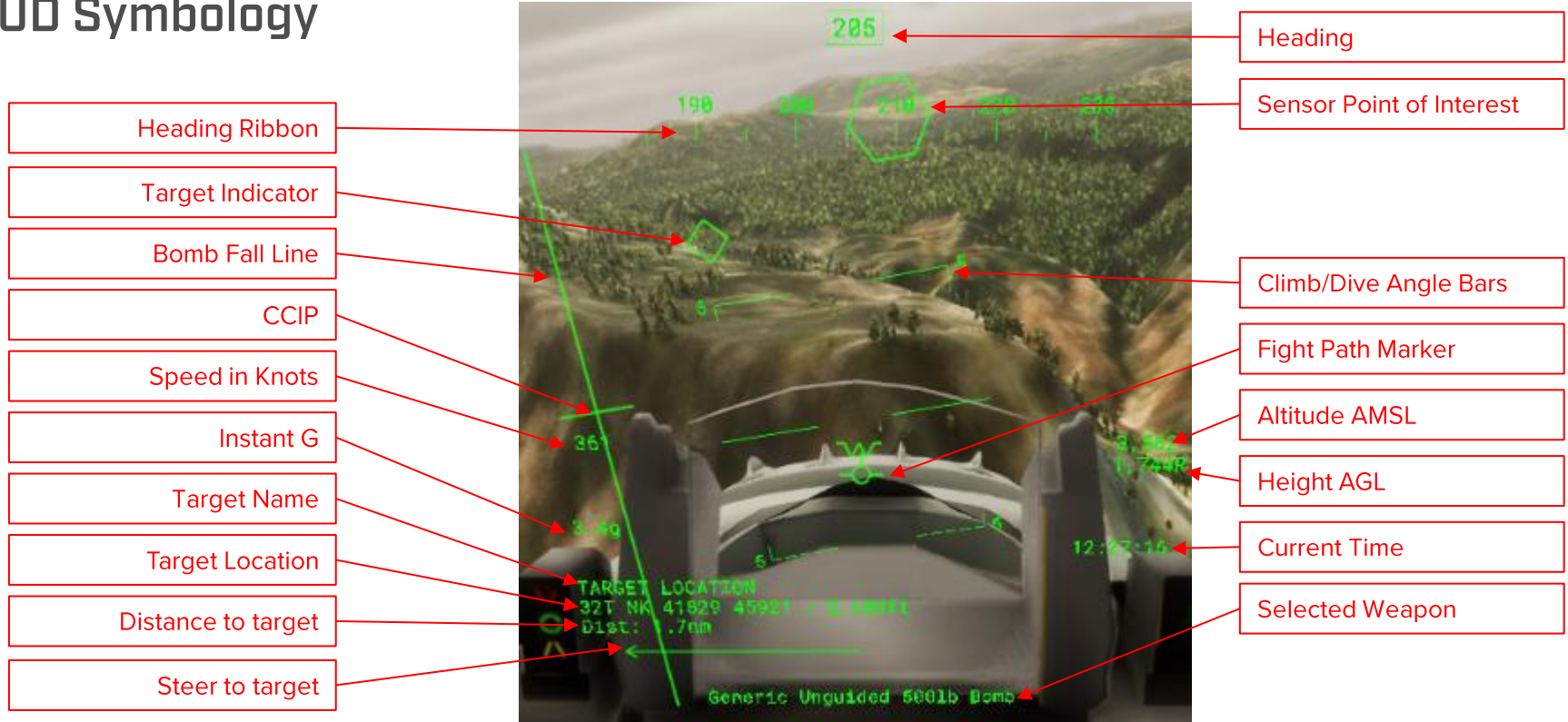


System Settings → Joystick



MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

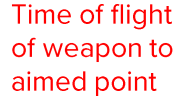
HUD Symbology



HUD Symbology – Air to Ground



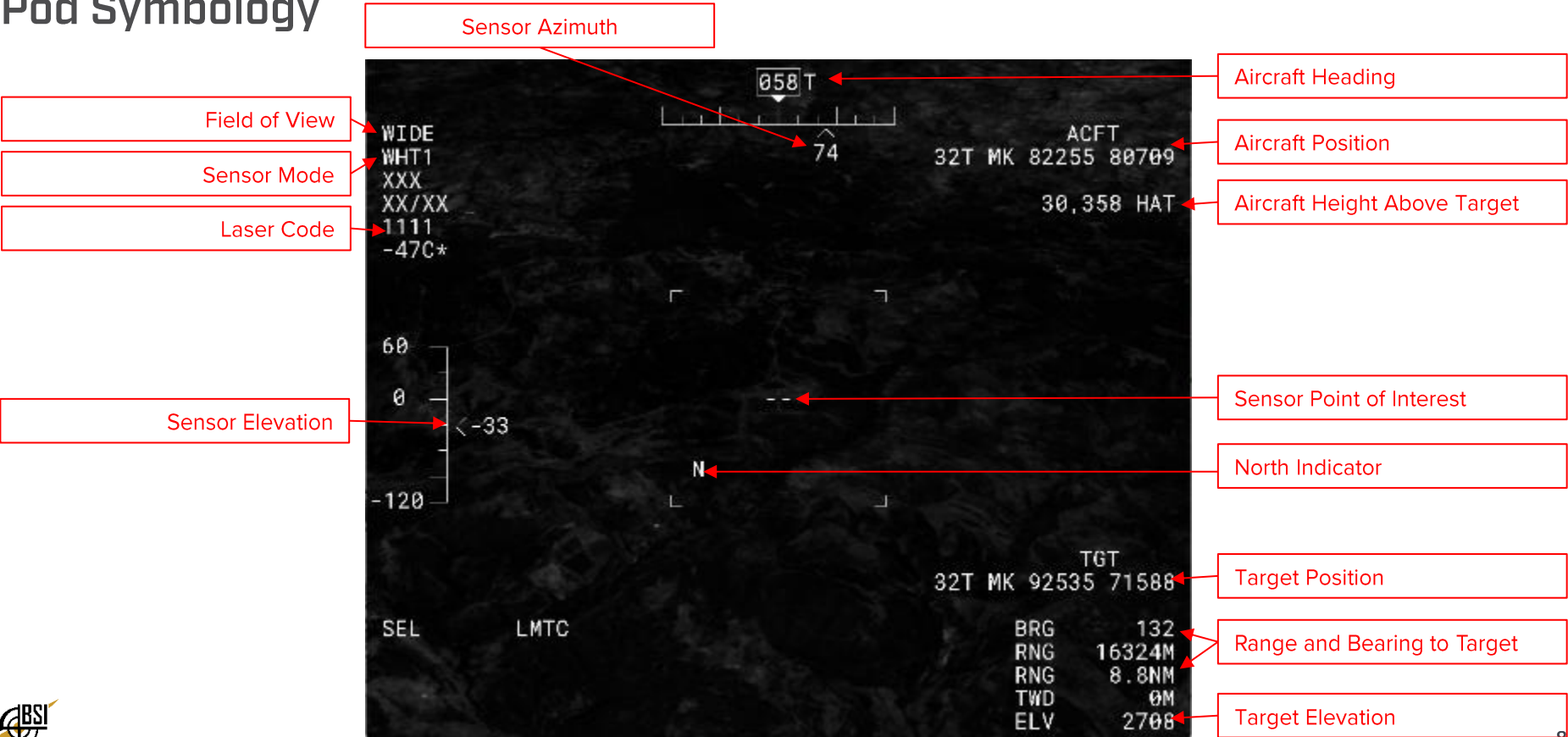
- **Release Point Indicator** is in view = in range of target
- **Release Point Indicator** crosses **Flight Path Marker** = Optimum release point



- 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

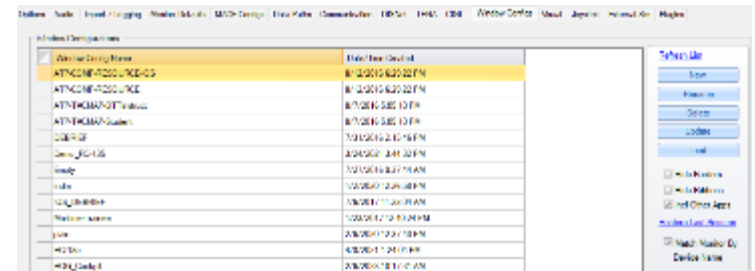


- Displays can be repositioned only when borders showing
- Double RMB Click on display to remove borders
- **System Settings > Window Configs**
 - Save and Restore Window Arrangements
 - Bind to a joystick button



TOP LOCK

Visuals & Displays
(Ownership)
Locked to this platform



MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

Typical Joystick Controls – Logitech F-310

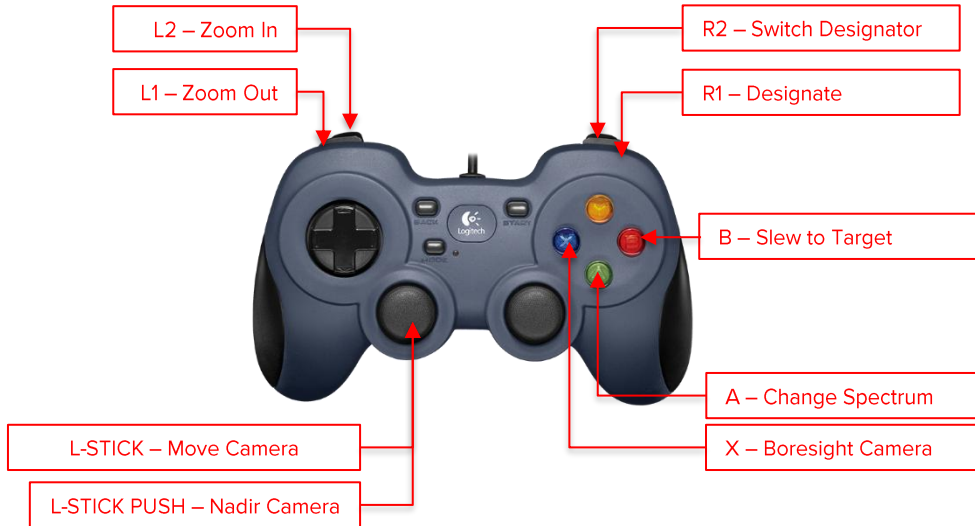
System Settings → Joystick

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

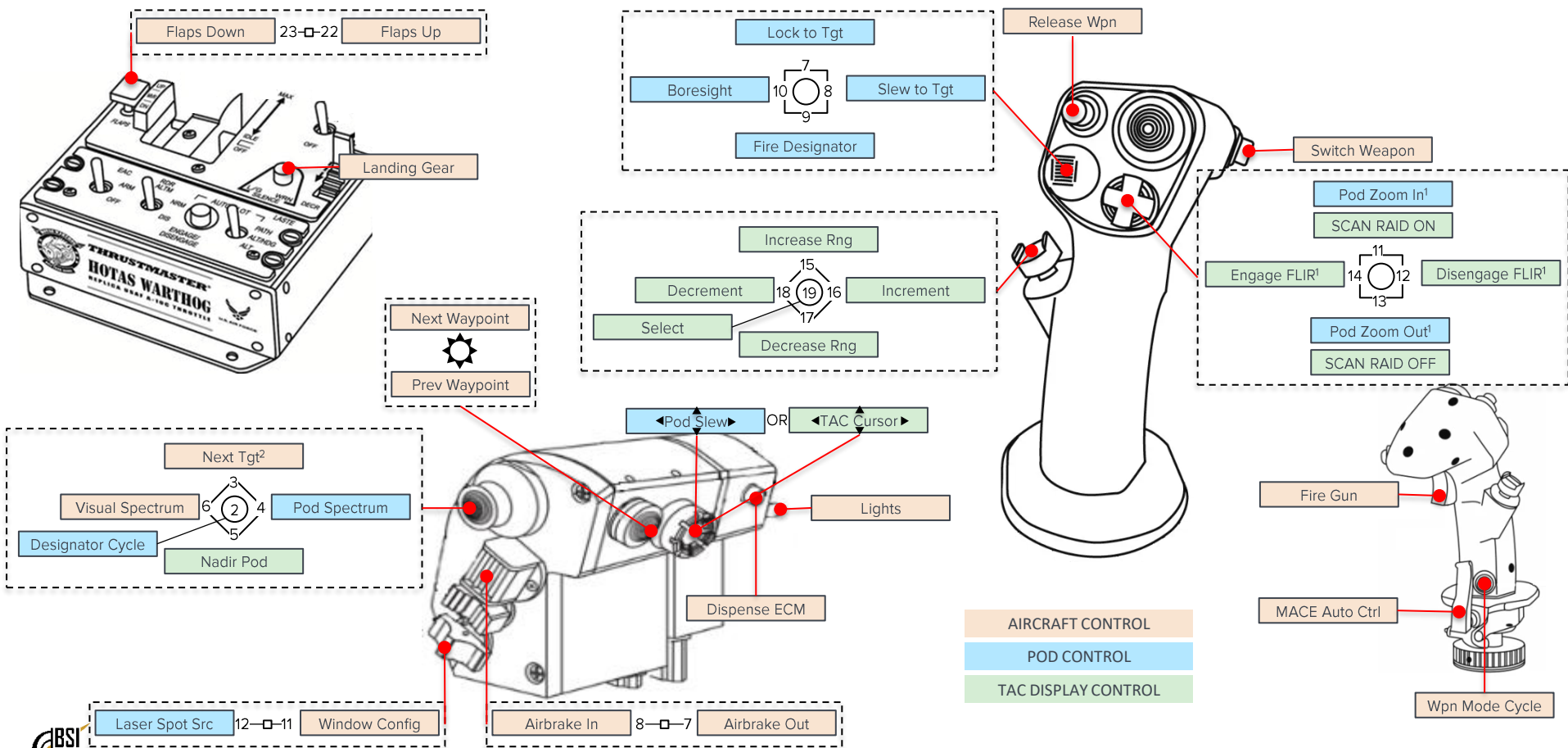


OWNSHIP CONTROL



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 87

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

☒ Continuous ☐ Step

Slew Rate (deg/FOV): 0.0100

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

☒ Color ☐ B/W ☐ NVG

☐ IR ☐ BH ☐ WH

Zoom

+ -

x /

1

Camera Direction

North

Southeast

Southwest

South

Image Capture

MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

Environment Settings



Date and Time
Time Zone

Clear / Open / Save
Environment settings

Refresh (if not auto
refreshing) in visual

Weapons and Aircraft
drift with wind

Fog and Haze

Cloud Layers
Thickness
Coverage

Rain and Snow

Sea States

Time of Day

Start Time (UTC): 13:00:00 January 24
Time Zone: (UTC) Coordinated 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 Atmospheric Data

Visibility: 10000 ft
Standard: 62.1 km
Ground Fog: Continuous

Cutting MSL (ft): 0 Visibility (ft): 0
Continuous

Clouds

Upper Layer: D0 Clear Thickness: 2000 ft
at: 0 0-10000 ft MSL

Lower Layer: D0 Clear Thickness: 2000 ft
at: 0 0-10000 ft MSL

Precipitation

Name: Rain Rain 0.5 in MSL

Effects

Lighting: Sea State: Calm (Glassy)

Storm System

Enable (Overrides Weather Region Cloud Layers and Precipitation)

System Type: Select Location Lat: 00 Lon: 00 Display Un Map

Dimension: 0.5 deg Altitude Offset: 0.5 ft Growth Decay Rate: 0.5 Span: 0.5 min

Controls

Lower Alt (ft): -1 Upper Alt (ft): -1
Use -1 to not automatically calculate when controls parameter

Fixed or Variable winds
with limits

Fixed or Variable winds
with limits

Editable table of winds at
different altitudes

MACE & ARMOR MANUAL ENTITY & CAMERA CONTROL

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 00000KT 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

NOTE – AIRFIELD DATA

MACE can pass only airfields that are published as ARINC data by respective country aviation authorities

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 1st 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

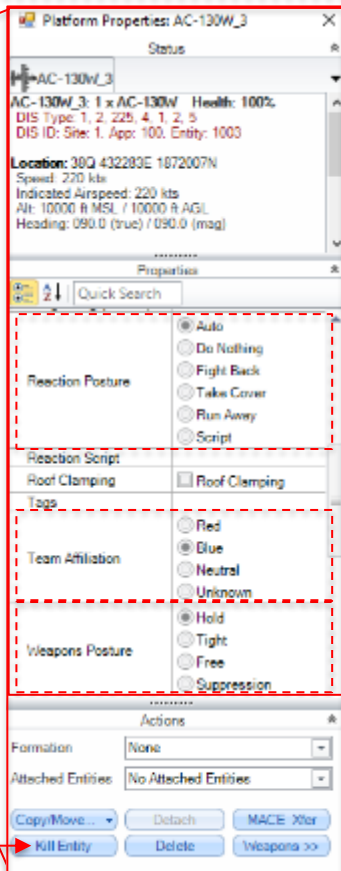
CHANGING WEAPON POSTURE, REACTION POSTURE

FROM PLATFORM PROPERTIES

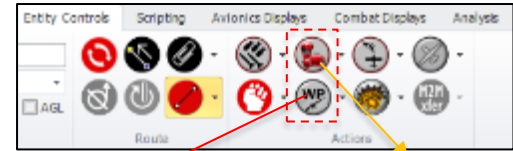
1. RMB on Platform



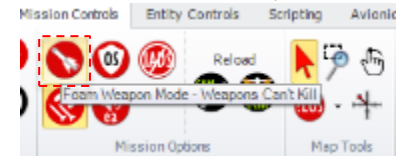
2. LMB on Properties



FROM ENTITY CONTROLS MENU



Mission Controls → Mission Options



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 LOS 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
	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

Weapon

Infrared Warning Receiver

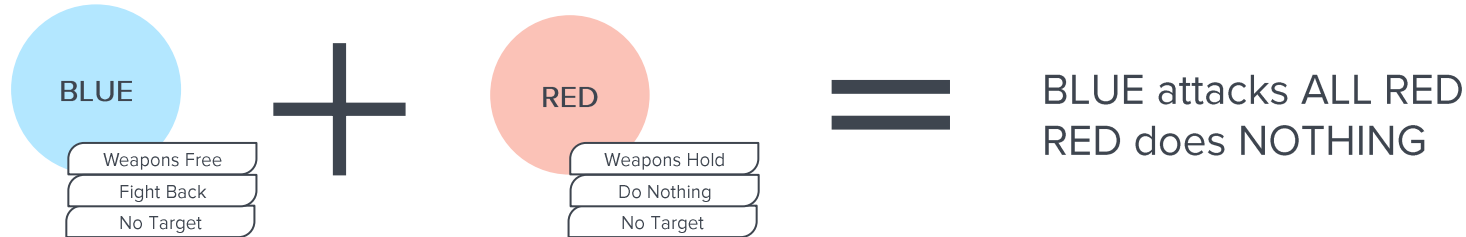
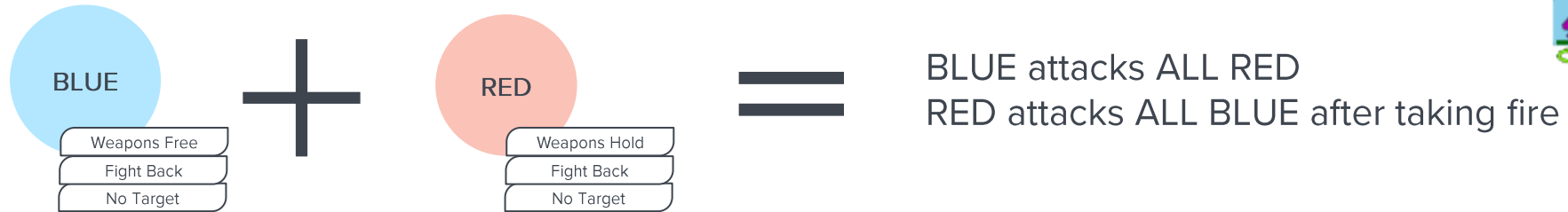
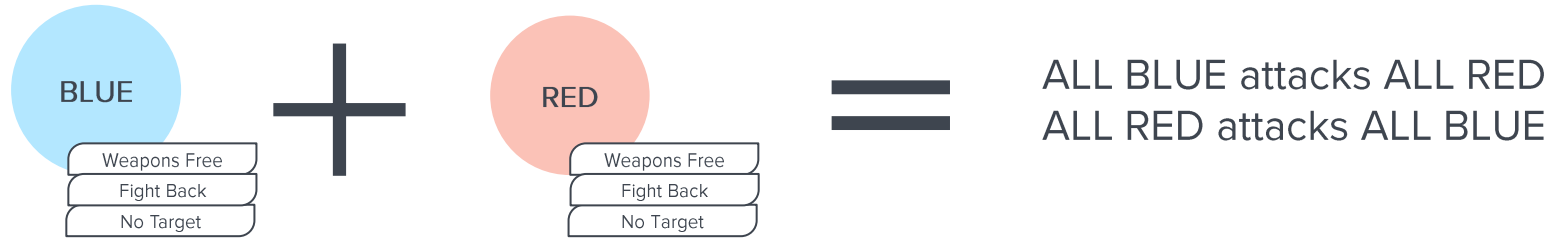
Laser Indicator Warning Device

RADAR Warning Receiver

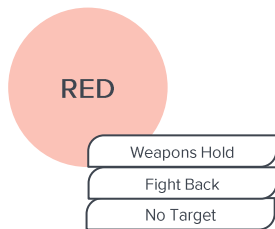
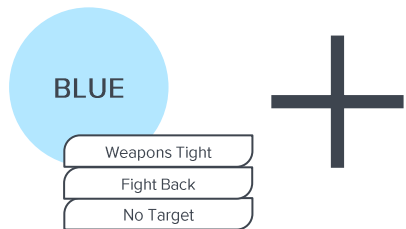
Visual Detection Airborne (A/L/S)



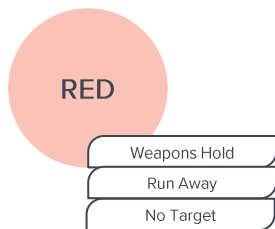
MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS



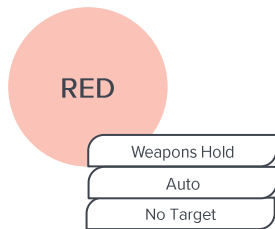
MACE SEMI-AUTONOMOUS PLATFORM BEHAVIOURS



No one attacks anyone



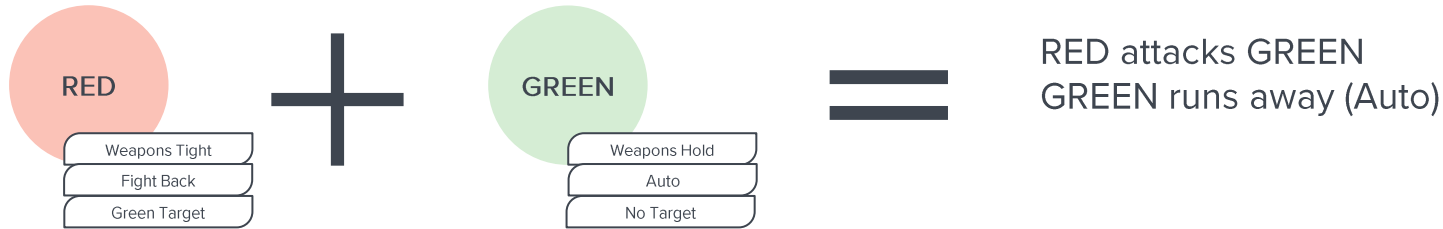
BLUE attacks TARGETED RED
RED runs away



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

MACE & ARMOR SHAPES

Learning objective:

- Learn how create, save, load and display 3D shapes in MACE and ARMOR

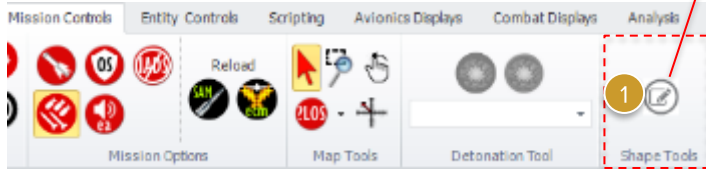
Enabling objectives

- Understand the basic functions of the MACE Shape tool
- Know how to draw basic shapes in MACE
- Understand 3D properties of MACE shapes
- Know how to change the appearance of shapes when creating
- Know how to save shape files
- Know how to import shapes to MACE (including ACO files)
- Know how to 'push' shapes to ARMOR
- Know how to edit the appearance of existing shapes

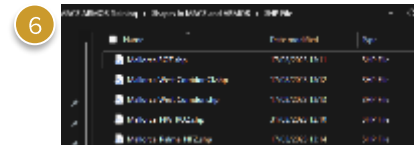
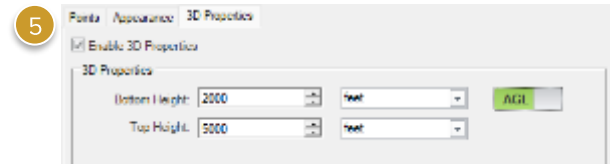
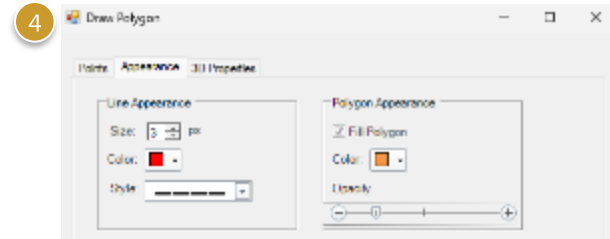
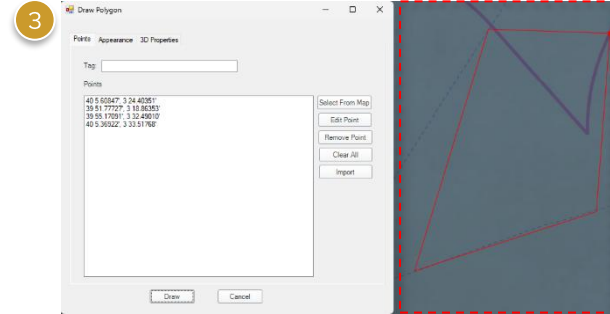
MACE & ARMOR SHAPES

Creating Shapes in MACE

MISSION CONTROLS → Shape Tools



- (1) Mission Controls → Shape Tools
- (2) Select Shape
- (3) Draw Vector Shapes on MACE Map
- (4) Assign Appearance Properties
- (5) Assign 3D Properties
- (6) Select [Draw] + Save with meaningful name!
 - Ideally Save with mission file in subfolder

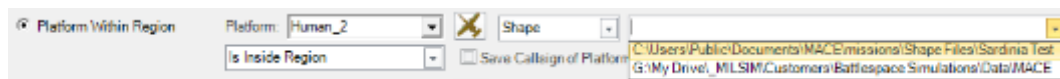
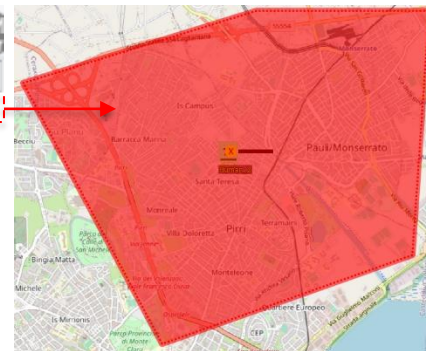
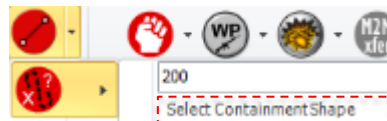
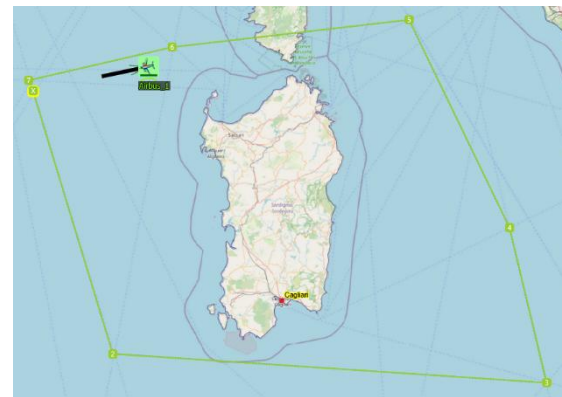
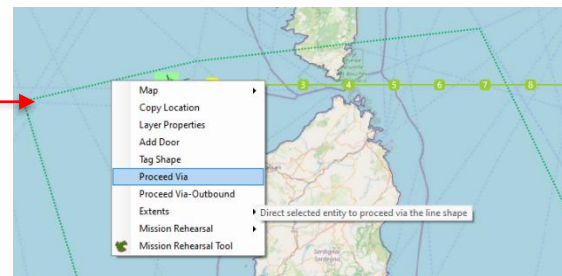


MACE & ARMOR SHAPES

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
- 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

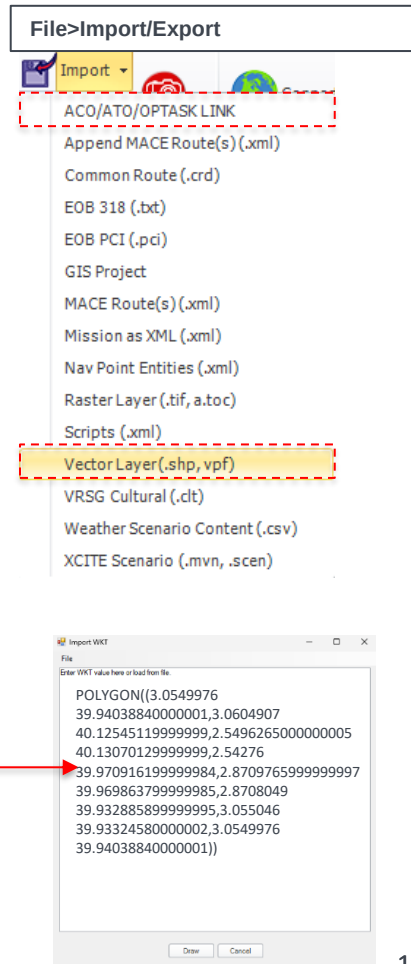


MACE & ARMOR SHAPES

Importing Shapes in MACE



- File Tab Import/Export
 - Vector Layers – Shape Files (.shp)
 - Airspace Coordination Order (.aco)
- Shape Tool – Text Import
 - Well Known Text (WKT)
 - Definition/creation of complex shape geometries
 - Imports and saves as .shp



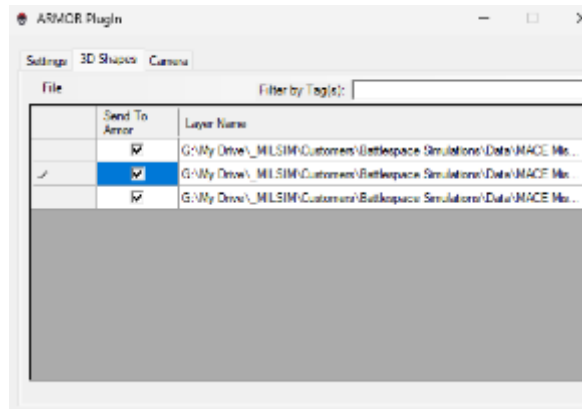
MACE & ARMOR SHAPES

Displaying MACE Shapes in ARMOR

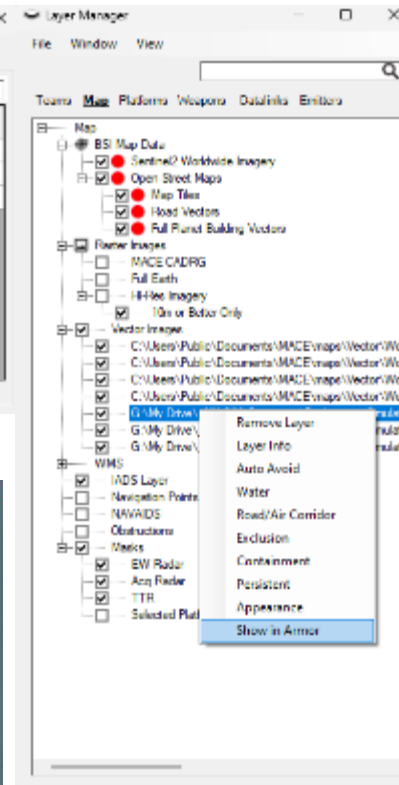
- Displayed via the MACE-ARMOR Plugin
- Only certain shapes (for now) can be displayed in ARMOR
 - Polygons
 - Circles
- Currently It Does Not Display in ARMOR:
 - Corridors
 - Lines
 - Points



Pre 2024 MACE View>IG View



Post 2024 MACE Layer Manager

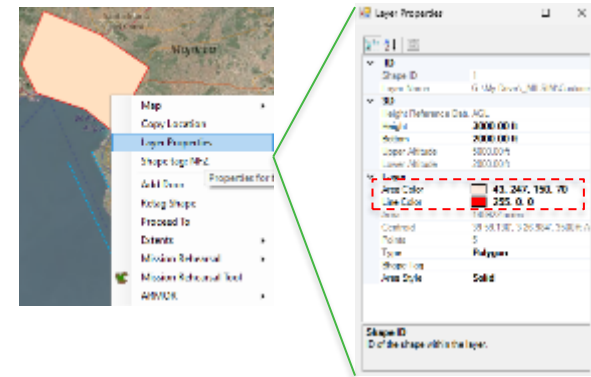


MACE & ARMOR SHAPES

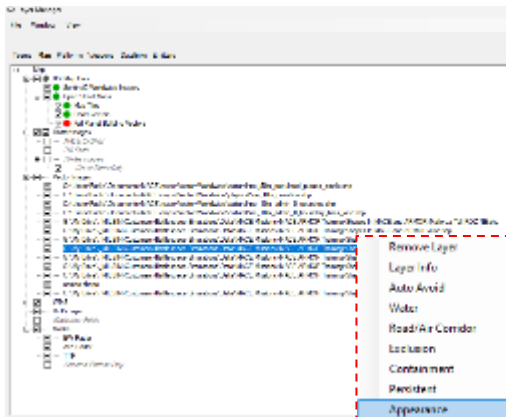
Editing Shape Properties

(1) Quick Colour Changes from the context Menu

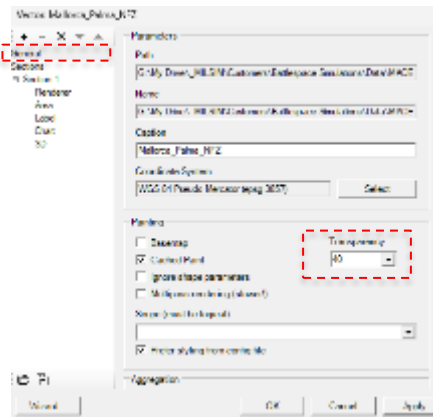
(2) All other changes use the **VIEW → Layer Manager → Map → Vector Images**



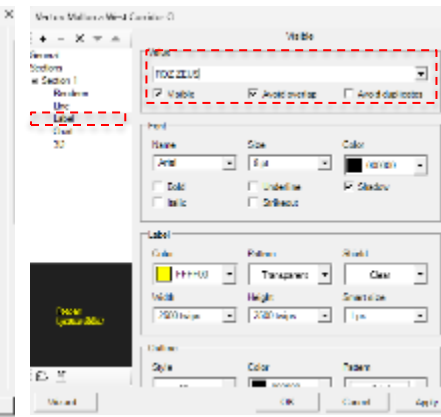
Layer Manager > Map > Vector Images



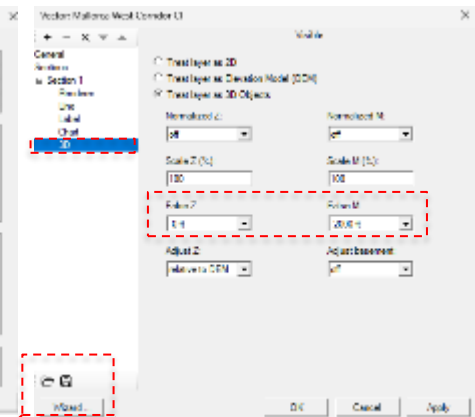
Transparency



Label (MACE Only)



3D Properties – top/bottom height



TIP – REMEMBER TO SAVE CHANGES

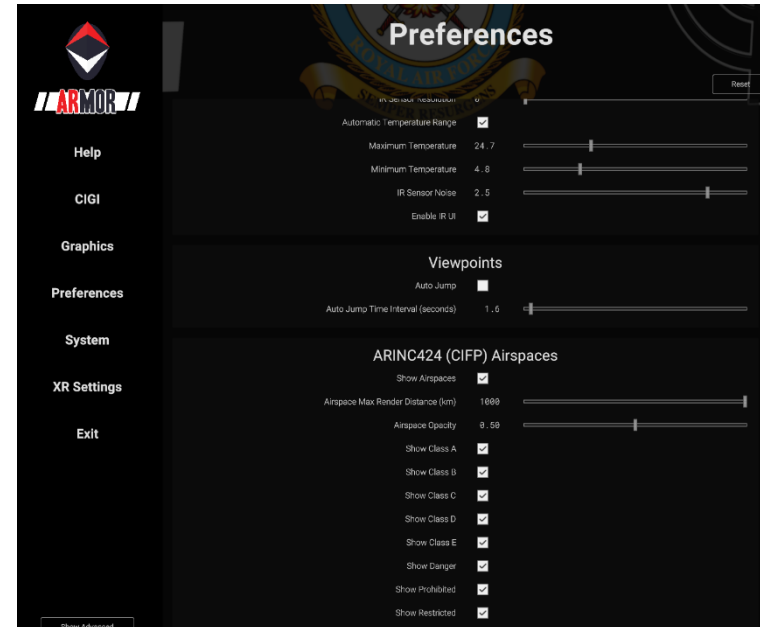
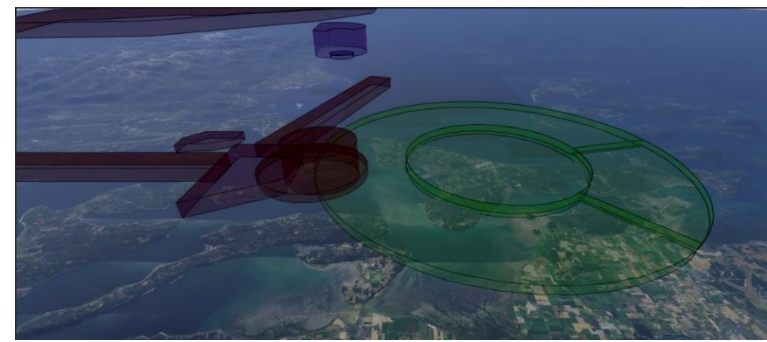
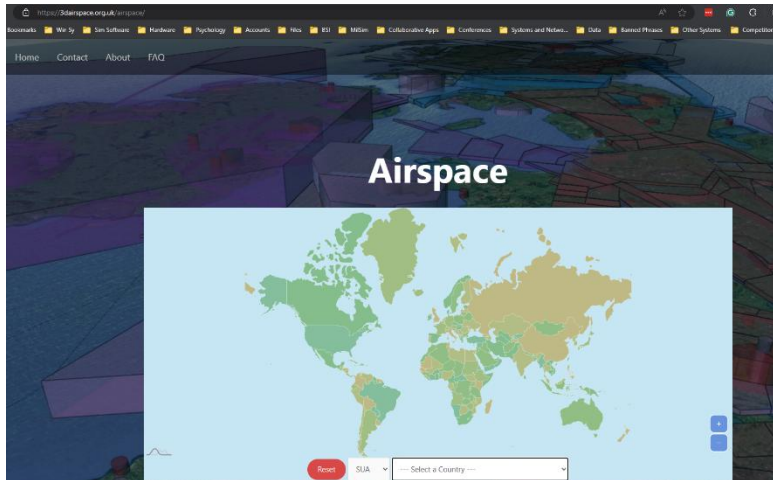
Changes can only be saved by pressing save button in bottom lefthand corner



MACE & ARMOR SHAPES

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



MACE & ARMOR SHAPES

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

1. (00:17) In a NEW mission , place a UAV in a delta orbit, place a FW fighter in a waypoint orbit elsewhere
2. (00:34) Make a ROZ (circle) centered on the UAV orbit, lower altitude 6000ft, upper altitude 15,000ft, 50% transparent – Name something easily recalled
3. (01:42) Make a multi-point line to be the centerline of a corridor
4. (02:42) Make a corridor from the multi-point line
5. (03:21) Make a No Fly Zone (polygon) over a built up area, from ground level to 5000ft, 80% opaque– Name something easily recalled
6. (04:23) Start the mission – push the shapes to ARMOR
7. (04:43) Detach from platform, use the camera to navigate to view the 3D shapes
8. (04:56) Select the FW aircraft and using the context menu have it 'proceed via' the corridor inbound and outbound
9. (06:00) Edit the color and top height of the ROZ to make it 20,000ft
10. (Optional) Import and ACO File

INTERMEDIATE ENTITY [INTENT] CONTROL 1

Learning objective:

- Learn how to control platforms in MACE using waypoints and platform properties

Enabling objectives

- Know how to display platform properties
- 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

THE MISSION WE WILL BUILD

- Set environment
- Save mission
- Add a Soldier – parameter sweep
 - General
 - Callsign
 - Label
 - Preferred Platform
 - Powered
 - Reaction Posture
 - Weapon Posture
 - Navigation
 - Route speed / altitude
 - Loop route
 - On Ground
 - Set appearance – weapon, stance
- Add waypoints – Use ARMOR ‘Y’ Map Matched

SAVE – CHECK – RELOAD

- Copy Soldier 3 different ways
 - With same route - reverse
 - With offset route – and move waypoints only
 - Select all 3 – and change callsigns one by one
 - Change reaction posture to take cover apply to all Formations for soldiers
- Echelon – change offset
- Trail route – move waypoints on leader and follower

SAVE – CHECK – RELOAD

- Add Friendly APC Near Soldier
 - M-Kill and F-Kill it
 - Make Powered for IR

SAVE – CHECK - RELOAD

- Add a helipad
 - Change team to blue
 - Change Callsign to LZ-1 and Label the same
- Add 500m Range ring
- Add Known Point within 30m of LZ
- Name – Mark
- Add 1 x Enemy APC a mile away
- Parameter sweep – ‘do nothing’ and route speed 10mph
- Pathfinding + CTRL + RMB Click to attach to road to route towards soldiers

SAVE – CHECK - RELOAD

- Add CH-47
 - Parameter Sweep - on ground – do nothing – route speed and alt – invulnerable
 - Name LZ as LZ-1
- Add waypoints for CH-47
 - Add a loiter waypoint action
 - Add an RTB action
- Add 2 x Soldiers
 - Attach to CH47
 - Detach
 - Attach to Position
 - Force Attach

- Copy CH-47 and change
 - Change into AH-64
 - Disable all but guns as auto weapons
 - Delete all waypoints
- Add B1 Bomber Aircraft – equip with GPS weapons – place in loiter
- Add Ground Attack Aircraft
 - Place in Loiter Racetrack
 - Parameter Sweep – Callsign – Label – Route values – Auto RP-Concealed
- Copy Aircraft
 - Change callsign
 - Formation on leader
 - Advanced Formation / Easy Formation

SAVE – CHECK – RELOAD

Execute Mission

- Make AH and CH take off
- CH-47 into intent
- CH 47 steer to loiter WP
- AH-64 formation on CH-47 – change elevation offset
- Rally soldiers to near LZ
- Det Tool smoke at Mark
- Before CH-47 lands put AH-64 in loiter over LZ
- Attach soldiers to landed CH-47
- CH-47 Take off
- Simple attack for Ground attack aircraft on 1 EF APC
- Simple attack for AH-64 on another EF APC

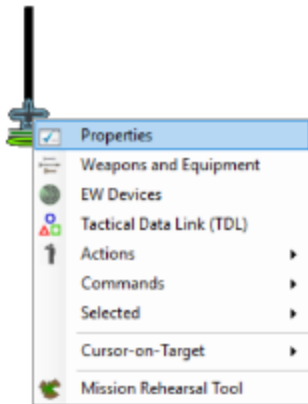
THIS EXECUTION IS ALL SCRIPTABLE – SEE LATER LESSON



INTERMEDIATE ENTITY (INTENT) CONTROL 1

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

A screenshot of the 'Platform Properties: JEFF-02' window. The window has a title bar with 'Platform Properties: JEFF-02' and a close button. Below the title bar is a 'Status' section with tabs for JEFF-02, JEFF-03, JEFF-01, and JEFF-04. The JEFF-02 tab is active, showing a green ellipse around the 'JEFF-02' tab label. The main area is divided into 'Behaviors', 'Connections', 'Data Link', and 'General' sections. The 'General' section contains various fields like 'Aimed Pitch', 'Assigned Role', 'Call Sign', 'Engagement Posture', 'Label', 'Laser Designator Code', 'Model', 'Number in Cell', 'Powered', 'Preferred Platform', 'Proficiency', 'Radar Control', and 'Range Ring'. At the bottom is an 'Actions' section with buttons for 'Formation', 'Attached Entities', 'Copy/Move...', 'Kill Entities', 'Detach', 'Delete', 'MACE Xler', 'Weapons >>', 'Apply', 'Apply To Group', and 'Status >>'. Red dashed boxes and arrows highlight specific areas: 'Active Platform' (title bar), 'Platforms in Group' (tabs), 'Status Window' (JEFF-02 tab), 'Data Entry' (General 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 'forming'
 - Attached entities to this platform – detach
 - Copy / move platform / Waypoints
 - Apply to Group

INTERMEDIATE ENTITY [INTENT] CONTROL 1

Parameter Sweep → Waypoints → Copy & Paste

- Add a Platform
 - Platform Properties
 - Parameter Sweep
- Add waypoints
 - Route Values
 - Leg Values
- Copy Platform 
 - Or use platform Move/Paste
 - Keep waypoints same OR
 - Offset Route

THUNDER	General
Assigned Role	Fighter
Call Sign	THUNDER02
Engagement Posture	☐ Normal ☐ Passive ☐ Aggressive
Label	
Laser Designator Code	1111
Model	Generic Fighter [Supplemental: /
Number in Cell	1
Powered	☒ Powered
Preferred Platform	☐ Preferred Platform
Proficiency	☐ Expert ☐ Competent ☐ Beginner
Radar Control	☐ Auto ☐ Manual
Range Ring	0.00 ft
Reaction Posture	☐ Auto ☐ Do Nothing ☐ Fight Back ☐ Take Cover ☐ Run Away ☐ Script
Reaction Script	
Roof Clamping	☐ Roof Clamping
Tags	☐ Red ☒ Blue ☐ Neutral ☐ Unknown
Team Affiliation	
Transport State Control	☐ Auto ☐ Stowed ☐ Deployed
Unlimited Ammo	☐ Unlimited Ammo
Weapons Posture	☐ Hold ☐ Tight ☐ Fines ☐ Suppression

Navigation	
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	☐ Ignore Terrain Effects
Landing Zone Callsign	
Leg Altitude	800 ft
Leg Altitude AGL or MSL	☐ AGL ☒ MSL
Leg Speed	500
Location (Lat/Lon)	40.22102, 8.46779
Location (MGRS)	32T MK 54717 52425
Loop Route	☒ Loop Route
Maximum Attach/Rally Speed	0
Movement Frozen	☐ Movement Frozen
Next Waypoint	1
On Ground	☐ On Ground
Parking Spot Callsign	
Push Delay	0
Push Time	13:00:00 01/24/2023
Random Walk Destination	☐ Random Walk Destination
Refueler Callsign	
Route Altitude	800 ft
Route Altitude AGL or MSL	☐ AGL ☒ MSL
Route Speed	500
Speed Units	☒ KTS ☐ MPH ☐ KPH ☐ MPS
Target Location (Lat/Lon)	0.00000, 0.00000
Target Location (MGRS)	

Quick Search
Behavior
Connections
Data Link
General
IFF
Lighting
Neurological
Physical

Multiple categories
Use search bar
(Remember to clear)

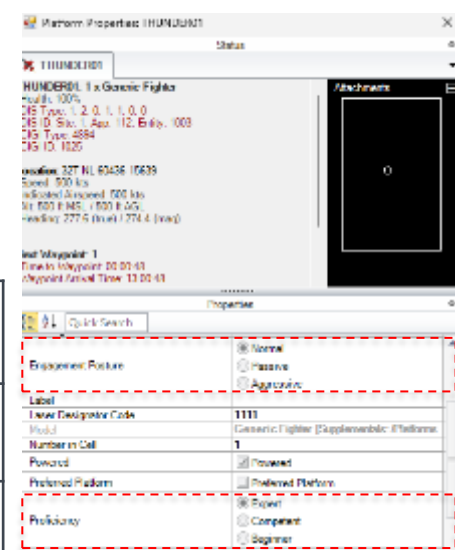
Green Symbols on Platform Icon:

 Entity invulnerable
 Airborne entity is on the ground
 Entity has concealment



INTERMEDIATE ENTITY (INTENT) CONTROL 1

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	Defence: 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 Unguided weapons are accurate. SOC: reacts within 1 second
	Competent	Defence: 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. Unguided weapons have heading and pitch errors of up to 0.5° SOC: reacts within 3 seconds
	Beginner	Defence: Responds slowly to being not release countermeasures and will take 10 seconds. May take several attempts to engage targets. Unguided weapons have heading and pitch errors of up to 1.5° SOC: reacts within 6 seconds



INTERMEDIATE ENTITY (INTENT) CONTROL 1

Adding Waypoints & Value Priority

WAYPOINT PRIORITY

Order of priority

Platform
ROUTE

(if waypoint following)
Overrides all legs in route to this value

Platform
LEG

Applies only to this leg

Waypoint
ROUTE

Overrides all subsequent legs on route to this value but not the ones before

Waypoint
LEG

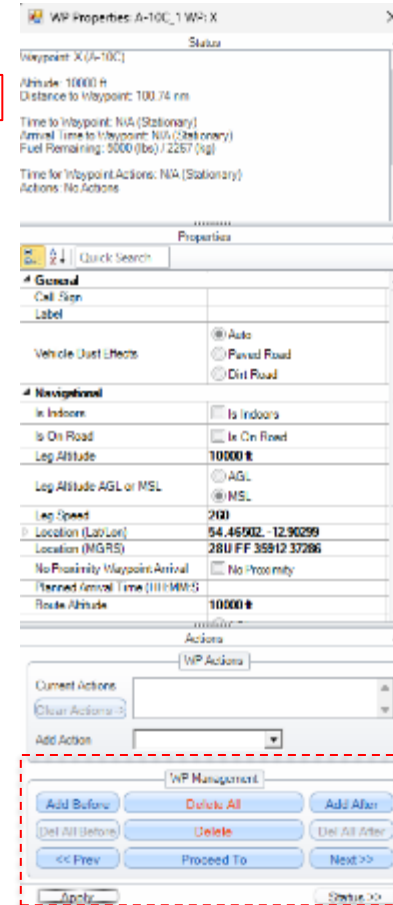
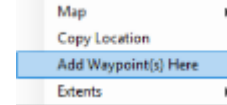
Applies only to this leg



Add Waypoint

OR

RMB on Map



INTERMEDIATE ENTITY (INTENT) CONTROL 1

Steering to waypoints



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



OR

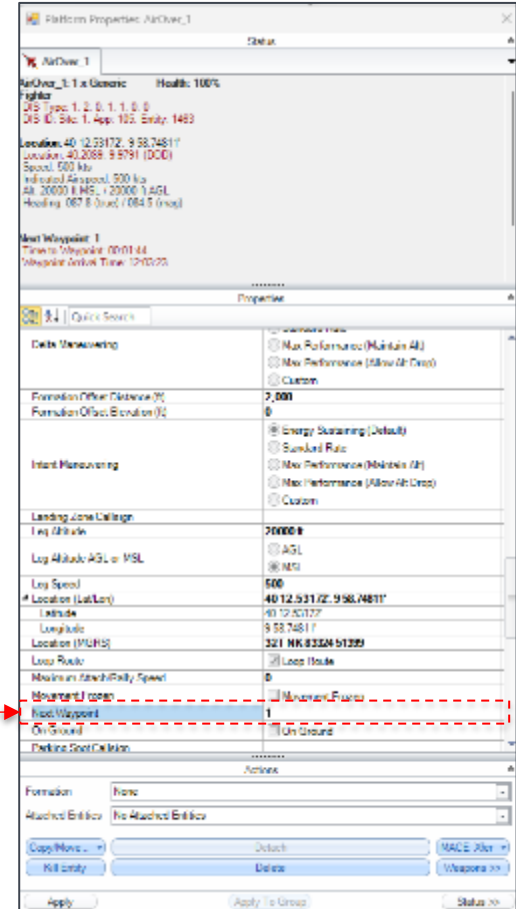
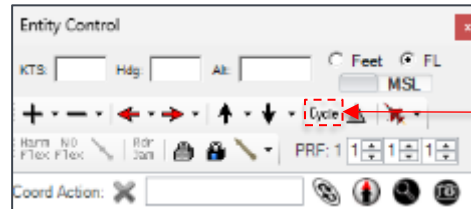
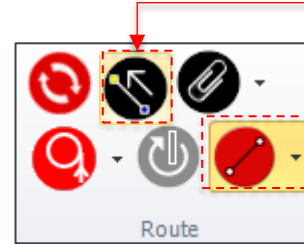
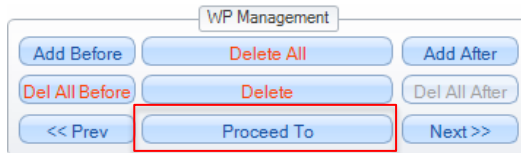
- Type Desired Waypoint in Platform Properties (Navigation)

OR

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

OR

- RMB on Waypoint – [Proceed To]

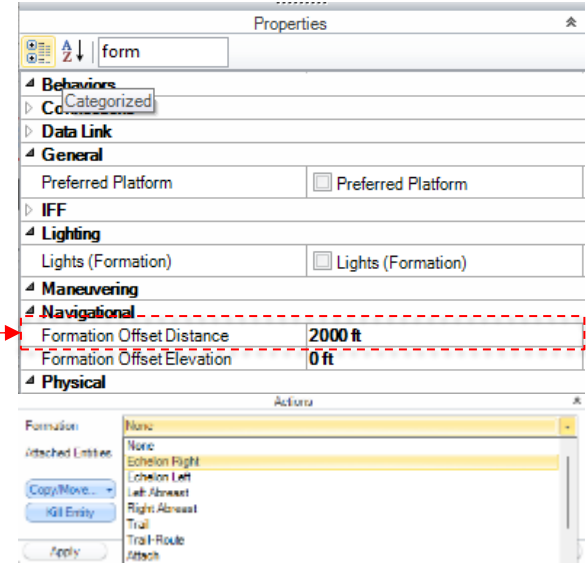


INTERMEDIATE ENTITY (INTENT) CONTROL 1

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

Formation Offset Distance

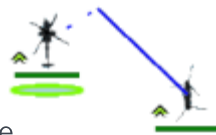


- Select Formation Offset
 - Formation Offset Distance
 - Formation Offset Elevation

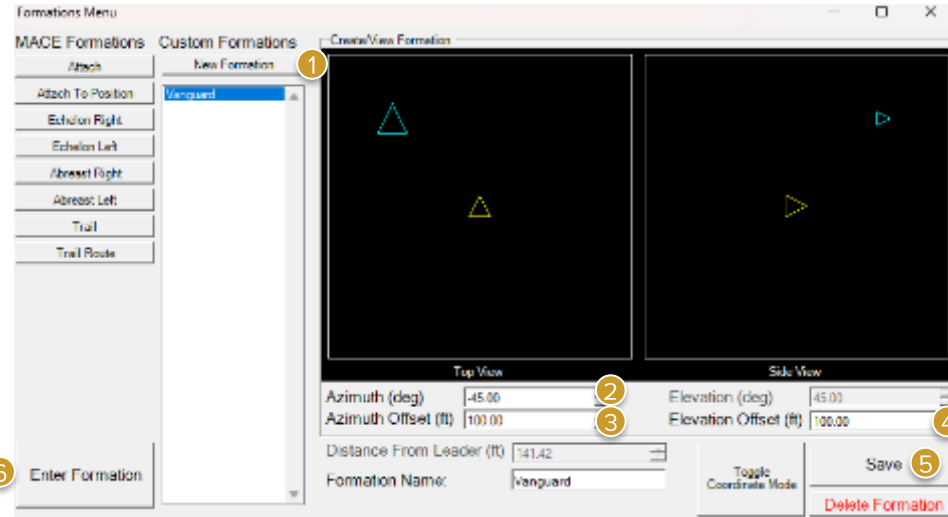
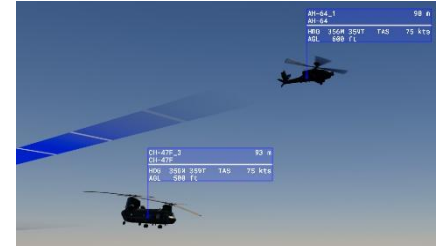
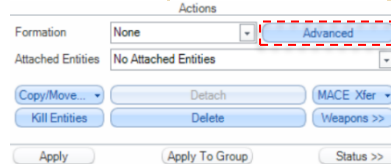
INTERMEDIATE ENTITY [INTENT] CONTROL 1

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
- Mission Builder> ‘Quick Formation’
 - Arrange the platforms on the mission area
 - Select all the entities
 - Press  Easy Formation
 - Select the leader



Platform Properties → Actions [Advanced]



INTERMEDIATE ENTITY (INTENT) CONTROL 1

Attaching Platforms to Other Platforms

- ‘Attaching platforms do the work’... usually

- Method 1: Platform Properties → Action → Formation

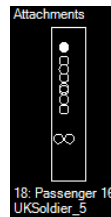
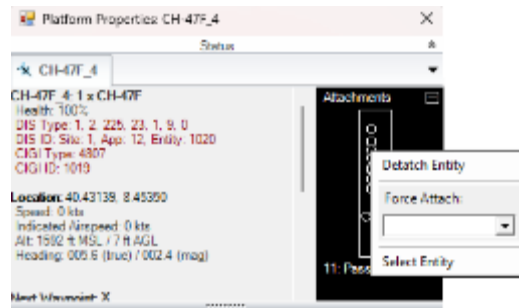
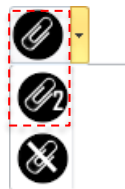
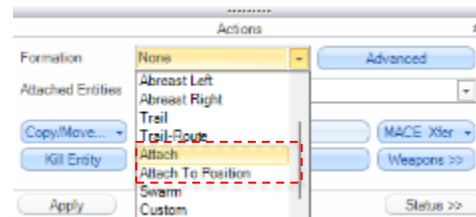
- Select platform which will attach to another – open formation dropdown
- Attach or Attach to Position ✦
- Select Entity to Attach To
- (If applicable) Select position from dropdown list
- ‘Pick Up’ and move entity on map over the attach to entity – will attach

- Method 2: Entity Controls → Route

- Select platform which will attach to another – open formation dropdown
- Select Paperclip icon to attach ✦
- 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

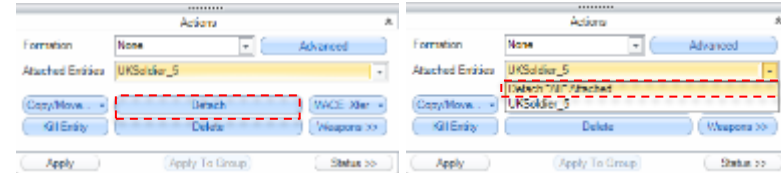


INTERMEDIATE ENTITY [INTENT] CONTROL 1

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]



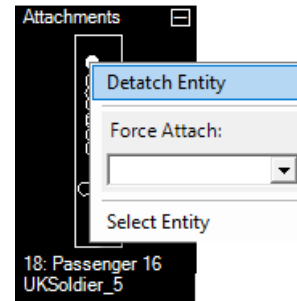
■ Method 2: Entity Controls → Route

- 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 to 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



INTERMEDIATE ENTITY (INTENT) CONTROL 1

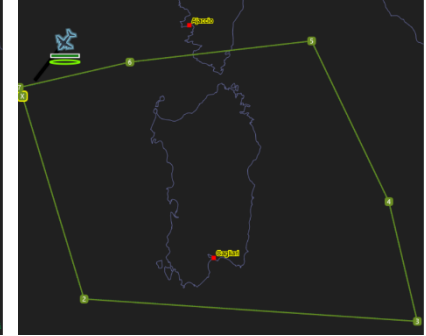
Attaching to Vectors and Roads

- 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

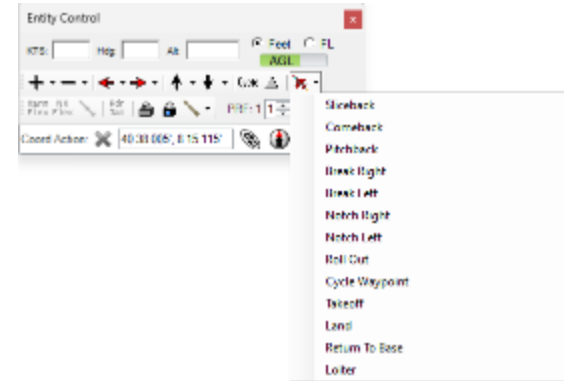
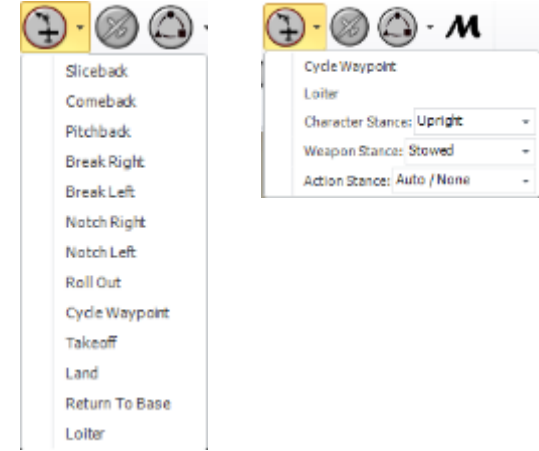


INTERMEDIATE ENTITY (INTENT) CONTROL 1

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

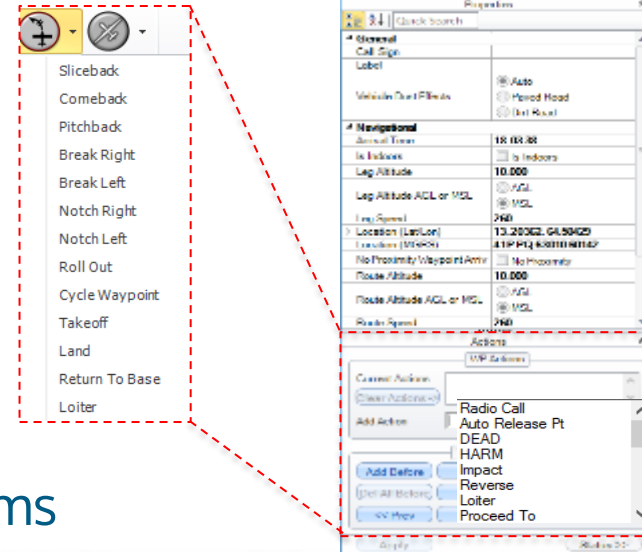


INTERMEDIATE ENTITY (INTENT) CONTROL 1

Waypoint Actions

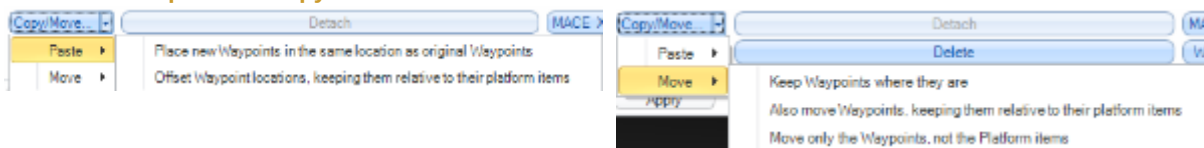
Same as **ENTITY CONTROLS>PLATFORM MANOEUVRE**

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
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

MACE ENTITY ICONS

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:

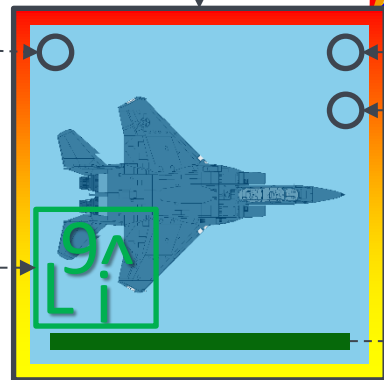
-  Sensor line and swathe
-  Attached to entity (formation)
-  Target line
-  Track Line

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

INTERMEDIATE ENTITY (INTENT) CONTROL 1

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...



INTERMEDIATE ENTITY (INTENT) CONTROL 1

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

INTERMEDIATE PLATFORM CONTROL 2 – 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

INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

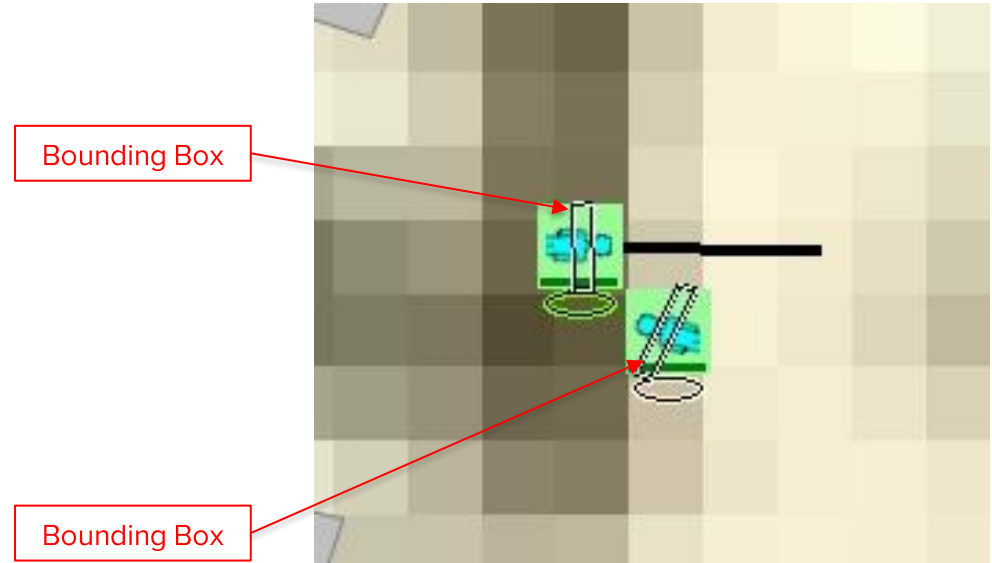
What Is Collision Avoidance

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)



INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

Collision Avoidance

Layers – Footprints

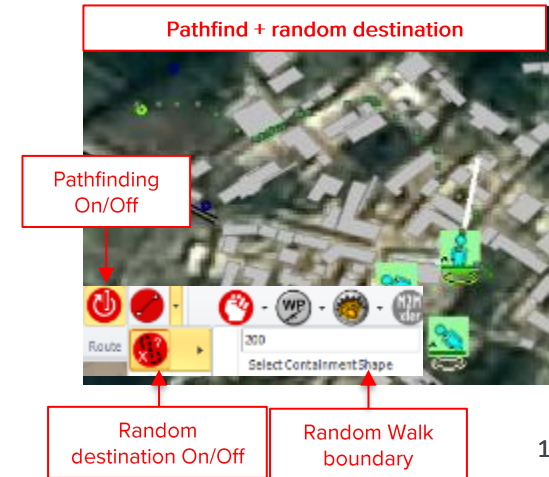
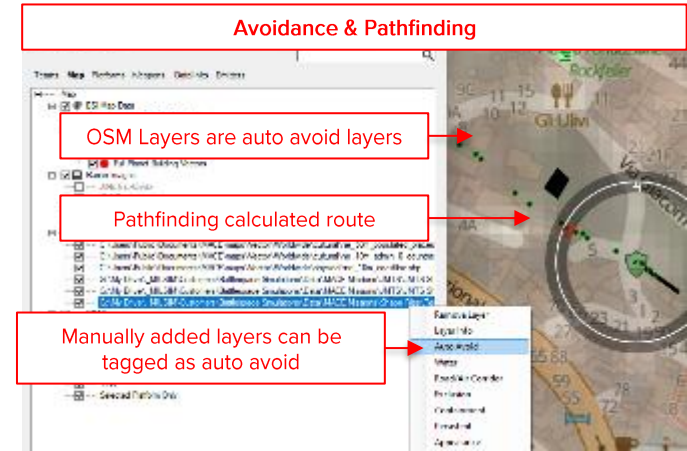
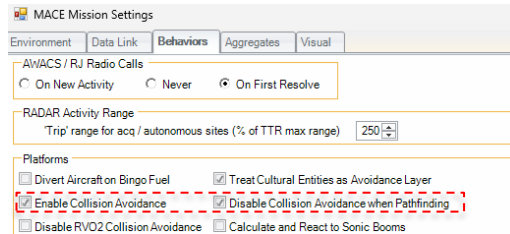
- All OSM Buildings are automatically avoided by pathfinders
- Non OSM Building footprints (polygon shapes) can be made AUTO-AVOIDANCE Layers
- Layer Manager – Avoidance
- Means that platforms with collision avoid enabled will not pass through

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

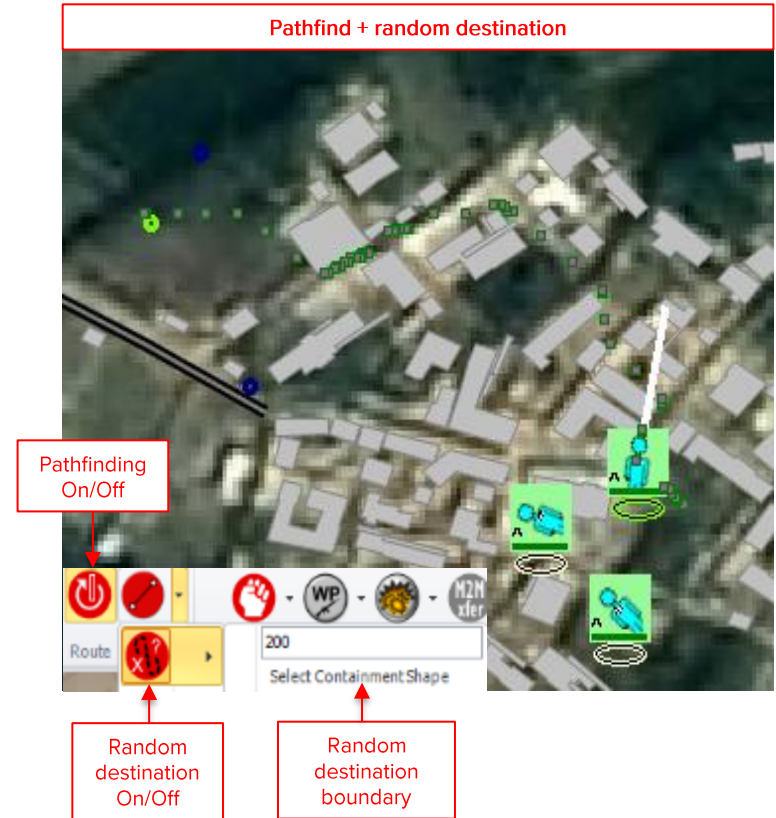
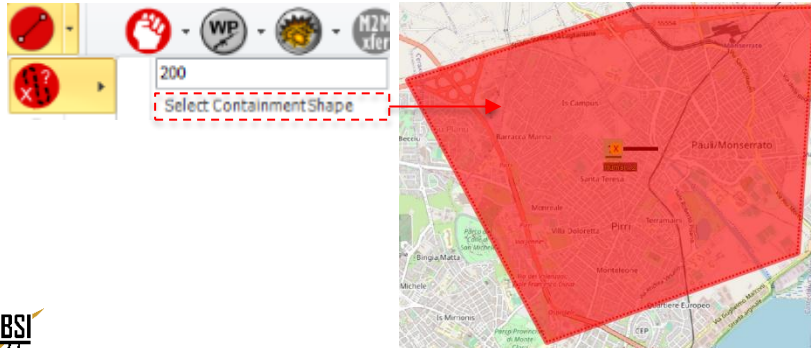
- Where areas are very tight the bounding box can stop people from getting down alleyways etc.
- Disable Collision Avoid While Pathfinding – Mission Settings



INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

Random Destination

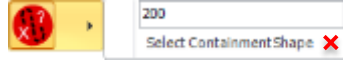
- Random destination
 - Select human entities
 - Select pathfinding
 - Select random walk – set boundary or containment shape
- Containment shape for random destination
 - Polygons can contain random walkers
 - Select containment shape (flashes red)
 - Select 'random destination' maneuver mode



INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

Surface Vessel Patrol Mode

- Random Destination
 - Select surface entities
 - Select random destination
 - Set boundary (Containment Shapes NOT Supported)
 - Surface entity will stay confined to its body of water avoiding land
 - If MACE is connected to BSI's Worldwide Map database

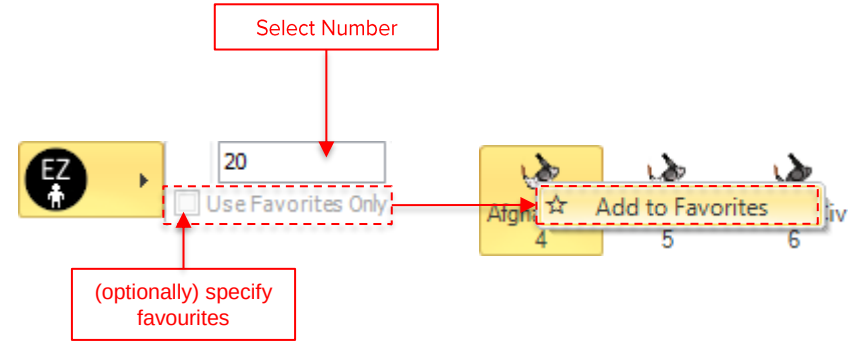


INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

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

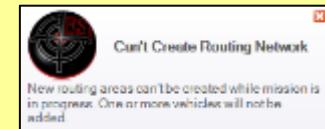
- Any platform can be designated a 'Random Walk Destination' in 'Platform Properties'
- Entities placed into 'random destination' mode will occasionally walk to 'random walk destinations' (e.g. a street vendor)

Platform Properties → Navigational



NOTE – EZ BUTTONS VS MISSION RUNNING & OSM DATA

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



INTERMEDIATE MISSION EDITING – 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

-SHORTCUTS-

CTRL + G

CTRL + W

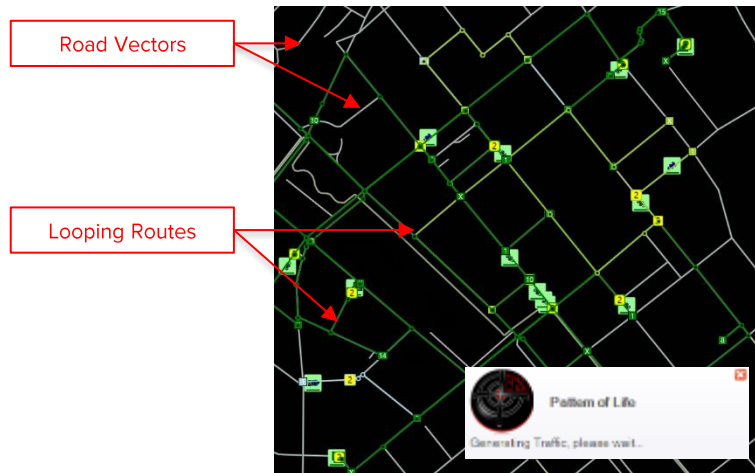
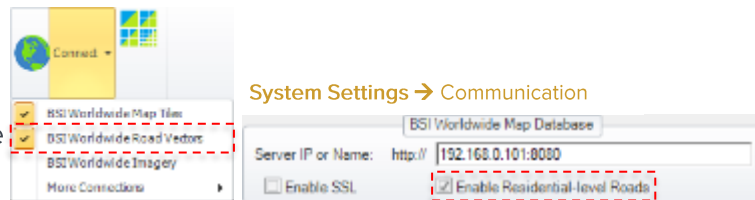
CTRL + RMB (on OSM Road Vector)

Update MACE auto-avoid grid

Reverse waypoints

Attach to Road

System Settings → Communication



LMB = Left Mouse Button
RMB = Right Mouse Button



INTERMEDIATE MISSION EDITING – PATTERN OF LIFE

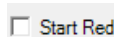
Traffic Lights

- Can be placed singly or as groups
- Sequenced using the 'Traffic Light Controller' accessed from the RMB context menu

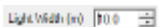


- Place carefully (at high zoom) to ensure road closure affect traffic (covers the right lane)

- Use the 'Start Red' tick box (Traffic Light Controller) to show closure temporarily while placing
- Use the white (out of intent) vector to rotate the traffic light to be correctly rotated to cover the lane



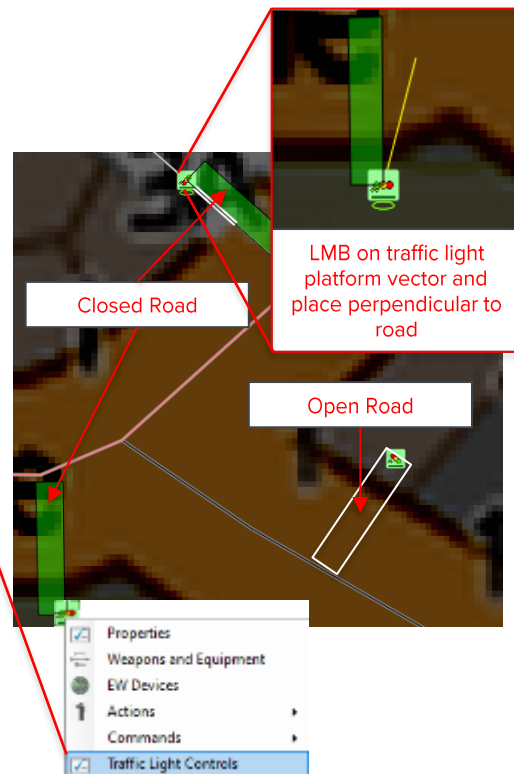
- Use the 'Light Width' setting (Traffic Light Controller)



- Lights only work if 'collision avoidance' is enabled

- Call Signs:** A list of all the traffic lights in the mission. Selecting one brings up more information on the right panel.
- Cycle Time:** The total time in seconds it takes for the selected light to complete one complete cycle (Green to red back to green).
- Start Red:** When selected, the light will start red, otherwise it will start green.
- Additional Delay:** The total time the mission needs to elapse before the first cycle starts.
- Light Width:** The width that the light will block or open in meters.
- Projected Times:** A list of times that the light will be green or red, colour coded.

Traffic Light Controller	
Call Sign	Cycle Time (s) 70 ☒ Start Red Additional Delay (s) 0
Trilight_1	Projected Times: Light Width (m) 10.0
Trilight_2	
Trilight_3	
Start Time	End Time
12:00:10 PM	12:00:18 PM
12:00:18 PM	12:00:30 PM
12:00:30 PM	12:00:38 PM
12:00:38 PM	12:00:50 PM
12:00:50 PM	12:00:58 PM
12:00:58 PM	12:01:10 PM
12:01:10 PM	12:01:18 PM
12:01:18 PM	12:01:30 PM
12:01:30 PM	12:01:38 PM
12:01:38 PM	12:01:50 PM
12:01:50 PM	12:01:58 PM
12:01:58 PM	12:02:10 PM
12:02:10 PM	12:02:18 PM
12:02:18 PM	12:02:30 PM
12:02:30 PM	12:02:38 PM



INTERMEDIATE PLATFORM CONTROL 2 – PATTERN OF LIFE

Red Buttons [Stateful]



Target (ACTION)

With platform(s) selected LMB then place the attack mouse pointer on the platform/point to be targeted



Path find (ACTION)

With platform(s) selected LMB enters into pathfinding mode



Return to/In Intent (ACTION)

With platform(s) selected LMB returns them to intent (follow waypoints)



Random destination (ACTION)

With platform(s) selected LMB and enter fence distance for random destination



Move to Target combined with  ACTION

With platform(s) selected, If platform has target, platform will move to an attack position



Rally (Information Only)



Formation (Information Only)



Delta – Out of Intent (Information Only)



Copy Selected Platform and Route



Waypoint (Not Delta) Orbit Tool



Paste selected platform route to another platform

MACE ENTITY ICONS

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:

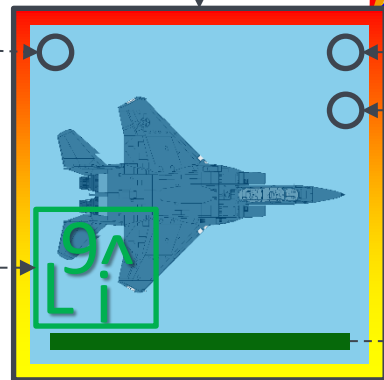
-  Sensor line and swathe
-  Attached to entity (formation)
-  Target line
-  Track Line

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

INTERMEDIATE PLATFORM CONTROL 2 – 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

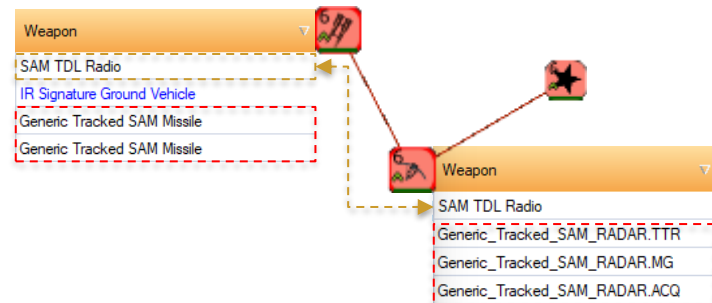


optional

Height Finder Radar (HF)

AGGREGATED AUTONOMOUS SITE

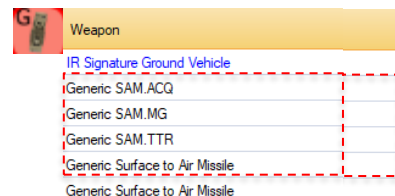
Separate platforms require SAM TDL Radio



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

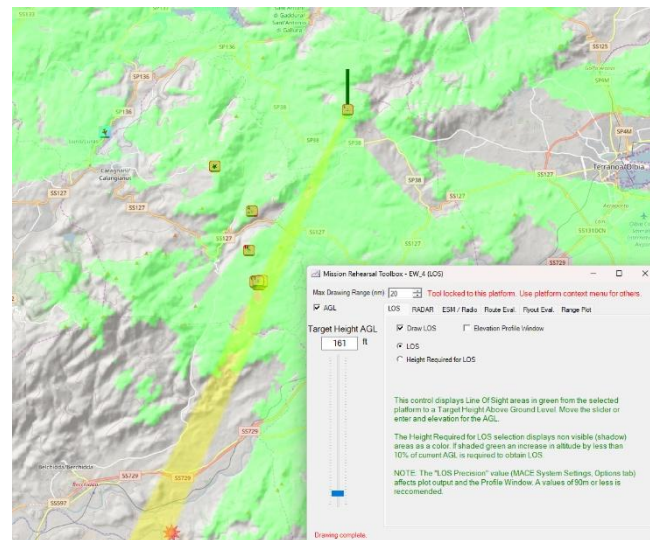
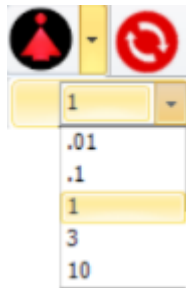
Single platforms do not require TDL



IADS AND AUTONOMOUS AD

Placing Air Defence Platforms – Tools That Help

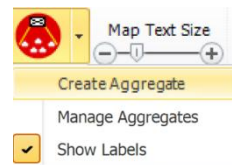
- LOS Tools
 - Mission Rehearsal Tool (more later)
 - RMB on any entity – select ‘Mission Rehearsal Toolbox’
 - LOS tab
 - Select incoming ‘Target Height AGL’
 - Draw LOS
 - Colour indicates where there IS Line of Sight
 - FROM the selected Entity
 - TO a target – at the height specified
 - Snap to Hight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



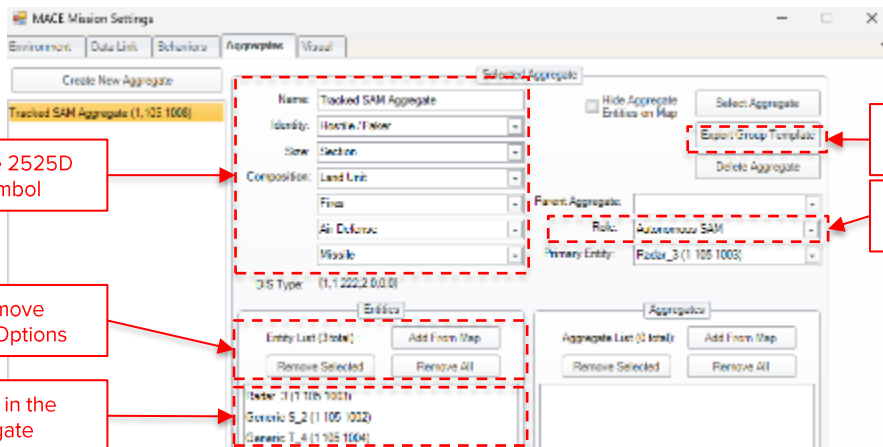
IADS AND AUTONOMOUS AD

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



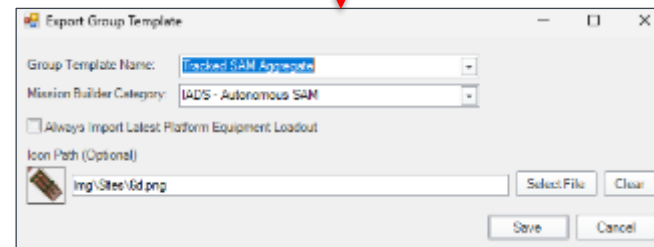
Defines the 2525D
Map Symbol

Add/Remove
Platforms Options

Platforms in the
Aggregate

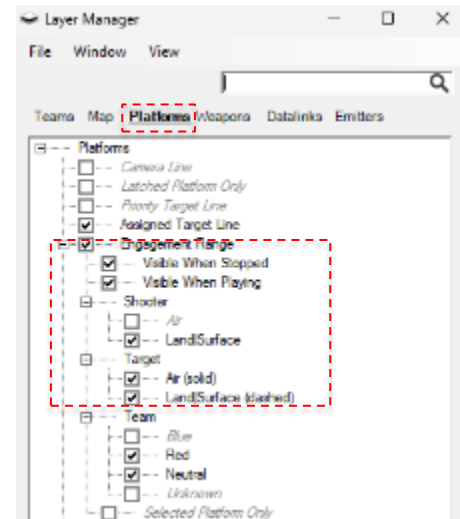
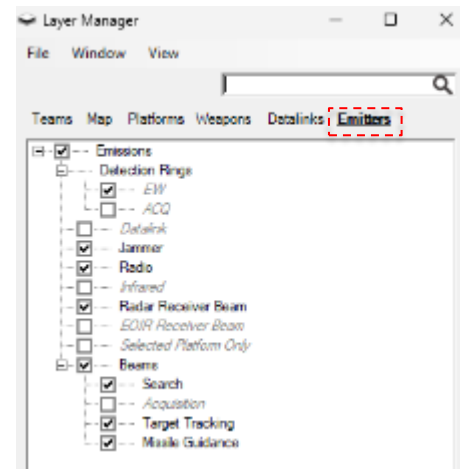
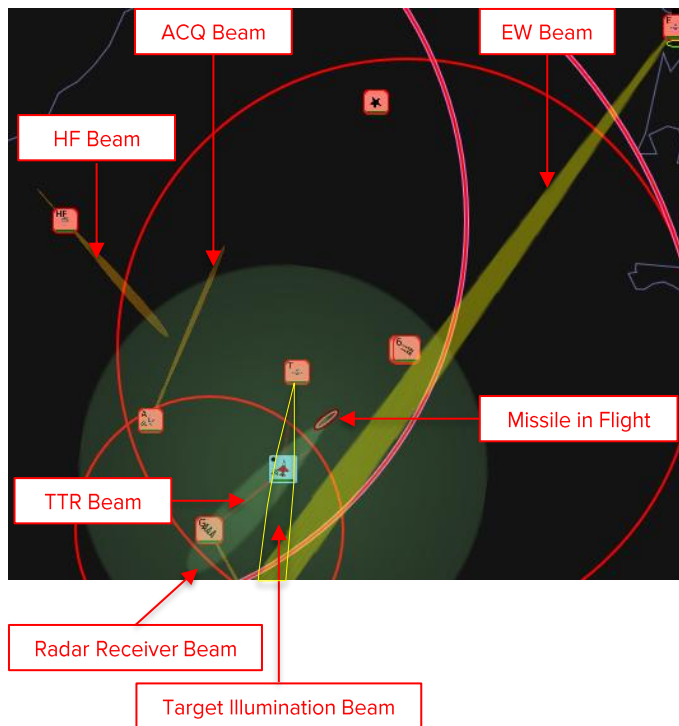
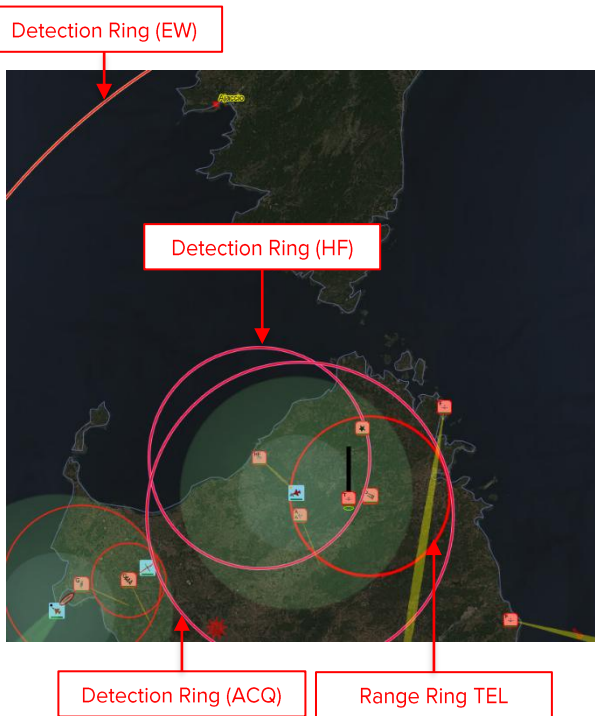
Export to appear in
Mission Builder Entity List

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

MACE Mission Settings

Environment Data Link Behaviors Aggregates Visual

Entities Networks Settings

☒ Enable Network Propagation Modeling

Available Networks

SAM TDL - SOC_3

Topology: ChainOfCommand Type: Other

Center Freq: 110.0 MHz Alt Type: C2_IADS_TDL

Bandwidth: 25.0 KHz Crypto: Other

Modulation:

Entities on the Network

Name	Equipment
HF_4 (1 101 1004)	SAM TDL Radio
SOC_3 (1 101 1003)	SAM TDL Radio
TEL_11 (1 101 1011)	SAM TDL Radio
TEL_12 (1 101 1012)	SAM TDL Radio
TEL_13 (1 101 1013)	SAM TDL Radio
TEL_14 (1 101 1014)	SAM TDL Radio
TEL_6 (1 101 1006)	SAM TDL Radio
TEL_7 (1 101 1007)	SAM TDL Radio
TEL_8 (1 101 1008)	SAM TDL Radio
TEL_9 (1 101 1009)	SAM TDL Radio
TT_10 (1 101 1010)	SAM TDL Radio
TT_5 (1 101 1005)	SAM TDL Radio

Show Entity Properties

Show Equipment Properties

Connection Types

Set Subordinates

Set All Subordinates

Landline Datalink

RF Datalink

Network Connections for TT_10 (1 101 1010)

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

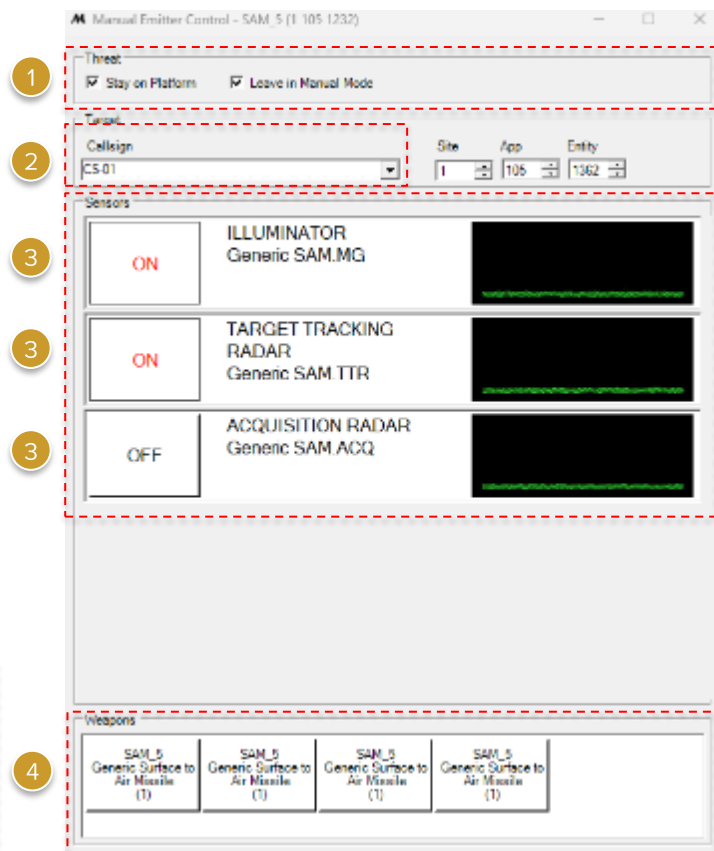


- (1) Select on the MACE Map the platform for manual emitter control
 - Tick 'Stay on Platform' – so further map selections don't jump to a new platform
 - Tick leave in manual mode if you do not want to return to MACE control after manual control
- (2) Choose a target to aim the beam at
- (3) Switch 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		1	☒
Generic SAM.ACQ	ACQ	1	☐
Generic SAM.MG		1	☐
Generic SAM.TTR		1	☐
Generic Surface to Air Miss...		1	☐
Generic Surface to Air Miss...		1	☐
Generic Surface to Air Miss...		1	☐
Generic Surface to Air Miss...		1	☒



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

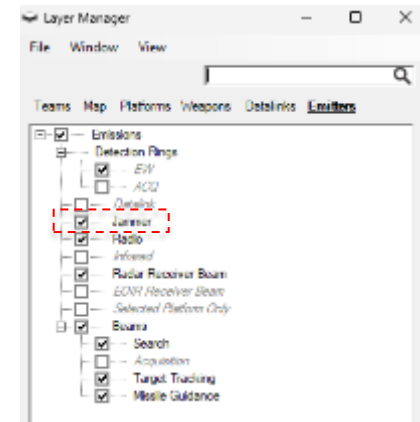
Enabling objectives

- 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

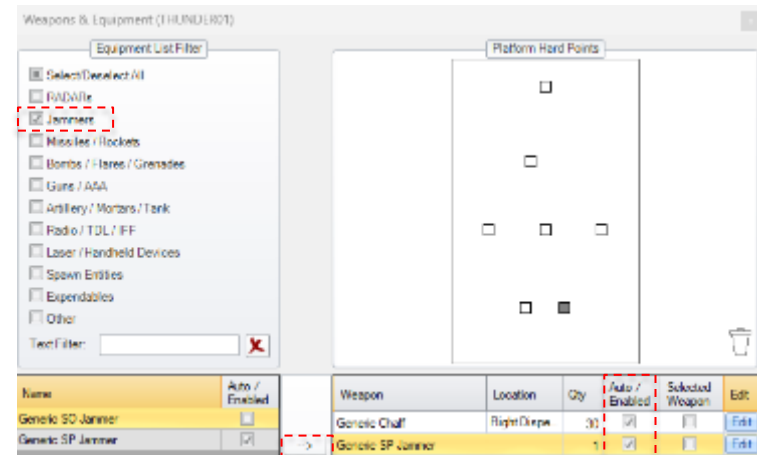
MACE & ARMOR EW VISUALIZATION & JAMMING

Equip Jammer / Emission & Jamming Indications

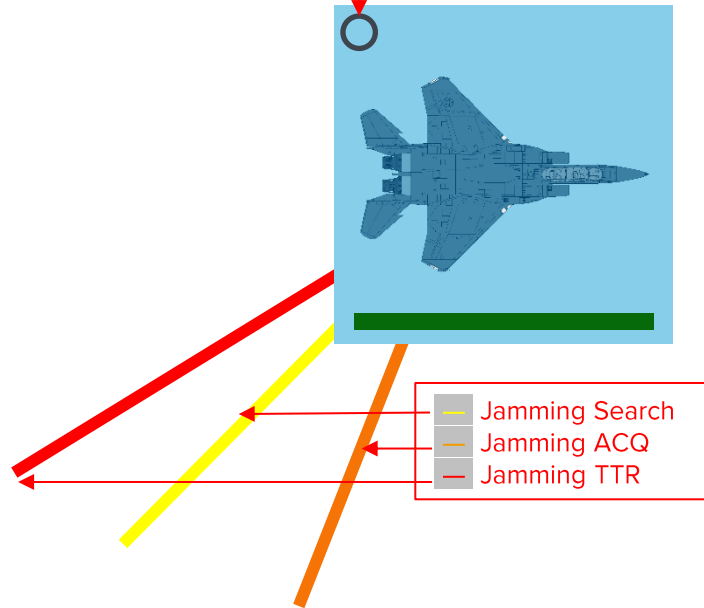
Layer Manager



Weapons and Equipment



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



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	☒	☐	Edit
Generic SP Jammer		1	☒	☐	Edit



Jammed (in last 15s)

Weapons and Equipment – on Jammed Platform

Weapon	Qty	Auto / Enabled	Selected Weapon	Edit
IR Signature Ground Vehicle	1	☒	☐	Edit
Generic_Tracked_SAM_RADAR.MG	1	☒	☐	Edit
Generic_Tracked_SAM_RADAR.TTR	1	☒	☐	Edit
Generic_Tracked_SAM_RADAR.ACQ	1	☒	☐	Edit
SAM TDL Radio	1	☒	☐	Edit

Sensor View

Generic_Tracked_SAM_RADAR.ACQ Properties

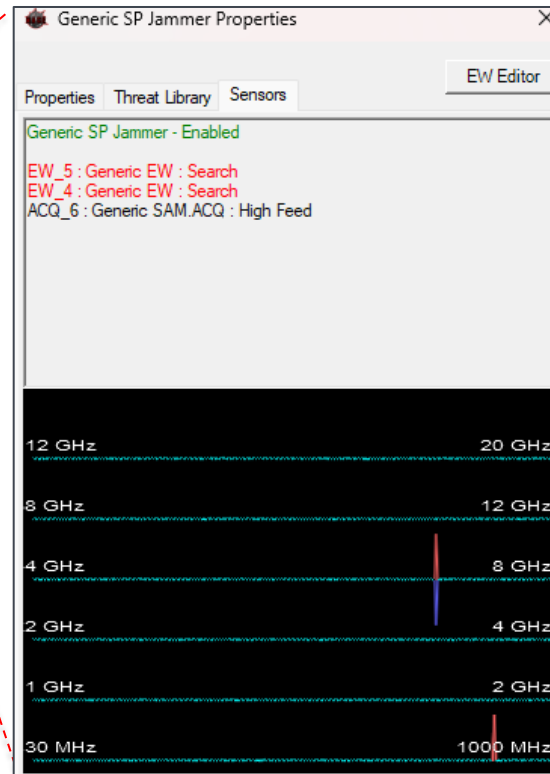
EW Editor

Properties Sensors

Generic_Tracked_SAM_RADAR.ACQ - Enabled

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

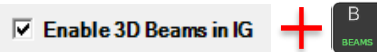
Sensor View



MACE & ARMOR EW VISUALIZATION & JAMMING

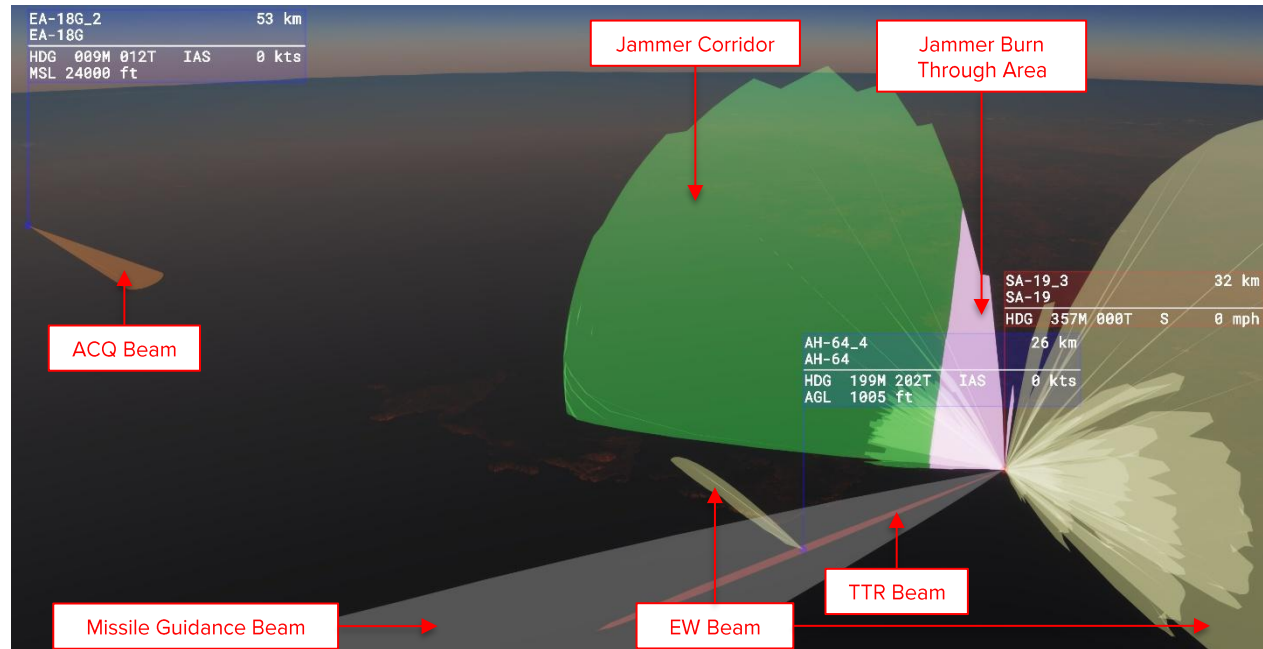
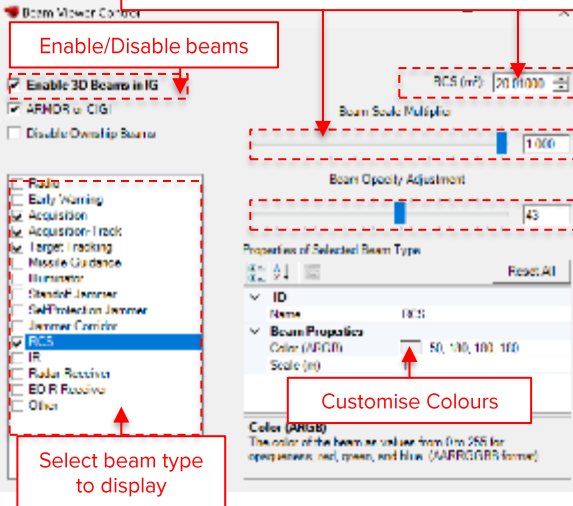
ARMOR EW Indications

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



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).

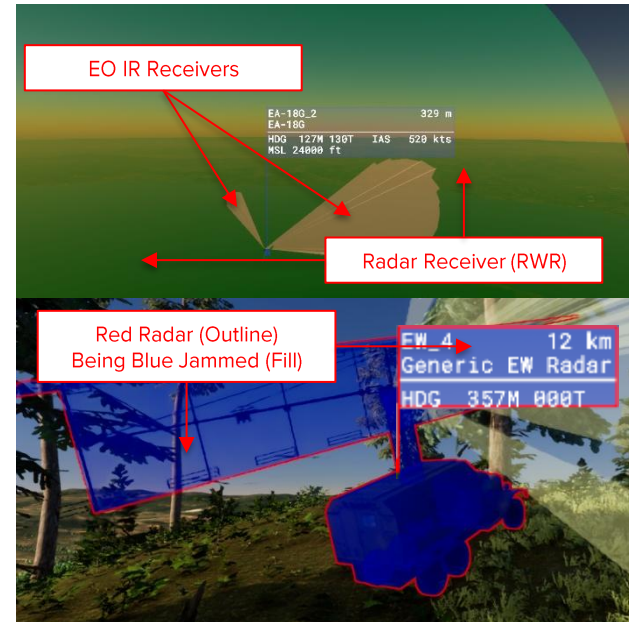
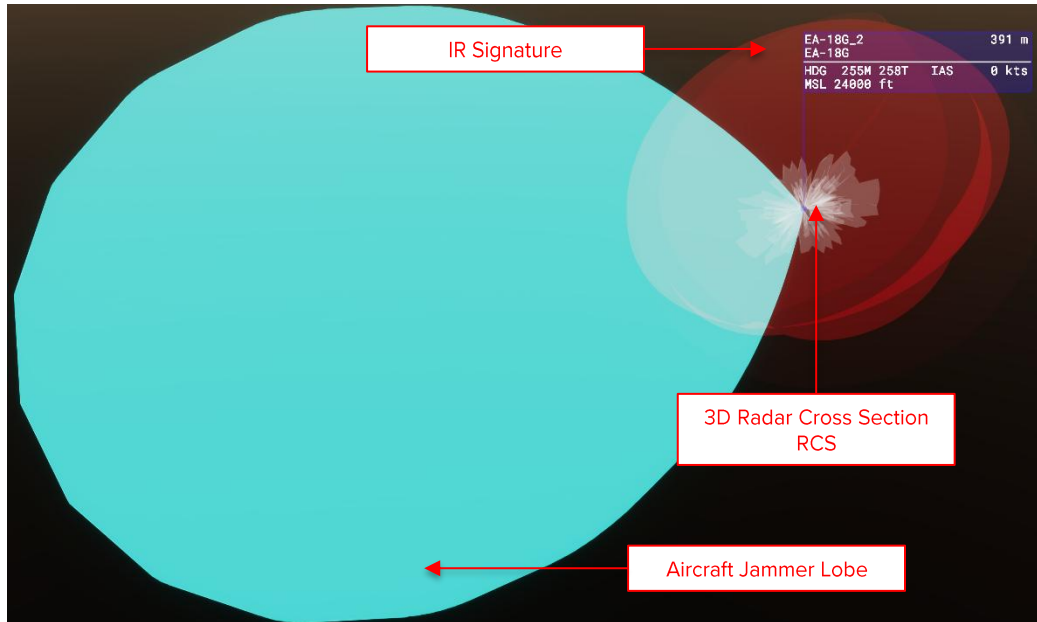
Scale - Maximum length of the beam in meters.



MACE & ARMOR EW Visualization & JAMMING

ARMOR EW Indications

VIEW > IG View > Beam Viewer



MACE & ARMOR EW VISUALIZATION & JAMMING

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

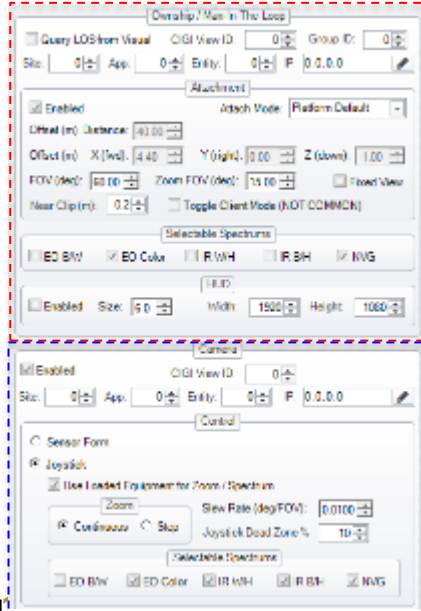
- Recap own-ship – top lock relationship
- Know how to open ownship combat displays
- Understand the RWR indications
- Understand the IRWR indications
- Know how to use the CMDS
- Know how to manually dispense chaff and flares
- Recap basic scripting
- Know how to DF a ground radio transmission

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



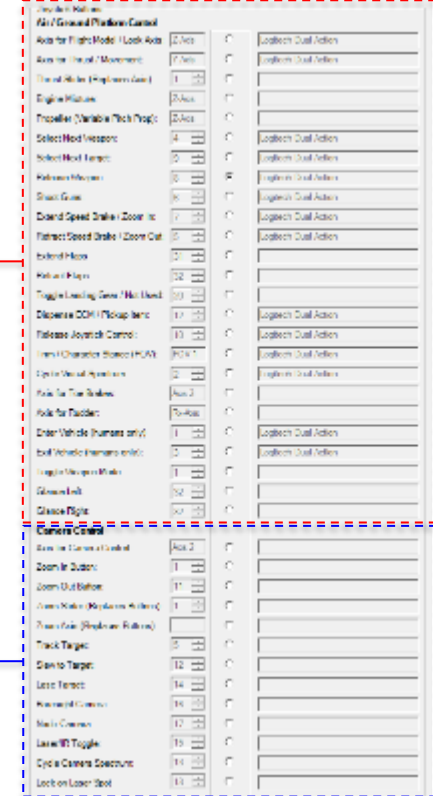
TOP LOCK
Visuals & Displays
(Ownship)
Locked to this platform



BOTTOM LOCK
Sensors / Camera
Locked to this platform



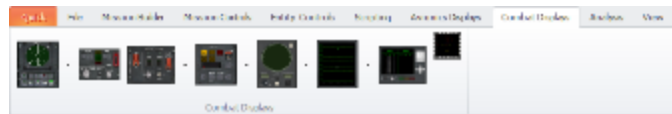
System Settings → Joystick



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

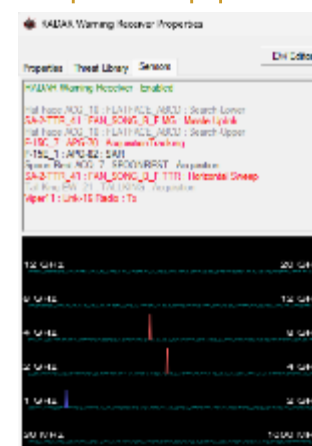
Power on/off

Weapons & Equipment

Weapon	Location	Qty	Auto / Enabled	Selected Weapon	Edit
RADAR Warning Receiver		1	☐	☐	Edit

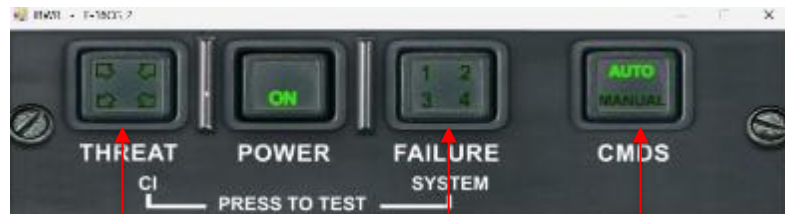
- Opening Combat Displays RWR appends RWR Equipment to **ownship** (Top-Locked platform) Weapons and Equipment
- Seen in **RED** in Weapons and Equipment List
- RWR displays identified emitters using green symbols positioned in the Azimuth Display
- RMB** or **[Edit]** on RWR Device opens Properties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

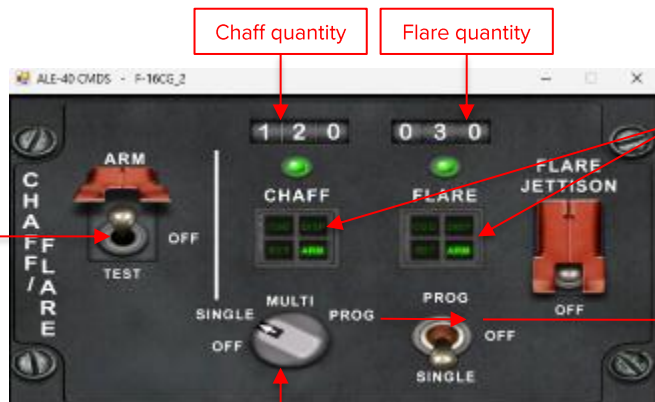
Indicates failure of sensor

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**

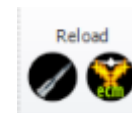


Press for Flare / Chaff COM – indicates command has been received

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



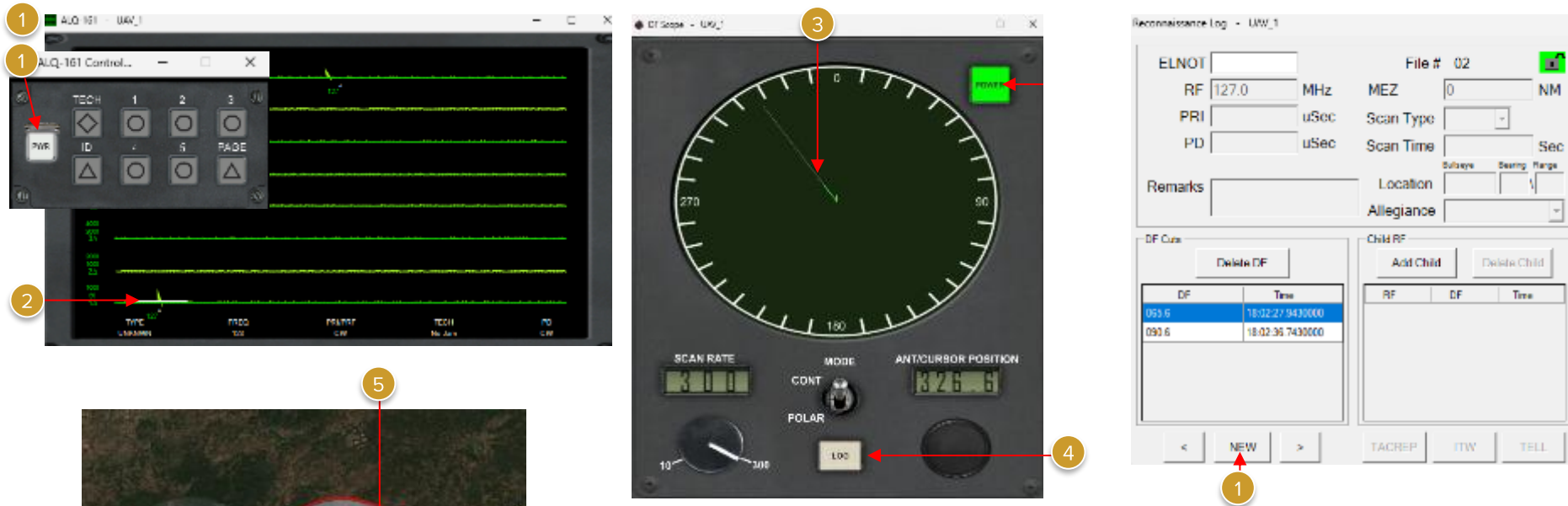
Weapons & Equipment

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

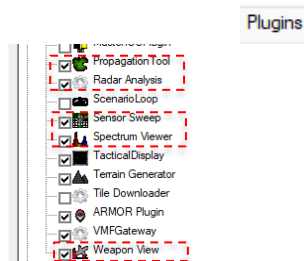
Enabling objectives

- 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

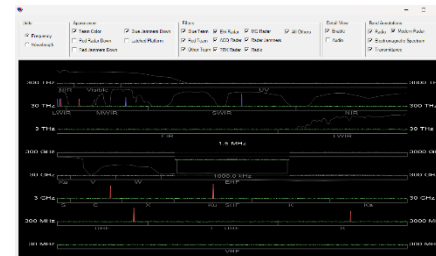
MACE & ARMOR EW ANALYSIS TOOLS 1

Activating Plugins – MACE Extensions

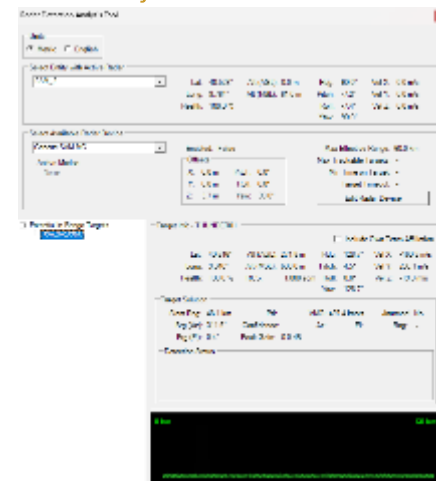
- The analysis tools may need to be activated in plugins
- **System Settings → Plugins → MACE Extensions**
 - Mission Rehearsal Toolbox (Propagation Tool)
 - Radar Analysis
 - Sensor Sweep
 - Spectrum Viewer
 - Weapon View



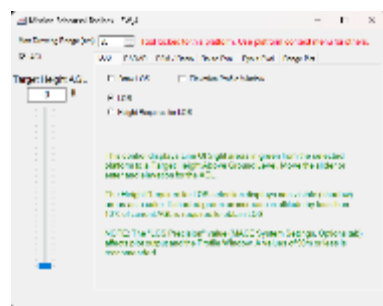
Spectrum Viewer



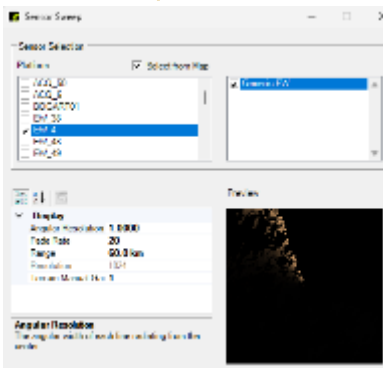
Radar Analysis Tool



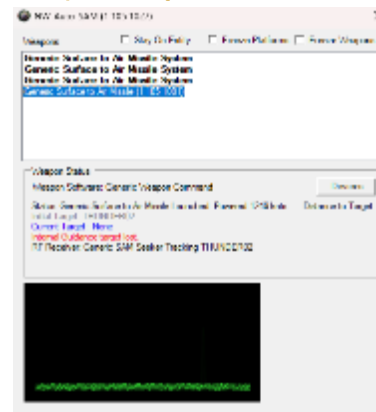
Mission Rehearsal Toolbox



Sensor Sweep



Weapon Analysis

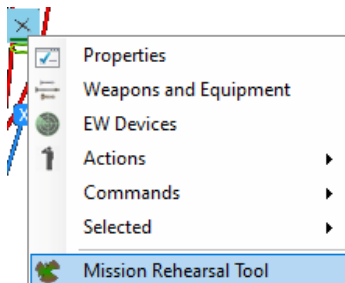


MACE & ARMOR EW ANALYSIS TOOLS 1

Mission Rehearsal Toolbox – General

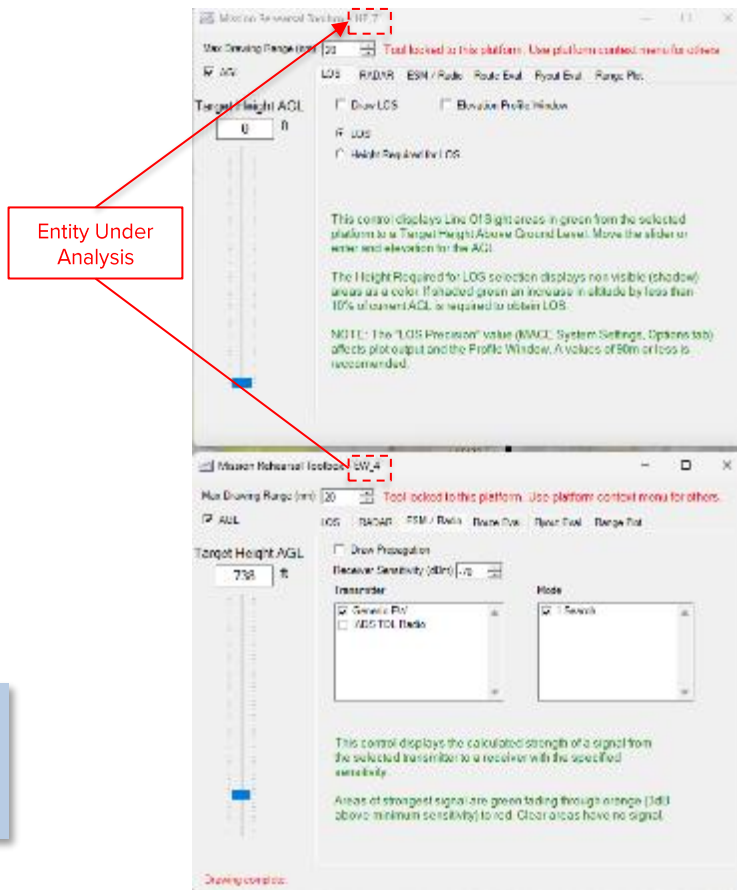
- Access from platform context menu (RMB on entity)
- Will be latched to that entity
- Always check the top of the form for entity name
- Does not change with subsequent entity selection
- May have many open

Platform RMB Context Menu



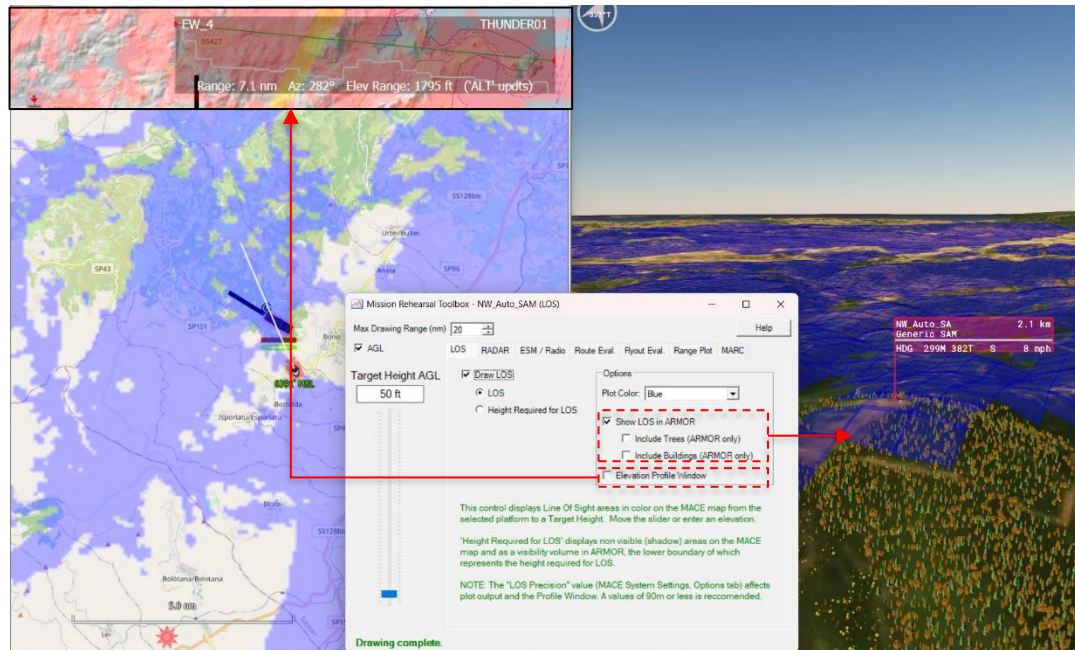
TIP – CLEAN UP TOOLBOXES AFTER USE

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

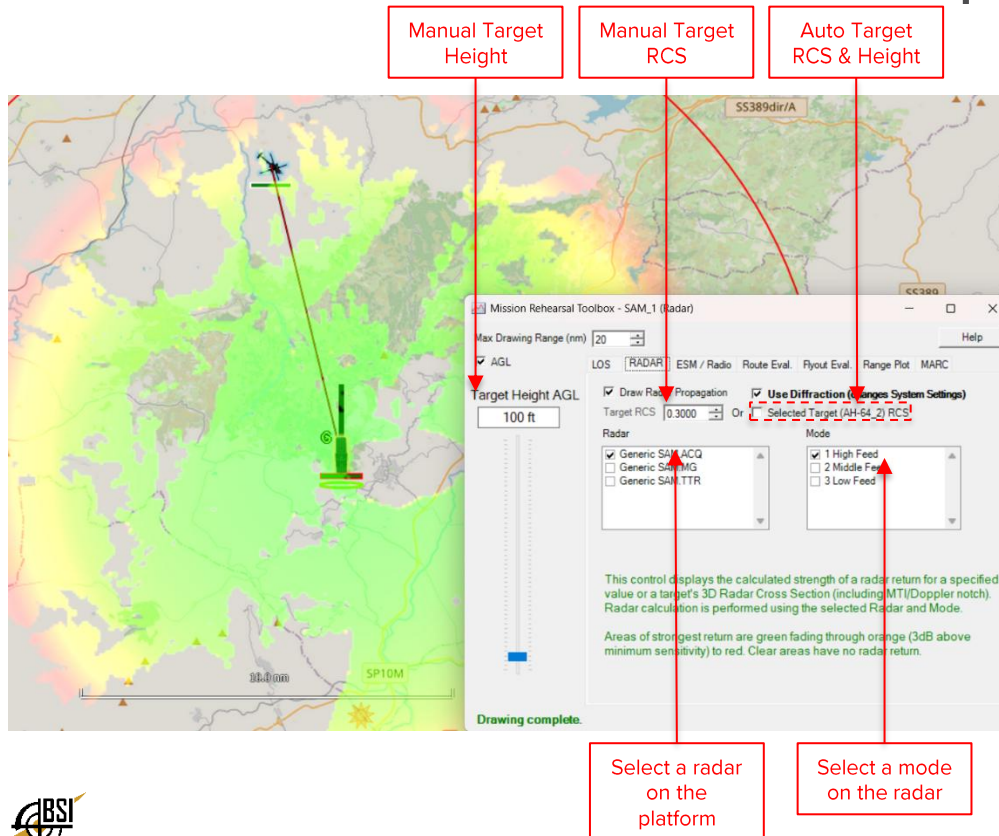
Mission Rehearsal Toolbox – Line of Sight Analysis



- 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

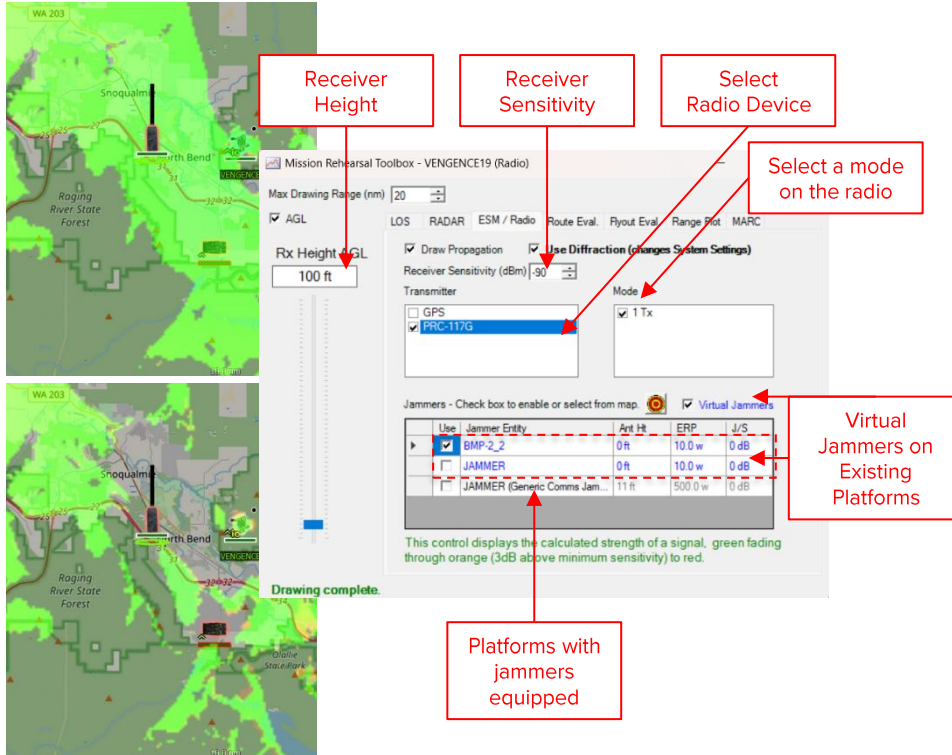
Mission Rehearsal Toolbox – Radar Propagation



- 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



- 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)

The screenshot shows the MARC software interface with the following numbered callouts:

- 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

The interface includes a map view, a 'Route' panel with a table of parameters, and a 'Threats' table.

Route	Speed	Vert Deviation	Indirect Masking	Terrain	Grid Resolution	Route Factor	ARMOR LOS	Scoring Weights
	75.0 kts	32.8 ft	False	250 meter	1000 m	1.0 x	False	
								Distance
								Weapon Range
								Tracking
								Weapon Tracking
								Detection

Threat	Timeout	Priority
SA11CP_11	100	100
SA15_1	100	100
SA15_7	100	100
SA19_8	100	100
SARCP_13	100	100
SA22_1	100	100

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

- (1) Select start and 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

The screenshot shows the Mission Rehearsal Toolbox - NASTY01 interface. The top panel displays a map with a route (red line) and waypoints (blue dots). The bottom panel shows the 'Route Eval' settings. The 'Evaluate Route' checkbox is checked. The 'Route Increments (m)' is set to 50. The 'LOS Precision (m)' is set to 250. The 'Start / End Waypoints' are set to 1 and 10. The 'Automatically Evaluate New Threats' checkbox is unchecked. The 'Possible Weapon Hit' checkbox is checked. The 'Tracking Sensor' checkbox is checked. The 'RED - Weapon impact possible.' checkbox is checked. The 'ORANGE - In weapon range, reduced tracking.' checkbox is checked. The 'YELLOW - Tracking but weapons cannot hit.' checkbox is checked. The 'GREEN - not in range or tracked.' checkbox is checked. The 'Tracking rad target 3D RCS masking.' checkbox is checked. The 'Weapon Hit or Tracking Sensor Mode' checkbox is checked. The 'Partial route selection via waypoints' checkbox is checked.

1. Select threats that are evaluated

2. Select platform to display waypoints

3. Resolution of Evaluation parameters

4. Weapon Hit or Tracking Sensor Mode

5. Partial route selection via waypoints

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

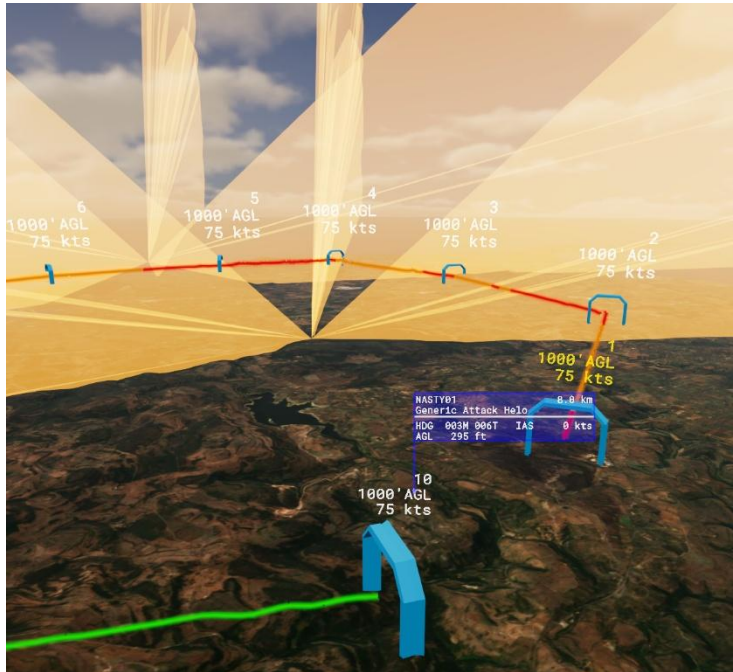
- (1) Leg altitude (best to select AGL!)
- (2) Tracking from selected threat platform(s) – sensors on platform
- (3) Must have platform selected in MACE to see waypoint route colouring
- (4) Select resolution
 - Segment width along route
 - LOS resolution from each threat to entity position along route
 - 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

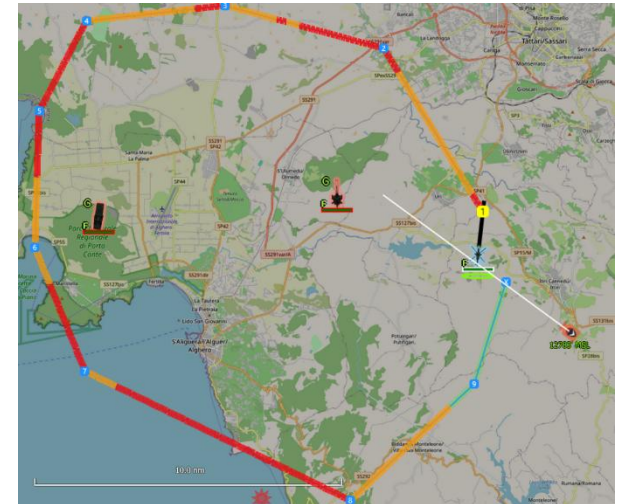
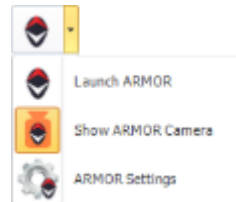
MACE & ARMOR EW ANALYSIS TOOLS 1

Mission Rehearsal Toolbox – Route Eval in ARMOR



- Use MACE Beam viewer plugin and 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

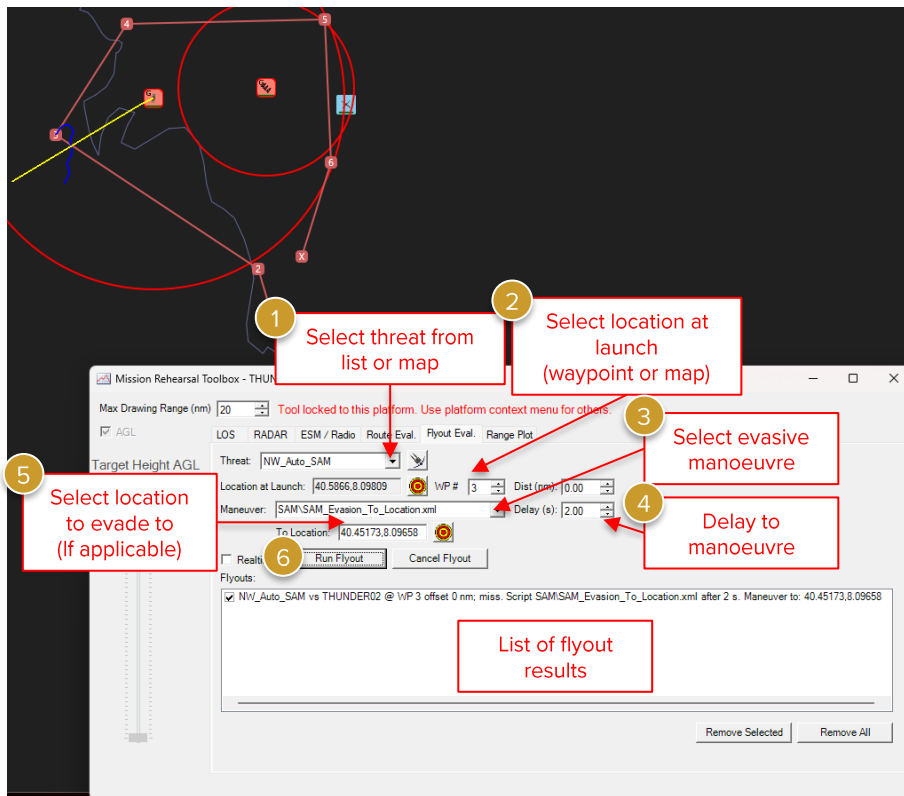


MACE & ARMOR EW ANALYSIS TOOLS 1

Mission Rehearsal Toolbox – Flyout Eval

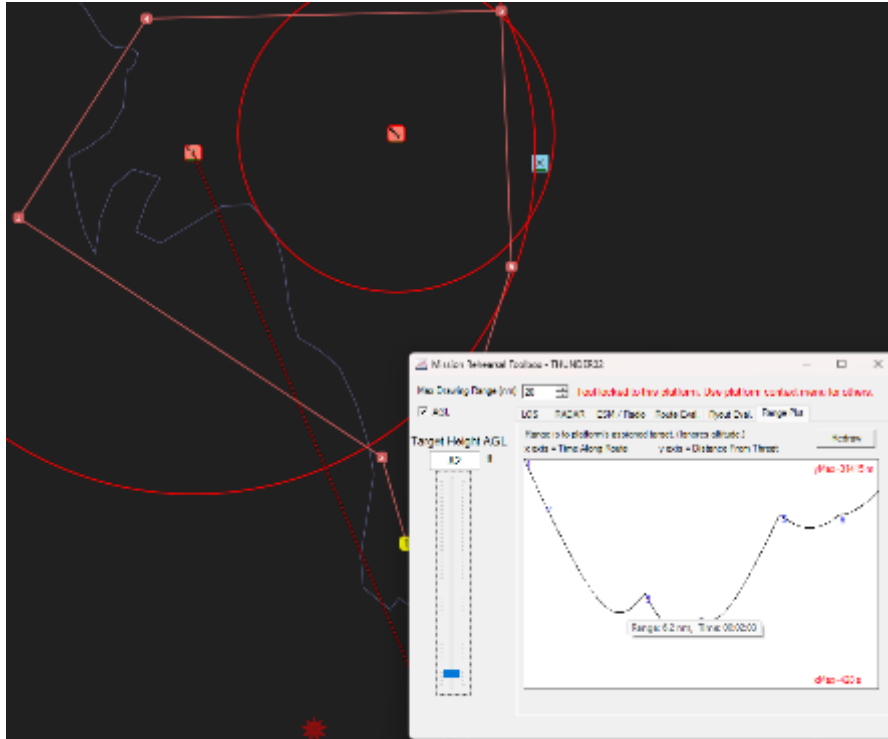
Evaluates manoeuvres at specific locations along route against a single threat

- (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

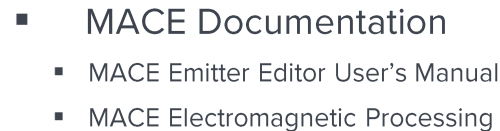
Mission Rehearsal Toolbox – Range Plot



- Selected entity's distance (Y) from its assigned target vs elapsed mission time (X)
- Numbers indicate entity's waypoints

About EM Modelling – Sources of Info

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



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

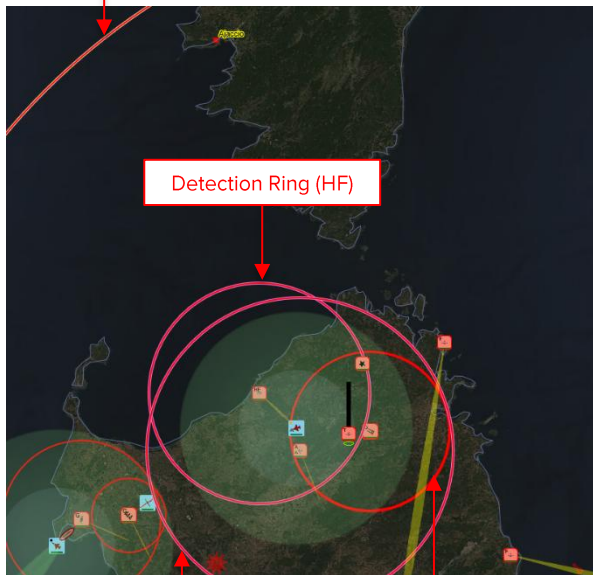
Enabling objectives

- 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)



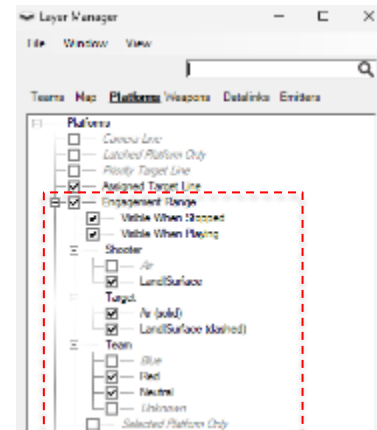
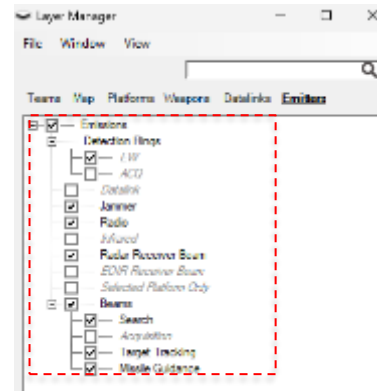
Detection Ring (ACQ)

Range Ring TEL



Radar Receiver Beam

Target Illumination Beam

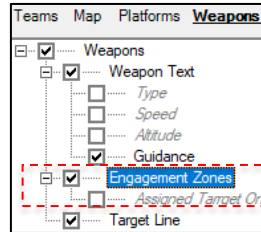
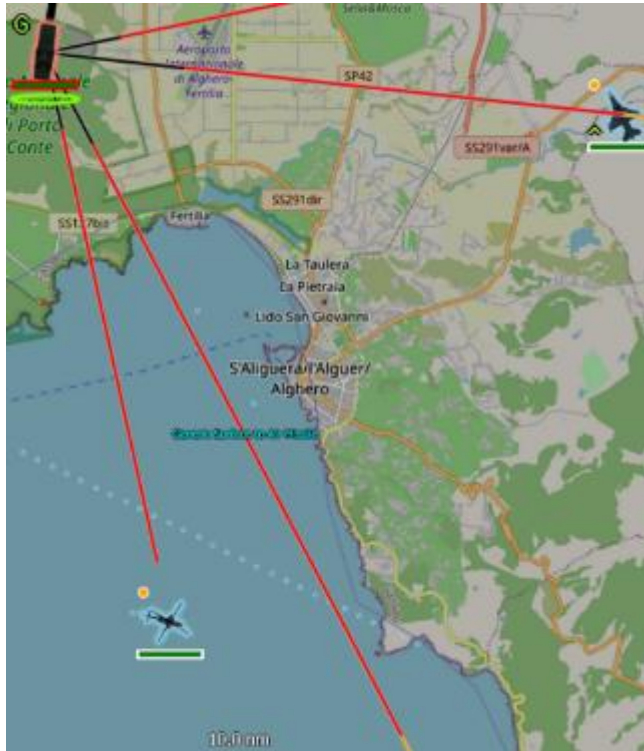


NOTE – DETECTION RINGS

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:

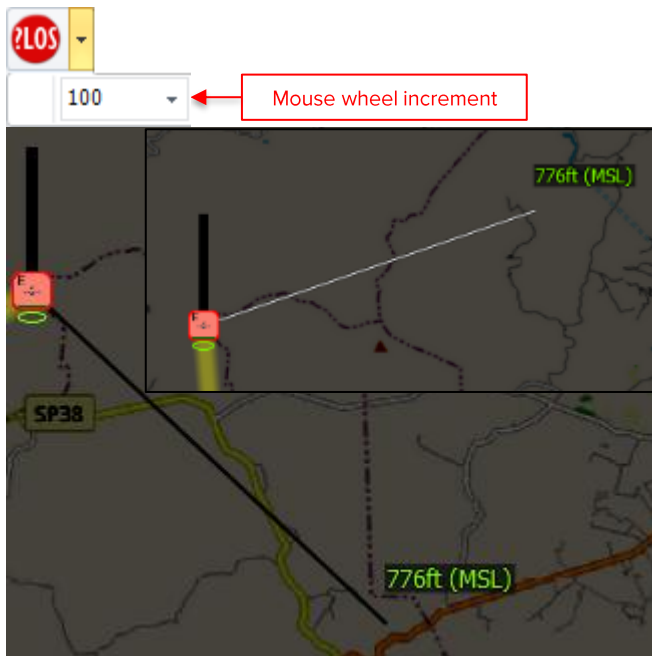
- R_{Max1} – Max doctrinal employment range for attacking a non-maneuvering target.
- R_{Max2} – Maximum doctrinal employment range for attacking a maneuvering target.
- $R_{NoEscape}$ – Range at which a target will be unable to evade the weapon even if it immediately turns to flee.
- R_{min} – The minimum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



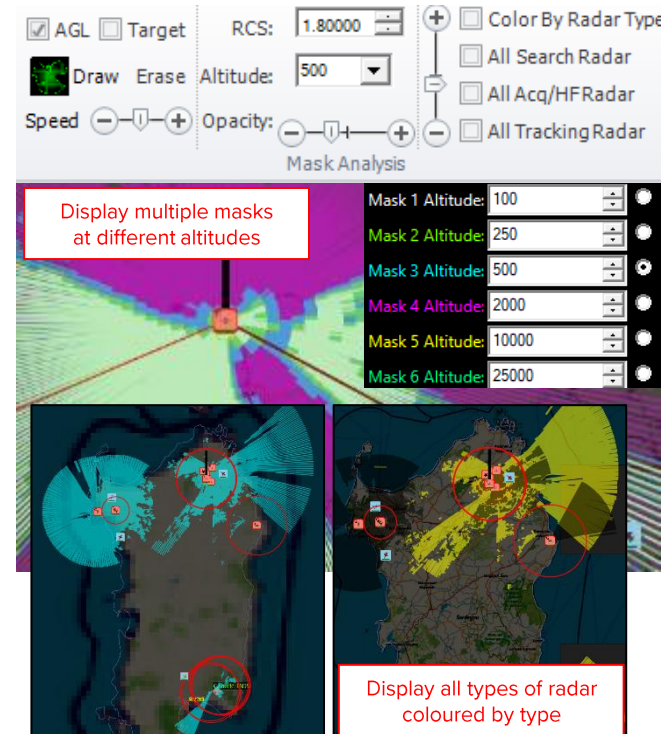
Can this platform see that platform?

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

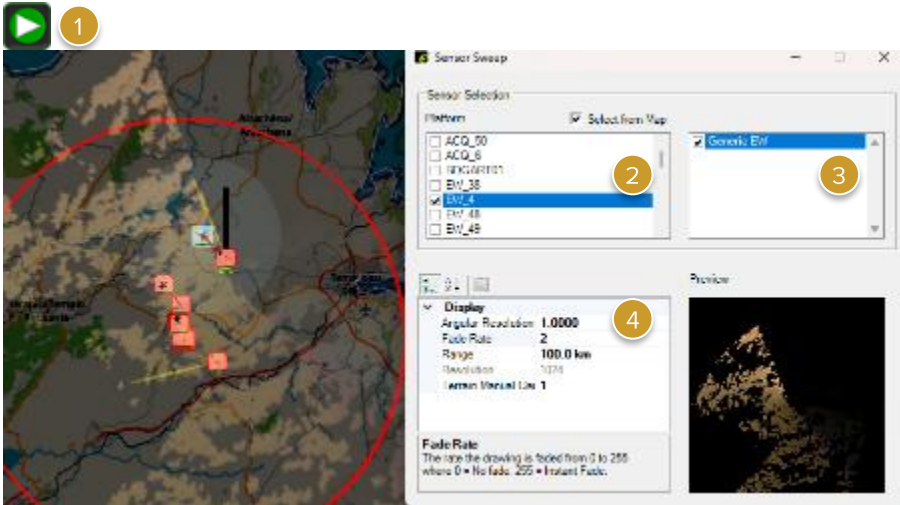
To view when mission is running press <CTRL> + <ALT>

MACE EW ANALYSIS TOOLS 2

Radar Sensor Sweep Display



ANALYSIS → Info/Status Windows → Radar Sweep



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

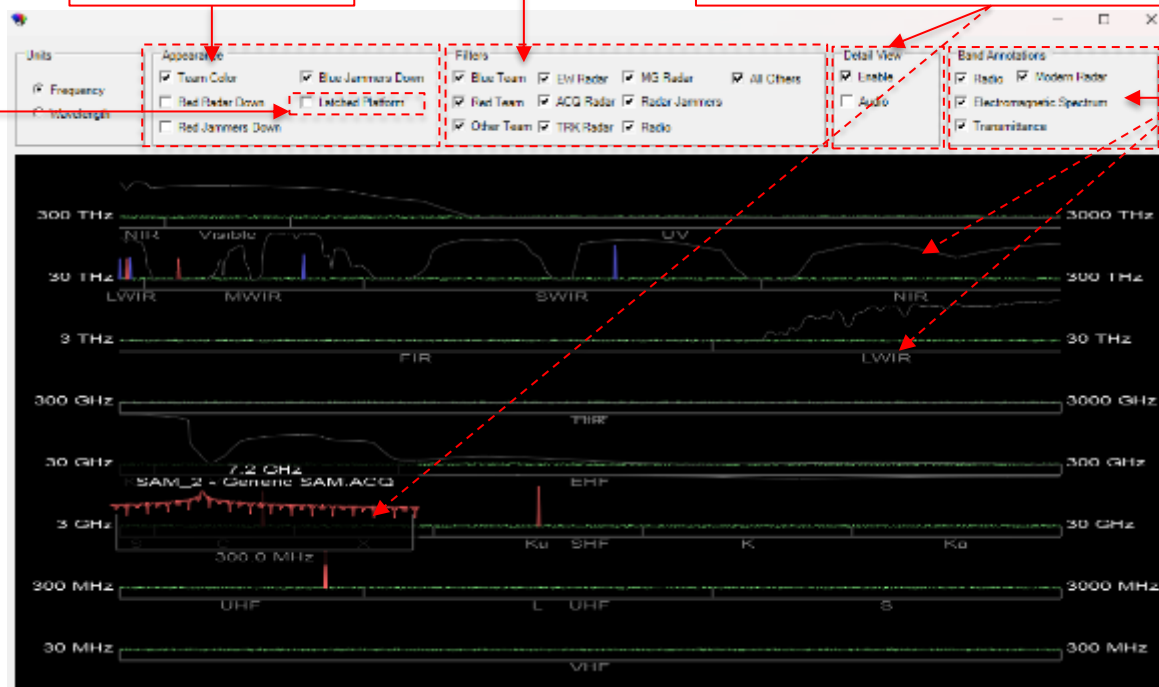
- Shows all transmitting EM Signals
- Unless Latched Platform is checked

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

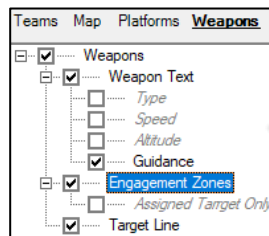
MACE EW ANALYSIS TOOLS 2

Weapon analysis



ANALYSIS → Info/Status Windows → Weapon Analysis

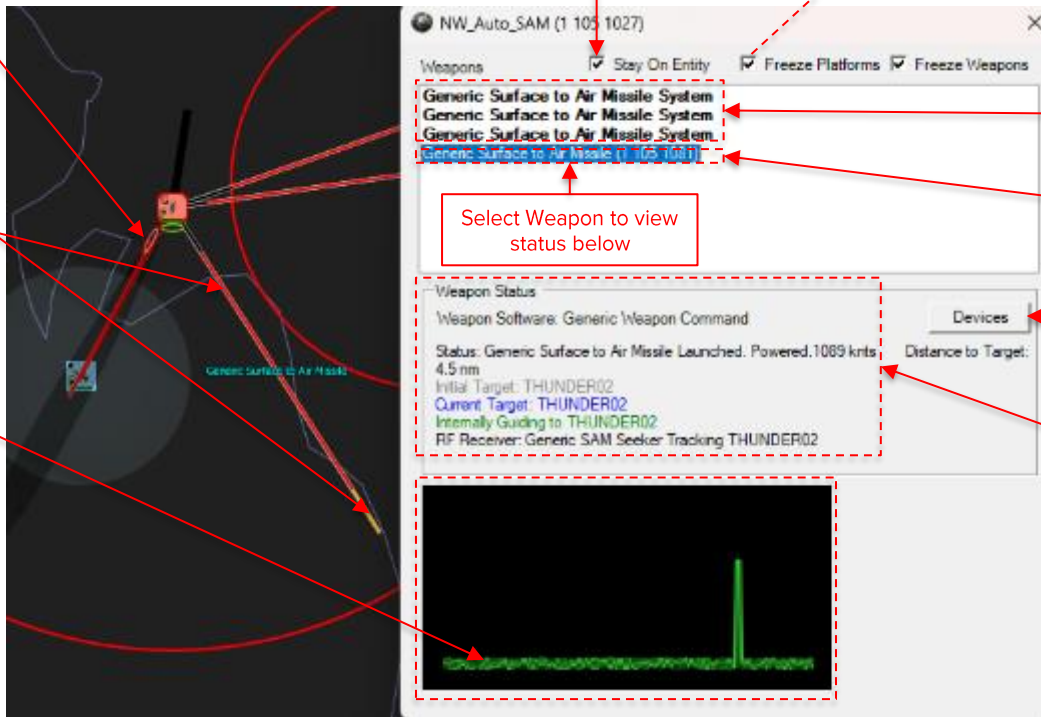
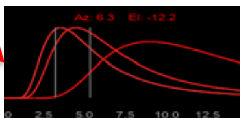
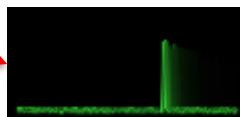
- Shows what each weapon on a platform is tracking
- Enables freezing of platforms and weapons



Weapon Icon

Signal data

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



Don't switch when selecting other entities



'F' Indicates Frozen

BOLD TYPE = Weapons ON selected platform

NORMAL TYPE = Weapons RELEASED by selected platform

Select Weapon to view status below

Opens EW Editor

Status

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

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' window. It has a 'Units' section with 'Metric' selected. Below is a 'Select Entity with Active Radar' dropdown showing 'SCRAM_1'. To its right is a 'Platform telemetry' table with fields: Lat, Long, Health, Alt (AGL/MSL), Pitch, Roll, Yaw, Vel X/Y/Z. Below the entity selector is a 'Select Available Radar Device' dropdown showing 'Generic CWS Radar'. To its right is a 'Radar status and requirements to track' table with fields: Enabled, Offsets (X, Y, Z), Max Effective Range, Max Trackable Targets, Min Time on Target, Target Timeout, and an 'Edit Radar Device' button. Below the radar selector is a 'Potential In-Range Targets' list showing '52mm Mortar HE'. To its right is a 'Tracked target Data' table with fields: Lat, Long, Health, RCS, Alt (AGL/MSL), Pitch, Roll, Yaw, Vel X/Y/Z. Below the target list is a 'Target Solution' table with fields: Slant Range, Brg (Az), Brg (El), Confidence, Peak Gain, Alt, Az, El, Range, and Jammed. Below the solution table is a 'Detection Status' section with 'Search' and 'Tracking' status descriptions. At the bottom right is a radar plot showing a green target. At the bottom left are 'Freeze Platforms' and 'Freeze Weapons' buttons.

Lat:	40.827°	Alt (AGL):	0.0 m	Pitch:	321.9°	Vel X:	0.0 m/s
Long:	8.772°	Alt (MSL):	445.5 m	Roll:	2.4°	Vel Y:	0.0 m/s
Health:	100.0 %			Yaw:	2.8°	Vel Z:	0.0 m/s

Enabled:	True	Max Effective Range:	37.0 km
Offsets:		Max Trackable Targets:	1
X:	0.0 m	Min Time on Target:	7.0 s
Y:	0.0 m	Target Timeout:	2.0 s
Z:	2.8 m		
Yaw:	-38.1°		

Lat:	40.827°	Alt (AGL):	-2.6 m	Pitch:	175.4°	Vel X:	-17.6 m/s
Long:	8.772°	Alt (MSL):	442.9 m	Roll:	-69.9°	Vel Y:	5.9 m/s
Health:	100.0 %	RCS:	0.020 sqm	Roll:	0.0°	Vel Z:	202.0 m/s
				Yaw:	175.4°		

Slant Range:	0.0 km	PV:	-	VMG:	362.8 knots	Jammed:	True
Brg (Az):	0.0°	Confidence:	-	Az:	-	El:	-
Brg (El):	-60.1°	Peak Gain:	0.0 dB				

Detection Status

Search: Capable of detecting target the selected target.

Tracking: Capable of detecting target the selected target.

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 sections highlighted:

- SCRIPT NAMES AND STATUS**: Points to the 'SCRIPTS' table at the top, which lists scripts with columns for Index, Name, Time Trigger, Triggers Enabled, Counting, and Last Time Executed. Red boxes highlight the 'Unique Identifier' (Index), 'Enable / Disable Triggers' (Triggers Enabled), and 'Manual Execution' (Counting) columns.
- TRIGGERS**: Points to the 'SELECTED SCRIPT' section, specifically the 'TRIGGERS' table. A large red box labeled 'IF THIS' covers the trigger conditions. A red box labeled 'AND / OR Toggle' points to the 'AND/OR' dropdown menu.
- ACTIONS**: Points to the 'ACTIONS' table at the bottom, which lists actions with columns for Index, Action, and Status. A large red box labeled 'THEN THAT' covers the action details.
- Buttons and Controls**: Various buttons are highlighted with red boxes and labels:
 - Make New Delete Copy Assign Start/Stop Buttonize**: Points to the right-hand side buttons.
 - Variables**: Points to the 'Variables' section in the 'SELECTED SCRIPT' area.
 - Script Name Make New Delete Edit Reorder**: Points to the 'Script Name' field and its associated buttons.
 - Make New Delete Edit Reorder Repeat/Skip**: Points to the bottom right buttons.
 - Reactivate / Stop / Repeat / Remove**: Points to the bottom status bar buttons.

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 | Behaviour | 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

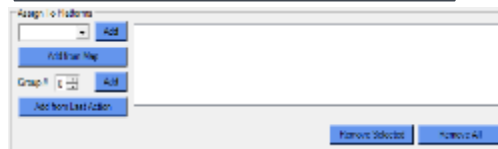
- Change selected weapons
- Shoot Weapon
- Control Emitter

Radio/TDL

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

Environment

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



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 <Owship's Leaders> to 20 Knots. Apply to leg only	Waiting

Add Action
Insert Action
Edit Action
Remove Action
Move Up
Move Down
Skip/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: [] Handpoint: []
Property: [] Value: []
☐ Log Event Other: [] Message: []
☐ Set Platform Lock Apply to: []
Don't Change Offset []
☐ Set Platform Equipment Add: [] 1 [] Equipment: [] Handpoint: []

WHAT THE ACTIONS ARE

☐ Set Layer Tag Layer: [] Tag: [] 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 # [0] Add []
Add from List Action []
Remove Selected [] Remove All []

WHEN NEXT ACTION IS ALLOWED TO START

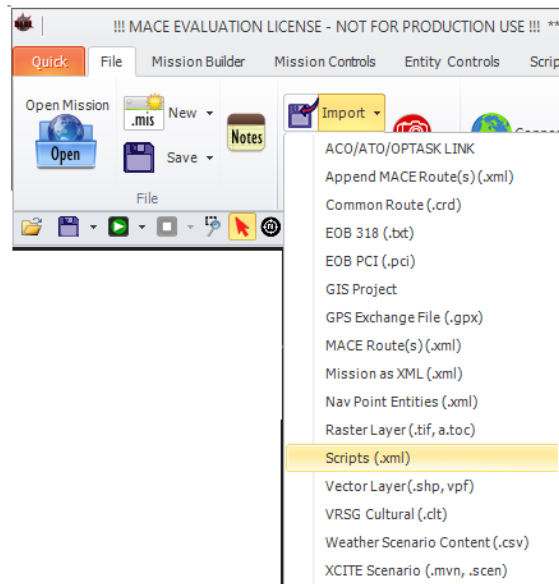
Completion
Action is instantaneous; it is complete as soon as it is executed

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

JTAC Lase for aircraft releasing weapon

■ Trigger

- When the aircraft releases a specific weapon

Platform Has Fired Weapon Shooter: Weapon:
Trigger when a platform has fired a weapon. ☒ Any Hardpoint

■ Actions

- Equip and fire laser (Shoot weapon)

Scripting 1 | Scripting 2 | Mission 1 | Mission 2 | Navigation 1 | Navigation 2 | Behavior | Appearance | Equipment

☐ Change Selected Weapon
☒ Shoot Weapon Hardpoint:
☒ Shoot regardless if equipped. ☐ Don't self-designate.
☐ Control Emitter Control:

- Wait until target is destroyed

☒ Delay Until

- Stop lasing (Shoot weapon again to stop)

☒ Shoot Weapon

■ Script Completion

SCRIPT COMPLETION

☐ Stop Execution ☐ Stop Execution & Disable Triggers ☒ Stop Execution & Enable Triggers ☐ Repeat Actions ☐ Remove Script

MACE Script Editor

SCRIPTS Highlight:

Index	Name	Time Trigger	Trigger Enabled	Executing	Last Time Executed
1	Lase For 5-Line		☒	☒	

SELECTED SCRIPT

Index: 1 Name: Lase For 5-Line Script Platform:

Number Variable: String Variable:

TRIGGERS Condition: ☒ OR ☐ AND ☐ Check Triggers Once

Index	Trigger	Status
0	Platform AirOver_3 has shot a weapon. Type: Genetic GBU-1000	Not Met

ACTIONS

Index	Action	Status
0	Shoot weapon Laser Designator from human_3 regardless if loaded.	Waiting
1	Delay until platform tank_9 is dead. (wait for action to finish.)	Waiting
2	Shoot weapon Laser Designator from human_3 regardless if loaded.	Waiting

SCRIPT COMPLETION

☐ Stop Execution ☐ Stop Execution & Disable Triggers ☒ Stop Execution & Enable Triggers ☐ Repeat Actions ☐ Remove Script

SCRIPT EXERCISES

Helicopter Landing Zones

- Land at Prescribed LZ
 - Trigger
 - Helicopter Arrives at Waypoint
 - Actions
 - Navigation 1 - Set Landing Zone
 - Navigation 1 - Assign Tactic “Land”
- Land at Prescribed LZ + Smoke
 - Trigger
 - As above
 - Actions
 - As above +
 - Scripting 1 – Delay Until Trigger
 - Platform Proximity – Helicopter to LZ
 - Environment – Set Wind
 - Mission 1 – Detonate Munition “Smoke”

Set landing zone of JEFF-11 to JEFF-LZ-2 and clear parking location.
Set landing zone of JON-12 to JON-LZ-2 and clear parking location.
Assign tactic land to JON-12,JEFF-11. (Wait for action to finish.)

Set landing zone of JEFF-11 to JEFF-LZ-2 and clear parking location.
Set landing zone of JON-12 to JON-LZ-2 and clear parking location.
Assign tactic land to JON-12,JEFF-11.
Delay Until Platform Proximity JEFF-11 is within 500 meters of JEFF-LZ-2. (Wait for a...
Set surface winds to 335 deg at 7 kts.
Detonate munition Smoke Grenade (Orange) on 10T ET 92516 59003.

MACE INTERMEDIATE MISSION EDITING SCRIPTING

Air to Air Commit

■ Trigger (AND)

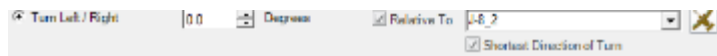
- When the red aircraft has ever reached a speed (Persist)

AND

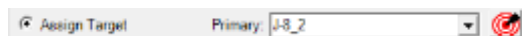
- Any later than an elapsed time

■ Actions

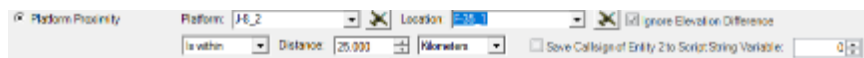
- Turn Blue Aircraft to face Red aircraft



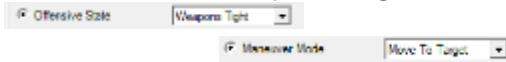
- Assign as Target to Blue Aircraft



- Wait until Red Aircraft is closer (25km of blue aircraft)



- Blue Aircraft Weapons Tight + Move to target



■ Script Completion

SCRIPT COMPLETION

☐ Stop Execution ☒ Stop Execution & Disable Triggers ☐ Stop Execution & Enable Triggers ☐ Repeat Actions ☐ Remove Script

TRIGGERS		Condition: ☐ OR ☒ AND	☐ Check Triggers Once
Index	Trigger		
0	Mission Elapsed Time: 0 hours 0 minutes 20 seconds or any later time.		
1	Platform J-8_2 speed is greater than or equal to 450 knots. (Persist)		

ACTIONS			
Index	Action	Status	
0	Turn = $\text{atan2}(\text{y}_2 - \text{y}_1, \text{x}_2 - \text{x}_1)$ degrees relative to: J-8_2 (wait for action to finish.)	Waiting	Add Action
1	Set target for = $\text{atan2}(\text{y}_2 - \text{y}_1, \text{x}_2 - \text{x}_1)$.	Waiting	Insert Action
2	Delay (UNTIL Platform Proximity J-8_2 is within 25 kilometers of F-35_1. (Wait for action to finish.)	Waiting	End Action
3	Offensive State F-35_1 to Weapons Tight.	Waiting	Remove Action
4	Move to mode = $\text{atan2}(\text{y}_2 - \text{y}_1, \text{x}_2 - \text{x}_1)$ to move to target.	Waiting	Move Up
5	Delay (UNTIL Platform F-35_1 has shot a weapon. (Wait for action to finish.)	Waiting	Move Down
6	Start Script: 0	Waiting	Toggle Skip

SCRIPT COMPLETION

☐ Stop Execution ☒ Stop Execution & Disable Triggers ☐ Stop Execution & Enable Triggers ☐ Repeat Actions ☐ Remove Script

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



The screenshot shows the Script Editor interface with several red dashed boxes and arrows pointing to specific features:

- SCRIPT NAMES AND STATUS**: Points to the 'SCRIPTS' table at the top, which lists scripts with columns for Index, Name, Time Trigger, Triggers Enabled, Counting, and Last Time Executed.
- TRIGGERS**: Points to the 'TRIGGERS' section, which includes a 'Condition' dropdown (IF, OR, AND), a 'Script Mode' dropdown, and a large area for defining triggers. A large red text overlay 'IF THIS' is present in this section.
- ACTIONS**: Points to the 'ACTIONS' section, which lists actions with columns for Index, Action, and Status. A large red text overlay 'THEN THAT' is present in this section.
- Unique Identifier**: Points to the 'Index' column in the 'SCRIPTS' table.
- Enable / Disable Triggers**: Points to the 'Triggers Enabled' column in the 'SCRIPTS' table.
- Manual Execution**: Points to the 'Counting' column in the 'SCRIPTS' table.
- Make New Delete Copy Assign Start/Stop Buttonize**: Points to the right-hand sidebar of the 'SCRIPTS' table, which contains buttons for these actions.
- Variables**: Points to the 'Variables' section in the 'SELECTED SCRIPT' area.
- AND / OR Toggle**: Points to the 'Condition' dropdown in the 'TRIGGERS' section.
- Script Name Make New Delete Edit Reorder**: Points to the right-hand sidebar of the 'TRIGGERS' section.
- Make New Delete Edit Reorder Repeat/Skip**: Points to the right-hand sidebar of the 'ACTIONS' section.
- Reactivate / Stop / Repeat / Remove**: Points to the bottom of the 'ACTIONS' section, which contains buttons for these actions.



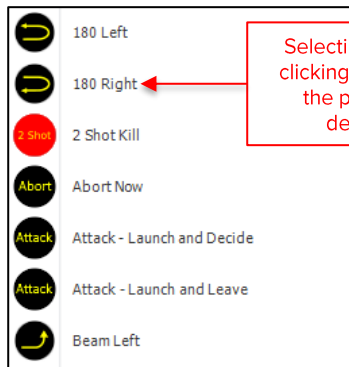
MISSION EDITING BUTTONIZED SCRIPTS



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##>	

Example of using script variables

Example of using script variables

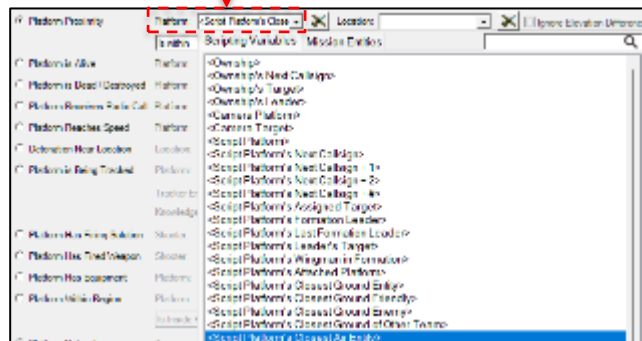


ACTION (THEN THAT)

- 

TRIGGER

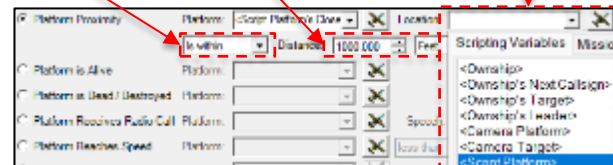
<Script Platform's Closest Air Entity>



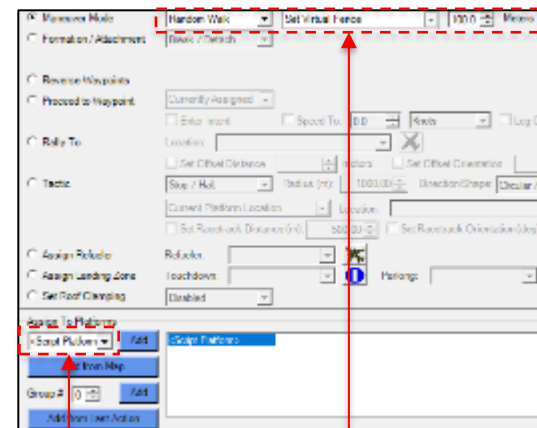
Is Within

1000ft

<Script Platform>



ACTION



<Script Platform>

Random Walk

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

1 Buttonize

2 Buttonize Path

3 Icon Path (Optional)

4 Buttonize Options

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

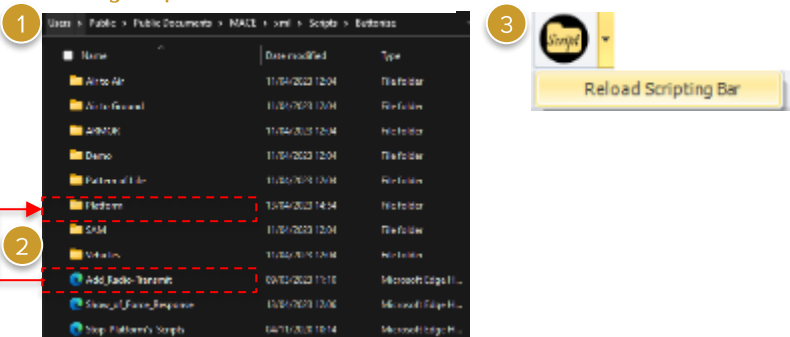
Allows user to enter a number variable

MISSION EDITING BUTTONIZED SCRIPTS

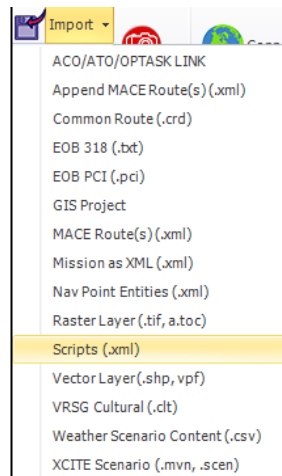
Moving and Editing buttonized scripts

- 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

The screenshot shows the 'ACTIONS' list in the Mission Editor. The 'While' loop is selected, and the 'Select Trigger' field is set to 'If Platform <Script Platform> does not have equipment Generic Radio at any hard ...'. The actions within the loop are:

| Index | Action |
|-------|---|
| 0 | If Platform <Script Platform> does not have equipment Generic Radio at any hard ... |
| 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 | Else |
| 4 | Make Radio Call: I have an old radio and I am using it to transmit messages ... |
| 5 | End If |
| 6 | End while |

- **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

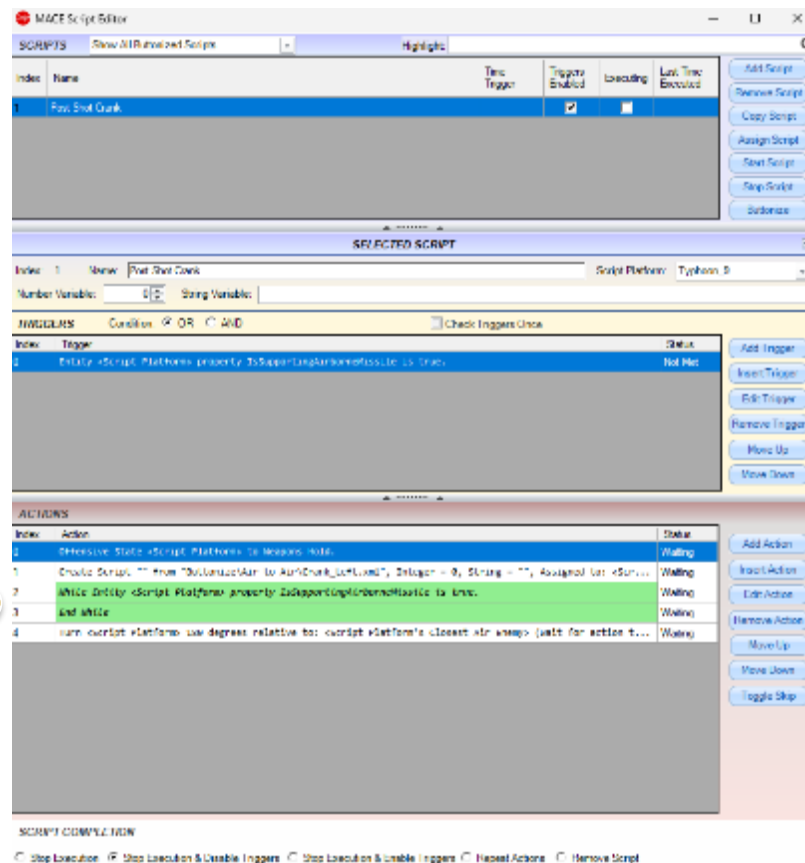
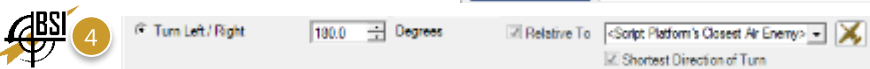
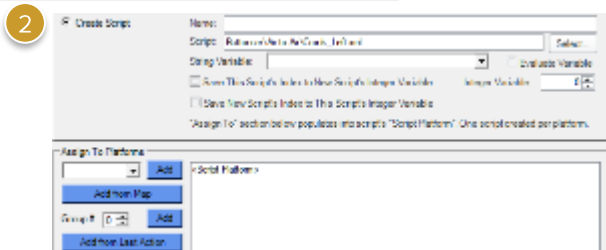
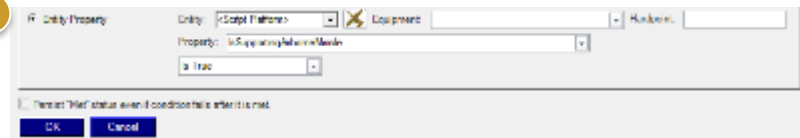
- Call a buttonized script from any other script
 - Replaces selecting platform manually
 - Pressing button
 - Entering data / clicking map
- Need to Specify:
 - <Script Platform>
 - User Inputs
 - <Script String Variable>
 - <Script Integer Variable>
- Name – what appears when script is ‘created’ in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

The screenshot shows the 'Script Action Editor' window. A red dashed box highlights the 'Create Script' section, which includes fields for 'Name', 'Script', 'String Variable', and checkboxes for saving script indices. Annotations point to these fields: 'Name to appear in script list' points to the 'Name' field (containing 'Land at LZ'), 'Buttonized Script to Execute' points to the 'Script' field (containing 'Buttonize Land_at_Known_LZ.xml'), and 'User Inputs' points to the 'String Variable' field (containing 'LZ-Z'). Below this, the 'Assign To Platforms' section is also highlighted with a red dashed box, showing a list of platforms with 'AH-64_5' selected. An annotation 'Scripted Platform(s)' points to this list. The interface includes tabs for 'Scripting 1', 'Scripting 2', 'Mission 1', 'Mission 2', 'Navigation 1', 'Navigation 2', 'Behavior', 'Appearance', 'Equipment', 'Radio / TDL', and 'Properties'. The 'Create Script' section has radio buttons for 'Execute Code Script', 'Comment', 'If', 'Else If', 'Else', 'End If', 'While', 'End While', 'Goto Action #', and 'Raise Event'. The 'Assign To Platforms' section has buttons for 'Add from Map', 'Add from Last Action', 'Remove Selected', and 'Remove All'.

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>



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 Threat>  
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 be able to use the common elements of any form-based attack in MACE

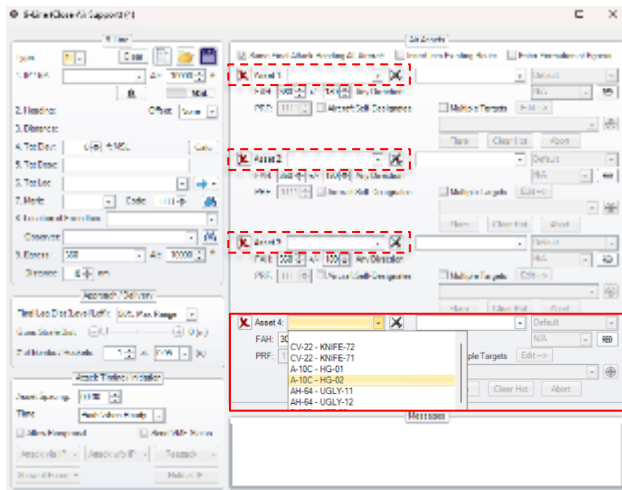
Enabling objectives

- Understand how to select attacking assets in 9-Line, 5-Line, and Call for fire forms
- Understand how to select targets in 9-Line, 5-Line, and Call for fire forms
- Understand how to select ordnance in 9-Line, 5-Line, and Call for fire forms
- Understand how to change attack profile and delivery parameters in 9-Line, 5-Line, and Call for fire forms
- Understand how to select attack initiation timing in 9-Line, 5-Line, and Call for fire forms
- Understand how to execute 9-Line, 5-Line, and Call for fire forms

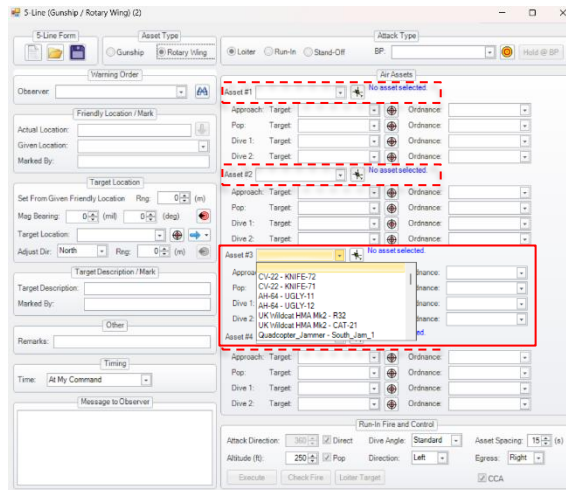
MACE FORM CONTROLLED ATTACKS COMMON

Select Attacking Asset

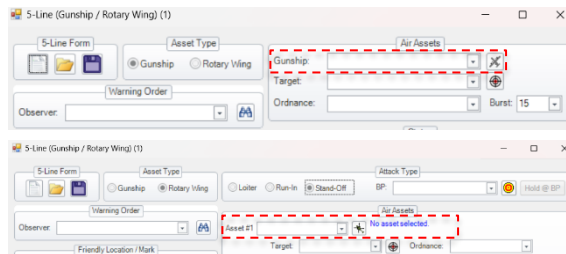
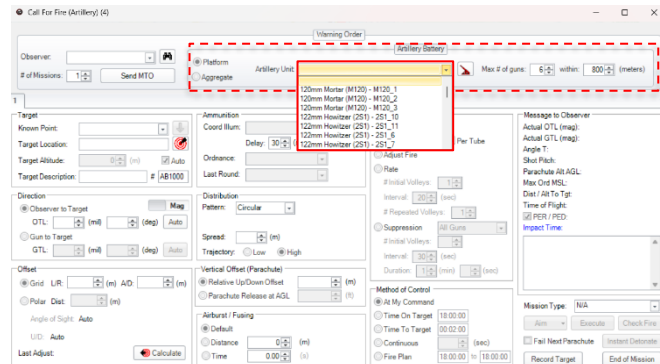
CAS 9-Line



5-Line



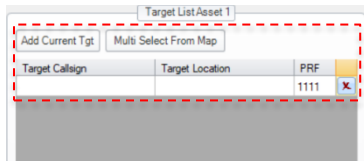
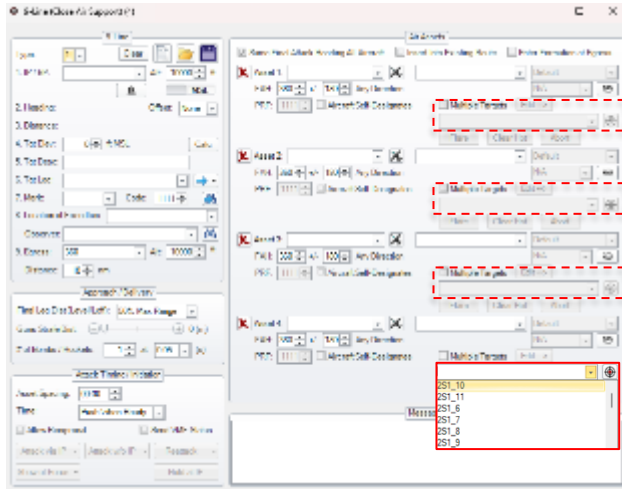
Call For Fire



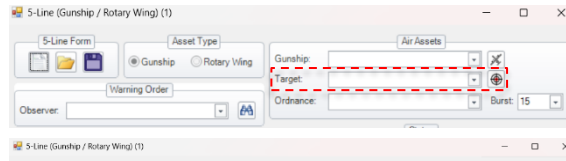
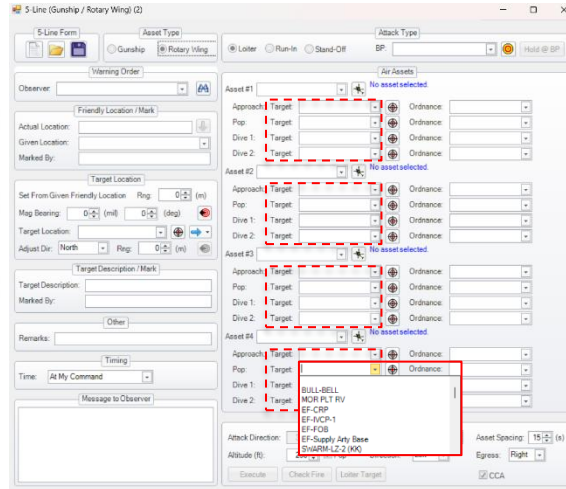
MACE FORM CONTROLLED ATTACKS COMMON

Select Target

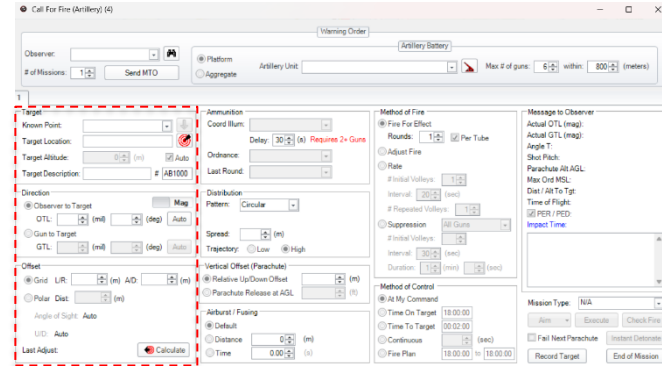
CAS 9-Line



5-Line



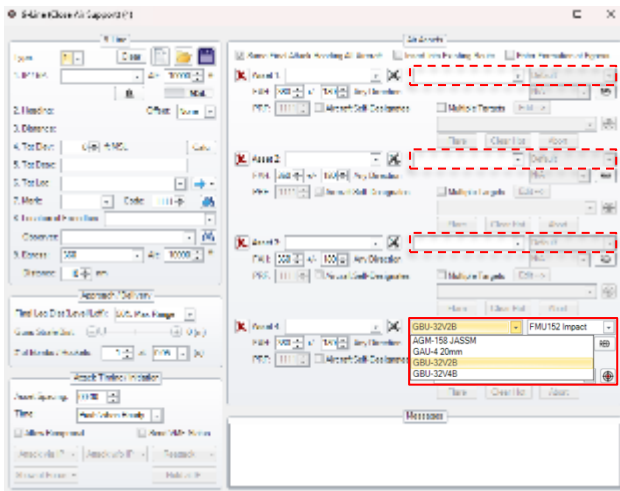
Call For Fire



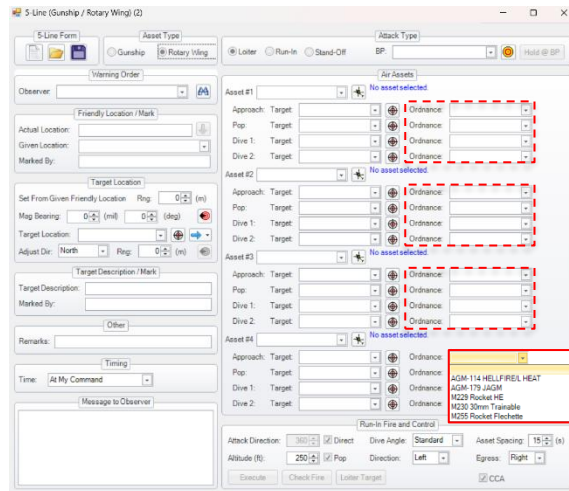
MACE FORM CONTROLLED ATTACKS COMMON

Select Ordnance

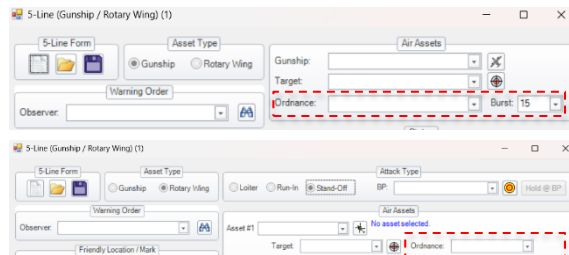
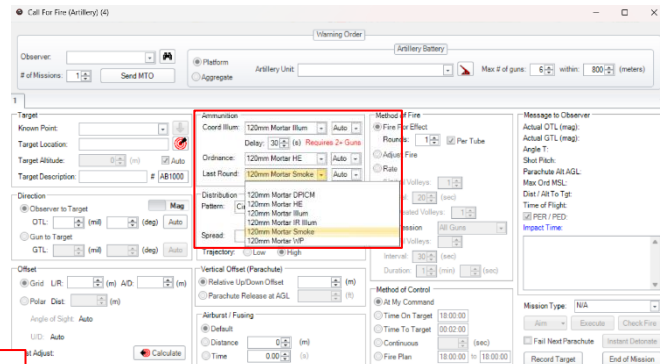
CAS 9-Line



5-Line



Call For Fire



MACE FORM CONTROLLED ATTACKS COMMON

Select Profile & Delivery Parameters

CAS 9-Line

4-Line/Cas9 Support (1)

Attack Type: SP

Attack Timing: Time To Release, Time To Impact

5-Line

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

Attack Type: SP

Attack Timing: Time To Release, Time To Impact

Call For Fire

Call For Fire (Artillery) (4)

Attack Type: SP

Attack Timing: Time To Release, Time To Impact

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

Attack Type: SP

Attack Timing: Time To Release, Time To Impact

MACE FORM CONTROLLED ATTACKS COMMON

Select Timing For Initiation

CAS 9-Line

The screenshot shows the CAS 9-Line interface. A red dashed box highlights the 'Attack Timing / Initiation' dropdown menu. The menu is open, showing options: 'Time', 'Push When Ready', 'Push When Ready', 'Time On Target', 'Time To Target', and 'Fire Plan'. The 'Time' option is selected.

5-Line

The screenshot shows the 5-Line interface. A red dashed box highlights the 'Time' dropdown menu. The menu is open, showing options: 'At My Command', 'At My Command', 'Time On Target', 'Time To Target', 'From Now', 'Continuous', and 'Repeat Interval'. The 'Time' option is selected.

Call For Fire

The screenshot shows the Call For Fire interface. A red dashed box highlights the 'Method of Control' dropdown menu. The menu is open, showing options: 'At My Command', 'Time On Target', 'Time To Target', 'Continuous', and 'From Now'. The 'At My Command' option is selected.

MACE FORM CONTROLLED ATTACKS COMMON

Execute

CAS 9-Line

The screenshot shows the CAS 9-Line interface. At the bottom, a red dashed box highlights the 'Execute' button, which is used to initiate the mission.

5-Line

The screenshot shows the 5-Line interface. At the bottom, a red dashed box highlights the 'Execute' button, which is used to initiate the mission.

Call For Fire

The screenshot shows the Call For Fire interface. At the bottom right, a red dashed box highlights the 'Execute' button, which is used to initiate the mission.

This is a close-up of the 'Fire and Control' section. It contains three buttons: 'Execute', 'Check Fire', and 'Return to Intent'. The 'Execute' button is highlighted with a red dashed box.

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

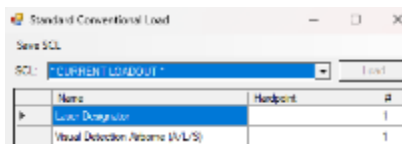
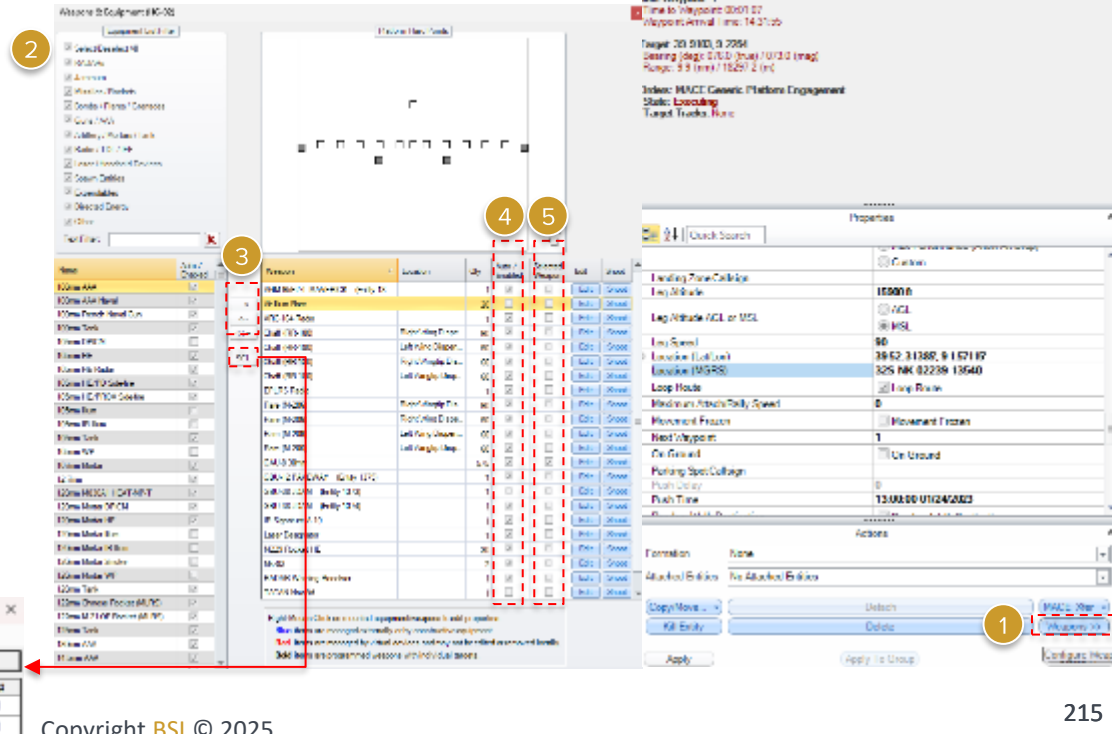
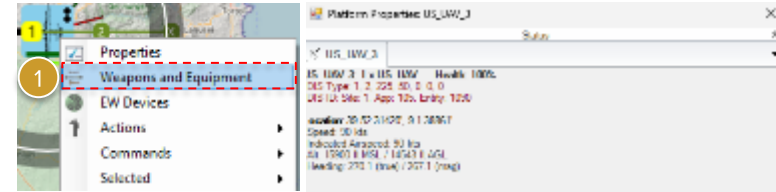
Enabling objectives

- 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



MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

4 -START POINT – IP (3D) (Optional)



90°/5nm
10,000ft
From TGT

Or Known Point From List
Or generate keyhole points

5 -END POINT (3D)

360°/10nm
10,000ft
From TGT



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

7 -COMMENCE ATTACK METHOD

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

9-Line (Close Air Support) (1)

Type: 9-Line Clear

1. IP / BP: 90 Alt: 10000 ft Distance: 5 nm Offset: None

2. Heading: Offset: None

3. Distance:

4. Tgt Elev: 0 ft MSL Calc

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

Gunn 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 Retrack

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

PRF: 1111 Aircraft Self-Designates

Waiting for Instruction

Laser: Good Heading Dive (30)

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 Edit-->

Flare Clear Hot Abort

Asset 3: Default

FAH: 360 +/- 180 Any Direction

PRF: 1111 Aircraft Self-Designates

Multiple Targets Edit-->

Flare Clear Hot Abort

Asset 4: Default

FAH: 360 +/- 180 Any Direction

PRF: 1111 Aircraft Self-Designates

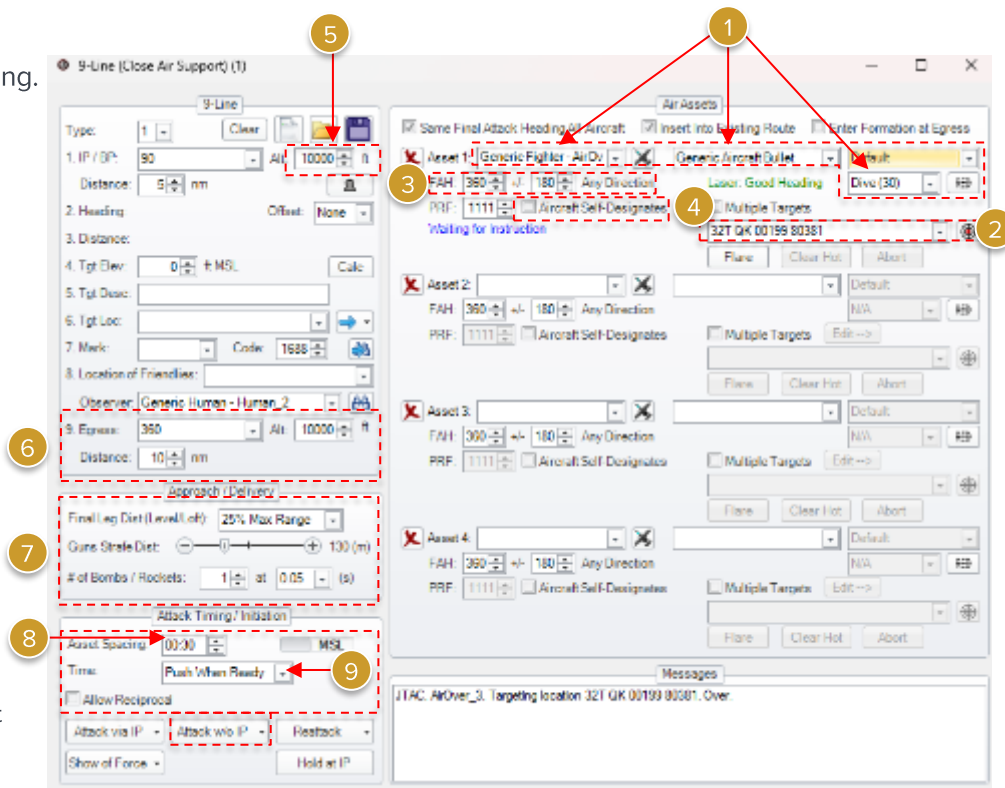
Multiple Targets Edit-->

Flare Clear Hot Abort

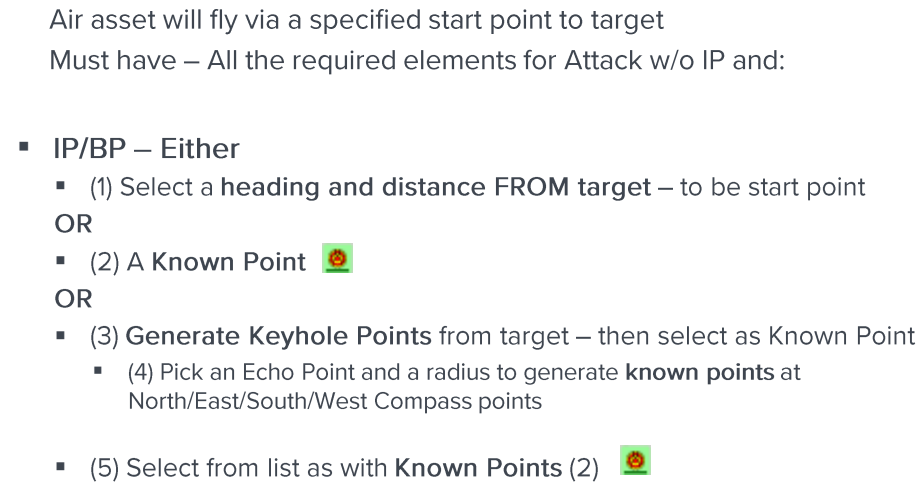
MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

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)



Attack Via IP – A specified 3D Start Point



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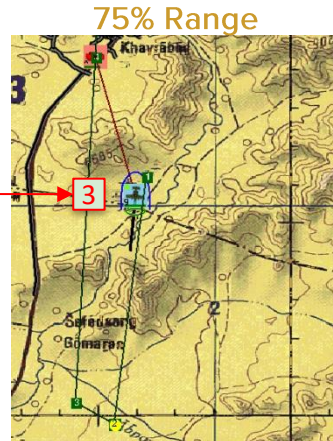
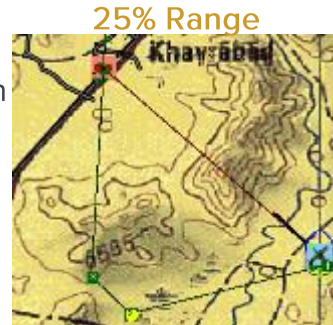
MACE FORM CONTROLLED ATTACKS 1 – SIMPLE CAS

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 2nd 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

Off Platform Laser Designation

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

- SET LASER CODE (PRF) FOR THE DESIGNATOR TO MATCH AIR ASSET PRF
 - ENTITY CONTROL WINDOW (PRF)
- OR
- Use PLATFORM PROPERTIES (General>Laser Designator Code)

- 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

| Name | Active / Enabled | Weapon | Location | Qty | Active / Enabled | Selected Weapon | E |
|-----------------------------|-------------------------------------|--------|----------|-----|------------------|-----------------|---|
| Active Denial System | ☒ | | | | | | |
| ALKA Directed Energy Weapon | ☒ | → | | | | | |
| Flamethrower | ☐ | | | | | | |
| Granade | ☐ | | | | | | |
| GPS | ☐ | | | | | | |
| IR Pointer | ☐ | | | | | | |
| IR Pointer (Steady) | ☐ | | | | | | |
| IR Striker | ☐ | | | | | | |
| Laser Designator | ☒ | | | | | | |

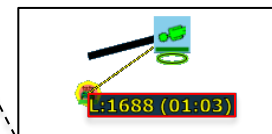


The screenshot shows the "Platform Properties" window for "USNAUTAC_10". The "General" tab is selected. Key information includes:

- Name:** USNAUTAC_10
- Health:** 100%
- Type:** 0.5 Type C, 1.225, 1.52, 1.2
- Size:** 80.50 M, Sep: 800, Daily: 10.00
- Includes:** AT&T Networks - Telephony
- Location:** 1.000
- IP:** 192.168.1.138-140
- Reading:** 20.00 (real), 1000.0 (mag)

At the bottom, there are two fields:

- User Designer Code:** 1008
- Log Mode Data:**



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 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

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

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:

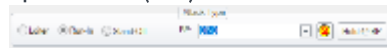
■ Loiter

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



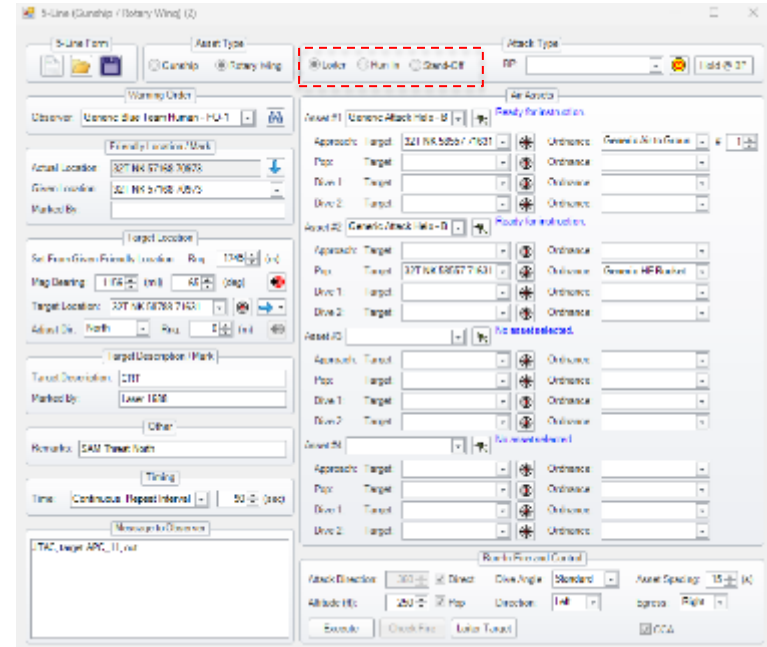
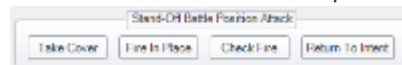
■ Run-In

- 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

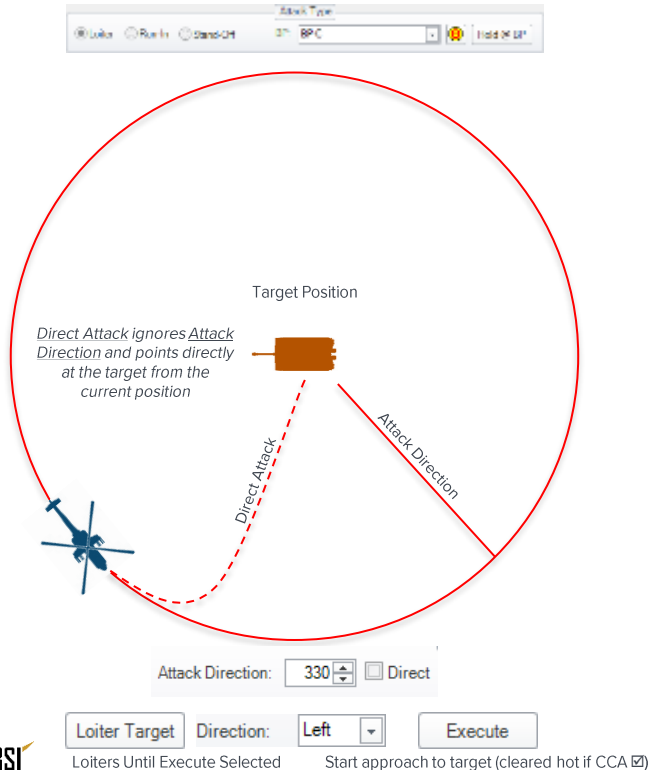
- Assets descend for cover from either their current position or from a Battle Position (BP)
- When attacking they ascend fire then descend back into cover
- “Take Cover” = assets descend to 50 ft AGL and hover in place OR Rally to BP and do the same



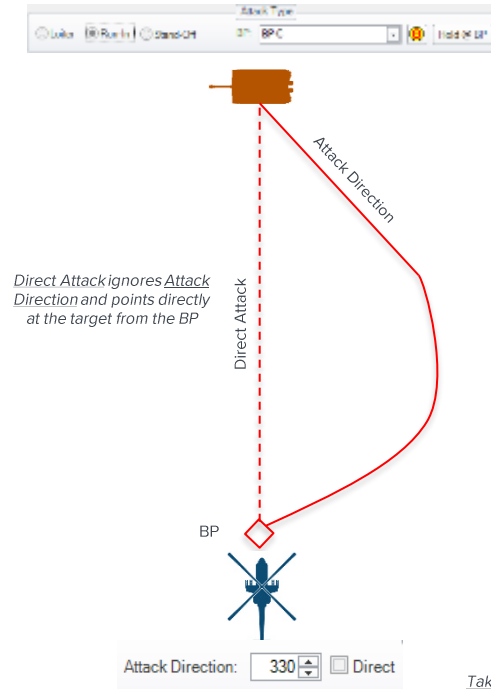
MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

Rotary Wing – Attack Types vs Behaviours

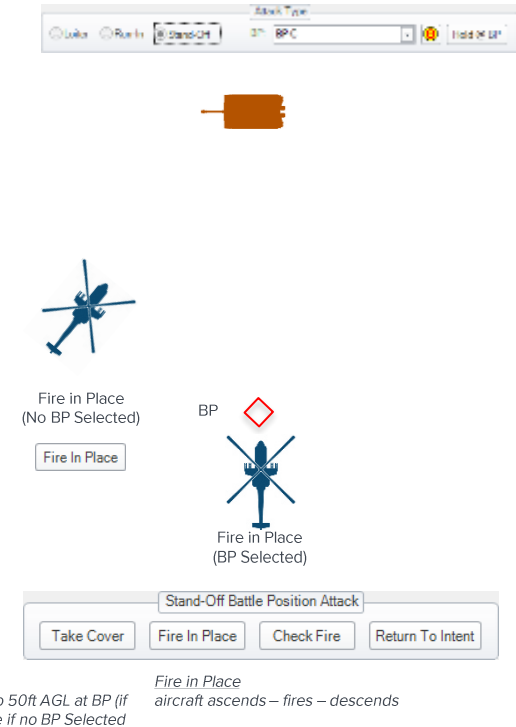
LOITER



RUN-IN



STAND-OFF



MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

Rotary Wing – Final Attack Profiles

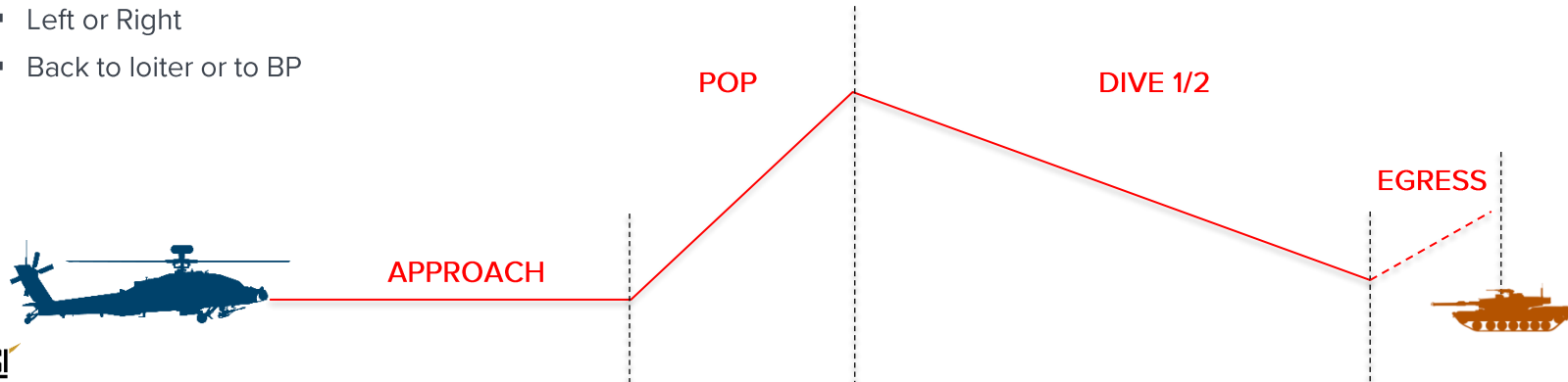
- **Approach**
 - On FAH but before pop
- **POP**
 - Gaining altitude before dive
- **Dive 1/2**
 - Occur simultaneously
 - Can allocate separate ordnance for up to 2 targets
- **Egress**
 - Left or Right
 - Back to loiter or to BP

Air Assets

Asset #1 Generic Attack Helo - B Ready for instruction.

| | | | | | | | |
|-----------|---------|--------------------|--|-----------|------------------------|---|---|
| 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)

The screenshot shows the '5-Line (Gunship / Rotary Wing) (2)' form with the following fields and callouts:

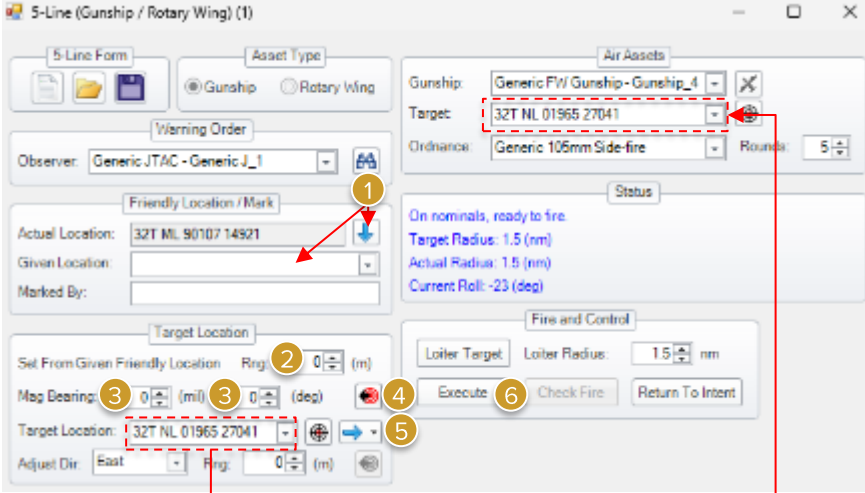
- 1** Gunship: C-130J - AC-130J_1
- 2** Target: 32T NK 58727 71574 (BRDM-2_1)
- 3** Ordinance: 30mm HE/PG Side-fire
- 4** Rounds: 5
- 5** Loiter Target (in the Fire and Control section)
- 6** Time: At My Command
- 7** Execute (button)
- 8** Adjust Dir: North

Other visible fields include: Asset Type (Gunship), Warning Order, Observer (Generic Blue Team Human - FO-1), Friendly Location / Mark (Actual/Given Location: 32T NK 57168 70973), Target Location (Set From Given Friendly Location, Range: 1745 m, Mag Bearing: 1156 mil/65 deg), Target Description / Mark (Target Description: CRT, Marked By: Laser 1638), Remarks (SAM Threat North), and Timing (At My Command).

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)' form. It is divided into several sections: '5-Line Form', 'Asset Type', 'Air Assets', 'Status', and 'Fire and Control'. The '5-Line Form' section includes fields for 'Observer' (Generic JTAC - Generic J_1), 'Actual Location' (32T NL 90107 14921), 'Given Location', and 'Marked By'. The 'Asset Type' section has radio buttons for 'Gunship' (selected) and 'Rotary Wing'. The 'Air Assets' section includes 'Gunship' (Generic FW Gunship - Gunship_4), 'Target' (32T NL 01965 27041), 'Ordnance' (Generic 105mm Side-fire), and 'Rounds' (5). The 'Status' section shows 'On nominals, ready to fire', 'Target Radius: 1.5 (nm)', 'Actual Radius: 1.5 (nm)', and 'Current Roll: -23 (deg)'. The 'Fire and Control' section includes 'Loiter Target', 'Loiter Radius: 1.5 (nm)', and buttons for 'Execute', 'Check Fire', and 'Return To Intent'. Numbered callouts are placed on the form: 1 points to the 'Actual Location' field; 2 points to the 'Range' field in the 'Target Location' section; 3 points to the 'Mag Bearing' field; 4 points to the 'Execute' button; 5 points to the 'Assign Target' button (blue arrow); and 6 points to the 'Execute' button in the 'Fire and Control' section. A red dashed box highlights the 'Target' field in the 'Air Assets' section.

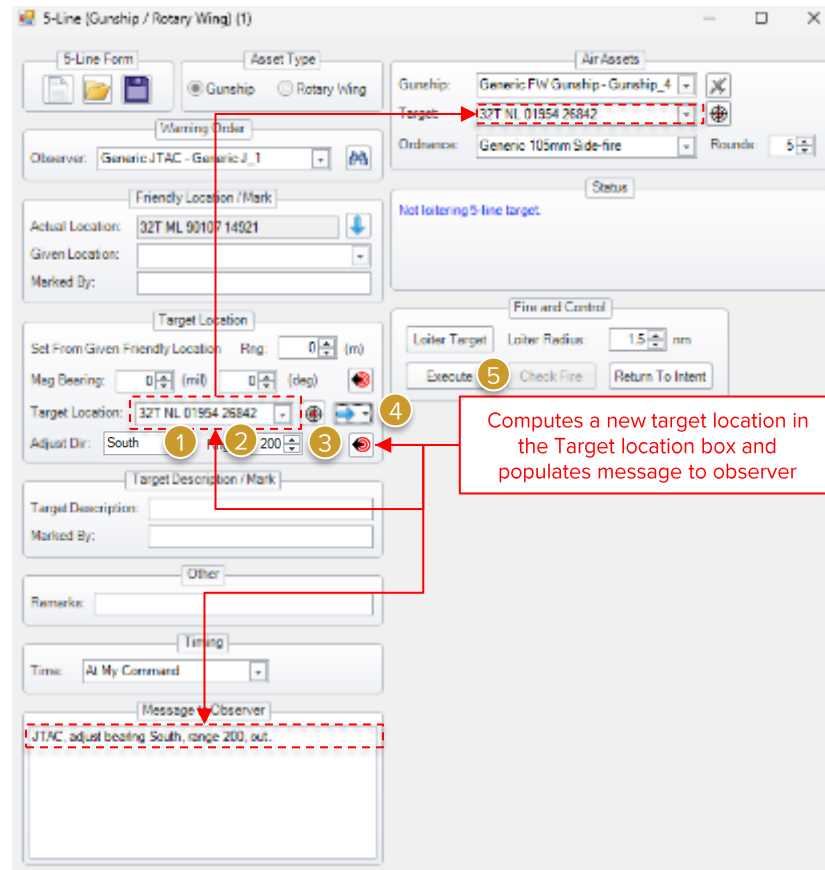
MACE FORM CONTROLLED ATTACKS 3 – 5 LINES

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 (Gunship / Rotary Wing) (1)

5-Line Form

Asset Type: ☒ Gunship ☐ Rotary Wing

Warring Order

Observer: Generic JTAC - Generic J_1

Friendly Location / Mark

Actual Location: 32T ML 00107 14921

Given Location:

Marked By:

Target Location

Set From Given Friendly Location: Ring: 0 (m)

Mag Bearing: 0 (mil) 0 (deg)

Target Location: 32T NL 01954 26842

Adjust Dir: South 1 2 200 3

Target Description / Mark

Target Description:

Marked By:

Other

Remarks:

Timing

Time: At My Command

Message 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

Computes a new target location in the Target location box and populates message to observer

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 in 2D 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

Observer: Generic Blue Team Hum 

of Missions: 5

Platform ☒ Aggregate ☐

Artillery Unit: Generic SP Artillery - SPArty_16  Max # of guns: 6 within: 800 (meters)

1 2 3 4 5

| | | | |
|---|--|--|--|
| <p>Target</p> <p>Known Point: <input type="text"/></p> <p>Target Location: 32T NK 04686 74765 </p> <p>Target Altitude: 0 (m) ☒ Auto</p> <p>Target Description: <input type="text"/> # AB1000</p> <p>Direction</p> <p>☒ Observer to Target ☐ Gun to Target</p> <p>OTL: <input type="text"/> (mil) <input type="text"/> (deg) <input type="button" value="Auto"/></p> <p>GTL: <input type="text"/> (mil) <input type="text"/> (deg) <input type="button" value="Auto"/></p> <p>Offset</p> <p>☒ Grid L/R: <input type="text"/> (m) A/D: <input type="text"/> (m)</p> <p>☐ Polar Dist: <input type="text"/> (m)</p> <p>Angle of Sight: Auto</p> <p>U/D: Auto</p> <p>Last Adjust: <input type="button" value="Calculate"/></p> | <p>Ammunition</p> <p>Coord Illum: <input type="text"/></p> <p>Delay: 30 (s)</p> <p>Ordnance: Generic Artillery HE <input type="button" value="Auto"/></p> <p>Last Round: <input type="text"/></p> <p>Distribution</p> <p>Pattern: Linear</p> <p>Attitude: 5600 (mils)</p> <p>Distance: 500 (m)</p> <p>Trajectory: ☐ Low ☒ High</p> <p>Vertical Offset (Parachute)</p> <p>☒ Relative Up/Down Offset <input type="text"/> (m)</p> <p>☐ Parachute Release at AGL <input type="text"/> (ft)</p> <p>Airburst / Fusing</p> <p>☒ Default</p> <p>☐ Distance <input type="text"/> (m)</p> <p>☐ Time <input type="text"/> (s)</p> | <p>Method of Fire</p> <p>☒ Fire For Effect</p> <p>Rounds: 1 ☒ Per Tube</p> <p>☐ Adjust Fire</p> <p>☒ Rate</p> <p># Initial Volleys: 1</p> <p>Interval: 30 (sec)</p> <p># Repeated Volleys: 1</p> <p>☐ Suppression All Guns</p> <p># Initial Volleys: 0</p> <p>Interval: 10 (sec)</p> <p>Duration: 60 (min) 0 (sec)</p> <p>Method of Control</p> <p>☐ At My Command</p> <p>☐ Time On Target 18:00:00</p> <p>☐ Time To Target 00:02:00</p> <p>☒ Continuous 30 (sec)</p> <p>☐ Fire Plan 12:00:00 to 12:10:00</p> | <p>Message to Observer</p> <p>Actual OTL (mag): 4623 (mil) 260 (deg)</p> <p>Actual GTL (mag): 3956 (mil) 223 (deg)</p> <p>Angle T: 666 (mil) 37 (deg)</p> <p>Shot Pitch: 907 (mil) 51.01 (deg)</p> <p>Parachute Alt AGL:</p> <p>Max Ord MSL: 3764 (m) 12350 (ft)</p> <p>Dist / Alt To Tgt: 9555 (m) / 14 (m)</p> <p>Time of Flight: 53 (s)</p> <p>☒ PER / PED: 46 / 12 (m)</p> <p>Impact Time:</p> <p>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.</p> <p>Mission Type: N/A</p> <p><input type="button" value="Aim"/> <input type="button" value="Execute"/> <input type="button" value="Check Fire"/></p> <p>☐ Fail Next Parachute <input type="button" value="Instant Detonate"/></p> <p><input type="button" value="Record Target"/> <input type="button" value="End of Mission"/></p> |
|---|--|--|--|

TARGET POSITION
AND
ADJUST

AMMUNITION AND
DETONATION
CHARACTERISTICS

METHOD OF FIRE
AND
TIMINGS

KEY INFORMATION
MESSAGES AND
EXECUTION

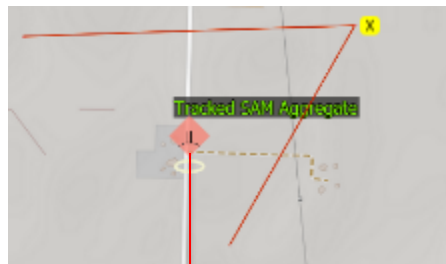
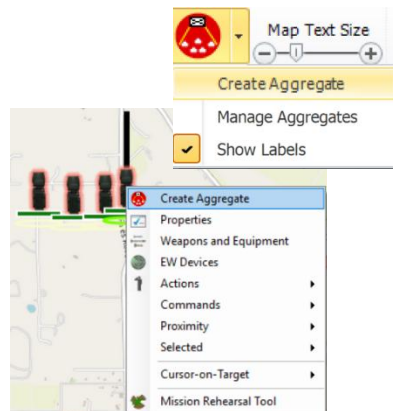
AGGREGATE REFRESHER

Saving and exporting aggregates

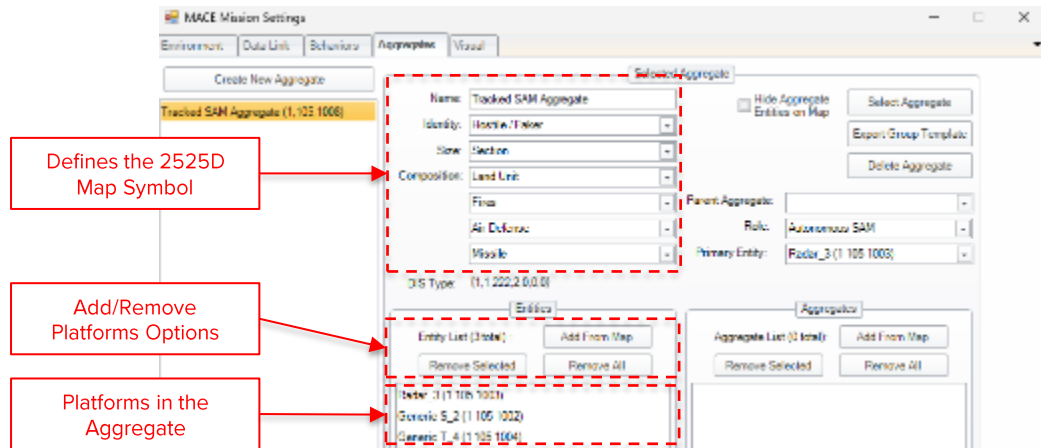
- Aggregates = groups of more than 1 entity
- Can be assigned MIL STD 2525D Symbol
- Can be assigned to a 'Parent Aggregate'

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



Defines the 2525D Map Symbol

Add/Remove Platforms Options

Platforms in the Aggregate

MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

Selecting Units

Observer: Generic Blue Team Hum 

of Missions: 5

☒ Platform ☐ 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

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-3

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

- 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



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

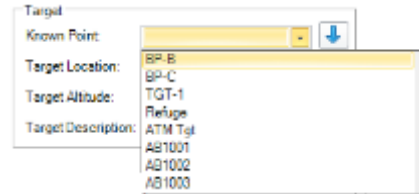
MACE FORM CONTROLLED ATTACKS 4 – CALL FOR FIRE

Target Location

- 3 Methods

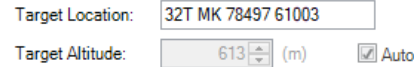
- Known Point

- 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

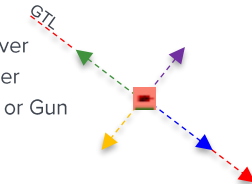
- Adjustments will be made along a line that joins
 - Observer position to target position (OTL) Or Gun position to target position (GTL)
 - The line can be entered incorrectly / arbitrarily
- Either: Specify a GTL or OTL Manually OR Auto calculate the GTL or OTL

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 UR: 0 (m) A/D: 500 (m)

☐ Polar Dist: 300 (m)

Angle of Sight: Auto

UID: Auto

Last Adjust: Gun D500 m

Direction

☒ Observer to Target

OTL: 4797 (mi) 270 (deg) Auto

☐ Gun to Target

GTL: 1800 (mi) 50 (deg) Auto

Offset

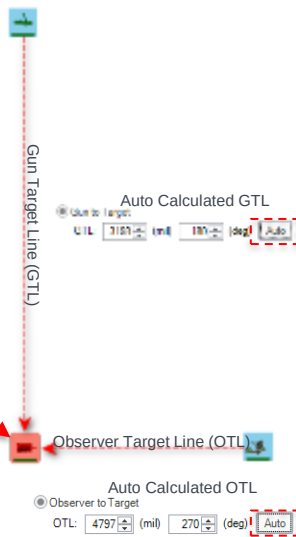
☒ Grid UR: 0 (m) A/D: 500 (m)

☐ Polar Dist: 300 (m)

Angle of Sight: Auto

UID: Auto

Last Adjust: Gun 1800 mi 50 deg



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.

Mission Type: N/A

☐ Fail Next Parachute

Target Description: # AB1000

PER/PED: ☒ PER / PED: 12 / 3 (m)

- Use probable error in range and deflection values
- Affects impact points by up to that value

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

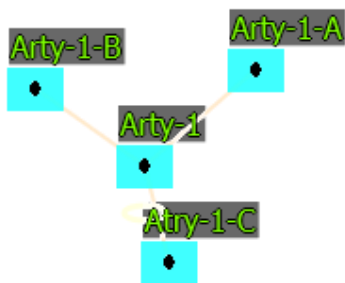
Enabling objectives

- 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 | Behavior | Aggregates | Visual

Create New Aggregate

Selected Aggregate

Name: Arty-1-A

Identity: Friend

Size: Section

Composition: Land Unit

Fires: Parent Aggregate: Arty-1 (1,105,1046)

Field/Artillery: Role: Primary Entry:

DIS Type: (1,1,225,2,0,0,0)

Entities

Entity List (3 total): Add From Map Remove Selected Remove All

Aggregates

Aggregate List (0 total): Add From Map Remove Selected Remove All

Arty-1 (1,105,1046)

Arty-1-A (1,105,1047)

Arty-1-B (1,105,1048)

Arty-1-C (1,105,1049)

Artillery_33 (1,105,1037)

Artillery_35 (1,105,1038)

Artillery_34 (1,105,1039)

Fire Plan Form

The screenshot displays the Fire Plan software interface, which is used for planning and executing fire missions. The interface includes a timeline at the top with a date and time selector (18:10 Jun 26) and a 'Set' button. Below this is a list of fire plan entries, each with a unique identifier (e.g., CFF #1, CFF #2, CFF #3, CFF #4, 9-line #1, 9-line #2, 9-line #3, 9-line #4, 5-line #1, 5-line #2) and a description (e.g., 'CFF #1', 'CFF #2', 'CFF #3', 'CFF #4', '9-line #1', '9-line #2', '9-line #3', '9-line #4', '5-line #1', '5-line #2'). The main area shows a timeline with various fire plan entries and their associated assets (e.g., 'AB1000', '1810 to 1820'). Annotations highlight key features and controls:

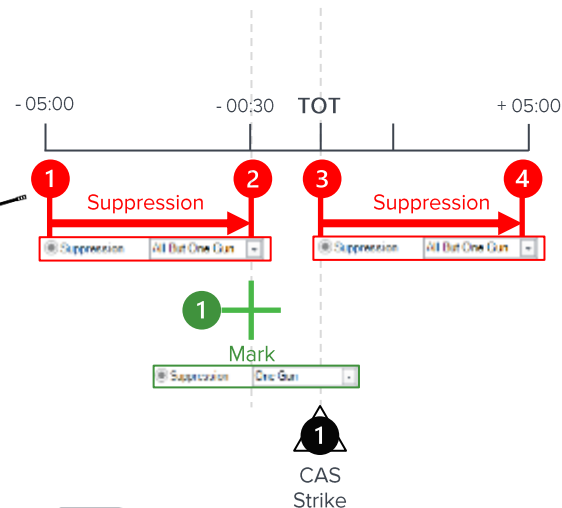
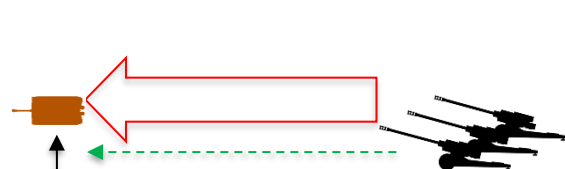
- To Mission Start / To Current Time:** A red box highlights the 'Set' button in the top left corner.
- Adjust Start Minute / Adjust End Minute:** Red boxes highlight the 'H-00 to H+10' and '1810 to 1820' time ranges for the 'CFF #4' entry.
- 'Mouseover' to see timings:** A red box highlights the 'CFF #4' entry in the list.
- Not Correctly Configured (e.g. no asset set):** A red box highlights the '9-line #3' entry in the list.
- 'Executing' Mission Execute Replaced With 'Check Fire':** A red box highlights the 'Check Fire' button in the bottom right corner.
- All Lines Actions:** A red box highlights the 'Execute All' button in the top right corner.
- Individual Execute / Abort / Check Fire (Per Line):** A red box highlights the 'Execute' button in the bottom right corner.
- Execute All:** A red box highlights the 'Execute All' button in the top right corner.

The interface also includes a 'Messages' section at the bottom, displaying mission details and status information. The overall layout is designed to provide a comprehensive view of the fire plan and allow for real-time adjustments and execution.

MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

Quick SEAD

- Allows a set of timings to be 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

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

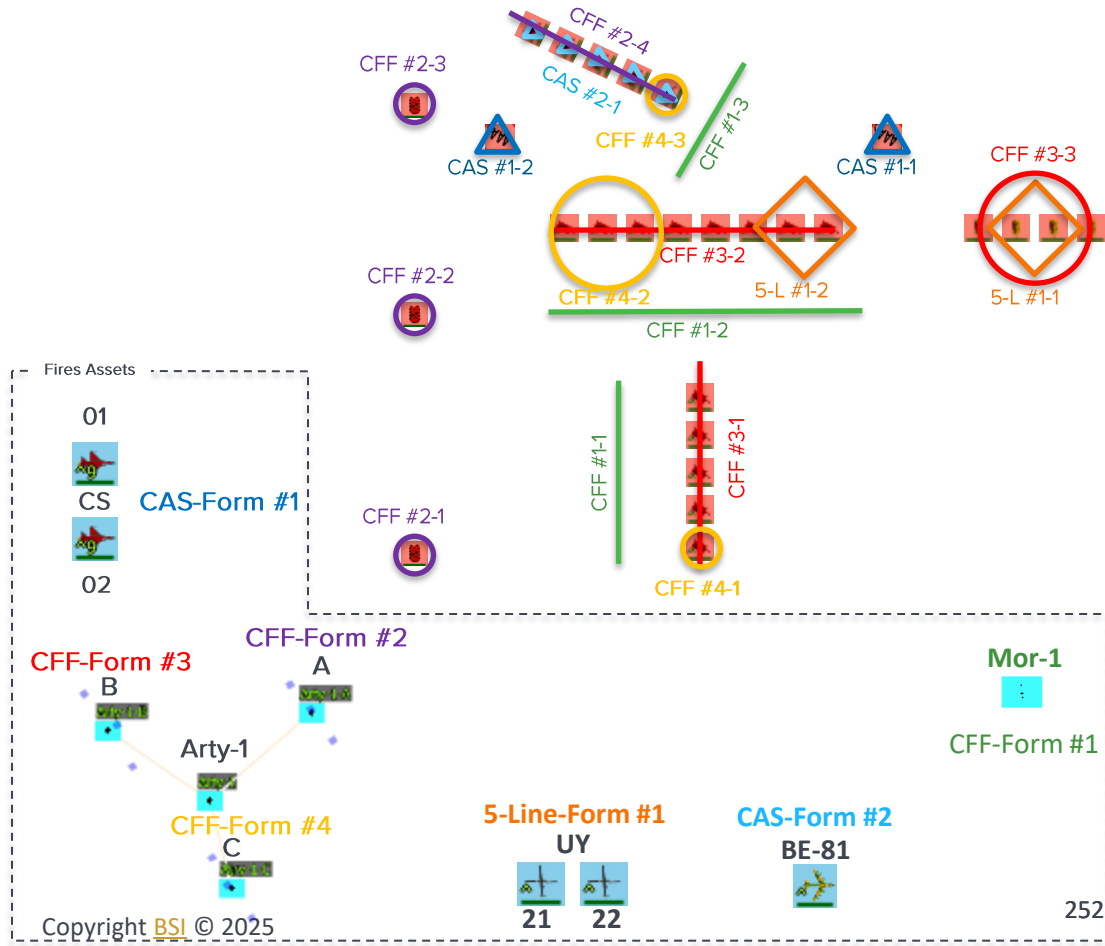
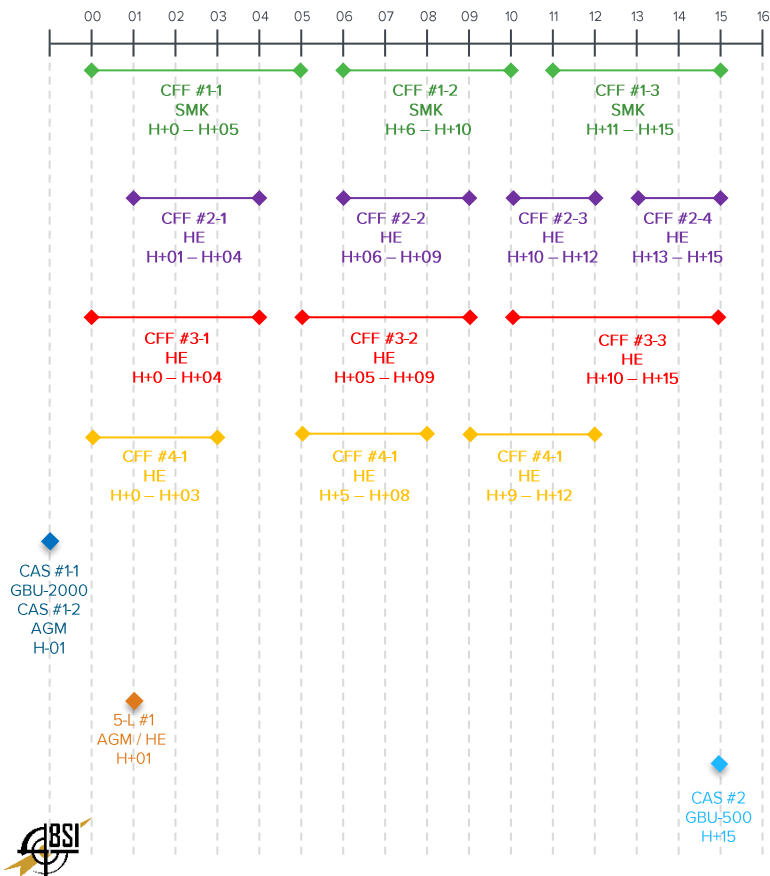
Restart Suppression at
3 00:00 after TOT

Restart Duration
4 05:00

Set Timings

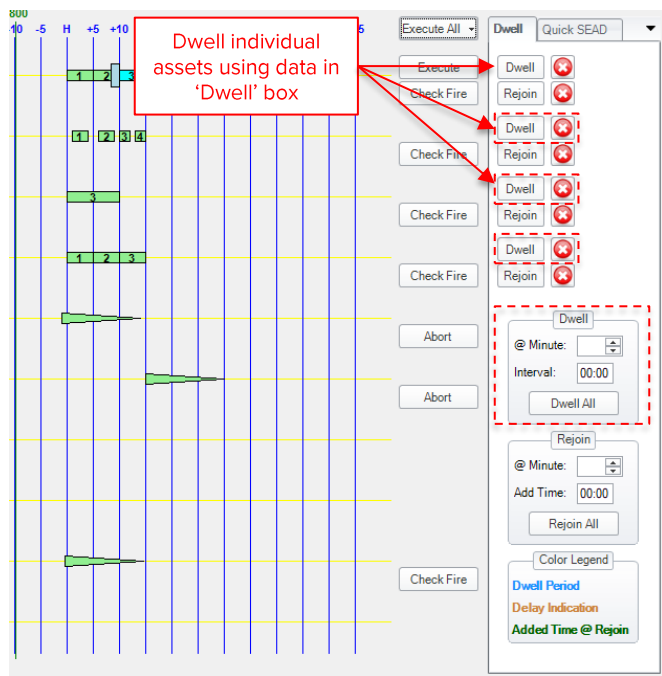
MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

Example Fire Plan



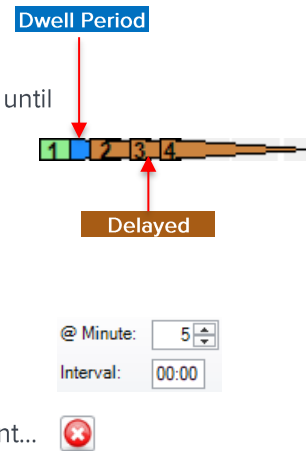
MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

CFF Form – Dwelling and Rejoining

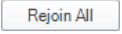


Dwell

- 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

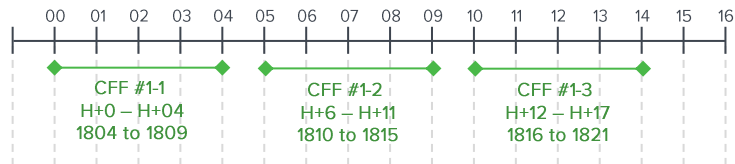


NOTE – CHANGING INDICATIONS

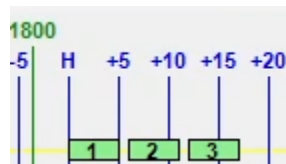
- The delay indications will disappear after a 'rejoin' is selected
- The added minutes will disappear and be appended to the light green plan as the timeline reaches that mission
- Dwells and Rejoins DO NOT affect 5-Line and CAS TOTs

MACE FORM CONTROLLED ATTACKS 5 – FIRE PLANNING

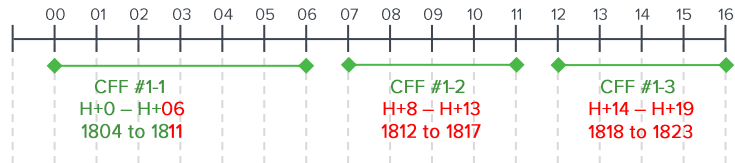
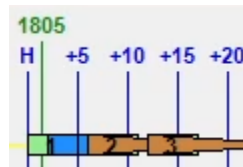
CFF Form – Dwelling and Rejoining Worked Example H=18:04



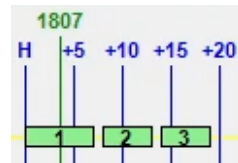
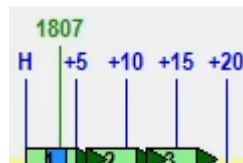
Initial Plan



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

MACE AIRCRAFT MULTIFUNCTION DISPLAY

Learning objective:

- To be able to use the MACE aircraft tactical display plugin for aircrew role player functions

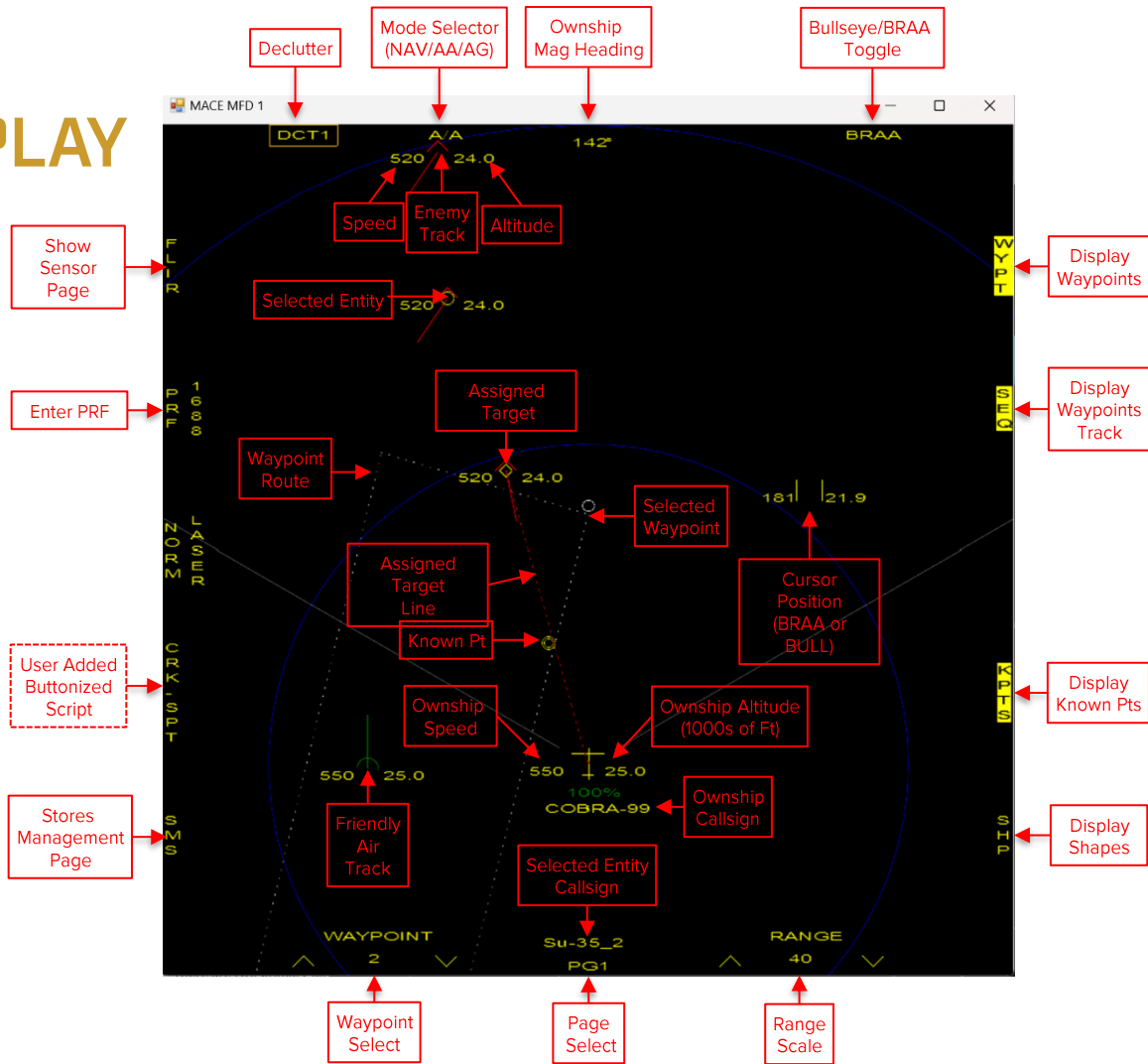
Enabling objectives:

- Know how to open the TAC display
- Know how the TAC display can limit the use of the targeting pod camera
- Understand the TAC display pages
- Know how to select TAC display functions and what they do
- Understand how to use the TAC Display for air-to-air engagement
- Know how to assign buttonized scripts with the TAC Display

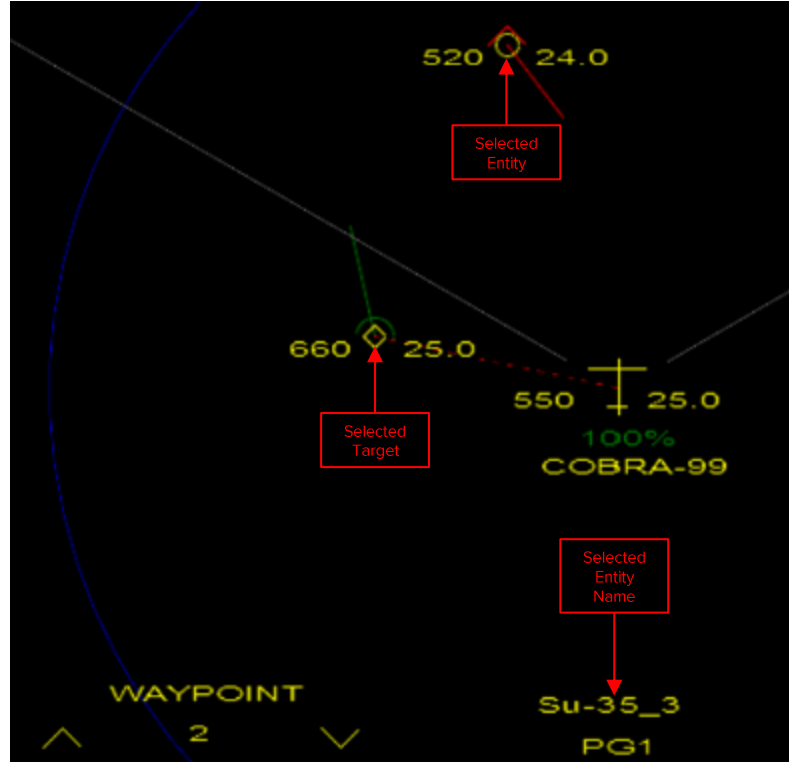
MACE AIRCRAFT MULTIFUNCTION DISPLAY

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

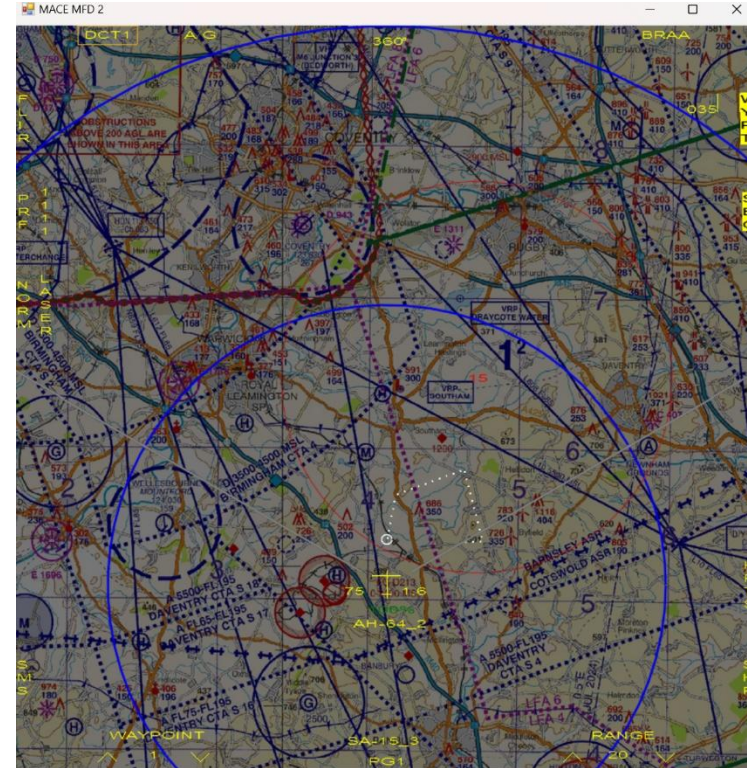
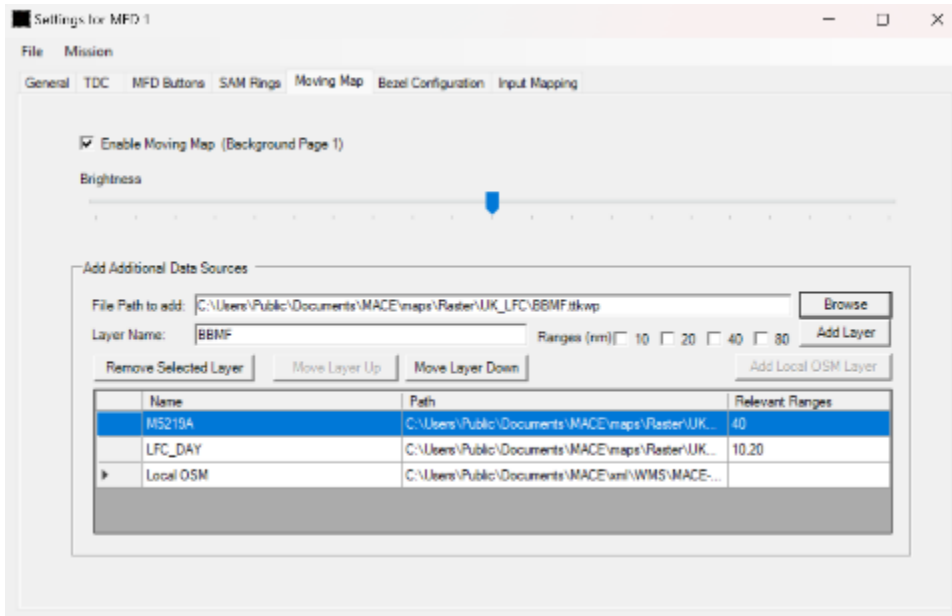


Tactical Display Cursor (TDC)



MACE AIRCRAFT MULTIFUNCTION DISPLAY

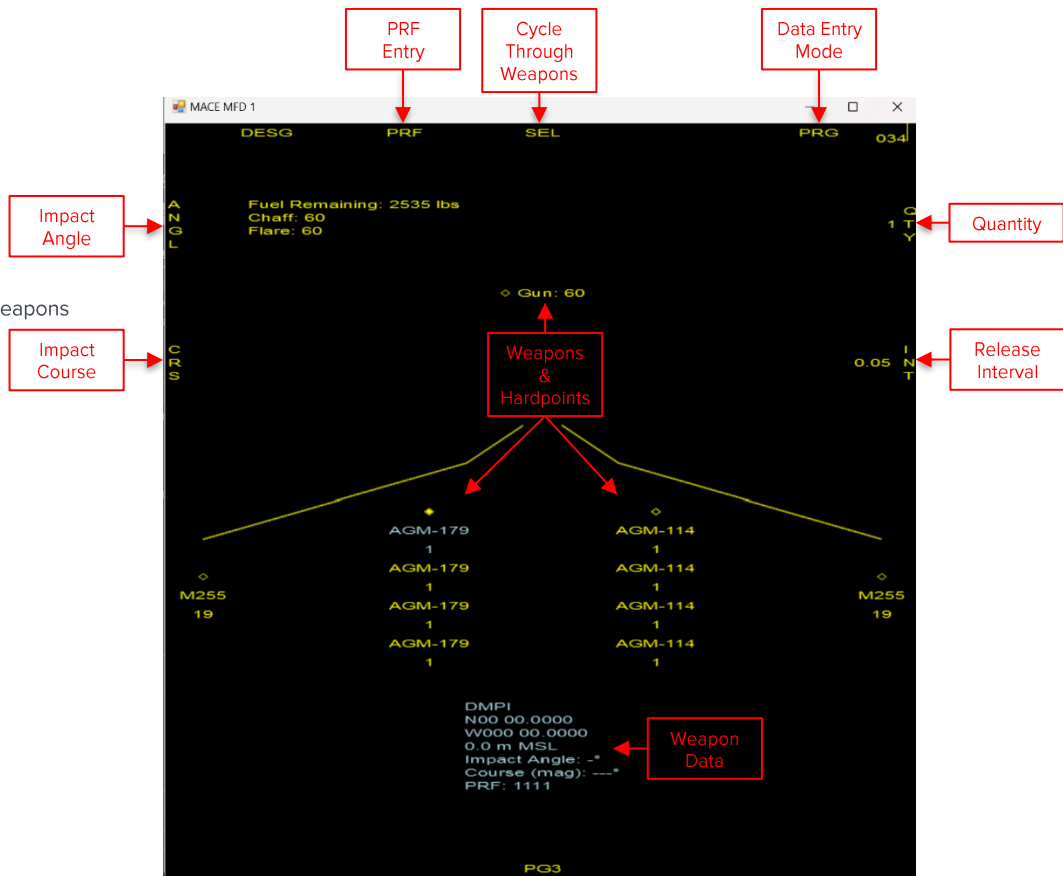
Moving Maps



MACE AIRCRAFT MULTIFUNCTION DISPLAY

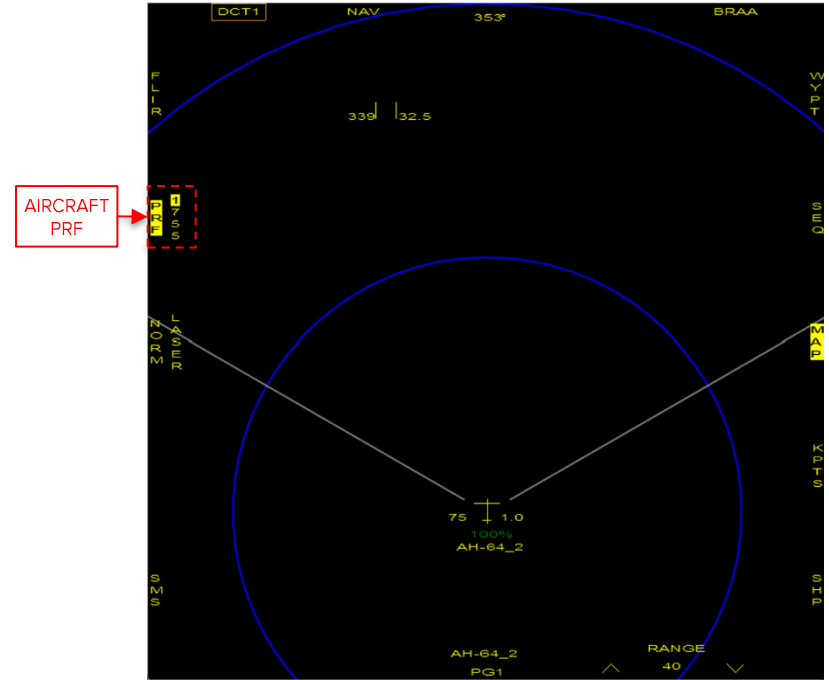
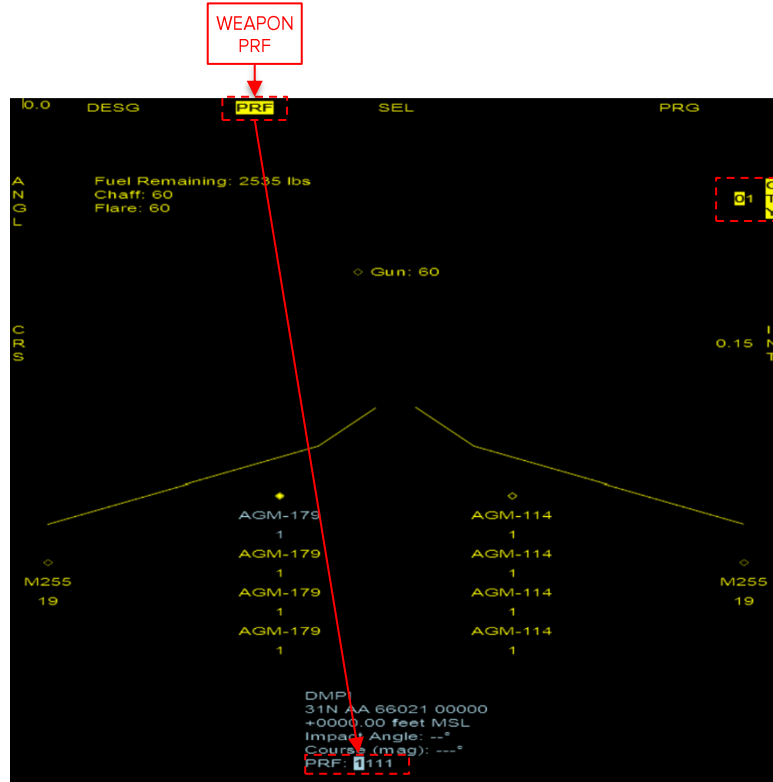
Stores Management Page

- 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)



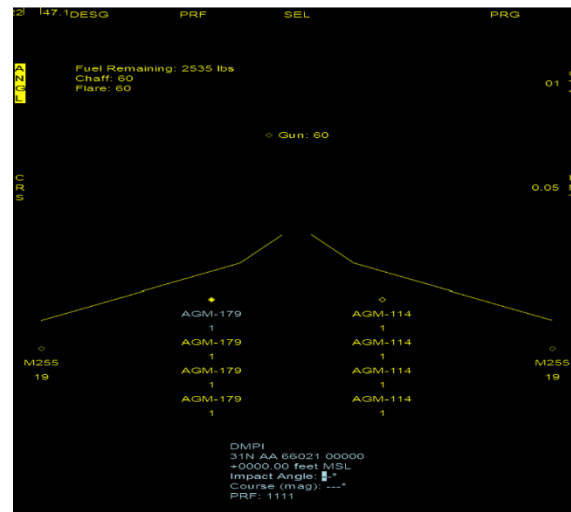
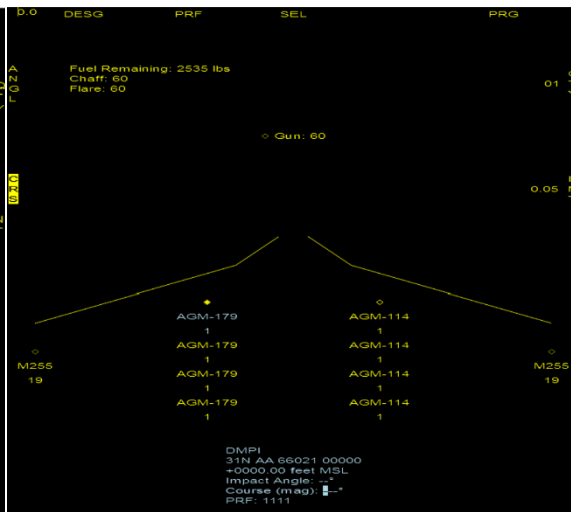
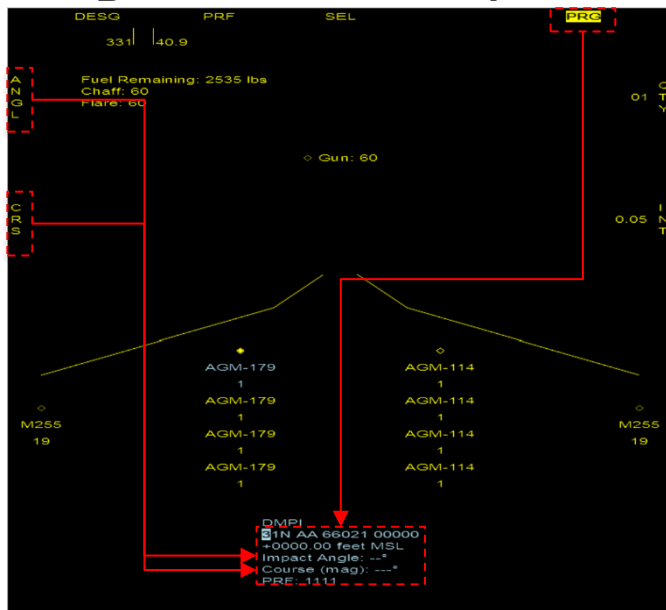
MACE AIRCRAFT TACTICAL DISPLAY

Programmable Weapons



MACE AIRCRAFT TACTICAL DISPLAY

Programmable Weapons

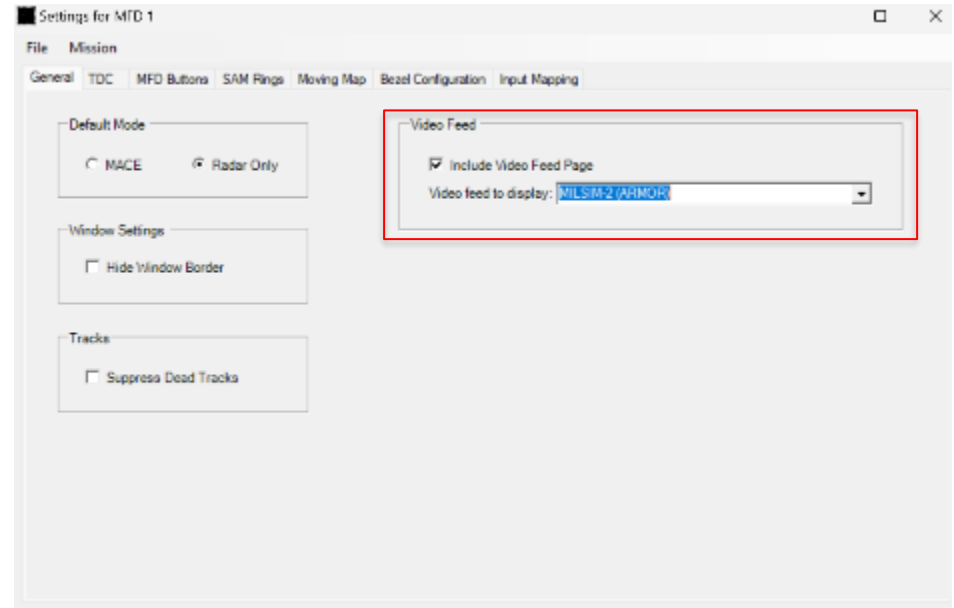


- [PRG]
 - Press 'd' to cycle formats (DD.DD / DD MM.MM / DD MM SS.SS / MGRS
 - In Lat/Long press N/S or E/W to change
 - Elevation – press 'f' or 'm' to change between ft and m
 - Elevation – press 'h' to change between MSL and HAE

MACE AIRCRAFT MULTIFUNCTION DISPLAY

FLIR/Sensor View Page

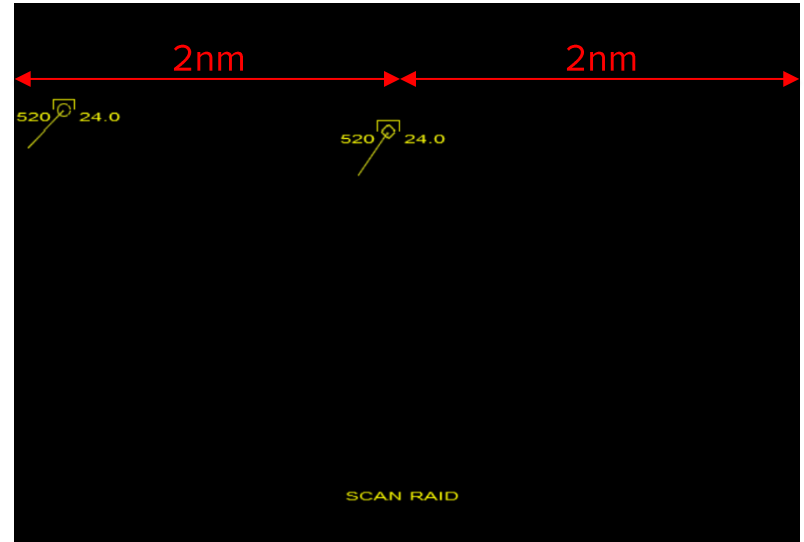
- Needs to be enabled in MFD Settings
- Needs to be enabled in ARMOR



MACE AIRCRAFT MULTIFUNCTION DISPLAY

SCAN RAID MODE

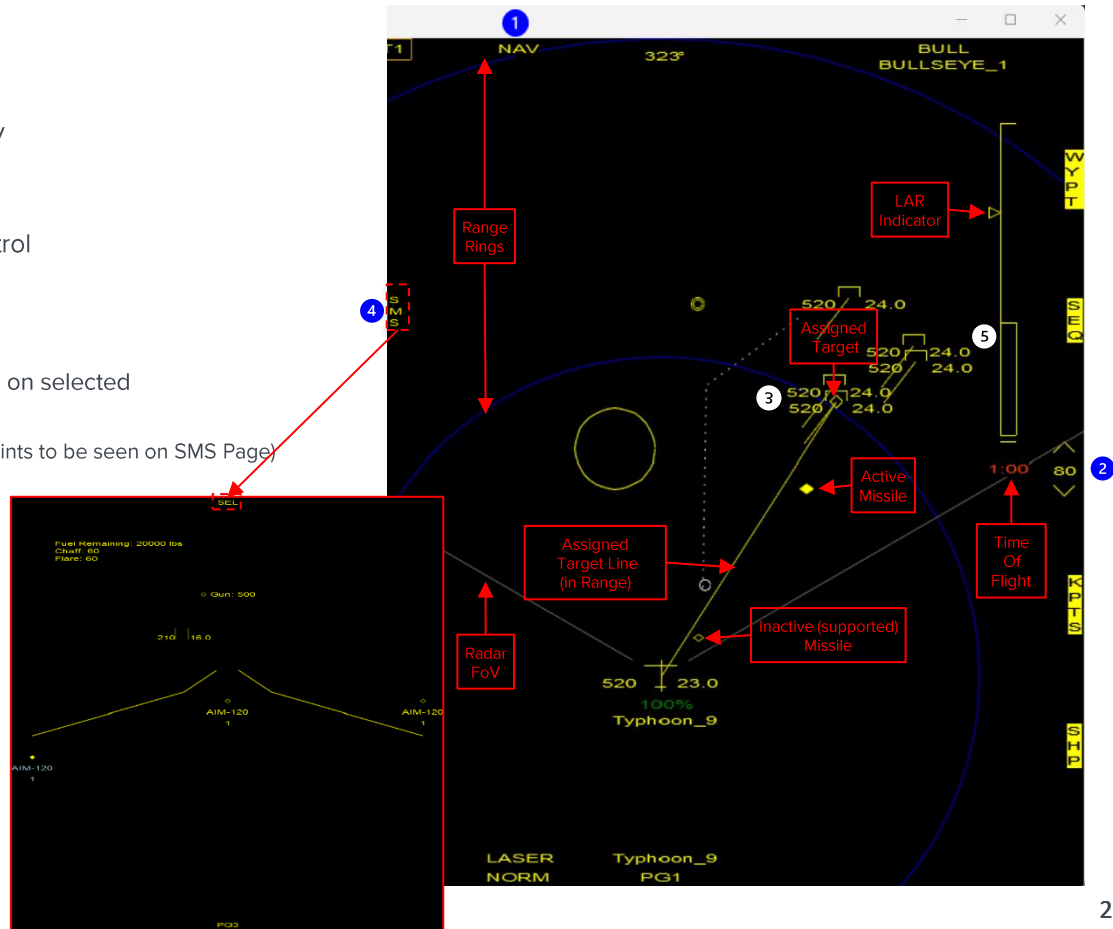
- Only if a target is selected
- Zooms the display to a scale 2nm either side of target
- Allows selection of targets that are close together



MACE AIRCRAFT TACTICAL DISPLAY

Engaging Air Targets

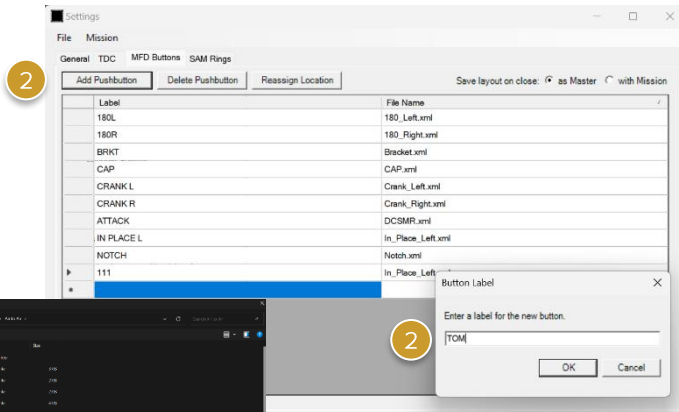
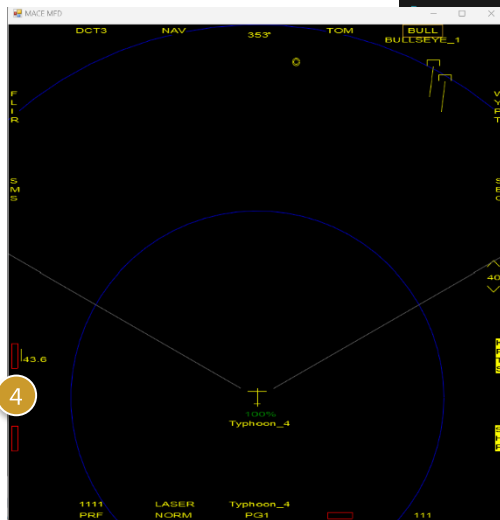
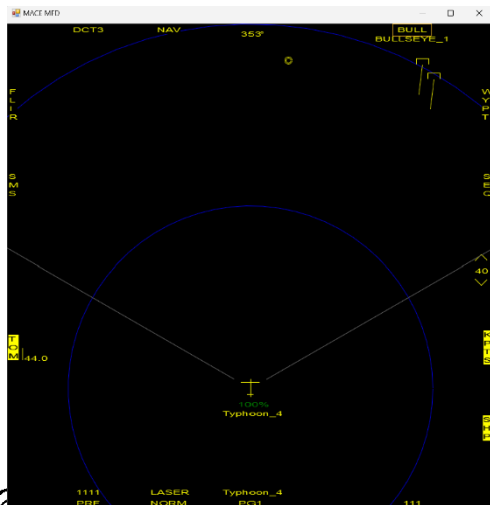
- Use for A/A Training
 - RMB on display – **Settings>Default Mode** – Radar Only
 - (1) Select A/A mode
 - (2) Use Range scale to see targets (or Joystick)
 - (3) RMB on target to assign or Use Joystick Cursor Control
 - MACE shows assigned target line
 - Dotted red if out of range
 - Solid yellow if in range
 - SCAN RAID to Aid Target Sorting – shows 4nm zoomed in on selected
 - (4) Weapon Control
 - Select [SMS] Button (Note: Weapons must be assigned to hardpoints to be seen on SMS Page)
 - Press [SEL] to cycle through active weapons (or use Joystick)
 - [PG3] to go back to main page
 - (5) Shoot when inside LAR
 - Use Joystick Release Weapon Button or MACE Weapon Release
- 



MACE AIRCRAFT TACTICAL DISPLAY

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. () Add 2 x Friendly Fighter Aircraft in Line Abreast Formation
3. () Use Group Add to add a VIC presentation of 3 groups of 3 Enemy Fighter Aircraft about 50nm away
4. () Ensure both groups are facing each other and the friendly leader has some waypoints
5. () Place a known point and name it BULL-01
6. ()(Optional) Draw a MACE shape between the 2 groups (e.g. a circle or a polygon)
7. () Save the mission and start then pause it
8. () Select the lead friendly fighter aircraft, Top-Lock to it, open 1 TAC Display
9. () Access the MFD settings and enable the mouse cursor and switch to radar only mode
10. () Ensure FLIR is unselected and switch the display to A/A mode
11. () Change the reference for the cursor from BRAA to Bullseye
12. () Display the waypoints, waypoint sequence, known points
13. () Add a buttonized script to perform a 'crank' to the display at a blank button location
14. () Run the mission on
15. () Change the range scale up to see the oncoming targets
16. () Select a target
17. () Access the weapons page and select a weapon for engaging the target (ideally an active or semi active missile)
18. Engage the target when in range and use the crank button



VIPER COMMUNICATIONS

Learning objective:

- To be able to use Viper for communications

Enabling objectives

- Understand the layout of the Viper UI
- Understand how the Press to Transmit buttons function with TX/RX and VOX
- Know how to attach and configure headsets with Viper Audio Properties
- Know how to set hot keys to transmit & other hot key functions
- Know how to add and remove comms channels
- Understand the difference between COMPlan settings and Viper General Settings

VIPER DIS RADIO

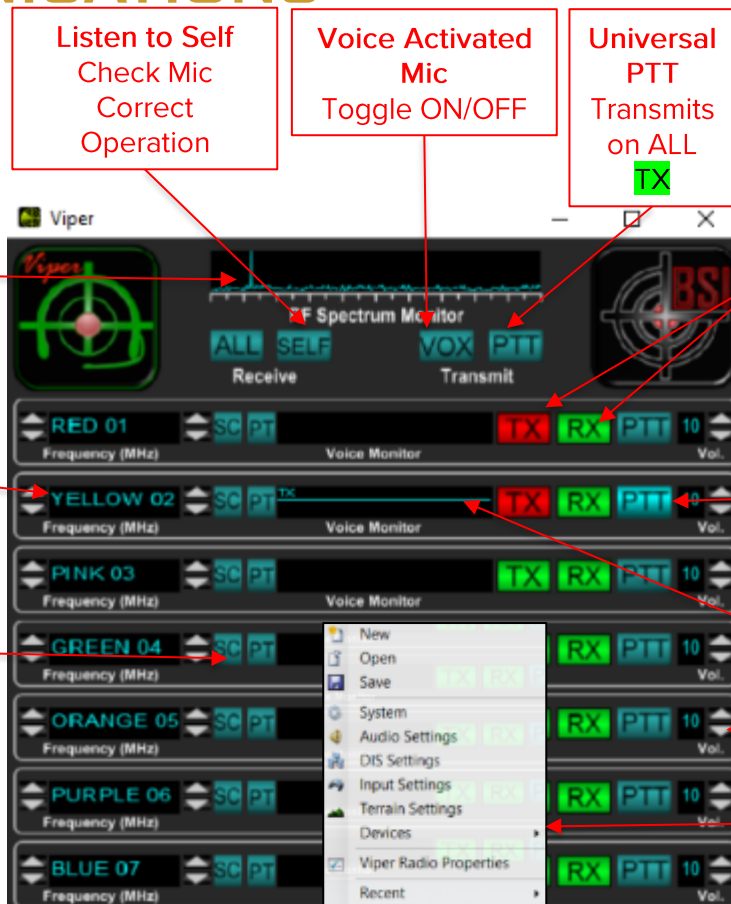
General

- DIS Radio
- No Server
- Settable radio frequency, power, bandwidth, sensitivity and dynamic range
- Create edit and load communications plans
- VOX and Push-To-Talk (PTT) on multiple selectable transmit frequencies
- Map to hardware
- Attach to DIS entity – propagation, terrain and jamming effects



VIPER COMMUNICATIONS

UI



Individual Channel Transmit / Receive Toggle

RX = Hear INCOMING Transmissions
TX = Allow OUTGOING Transmission
ns

RX = No Receive
TX = No TX (Except individual PTT)

Individual Channel PTT
Overrides **TX**

Individual Channel RF Indicator
Shows Transmissions on this channel

Individual Channel Volume

RMB on Skin
Open Menu



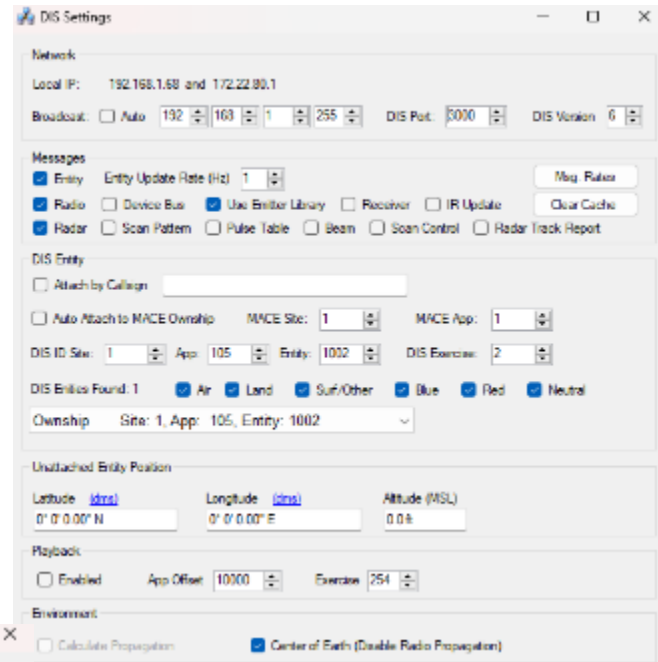
VIPER COMMUNICATIONS

DIS Settings

- Same as MACE
 - Broadcast Address on same Subnet
 - Same DIS Port - some use 3001 for DIS Comms (NB: DISCORD)
 - Same Exercise Number
- If required Auto Attach
 - To Callsign: Useful if using same callsigns every mission
 - To MACE Ownship: defined by Site / App
- Propagation
 - Usually paired with Terrain for full simulation of comms

Terrain Settings

- For propagation and masking
 - Set 2 Terrain Paths (Pri / Sec)
 - Use ARMOR Terrain



DIS Settings

Network

Local IP: 192.168.1.68 and 172.22.80.1

Broadcast: ☐ Auto ☐ 192 ☐ 163 ☐ 1 ☐ 255 ☐ DIS Port: 3000 DIS Version: 6

Messages

☒ Entity Entity Update Rate (Hz): 1

☒ Radio ☐ Device Bus ☒ Use Entity Library ☐ Receiver ☐ IR Update

☒ Radar ☐ Scan Pattern ☐ Pulse Table ☐ Beam ☐ Scan Control ☐ Radar Track Report

DIS Entity

☐ Attach by Callsign

☐ Auto Attach to MACE Ownship MACE Site: 1 MACE App: 1

DIS ID Site: 1 App: 105 Entity: 1002 DIS Exercise: 2

DIS Entities Found: 1 ☒ Air ☒ Land ☒ Surf/Other ☒ Blue ☒ Red ☒ Neutral

Ownship Site: 1, App: 105, Entity: 1002

Unattached Entity Position

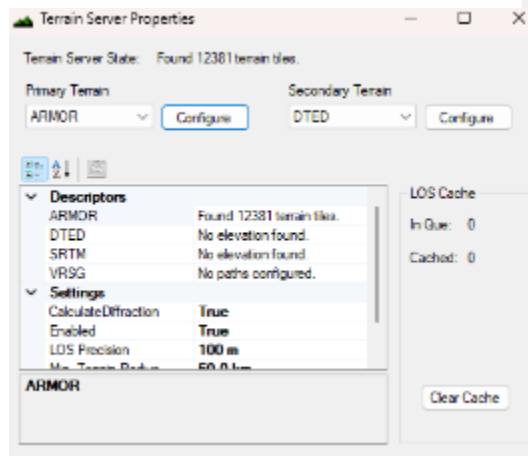
Latitude: Longitude: Altitude (MSL):

Playback

☐ Enabled App Offset: 1000 Exercise: 254

Environment

☐ Calculate Propagation ☒ Center of Earth (Disable Radio Propagation)



Terrain Server Properties

Terrain Server State: Found 12381 terrain files.

Primary Terrain: ARMOR Secondary Terrain: DTED

Descriptors

| | |
|-------|----------------------------|
| ARMOR | Found 12381 terrain files. |
| DTED | No elevation found. |
| SRTM | No elevation found. |
| VRSG | No paths configured. |

Settings

| | |
|-----------------------|----------|
| Calculate Diffraction | True |
| Enabled | True |
| LOS Precision | 100 m |
| Max Terrain Radius | 500.0 km |

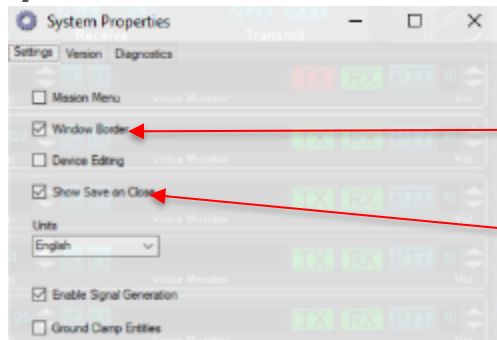
LOS Cache

In Queue: 0

Cached: 0

VIPER COMMUNICATIONS

System / Audio Settings



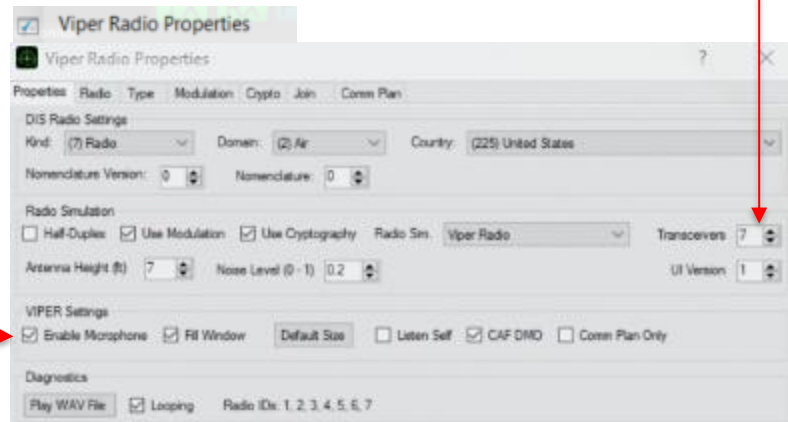
Window Boarder

Save on Close
Disable to allow
command shutdown

Enable Speakers

Enable Microphone

Enable Microphone

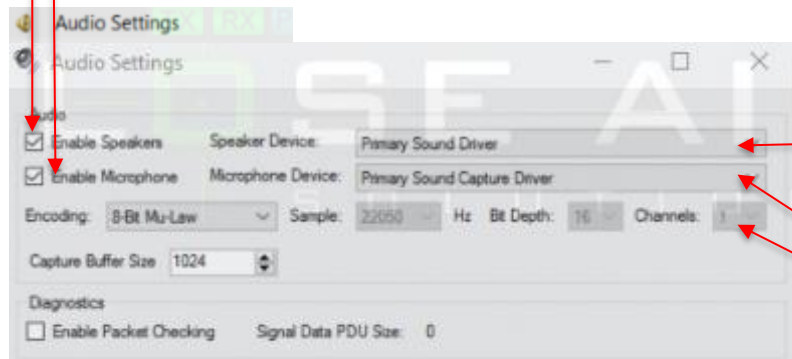


Add Channels
To GUI

Select Output

Select Input

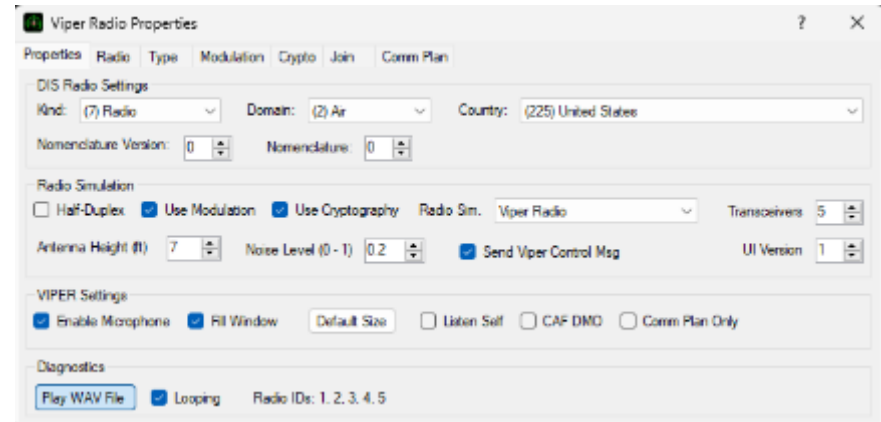
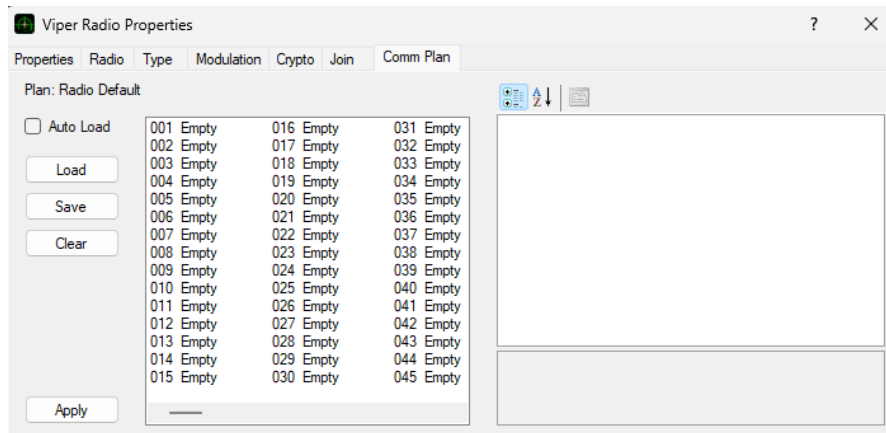
2 Channel Input – Must be set
with 'Encoding' set to Custom



VIPER COMMUNICATIONS

Properties

- Set each channel's parameters
 - Viper settings can be transferred
 - C:\Users\Public\Documents\DSC\Viper.xml
- Comms Plan
 - Write comms plan – with each channel's properties
 - Save and load in other Vipers



Viper Radio Properties

Properties Radio Type Modulation Crypto Join Comm Plan

| Ch# | Name | Stereo | Frequency (MHz) | Bandwidth (KHz) | Min. Frequency (MHz) | Max. Frequency (MHz) | Power (dBm) | Sensitivity (dBm) | Dynamic Range (db) |
|-----|---------|--------|-----------------|-----------------|----------------------|----------------------|-------------|-------------------|--------------------|
| 1 | | Both | 135 | 10 | 0.001 | 1000000 | 40 | -120 | 80 |
| 2 | | Both | 150 | 10 | 0.001 | 1000000 | 40 | -120 | 80 |
| 3 | BLUE-03 | Both | 123 | 10 | 0.001 | 1000000 | 40 | -120 | 80 |
| 4 | GOLD-99 | Both | 120 | 10 | 0.001 | 1000000 | 40 | -120 | 80 |
| 5 | RED-03 | Both | 120 | 10 | 0.001 | 1000000 | 40 | -120 | 80 |

Viper Radio Properties

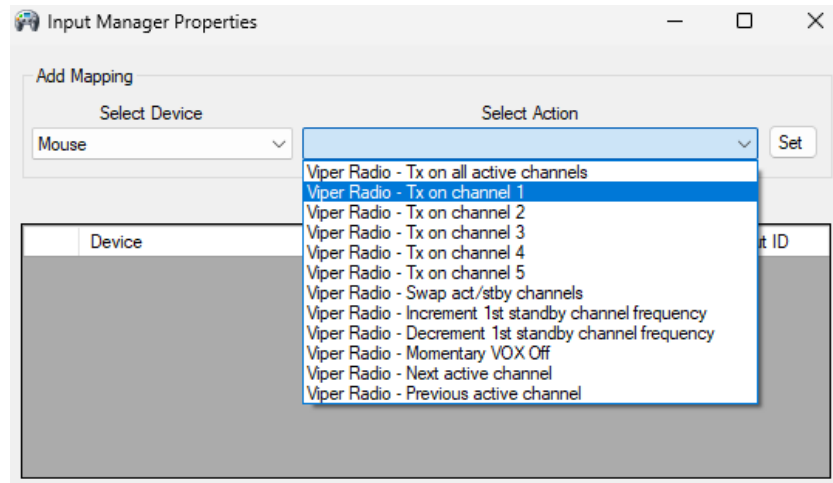
Properties Radio Type Modulation Crypto Join Comm Plan

| Ch# | Name | Freq. Hop | Pseudo Noise | Time Hop | Major Modulation | Detailed Modulation | Radio System | Params |
|-----|---------|--------------------------|--------------------------|--------------------------|------------------|---------------------|--------------|--------|
| 1 | | ☐ | ☐ | ☐ | (1) Amplitude | (2) AM | (1) Generic | n/a |
| 2 | | ☐ | ☐ | ☐ | (1) Amplitude | (2) AM | (1) Generic | n/a |
| 3 | BLUE-03 | ☐ | ☐ | ☐ | (1) Amplitude | (2) AM | (1) Generic | n/a |
| 4 | GOLD-99 | ☐ | ☐ | ☐ | (1) Amplitude | (2) AM | (1) Generic | n/a |
| 5 | RED-03 | ☐ | ☐ | ☐ | (1) Amplitude | (2) AM | (1) Generic | n/a |

VIPER COMMUNICATIONS

Input Manager

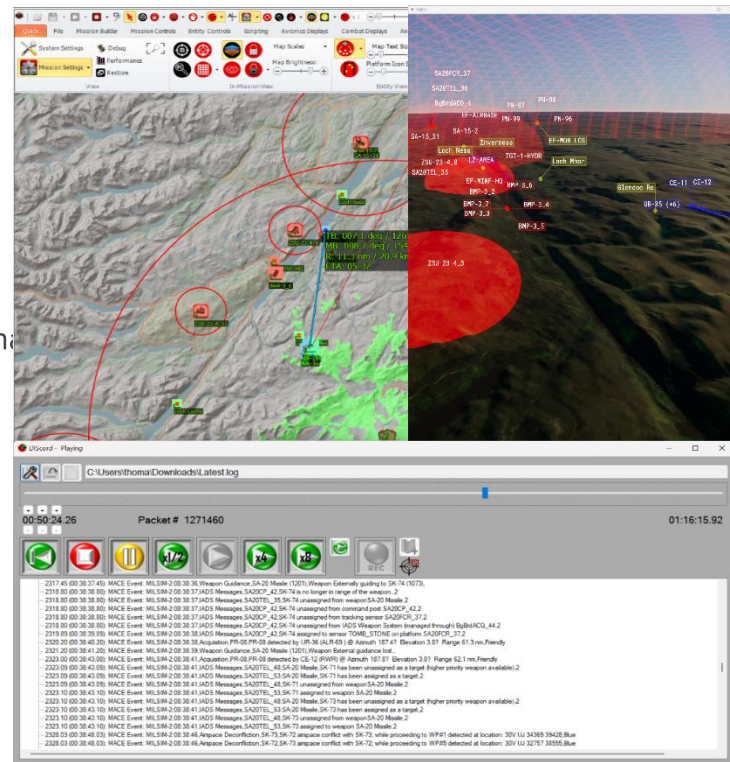
- Map hardware to radio functions
 - Transmit on specific channels
 - Transmit on ALL Active
 - Swap Active and Stby
 - Move through channels
 - etc



AFTER ACTION REVIEW

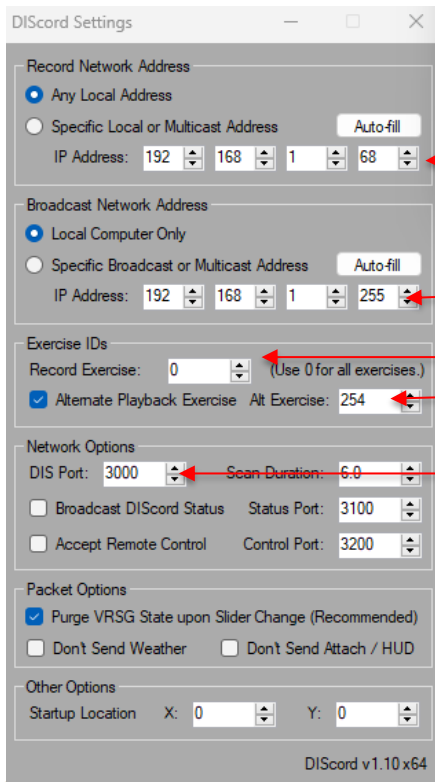
DISCORD

- DIS network traffic and additional data) record and playback tool
- Record any DIS traffic on network
- Insert bookmarks during the recording.
- Play back DIS PDUs at slow, normal, 4x, or 8x speed
- "Jump" to key scenario events in recorded session (bookmarks, fires, detonations)
- Hear radio calls in Viper - able to mute or change volume on any channels
- See the entity movements, emissions, and engagements in MACE
- View any perspective from anywhere in the 3D environment in ARMOR
- See all MACE Logs



AFTER ACTION REVIEW

DISCORD – DIS Setup



DISCORD Settings

Record Network Address

☒ Any Local Address

☐ Specific Local or Multicast Address Auto-fill

IP Address: 192 168 1 68

Broadcast Network Address

☒ Local Computer Only

☐ Specific Broadcast or Multicast Address Auto-fill

IP Address: 192 168 1 255

Exercise IDs

Record Exercise: 0 (Use 0 for all exercises.)

☒ Alternate Playback Exercise Alt Exercise: 254

Network Options

DIS Port: 3000 Scan Duration: 6.0

☐ Broadcast DISCORD Status Status Port: 3100

☐ Accept Remote Control Control Port: 3200

Packet Options

☒ Purge VRSG State upon Slider Change (Recommended)

☐ Don't Send Weather ☐ Don't Send Attach / HUD

Other Options

Startup Location X: 0 Y: 0

DISCORD v1.10 x64

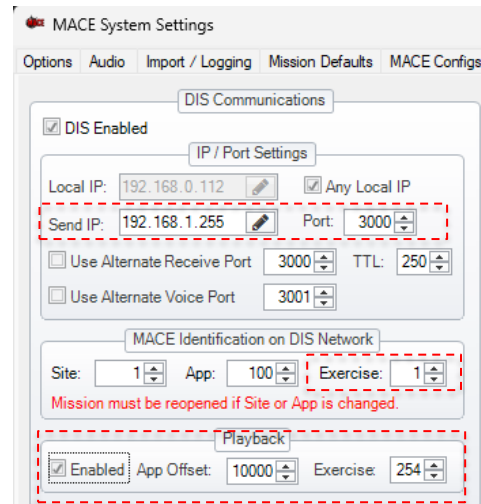
Local IP Address

Must be same as your MACE Broadcast Address (255)

Must be same as your MACE Ex No. or 0 for all

Same as MACE Alt Ex

Must be same as your MACE DIS Port (and Viper if recording)



MACE System Settings

Options Audio Import / Logging Mission Defaults MACE Configs

DIS Communications

☒ DIS Enabled

IP / Port Settings

Local IP: 192.168.0.112 ☒ Any Local IP

Send IP: 192.168.1.255 Port: 3000

☐ Use Alternate Receive Port 3000 TTL: 250

☐ Use Alternate Voice Port 3001

MACE Identification on DIS Network

Site: 1 App: 100 Exercise: 1

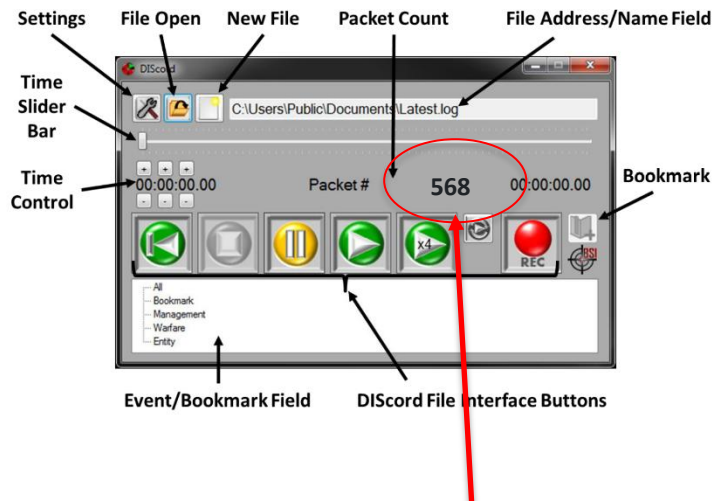
Mission must be reopened if Site or App is changed.

Playback

☒ Enabled App Offset: 10000 Exercise: 254

AFTER ACTION REVIEW

DISCORD – Operation



No Packets Here = Not recording anything

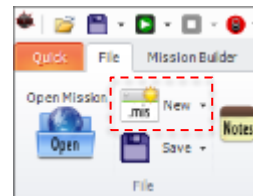
| Time | Type | Entity | Event |
|----------|---------------|-------------------|---|
| 17:59:59 | Mission Fails | CFF | CFF - Course File Target Number AE1000 |
| 17:59:59 | Weapon Launch | IN-219-140 ATACMS | External Entity fired IN-219-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | IN-219-140 ATACMS | External Entity fired IN-219-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | IN-142 HIMARS fired MGM-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | IN-142 HIMARS fired MGM-140 ATACMS at Ground |

Recording a Scenario

- NEW File – create recording file before starting record
- Record
- Packet # indicates successful recording
- Use Bookmarks if required to flag events for later
- Press Stop when finished
- Can append to existing recording

Playback a Scenario

- In MACE – 'New Mission'
- (if required) Open Event Log



DISCORD Playback

- Open File
- Play
- Packet # indicates playback
- Use slider / increments / events / bookmarks to skip to time

AFTER ACTION REVIEW

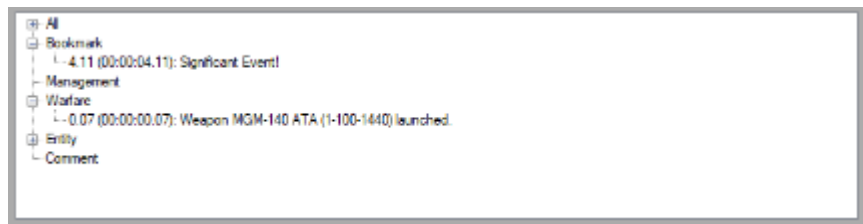
MACE – Logging

- MACE System Settings <Import/Logging>
 - Log to Network = DISCORD
 - Log to File = C:\Users\Public\Documents\MACE\output
 - Log to Event Window = Alt + E

Logging

☒ Log Error Messages ☐ Show Incoming Network Logs

| Event Type | Log to Event Window | Log to File | Log to Network |
|--------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Acquisition | ☐ | ☐ | ☐ |
| Airspace Deconfliction | ☐ | ☐ | ☐ |
| Countermeasures | ☒ | ☐ | ☐ |
| UDS Messages | ☐ | ☐ | ☐ |
| Jamming | ☐ | ☐ | ☐ |
| Kill | ☒ | ☐ | ☐ |
| Mission Fails | ☒ | ☐ | ☐ |
| Navigation | ☒ | ☐ | ☐ |
| Other | ☒ | ☒ | ☒ |
| TDL Messages | ☐ | ☐ | ☐ |
| Terrain | ☐ | ☐ | ☐ |
| Waypoint Action | ☐ | ☐ | ☐ |
| Weapon Detonation | ☒ | ☐ | ☐ |
| Weapon Detonation (Small Arms) | ☐ | ☐ | ☐ |
| Weapon Fight | ☐ | ☐ | ☐ |
| Weapon Guidance | ☒ | ☒ | ☒ |
| Weapon Launch | ☒ | ☒ | ☒ |
| Weapon Launch (Small Arms) | ☐ | ☐ | ☐ |



```
18:10:10,Weapon Guidance,M142_30,M142_30 (00 10'30'' S 28'17'' E) shot MGM-140 ATACMS at 00 10'18'' S 30'23'' East: 2.168 m
18:10:11,Weapon Guidance,MGM-140 ATACMS (1005),Enable Guidance: 0 internal sensors tracking Ground (0)
18:10:11,Weapon Guidance,MGM-140 ATACMS (1005),Weapon Internal guidance lost.
18:10:12,Weapon Launch,M142_30,M142_30 (00 10'30'' S 28'17'' E) shot MGM-140 ATACMS at 00 10'18'' S 30'23'' East: 2.168 m
18:10:13,Weapon Guidance,MGM-140 ATACMS (1007),Enable Guidance: 0 internal sensors tracking Ground (0)
18:10:13,Weapon Guidance,MGM-140 ATACMS (1007),Weapon Internal guidance lost.
18:10:13,Weapon Launch,M142_34,M142_34 (00 10'30'' S 28'17'' E) shot MGM-140 ATACMS at 00 10'18'' S 30'23'' East: 2.168 m
18:10:14,Weapon Guidance,MGM-140 ATACMS (1440),Enable Guidance: 0 internal sensors tracking Ground (0)
18:10:14,Weapon Guidance,MGM-140 ATACMS (1440),Weapon Internal guidance lost.
```

| Event Log | | | |
|-----------|---------------|----------------|---|
| Time | Type | Entity | Event |
| 17:58:59 | Mission Fails | OFF | OFF: Course File Target Number AB1000 |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | External Entry fired MGM-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | External Entry fired MGM-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | M-42 HIMARS fired MGM-140 ATACMS at Ground |
| 17:59:59 | Weapon Launch | MGM-140 ATACMS | M-42 HIMARS fired MGM-140 ATACMS at Ground |

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 overwrite 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
Ethernet adapter Ethernet 0:
. . . . . :
Wireless LAN adapter Wi-Fi:
. . . . . :
Connection-specific Name Suffix . . :
Link-local IPv6 Address . . . . . : fe80::88c8:2332:333a:6320
IPv4 Address. . . . . : 192.168.0.10
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.0.1

Ethernet adapter Ethernet Network Connections:
C:\Users\Tom>ipconfig /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=1ms TTL=64
Reply from 192.168.1.1: bytes=32 time=1ms TTL=64

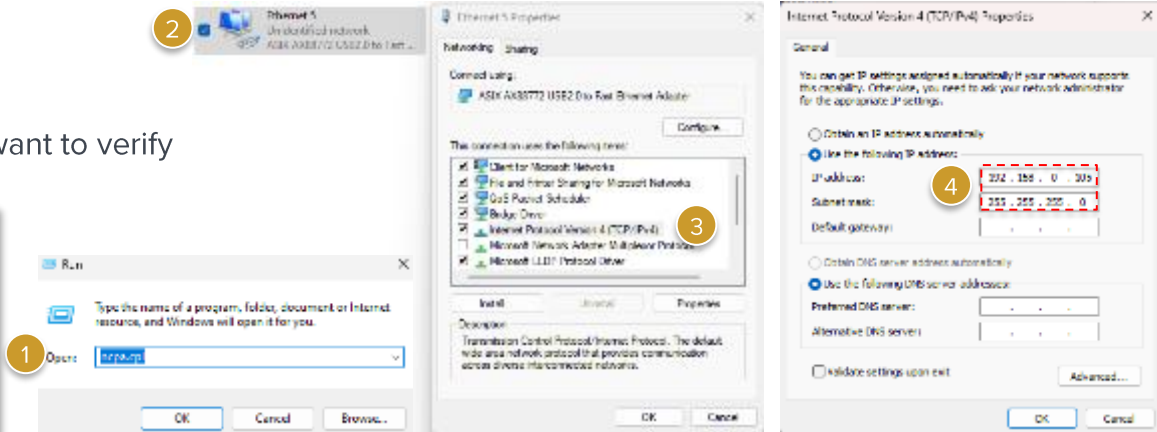
Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milliseconds:
        Minimum = 1ms, Maximum = 14ms, Average = 1ms
C:\Users\Tom>
```

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

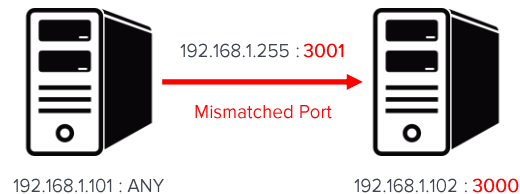
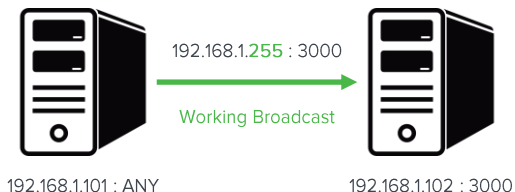
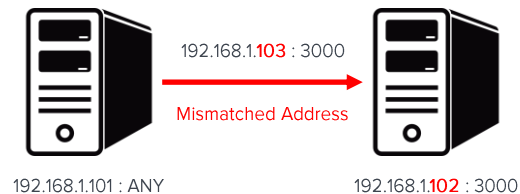
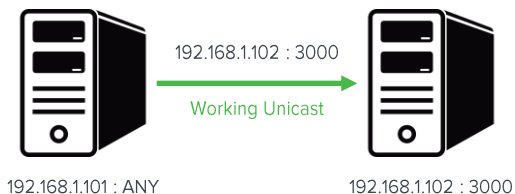
If the network IP addresses fall in the same subnet issues occur



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



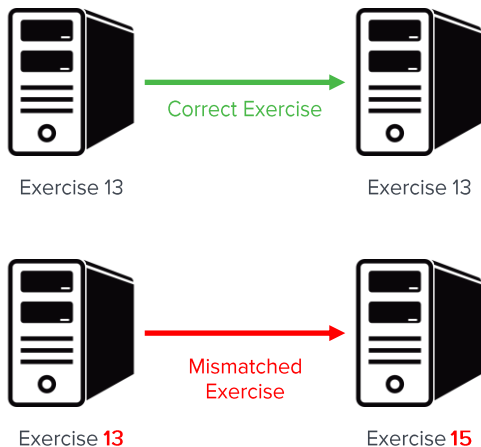
INTRODUCTION TO DIS NETWORKING

- 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

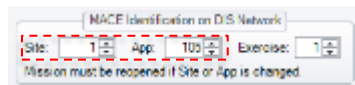
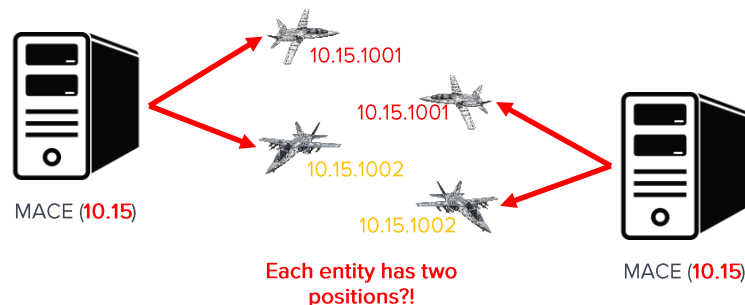
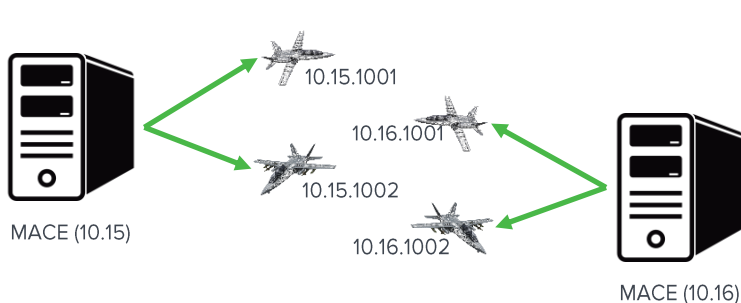


The screenshot shows the "MACE System Settings" window with the "MACE Configs" tab selected. The "DIS Communications" section is expanded, showing "DIS Enabled" checked. Under "IP / Port Settings", the Local IP is 192.168.0.105, Send IP is 192.168.0.255, Port is 3000, and TTL is 250. The "MACE Identification on DIS Network" section shows Site: 1, App: 105, and Exercise: 1. A red dashed box highlights the Exercise field. Below this, a note states: "Mission must be reopened if Site or App is changed." The "Playback" section at the bottom shows "Enabled" unchecked, App Offset: 10000, and Exercise: 254.

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

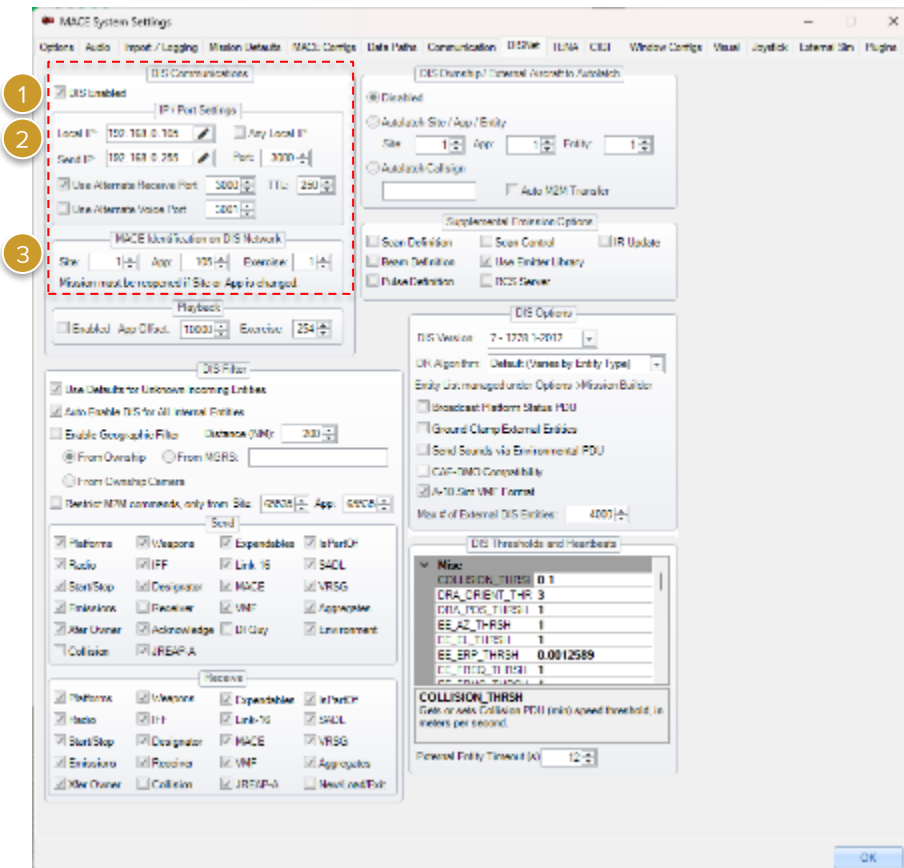


NR-77: 1 x Generic Utility Health: 100%
Helo
DIS Type: 1, 2, 0, 21, 0, 0, 0
DIS ID: Site: 1, App: 100, Entity: 1241

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



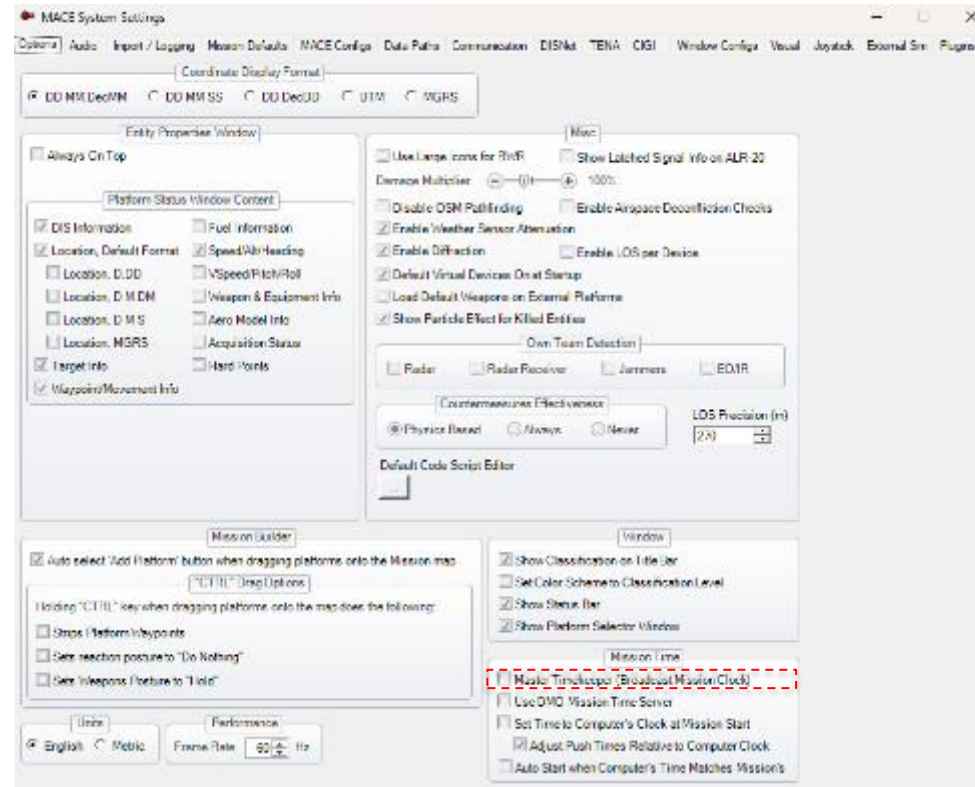
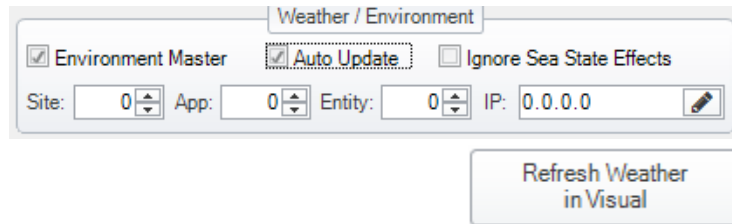
Less Frequently used DIS Settings

-
- MAACE System Settings
- Options Audio Input/Logging Mission Defaults MACCE Configs Data Paths Communication DISNET HUD/A CUI Window Configs Visual Joystick External Sins Plugins
- DIS Communications
- ☒ JIS Enabled
- IP Port Settings
- Local IP: 150.168.0.105 Any Local IP: ☐
- Send IP: 150.168.0.255 Port: 3000-4
- ☒ Use Alternative Receive Port: 3000 TTL: 250
- ☐ Use Alternative Voice Port: 3001
- MACCE Identification on DIS Network
- Size: 128 App: 101-4 Exercise: 1-4
- Mission must be requested if Size or App is changed
- Playback
- ☐ Enabled App Offset: 1000 Exercise: 254
- DIS Filter
- ☒ Use Defaults for Unknown Incoming Entities
- ☒ Auto Enable DIS for All Internal Entities
- ☒ Enable Geographic Filter Distance (NM): 300
- ☒ From Ownership ☐ From MGRS:
- ☐ From Clamping Camera
- ☐ Denote NTM commands, only from Size: 1000-4 App: 1000-4
- DIS Options
- DIS Version: 7-1720-10017
- URI Algorithm: Default (Varies by Entity Type)
- Entity List managed under Options > Mission Builder
- ☐ Broadcast Platform Status (ID)
- ☐ Ground Clamp External Entities
- ☐ Send Sounds via Environmental PDU
- ☐ CAC-WMO Compatibility
- ☒ A-10 Sim VNF Format
- Max # of External DIS Entities: 4000
- DIS Thresholds and Hysteresis
- Max
- COLLISION_THRSH 0.1
- CRASH_EXIT_THR 3
- CRASH_EXIT_THR 3
- EE_A2_THRSH 1
- EE_C1_THRSH 1
- EE_C2_THRSH 1
- EE_ERP_THRSH 0.0012589
- EE_EXIT_THRSH 1
- EE_EXIT_THRSH 1
- COLLISION_THRSH
- Gain or Area Collision PDU (m/s) speed threshold, in meters per second
- Forward Entity Timeout (s) 12

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

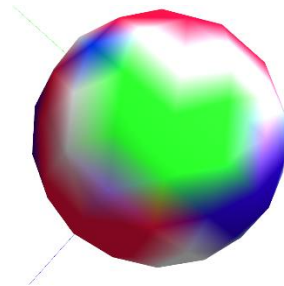
Corresponding 3D Model



1 2 225 2 4 3 0 animal-camel-001.hpy

DIS Enumeration

Different 3D Model!!



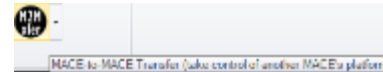
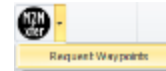
If MACE tries to use a DIS enumeration that VRSG does not recognize, VRSG displays a beach ball!!

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

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

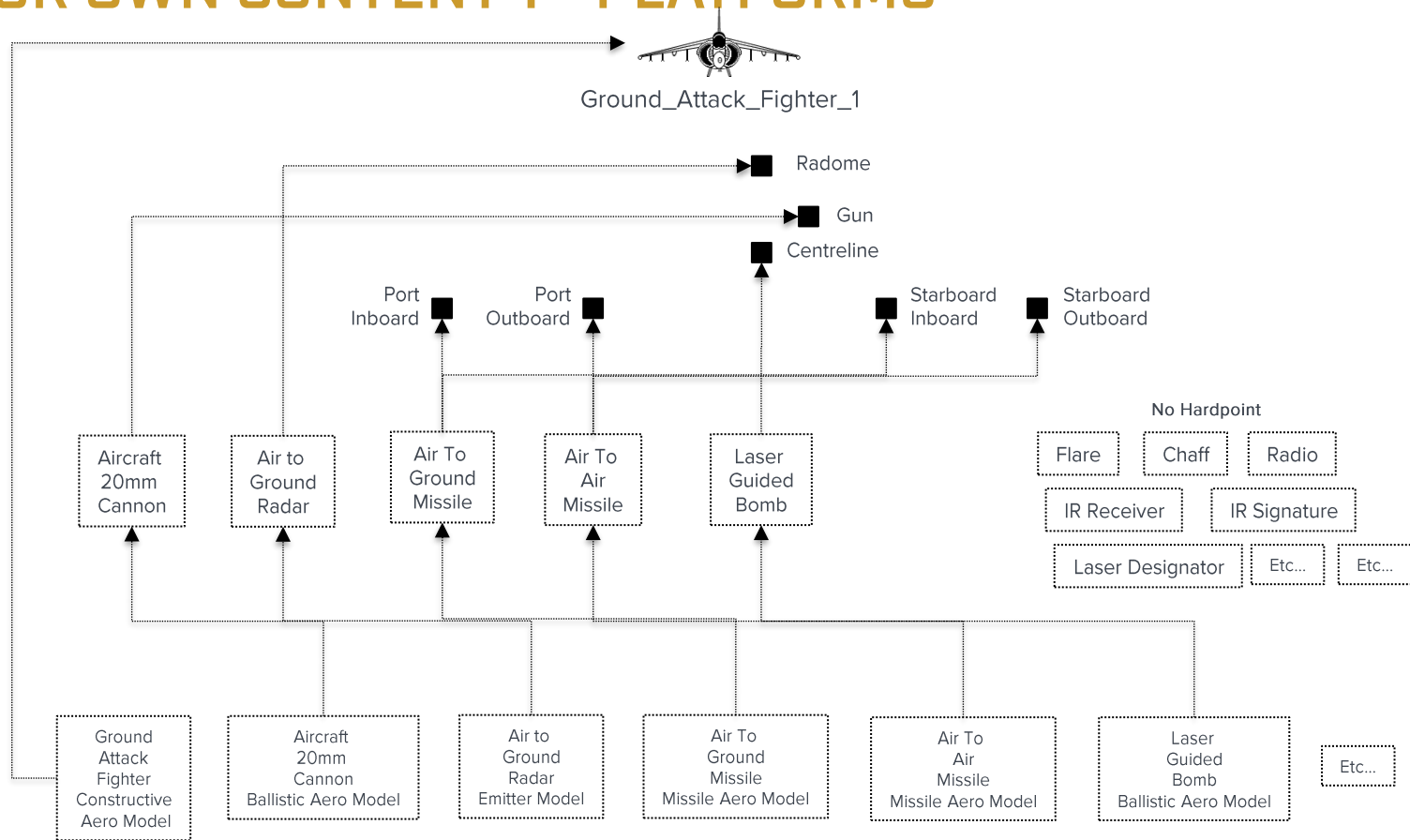
- 3D Position on platform
- Can have parents and children
- Az Pitch Roll limits
- Pairable with sensors
- Equipment may or may not be attached to a hard point

Equipment

- Weapons
- Sensors
- Expendables
- Devices
- Signatures

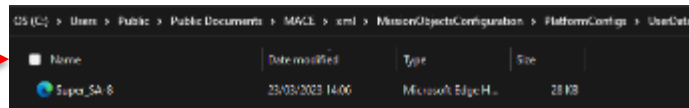
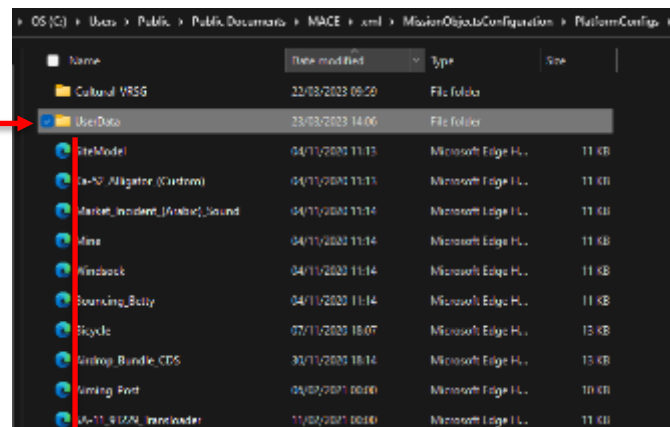
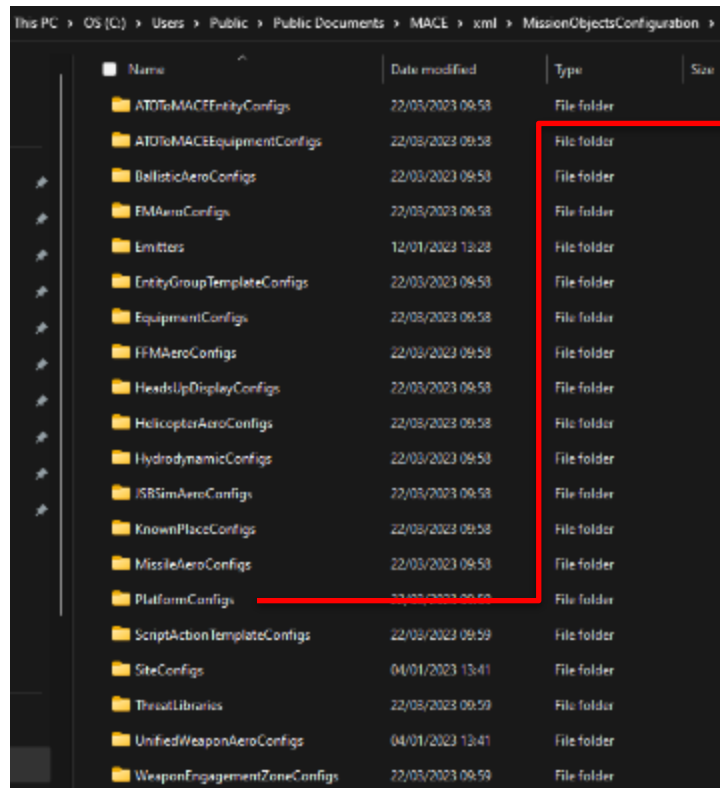
Models

- Ballistic
- Missile
- Fixed Wing Flight
- Rotary Wing Flight
- Emitters
- Threat Libraries



MAKING YOUR OWN CONTENT 1 - PLATFORMS

XML File Structure



NOTE – MACE CHOOSES USER DATA

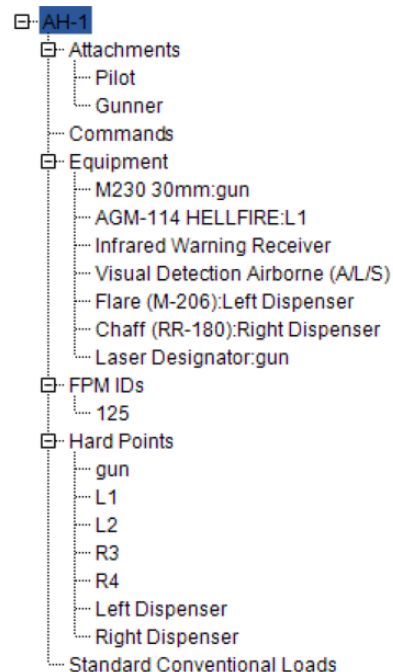
User data overrides MACE installed data – so if there are 2 xmls of the same name one in user data folder and one in normal config folder MACE will use the User Data xml

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





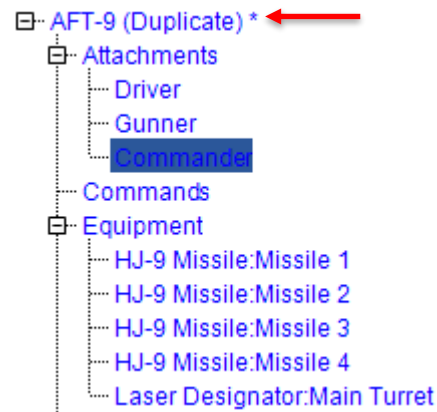
MAKING YOUR OWN CONTENT 1 - PLATFORMS

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!)



| | | | |
|------------|--------------|-------|------|
| Expand All | Collapse All | Close | Save |
|------------|--------------|-------|------|



NOTE – NO SAVE REMINDERS

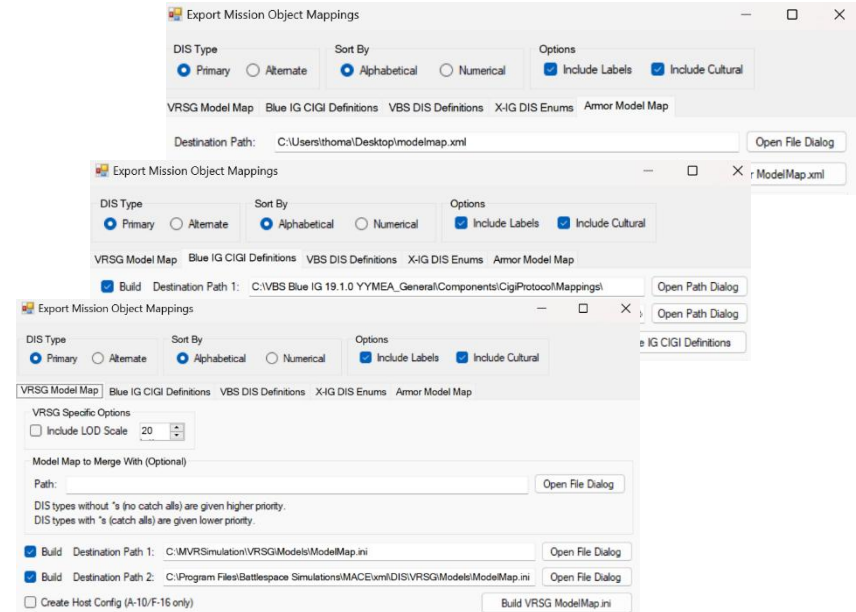
Don't forget to Save each XML (Tab in MOCT) as it's very easy to miss unsaved and close without saving – there is no prompt for unsaved data on closing



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

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)

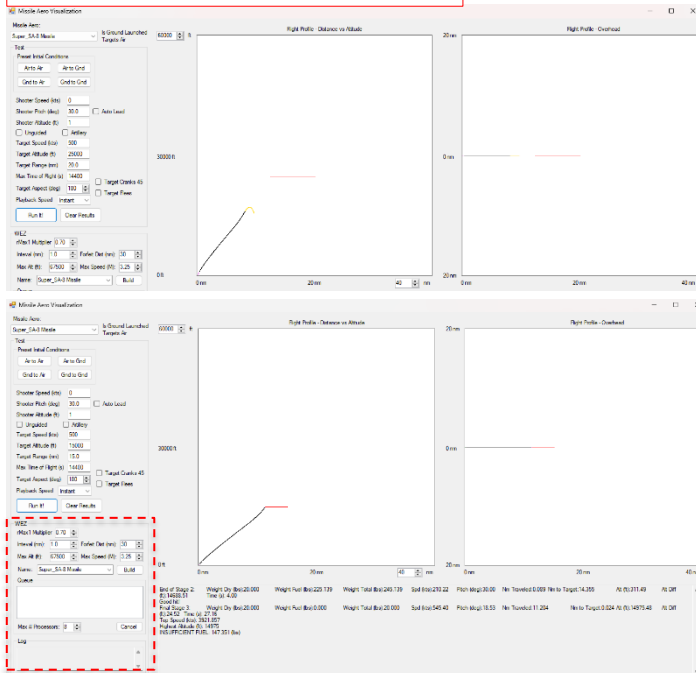
NOTE – WEAPON DAMAGE EFFECTS

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.



Missile Aero Model Parameters and Visualisation

Missile Aero Visualisation Tool Flyouts

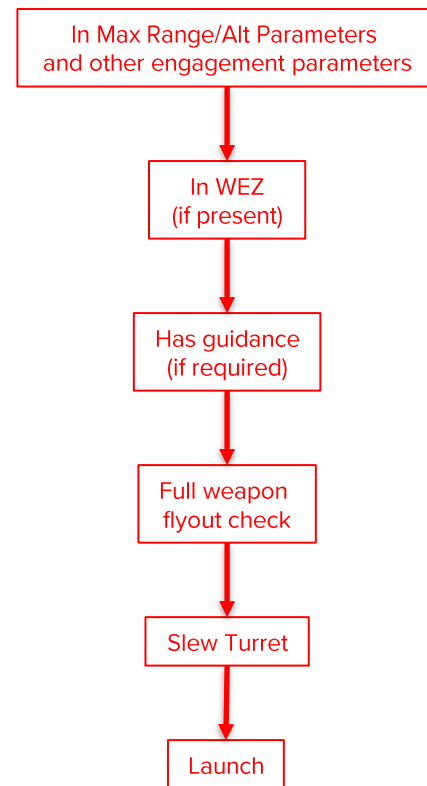


WEZ Builder

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

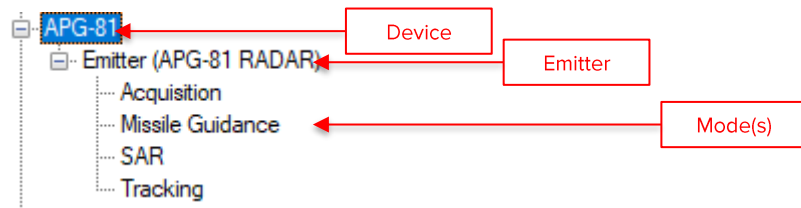
Learning objective:

- To be able to configure emitters and add them as associated devices to equipment

Enabling objectives

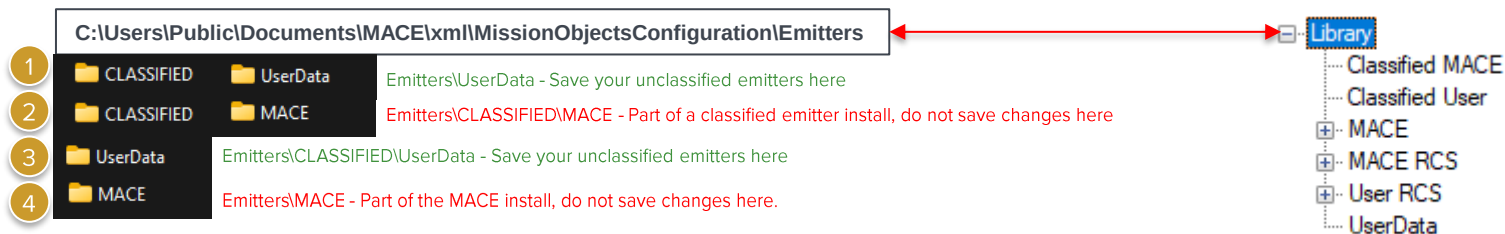
- Know how to open the Emitter editor and create a duplicate emitter as user data
- Understand that guidance / illuminator parameters must match missile seeker parameters
- Know how to configure an emitter's parameters and roles
- Know how to save a new emitter to user data
- Understand how equipment 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



- EW Editor is available offline (MOCT) and at runtime
- Some information only available at runtime
- Live data from the Signal Generator Engine

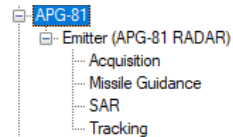
Order of evaluation



MAKING YOUR OWN CONTENT 3

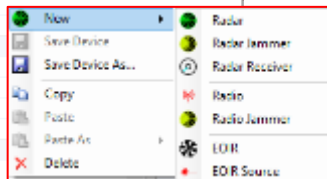
General Pattern To Edit a New Emitter

- 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

| | |
|---------------------------------------|--|
| Classification | Unclassified |
| Data Source | |
| ID | |
| Ownship Name | |
| Device ID | 131072 |
| Device Name | APG-81 |
| Device Type | Radar |
| Antenna | |
| Height Offset | 0.00 ft |
| Length Offset | 0.00 ft |
| Width Offset | 0.00 ft |
| Boresight (Azimuth) | 0° |
| Boresight (Elevation) | 0° |
| Antenna Limits - Set by the Hardpoint | |
| Antenna Mount Limits | Azimuth_Elevation |
| Antenna Center (Azimuth) | 0° |
| Antenna Center (Elevation) | 0° |
| Antenna Range (Azimuth) | 0.0° |
| Antenna Range (Elevation) | 0.0° |
| Beam Limits | |
| Beam Steering Limits | Azimuth_Elevation |
| Beam Range (Azimuth) | 240° |
| Beam Range (Elevation) | 90° |
| Descriptors | |
| ESA | True |
| Hardpoint | radome |
| Max Targets | 4 |
| Modeling | |
| 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 |
| Position | |
| Device Location | Latitude: 0° 0' 0.00" N Longitude: 0° 0' 0.00" E Altitude: 0 |



Evaluated First
Before any modes
are tested

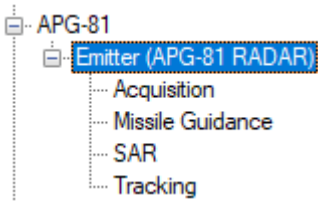
- General information about a device
- Some of info is populated at runtime such as:
 - DIS ID , Ownship name, Position etc.
- Some info is set in Selection of Type of Device
 - Device Type, Device ID

- 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.

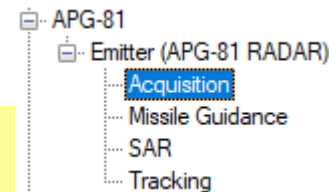
NOTE – ESA - (Electronically Scanned Array, includes PESA and AESA radars)

- 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



MAKING YOUR OWN CONTENT 3



- 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 | |
|--------------------------|-----------------------------|-------------------------|-------------------------|----------------------------|------------|---------------|----------------|
| ID | | Antenna | | Receiver | | Sensitivity | |
| Beam Function | Acquisition | Receiver Antenna Gain | 30.00 dB | Bandwidth | 50.0 kHz | Sensitivity | -162.99 dBm |
| Beam Parameter Index | 5001 | Noise Figure | 3.00 dB | Pulse Compression Gain | 46.00 dB | Ambient Noise | None |
| Mode Group | 1 | Required SNR | 4.00 dB | Receiver Loss | 3.00 dB | Range Max | 99.5 nm (75.2) |
| Mode ID | 1 | Temperature | 290.0 °K | | | | |
| Mode Name | Acquisition | | | | | | |
| Descriptors | | Simulation | | Velocity Filter | | | |
| RequireTrackToAutoEnable | False | Detection Quality | Az: 99% E: 99% Rg: 100% | MTI / Doppler Speed | 10.0 knots | | |
| ScanData | ScanWrapperRandomSector,Sta | Total Detection Quality | 99% | Enable MTI / Doppler Speed | True | | |
| Power | | Range Resolution | 0 ft | | | | |
| Average Power | 0.0007 kW | Clutter Rejection | False | | | | |
| ERP | 83.3579 dBm | | | | | | |
| Peak Power | 0.0300 kW | | | | | | |
| Scan Control | | | | | | | |
| Max Target Tracks | Unlimited | | | | | | |
| Repeat Sequence Period | 0 | | | | | | |
| Scan Center Azimuth | 0° | | | | | | |
| Scan Center Elevation | 0° | | | | | | |
| Scan Offset Azimuth | 0° | | | | | | |
| Scan Offset Elevation | 0° | | | | | | |
| Scan Parameters | Undefined | | | | | | |
| State | | | | | | | |
| Transmittion | False | | | | | | |

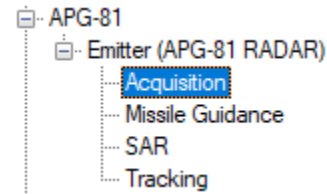
- Beam Function - DIS beam function per CAF DMO SISO – must be correct for AI in MACE
- Beam Parameter Index - DIS Beam Parameter Index. With DIS Emitter Name identifies the type. Valid range is between 5000-5099.
- Mode Group - All modes that have the same ModeGroup number will not transmit simultaneously
 - 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

Mode – Pulse Data



- 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 pulsewords 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

Add < > Delete

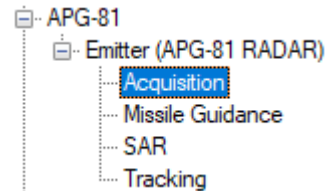
Interpolate: ☒ Freq. ☒ Phase ☒ Amp.
☐ CW ☐ Quantum Illuminator
 Coherency: 100.0% Calculated PCG: 46.8 dB

| | 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

Mode — Beam Shape



- Allows beam editing for each cross section of a beam

Click and drag to add
additional lobes
LMB = Gaussian
RMB = Square

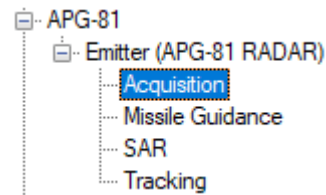
The screenshot shows the 'Beam Shape' editor interface with two radar plots (Horizontal and Vertical Sections) and a control panel. Annotations include:

- Delete Custom Lobes:** Points to the 'Delete Cust. Lobe 4' button in the Horizontal Section controls.
- Expand or contract shape by modifying main lobe:** Points to the 'Beam Width' slider.
- Change polarization:** Points to the 'Polarization' dropdown menu.
- Attenuate side lobes (dB):** Points to the 'Side Lobe Down' slider.
- Scale with mouse scroll wheel in graphic area:** Points to the radar plots.
- Dropdown mathematical functions that define the shape:** Points to the function dropdown menu in the Vertical Section controls, which lists: Sinc, Sinc, SincNormal, Cosine, Cosine2, CosinePedestal, Cosine2, and Square.



MAKING YOUR OWN CONTENT 3

Mode – Scan Pattern



- 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

Speed of scan graphic

Elapsed time from beginning of the table

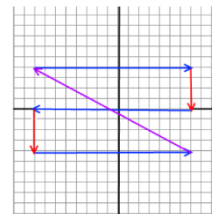
Secondary Motion

Time (s) beam executes for

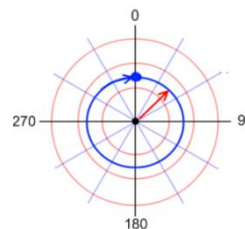
Starting elevation and azimuth

The rate °/s the beam will move vertically or horizontally

| 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

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

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:

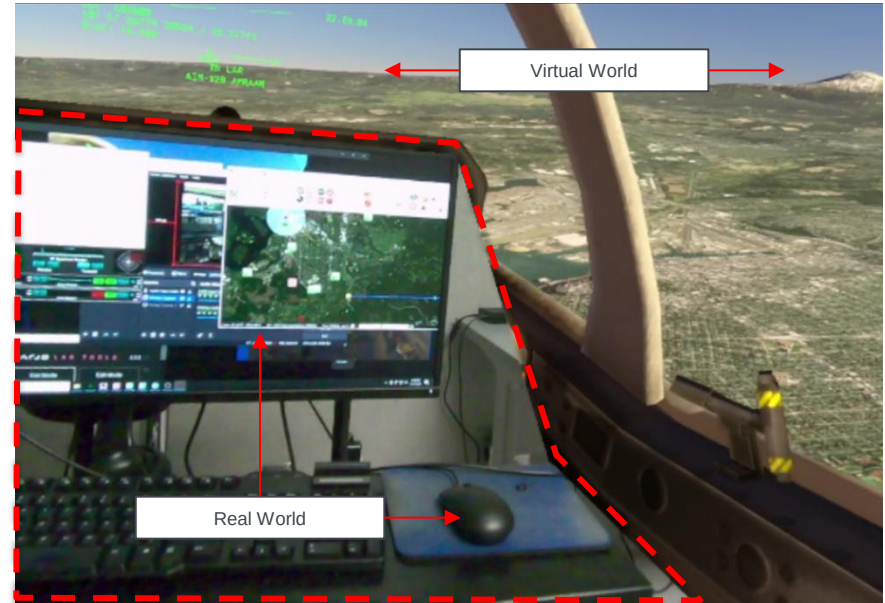
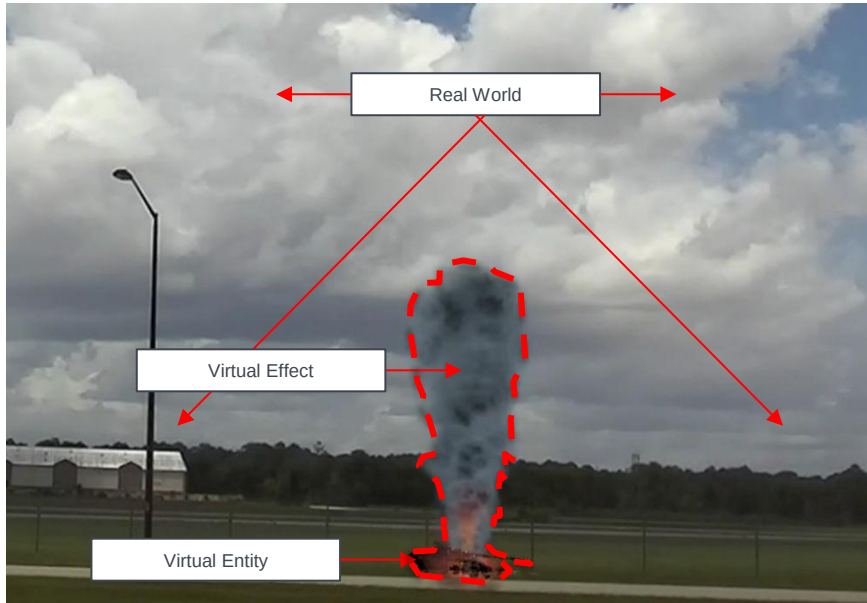
- To be able to configure and use ARMOR with XR devices

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

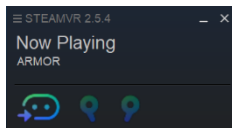
Mixed Reality



ARMOR – XR

XR Headsets (Using Steam VR)

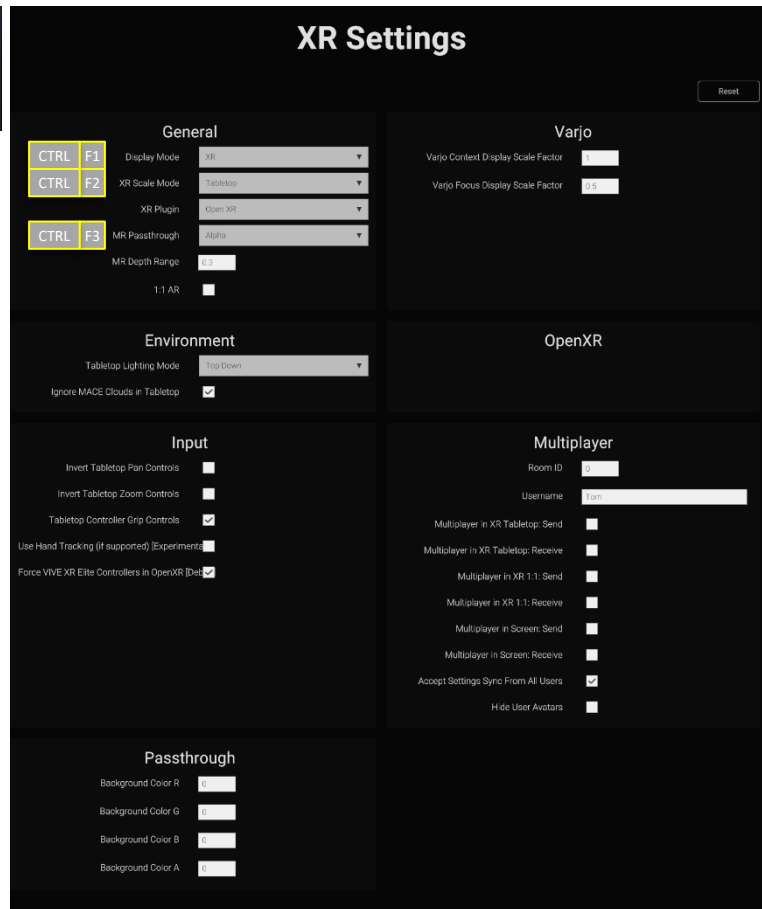
- Install & Configure Steam VR
- Install & Configure Headset Software (e.g. Vive business Streaming)
- Run ARMOR
- XR Mode Changes in ARMOR
 - CTRL + F1 – to change to XR
 - CTRL + F2 – to change between 1:1 and Tabletop Mode
 - CTRL + F3 – to change between MR/VR & Passthrough modes
- Controlling Overlays
 - 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

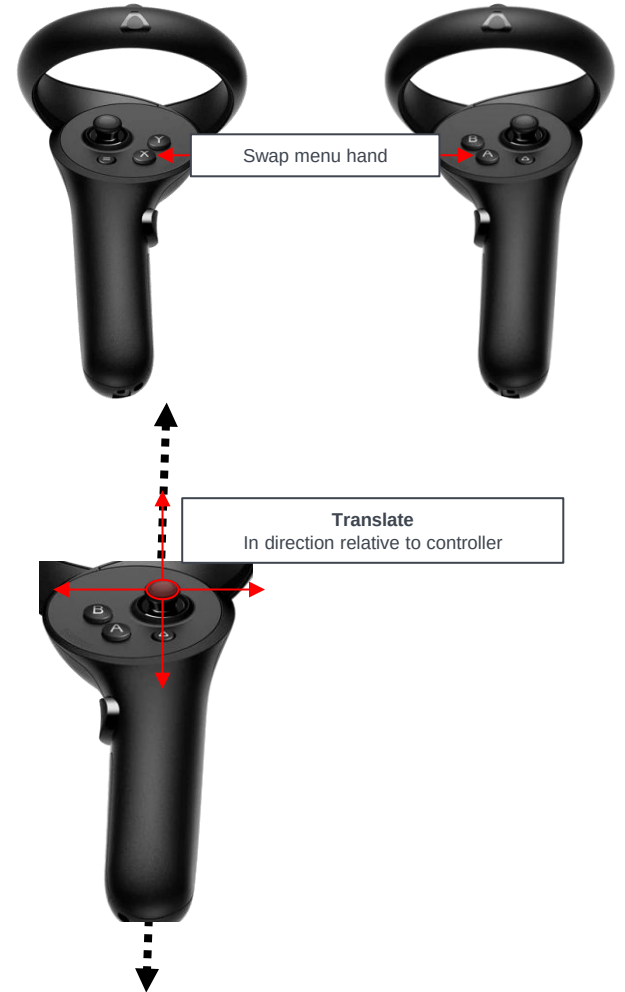
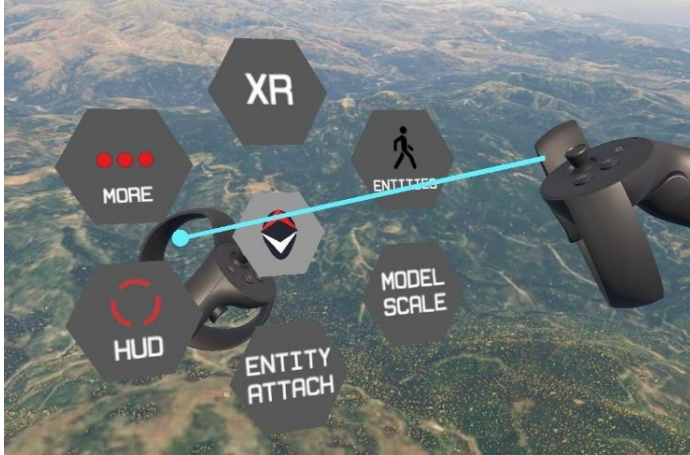


VR Controller Interface in ARMOR
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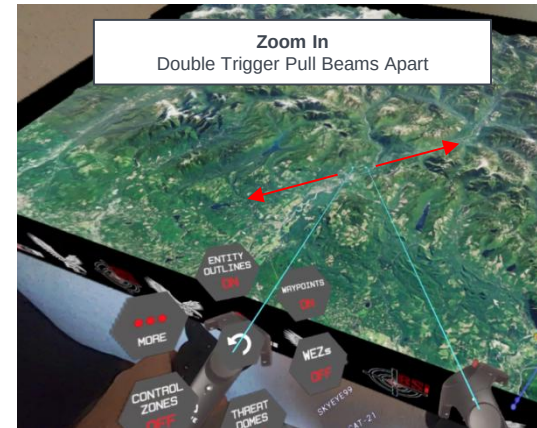
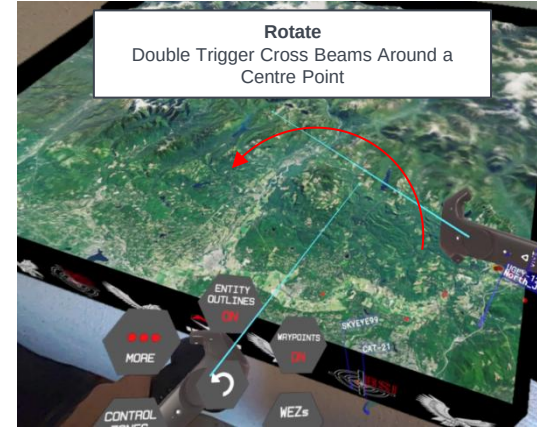
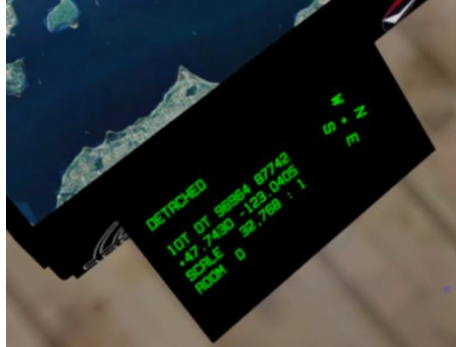
ARMOR – XR

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

ALL THE SHORTCUTS

A collection of all the shortcut slides and decodes

MISSION EDITING - GROUP - MAP TOOLS

- Properties
- CTRL + [Icon] Display Name & Summary Data
- CTRL + [Icon] Move Object
- SHIFT + [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

MISSION & ENTITY CONTROL

- F5 Start Mission
- F6 Stop Mission
- CTRL + [Icon] Rally to (Ground) / Loiter (Air)
- CTRL + L Enter Loiter
- CTRL + T Display Platform Control Tapes
- ALT + H / S / L Open Entity Control Window
- CTRL + D Data Link Settings on Selected
- CTRL + R Resurrect All
- ALT + C Dispense Chaff on Selected
- ALT + F Dispense Flare on Selected
- ALT + B Dispense Chaff & Flare on Selected

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

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

OUTLINE - ENGAGEMENT

CLEAR Weapons Hold
AMBER Weapons Tight
RED Weapons Free
YELLOW Suppression

CTRL + T Display Platform Control Tapes

True North
Magnetic North
RED Planned Heading
YELLOW Instant Heading
RED Planned Altitude or Speed
YELLOW Instant Altitude or Speed
Ground Level

ALT + [Icon] Move Triangles

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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

| | | | | |
|------------|-----------------------------|-----------------------------|--------------------------------|-----------------------------------|
| ABC 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

| | | | |
|-----------------------------------|---------------------------------|--------------------------------|----------------------------|
| [Icon] B MACE Beams On / Off | [Icon] G Designators On / Off | [Icon] G Threat Domes On / Off | [Icon] K Airspace On / Off |
| [Icon] O Entity Outlines On / Off | [Icon] U Control Zones On / Off | [Icon] N WEZs On / Off | [Icon] 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

- 1 1st Person
- 2 Trail
- 3 Trail Fixed Horizon
- 4 Orbit
- 5 North Up
- 6 Heading Up
- 7 Target
- 8 Equipment
- 9 Sensor
- 0 Picture in Picture
- I Munition Camera
- J 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: [Icon]

Movement Speed: [Icon]

Fast Move: SHIFT
Slow Move: CTRL

CAMERA APPEARANCE

SPECTRUM & POLARITY

- [Icon] Z Primary Camera Spectrum
- [Icon] X Primary Camera Polarity
- SHIFT [Icon] Z Sensor Camera Spectrum
- SHIFT [Icon] 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

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MACE BASIC MISSION BUILDING

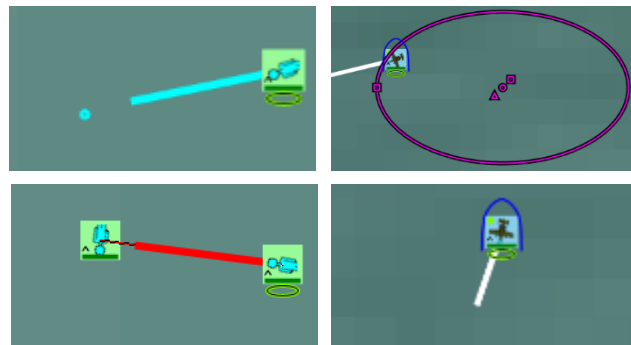
Intent and delta

■ 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

