

ASM(IR) Demonstration Engagements (Anti-Ship Missile Imaging IR Homing)

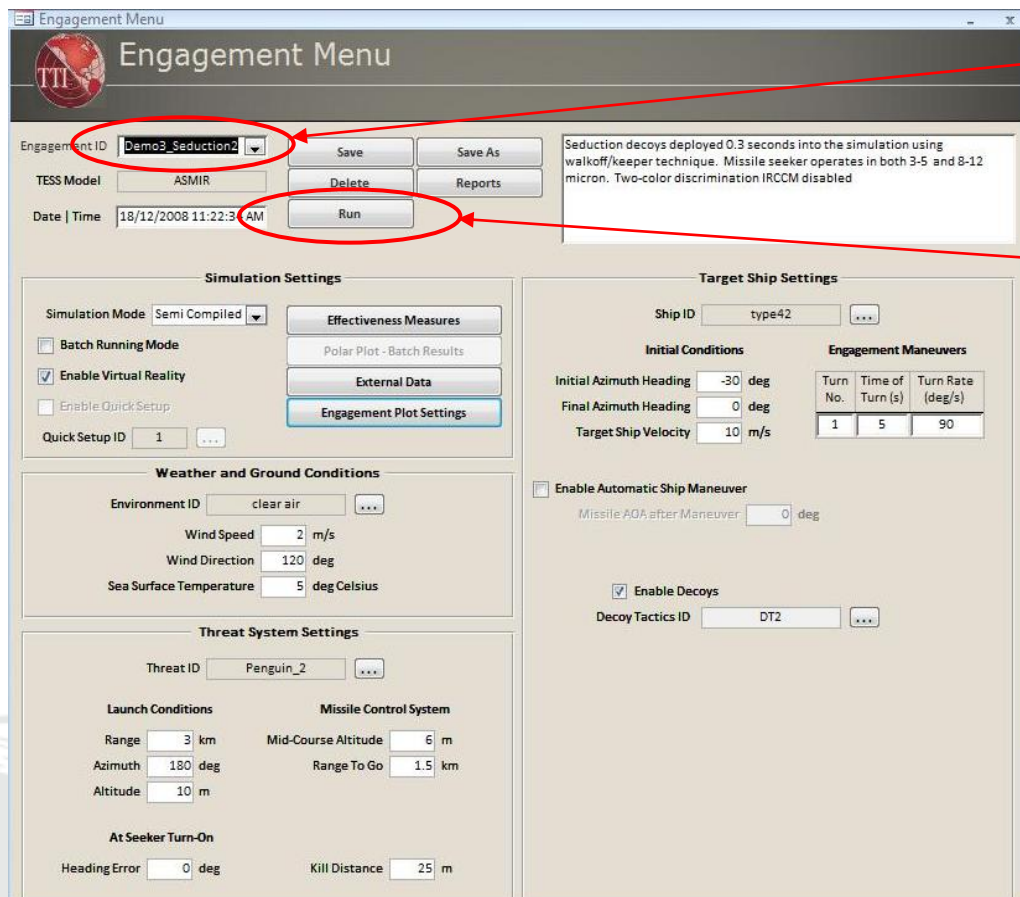
- The demonstration scenarios are:
 - 1) Demo 1 - Distraction: Anti-ship missile (single band) versus target ship deploying two distraction decoys
 - 2) Demo 2 - Seduction: Anti-ship missile (dual band) versus target ship deploying a seduction decoy with 6 sub-munitions
- A brief interpretation of the major events occurring in each engagement is provided by reference to the time and spatial plots.
- Critical input parameters are shown.
- Selected output graphics are shown including time plots, IR Images, Virtual Reality and 3D Plots.

Sea IR Master Interface



- The main screen of the Sea IR Master Interface is shown
- Clicking on the Engagements button opens the Engagement menu shown next page

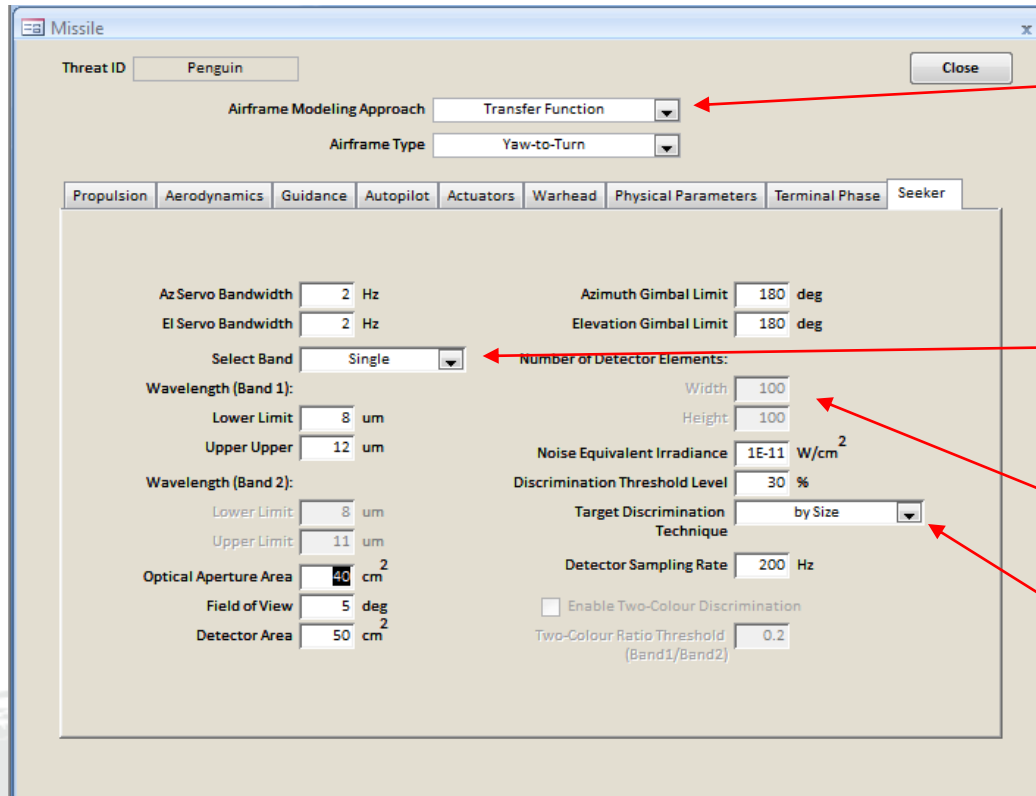
Sea IR Master Interface Engagement Menu



The Engagement ID of the Sea IR Master Interface is indicated

The sample engagements may be executed by selecting the engagement of interest in the Engagement ID Menu and clicking on the Run button

Demo 1 – Distraction - Select Seeker Parameters



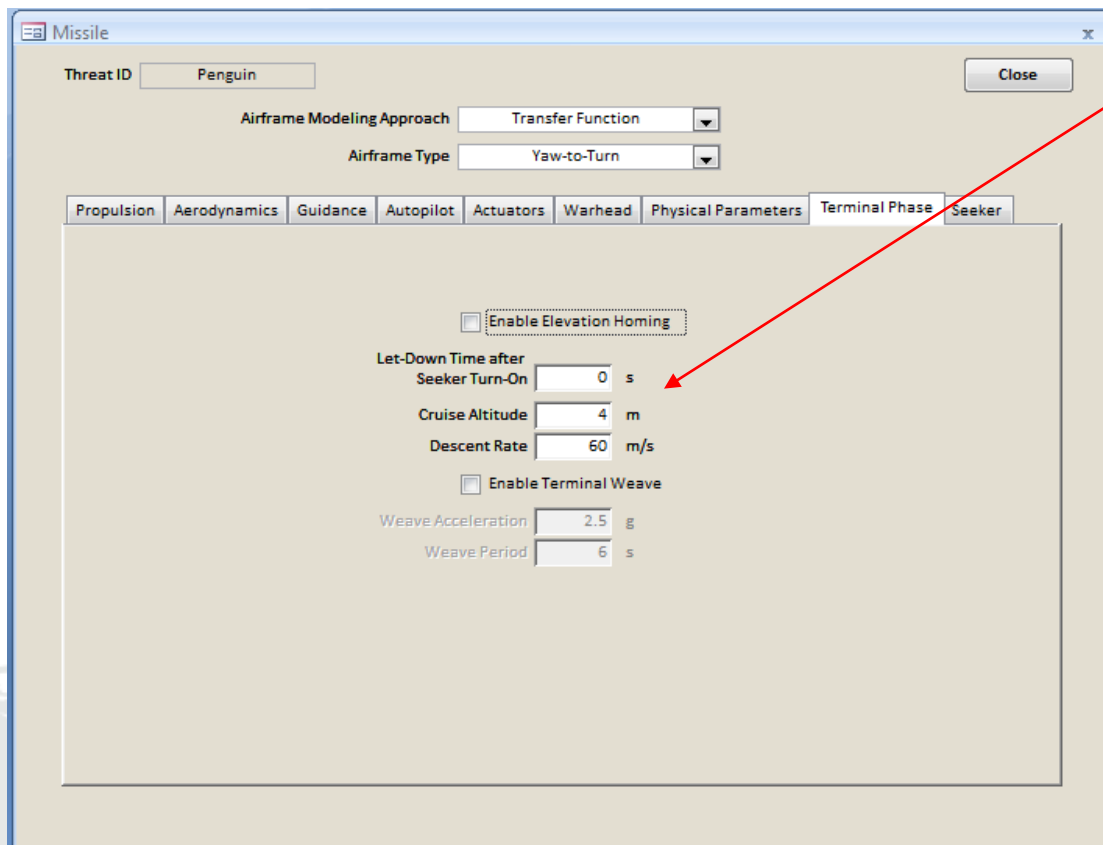
Airframe Modeling Approach is set as Transfer Function type

Missile seeker is set as Single Band type with indicated limits

IR Detector Array set to 100 x 100

Discrimination based on object Size

Demo 1 – Distraction - Select Seeker Parameters



Missile

Threat ID

Airframe Modeling Approach

Airframe Type

Propulsion | Aerodynamics | Guidance | Autopilot | Actuators | Warhead | Physical Parameters | Terminal Phase | **Seeker**

Enable Elevation Homing

Let-Down Time after Seeker Turn-On s

Cruise Altitude m

Descent Rate m/s

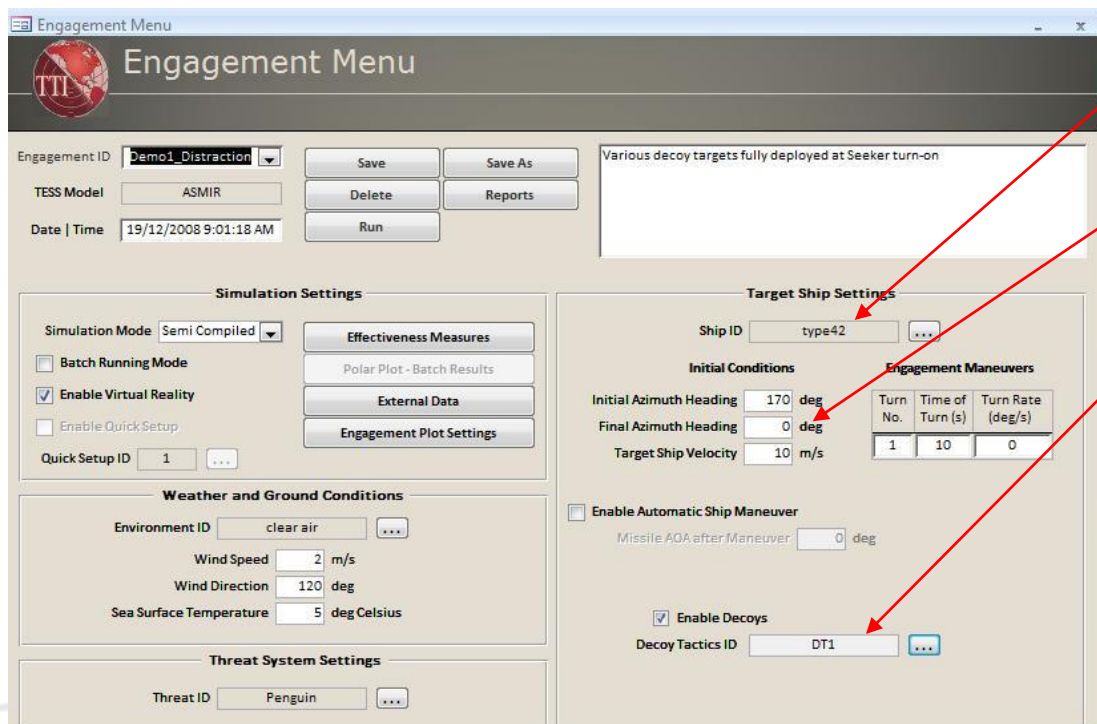
Enable Terminal Weave

Weave Acceleration g

Weave Period s

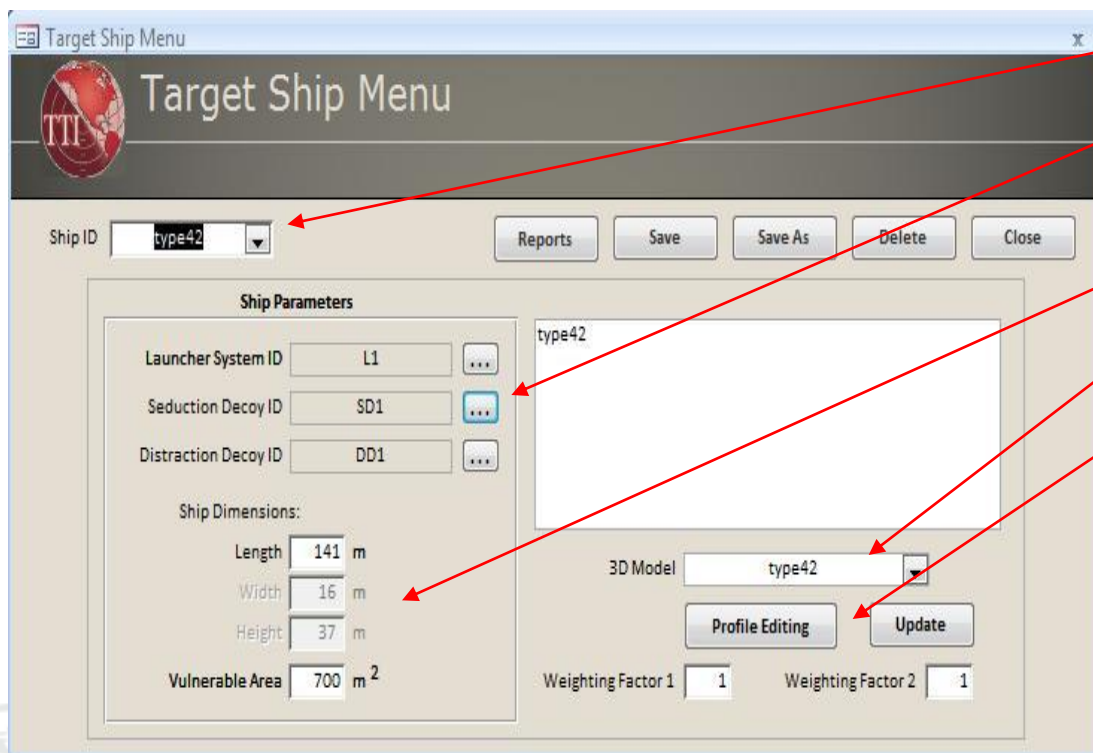
Missile will perform let down maneuver upon completion of mid course phase

Demo 1 – Distraction - Target Ship Parameters



- Target Ship ID: type42
- Target Ship initial conditions
- Decoy Tactics ID: DT1

Demo 1 – Distraction - Target Ship Parameters



Target Ship ID

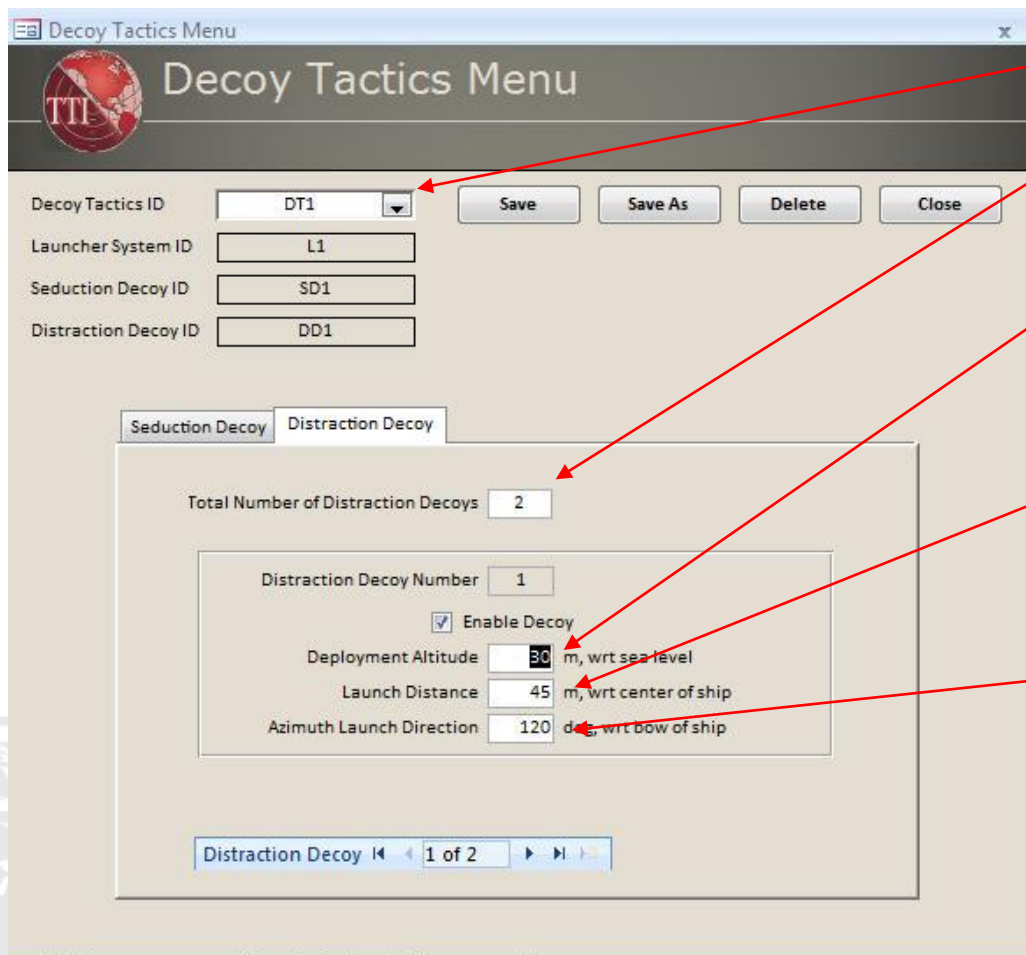
Target Ship Subsystems

Physical Dimensions

3D physical model

IR Signature Editing

Demo 1 – Distraction - Select Decoy Parameters



The screenshot shows the 'Decoy Tactics Menu' window. At the top, the title bar reads 'Decoy Tactics Menu'. Below the title bar is a header with the TTI logo and the text 'Decoy Tactics Menu'. The main interface contains several input fields and buttons:

- Decoy Tactics ID:** A dropdown menu set to 'DT1'. A red arrow points from this field to the text 'Tactic ID: DT1' on the right.
- Launcher System ID:** A text box containing 'L1'.
- Seduction Decoy ID:** A text box containing 'SD1'.
- Distraction Decoy ID:** A text box containing 'DD1'.
- Buttons:** 'Save', 'Save As', 'Delete', and 'Close' are located to the right of the Decoy Tactics ID dropdown.
- Distraction Decoy Configuration Panel:** This panel is titled 'Distraction Decoy' and contains:
 - Total Number of Distraction Decoys:** A text box containing '2'. A red arrow points from this field to the text 'Total of 2 Distraction Decoys Deployed' on the right.
 - Distraction Decoy Number:** A text box containing '1'.
 - Enable Decoy:** A checked checkbox.
 - Deployment Altitude:** A text box containing '30' followed by 'm, wrt sea level'. A red arrow points from this field to the text 'Decoy 1 and 2 Deployment Altitude: 30 m' on the right.
 - Launch Distance:** A text box containing '45' followed by 'm, wrt center of ship'. A red arrow points from this field to the text 'Decoy 1 and 2 Launch Distance in horizontal plane: 45 m' on the right.
 - Azimuth Launch Direction:** A text box containing '120' followed by 'deg, wrt bow of ship'. A red arrow points from this field to the text 'Launch Direction: Decoy 1 = 120 deg Decoy 2 = -60 deg' on the right.
- Navigation:** At the bottom of the panel, there is a control bar with 'Distraction Decoy', a left arrow, '1 of 2', a right arrow, and a refresh icon.

Tactic ID: DT1

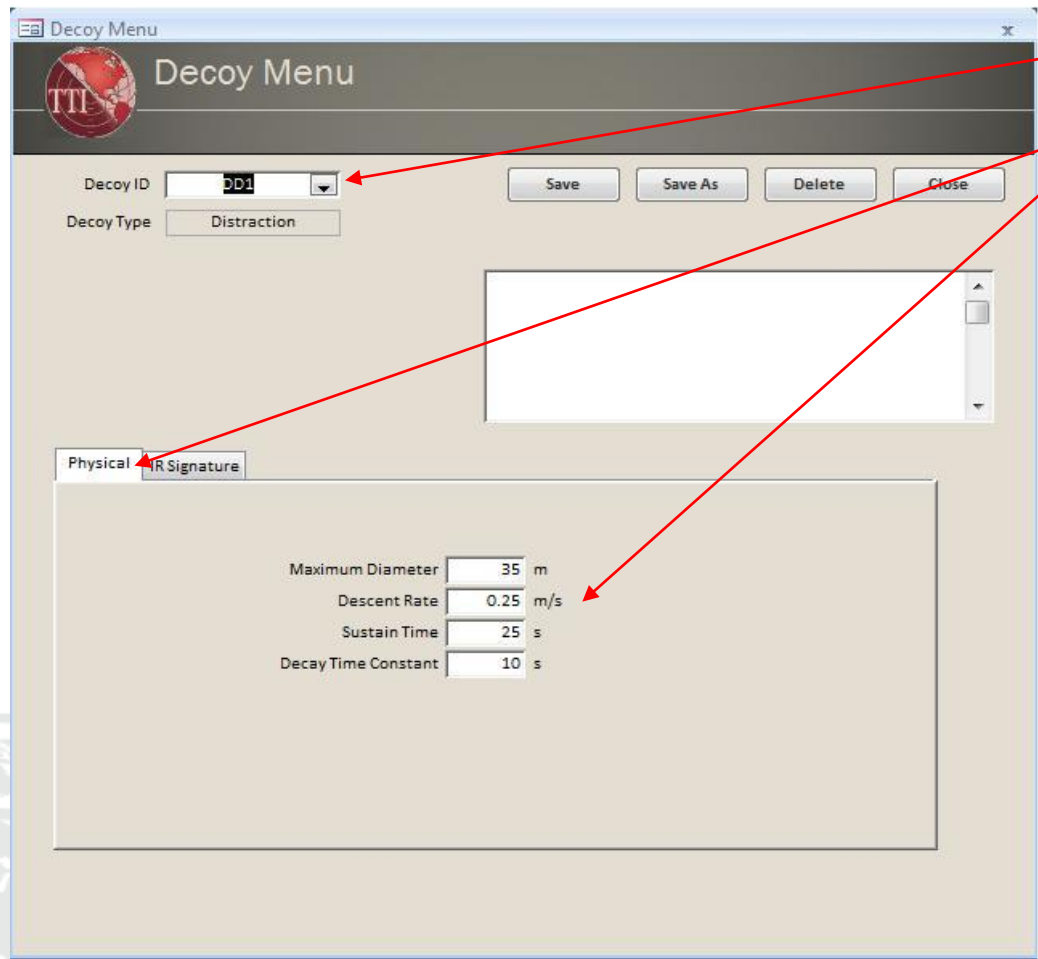
Total of 2 Distraction Decoys Deployed

Decoy 1 and 2 Deployment Altitude: 30 m

Decoy 1 and 2 Launch Distance in horizontal plane: 45 m

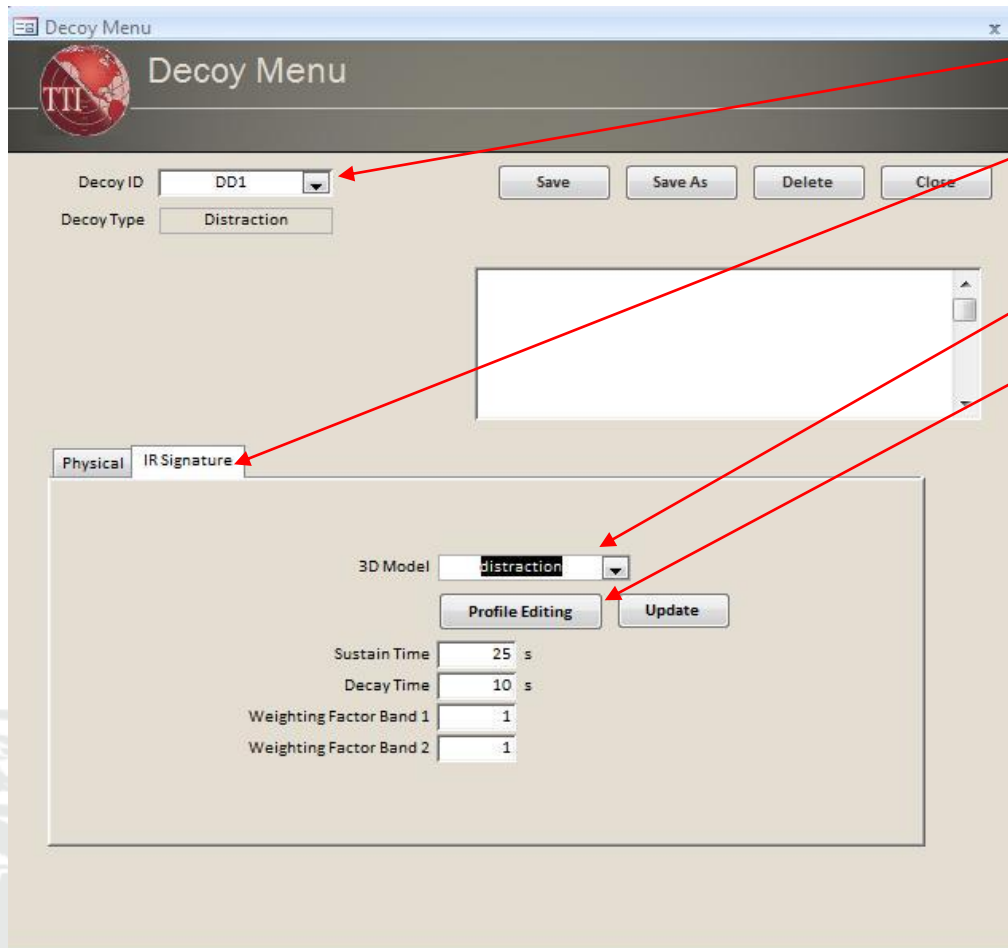
Launch Direction:
Decoy 1 = 120 deg
Decoy 2 = -60 deg

Demo 1 – Distraction - Decoy Physical Parameters



Decoy ID: DD1
Physical Parameters

Demo 1 – Distraction - Decoy Signature Parameters



The screenshot shows the 'Decoy Menu' application window. At the top, there is a header with the TTI logo and the title 'Decoy Menu'. Below the header, there are several input fields and buttons:

- Decoy ID:** A dropdown menu set to 'DD1'.
- Decoy Type:** A button labeled 'Distraction'.
- Buttons:** 'Save', 'Save As', 'Delete', and 'Close'.
- 3D Physical Model:** A large empty rectangular area.
- IR Signature Tab:** A tab labeled 'IR Signature' is selected. It contains:
 - 3D Model:** A dropdown menu set to 'distraction'.
 - Buttons:** 'Profile Editing' and 'Update'.
 - Sustain Time:** A text input field with '25 s'.
 - Decay Time:** A text input field with '10 s'.
 - Weighting Factor Band 1:** A text input field with '1'.
 - Weighting Factor Band 2:** A text input field with '1'.

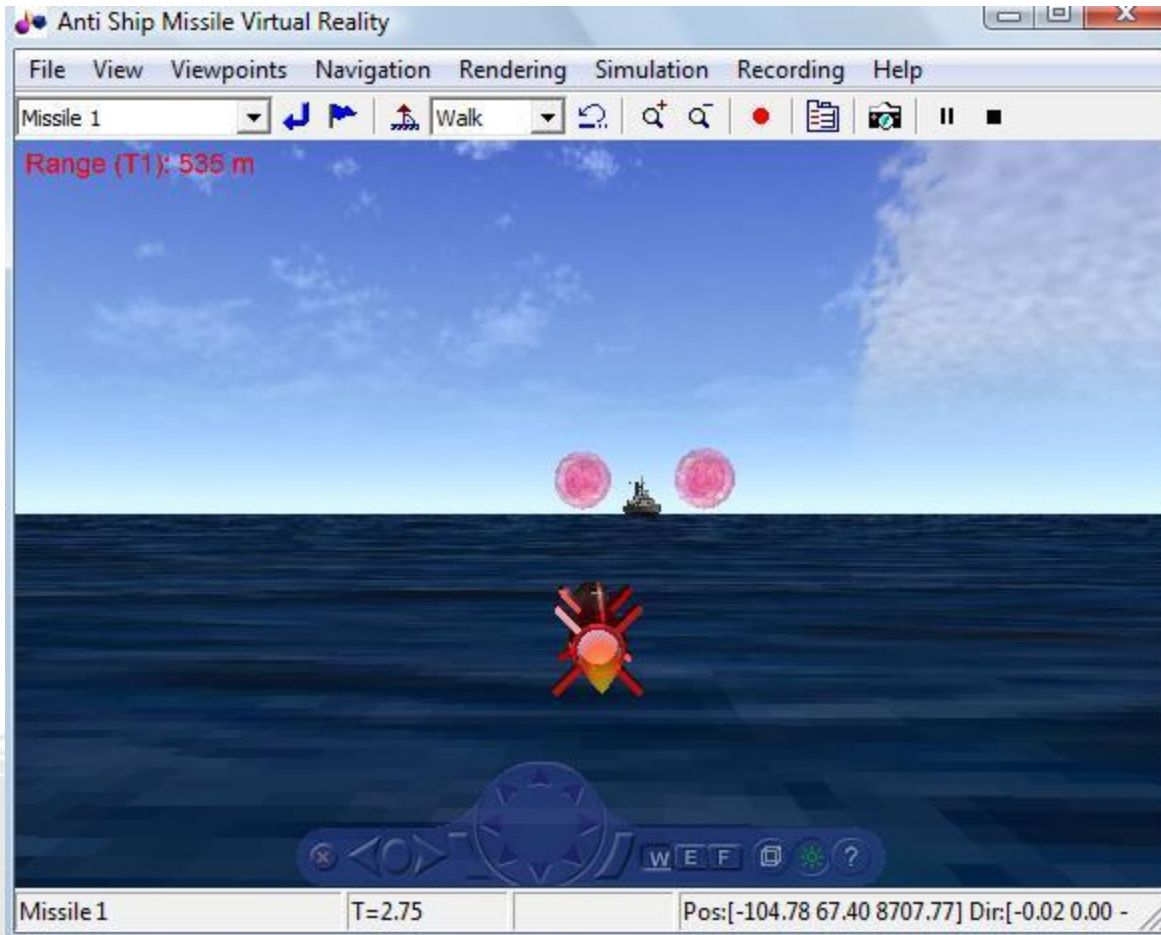
Decoy ID: DD1

IR Signature
Parameters

3D Physical Model

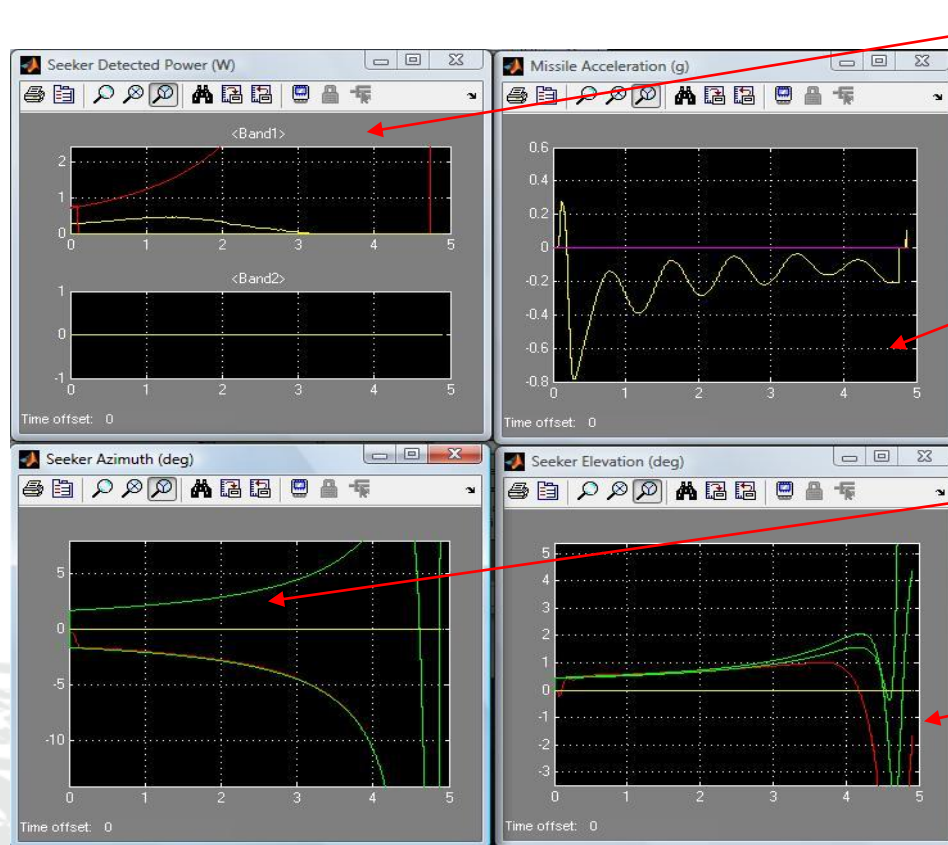
Open IR Profiler to
edit IR Signature

Demo 1 – Distraction - Select Engagement Output



- Virtual Reality display shows missile part way through the simulation
- Distraction Decoys (magenta) and the target ship are visible

Demo 1 – Distraction - Select Engagement Output



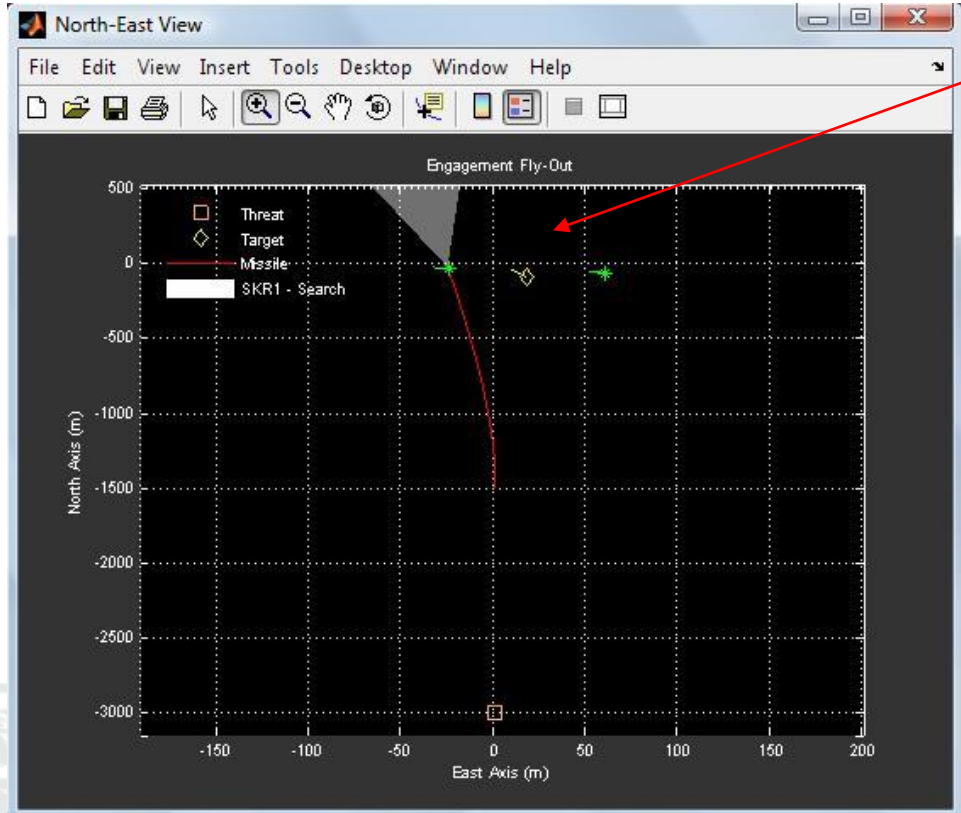
● Target ship (yellow)
and Distraction
Decoys (red)
radiating in Band 1

● Missile Acceleration
throughout
engagement

● Seeker tracking (red)
Distraction Decoy
(green) in azimuth

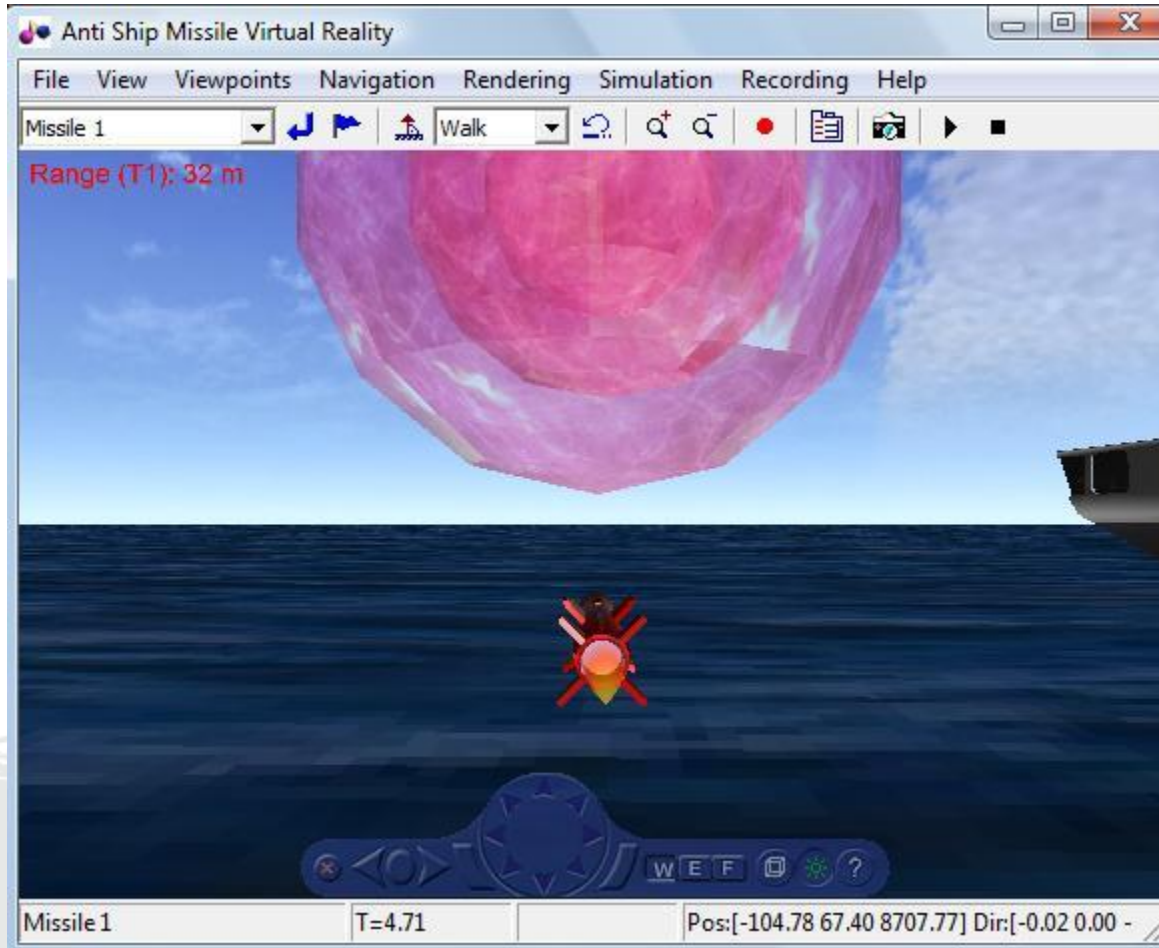
● Seeker tracking (red)
Distraction Decoy
(green) in elevation

Demo 1 – Distraction - Select Engagement Output



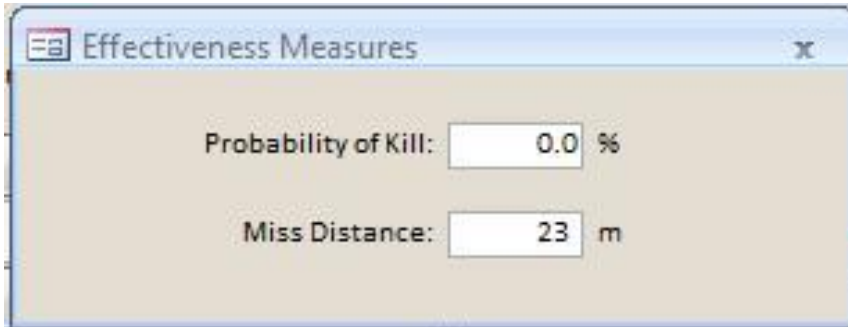
Missile tracks
Distraction Decoy

Demo 1 – Distraction - Select Engagement Output



- Virtual Reality display shows missile closing in on Distraction Decoy

Demo 1 – Distraction - Select Engagement Output

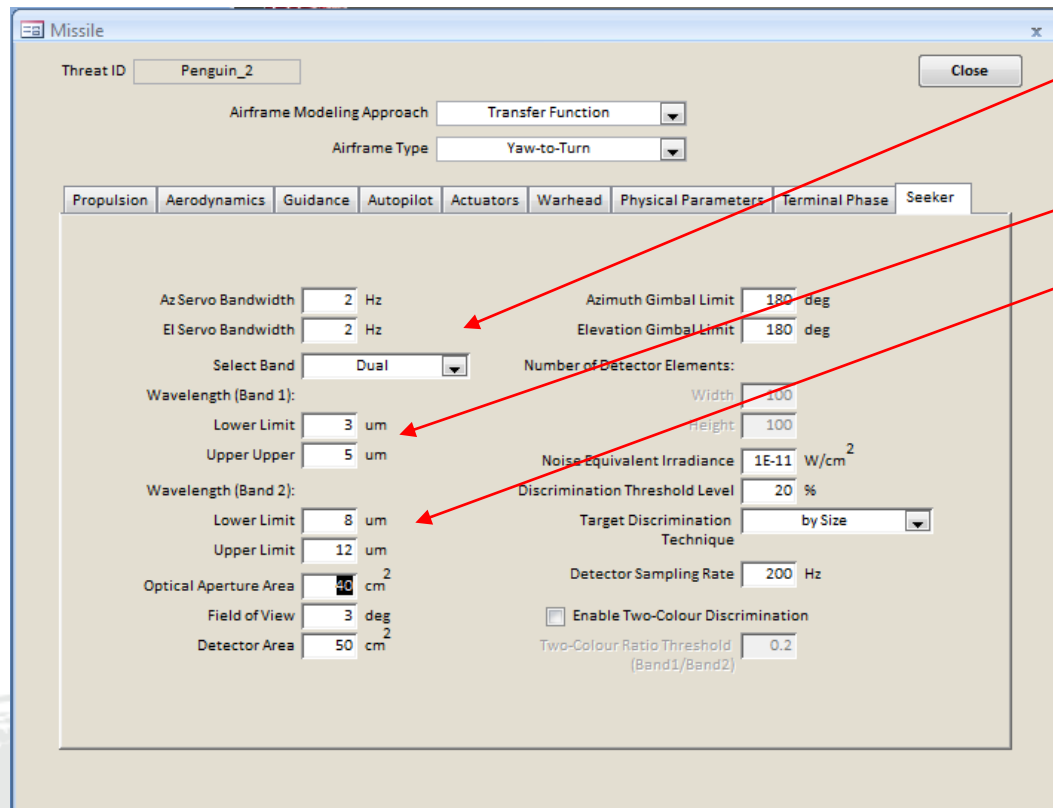


The screenshot shows a dialog box titled "Effectiveness Measures" with a close button (X) in the top right corner. The dialog contains two text input fields. The first field is labeled "Probability of Kill:" and contains the value "0.0 %". The second field is labeled "Miss Distance:" and contains the value "23 m".

Field	Value
Probability of Kill:	0.0 %
Miss Distance:	23 m

- Probability of Kill = 0 %
- Missile to Target
Platform miss distance =
23 meters

Demo 1 – Seduction - Select Seeker Parameters

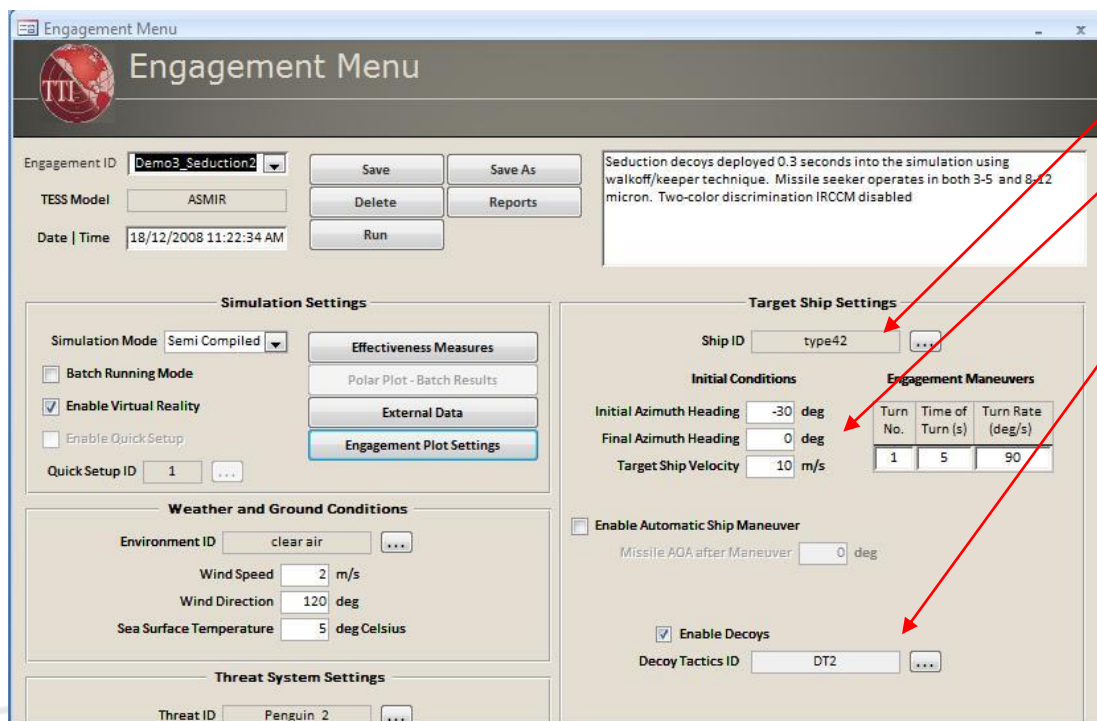


Dual Band Missile Seeker

Band 1: [3 5] microns

Band 2: [8 12] microns

Demo 1 – Seduction - Select Target Ship Parameters

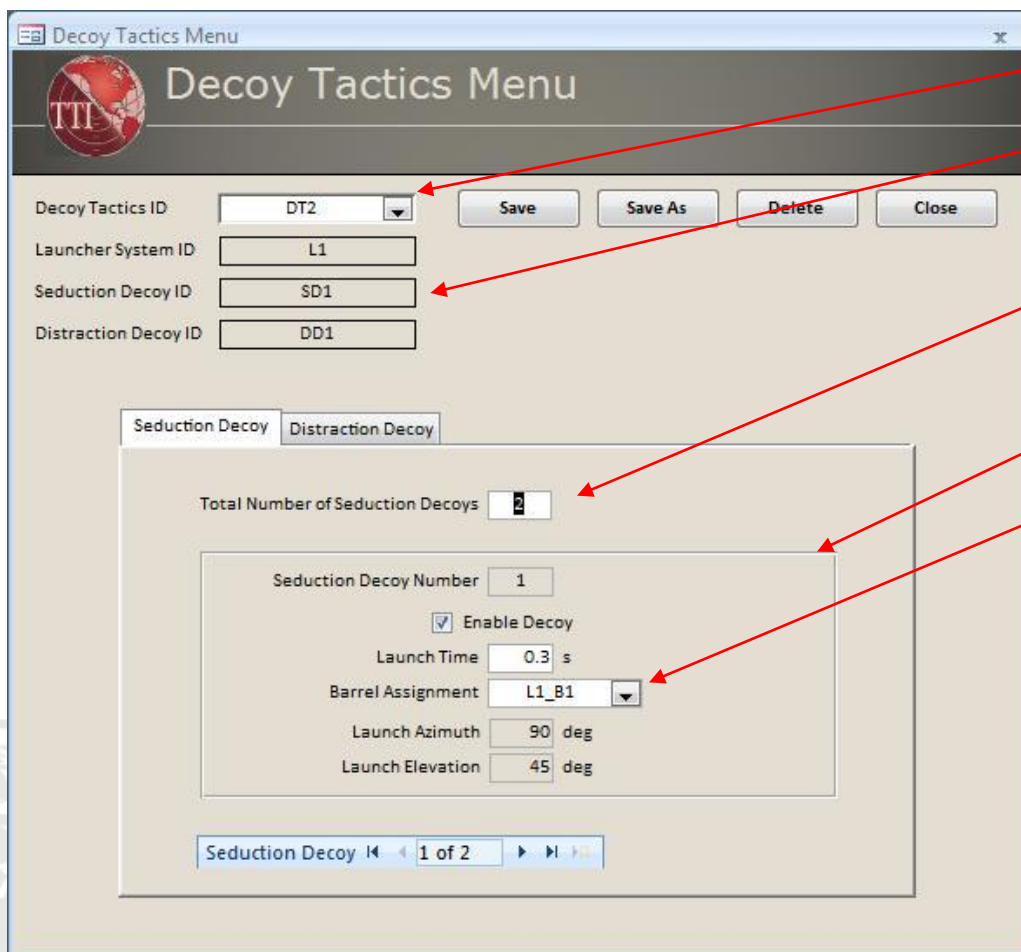


Target Ship ID

Target Ship initial conditions

Decoy Tactics ID: DT2

Demo 1 – Seduction - Select Decoy Tactics



Tactic ID: DT2

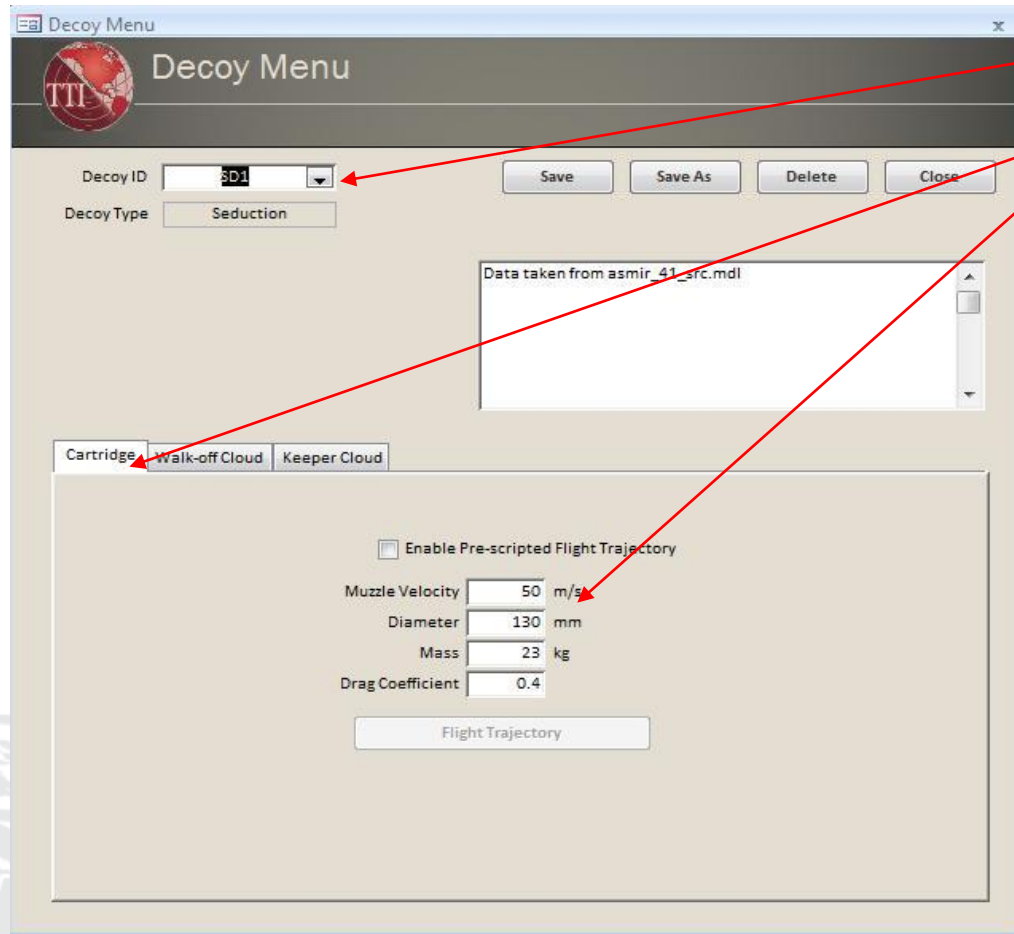
DT2 Associated Subsystems

2 Seduction Decoys , Decoy 1 Enabled

Launch Parameters

Decoy cartridge assigned to Barrel 1 of Launcher 1

Demo 1 – Seduction - Select Decoy Tactics



Decoy Menu

Decoy ID: SD1

Decoy Type: Seduction

Data taken from asmir_41_src.mdl

Cartridge | Walk-off Cloud | Keeper Cloud

Enable Pre-scripted Flight Trajectory

Muzzle Velocity: 50 m/s

Diameter: 130 mm

Mass: 23 kg

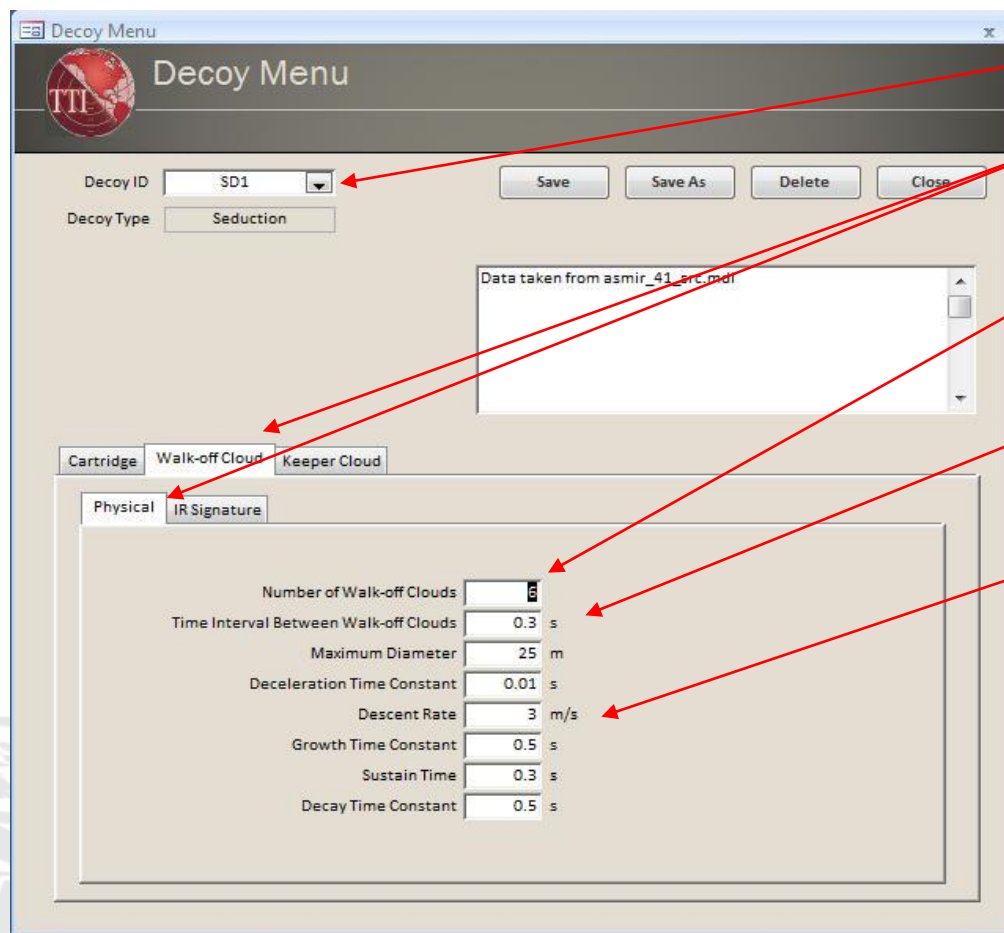
Drag Coefficient: 0.4

Flight Trajectory

Decoy ID: SD1

Trajectory Parameters

Demo 1 – Seduction - Decoy Walk-off Parameters



Decoy ID: SD1

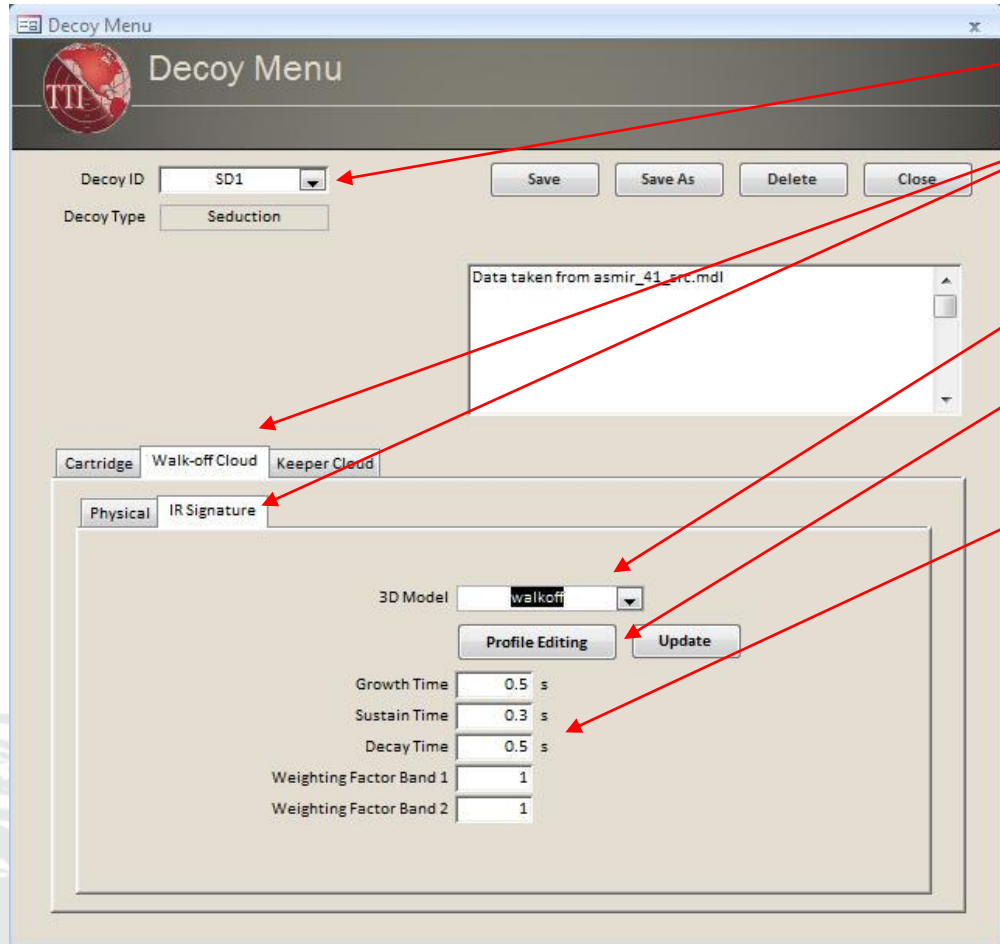
Walk-off Physical Parameters

Number of sub-munitions

Time between sub-munitions ejection

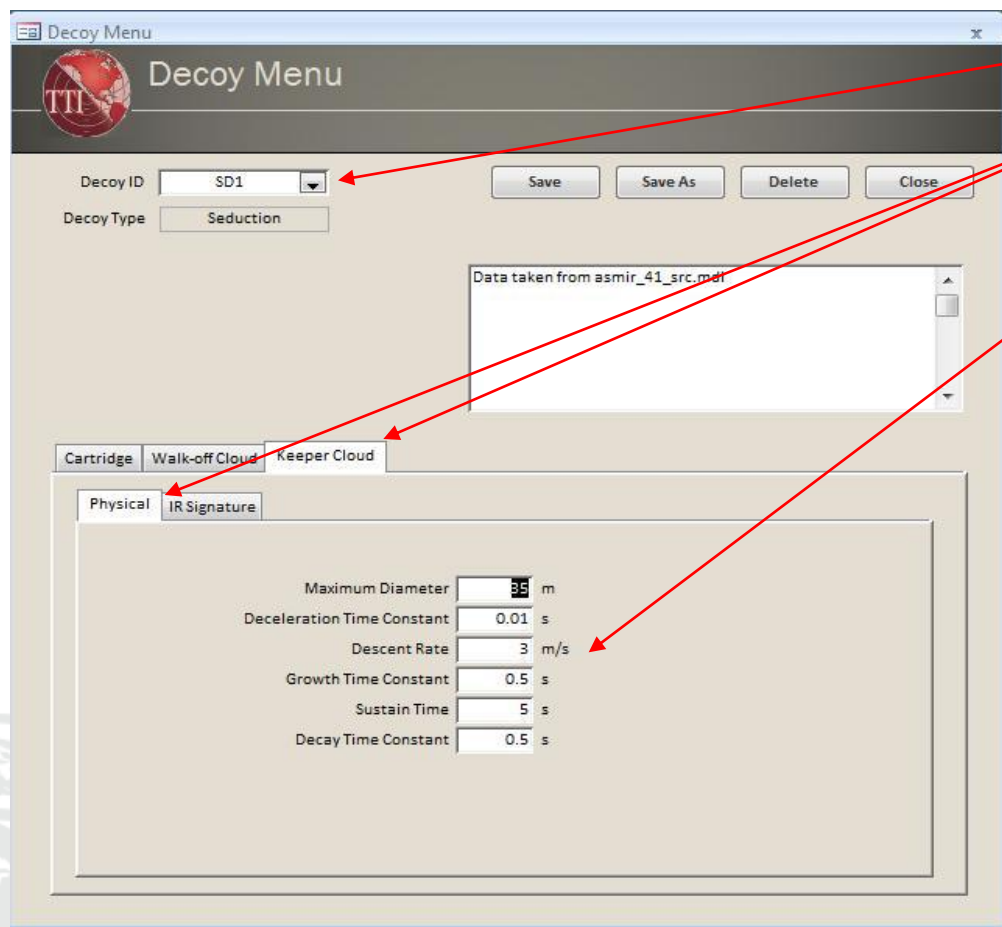
Other physical parameters

Demo 1 – Seduction - Decoy Walk-off Parameters



- Decoy ID: SD1
- Walk-off IR Parameters
- Physical 3D Model
- Open IR Profiler to edit IR Signature
- Other IR Signature parameters

Demo 1 – Seduction - Decoy Keeper Parameters

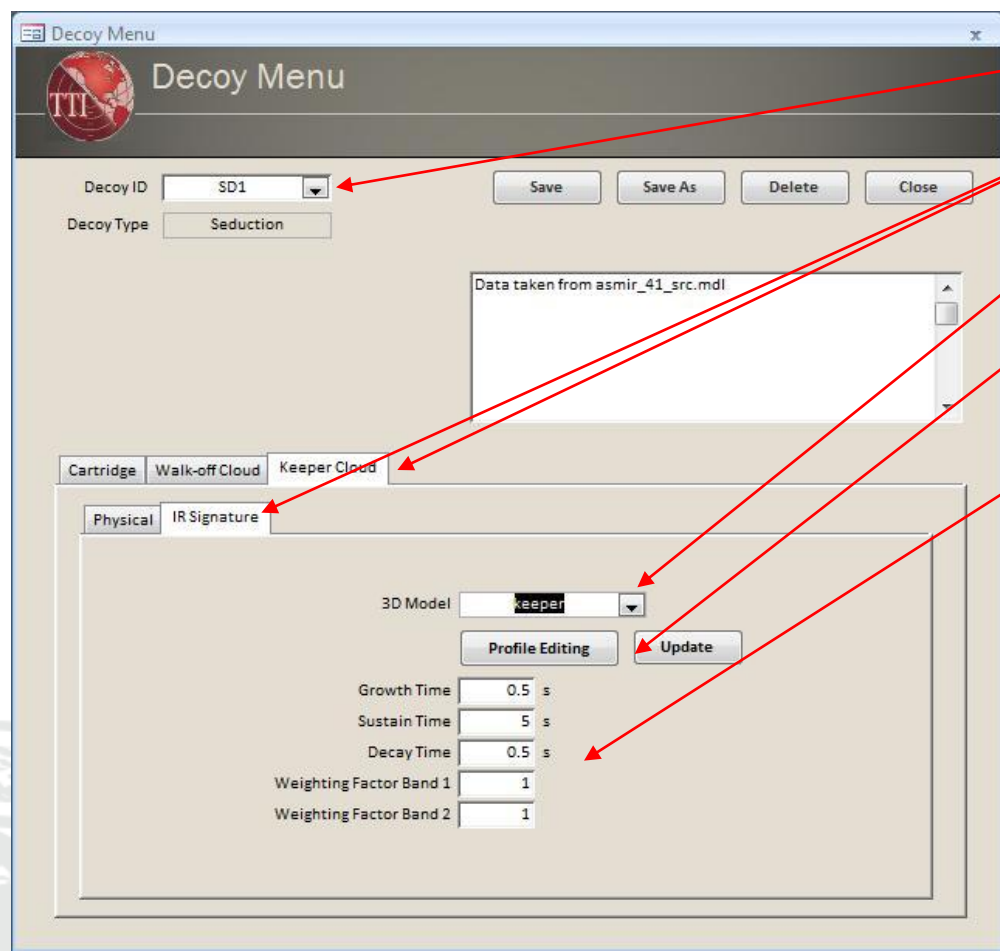


Decoy ID: SD1

Keeper Physical Parameters

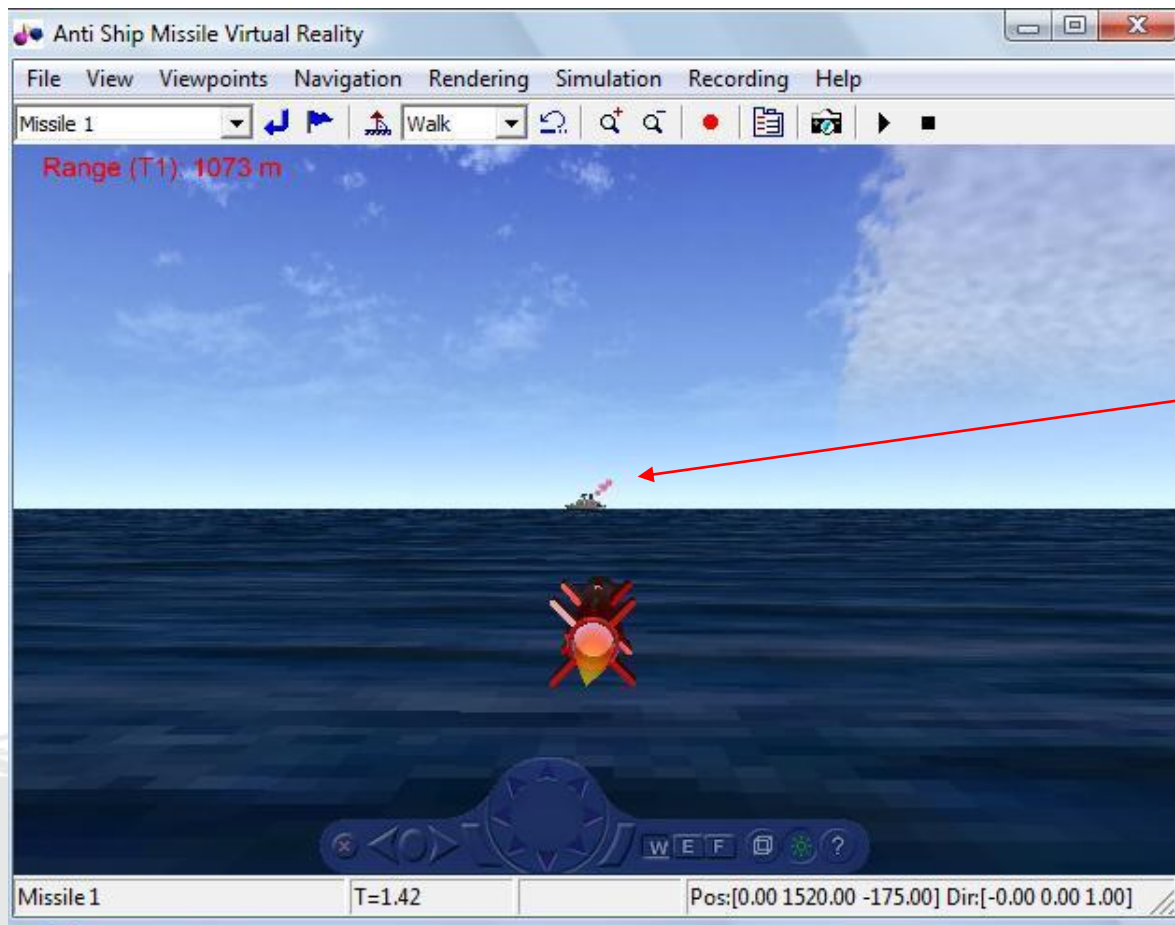
Other physical parameters

Demo 1 – Seduction - Decoy Keeper Parameters



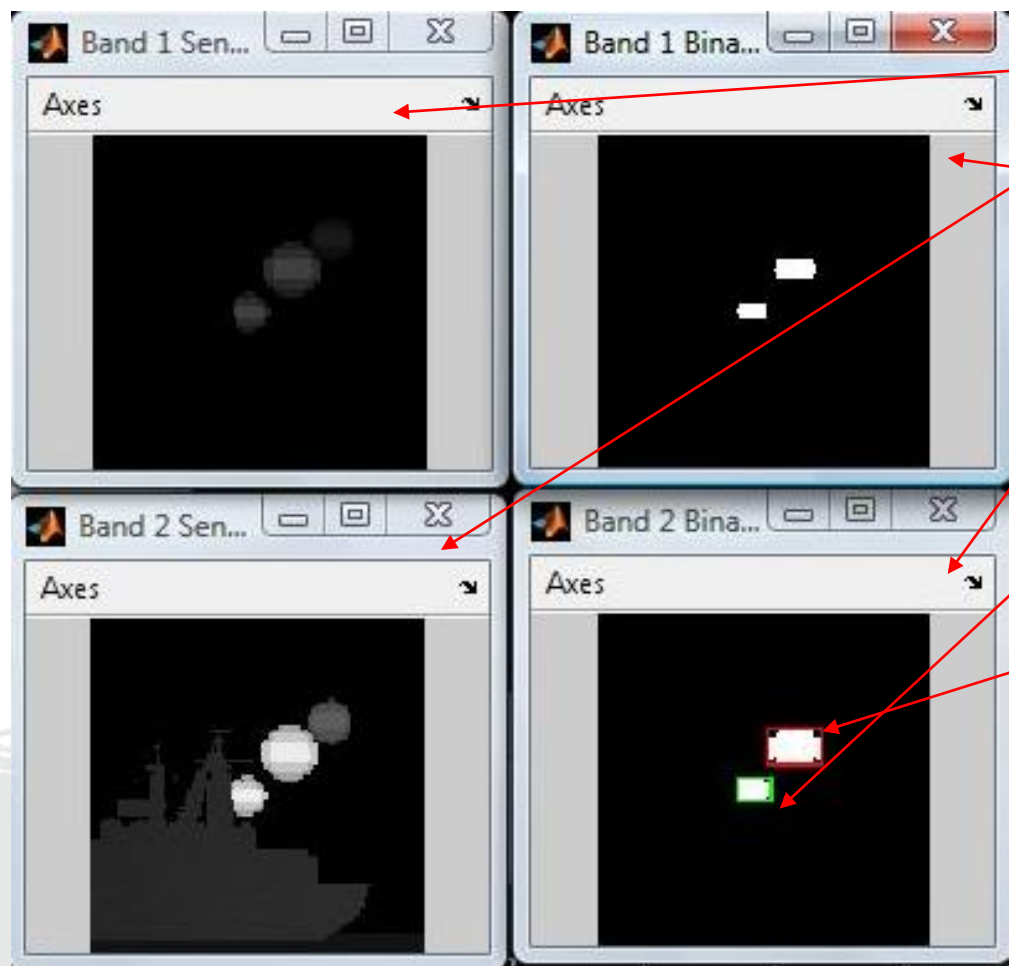
- Decoy ID: SD1
- Keeper IR Parameters
- Physical 3D Model
- Open IR Profiler to edit IR Signature
- Other IR Signature parameters

Demo 2 – Seduction - Engagement Output



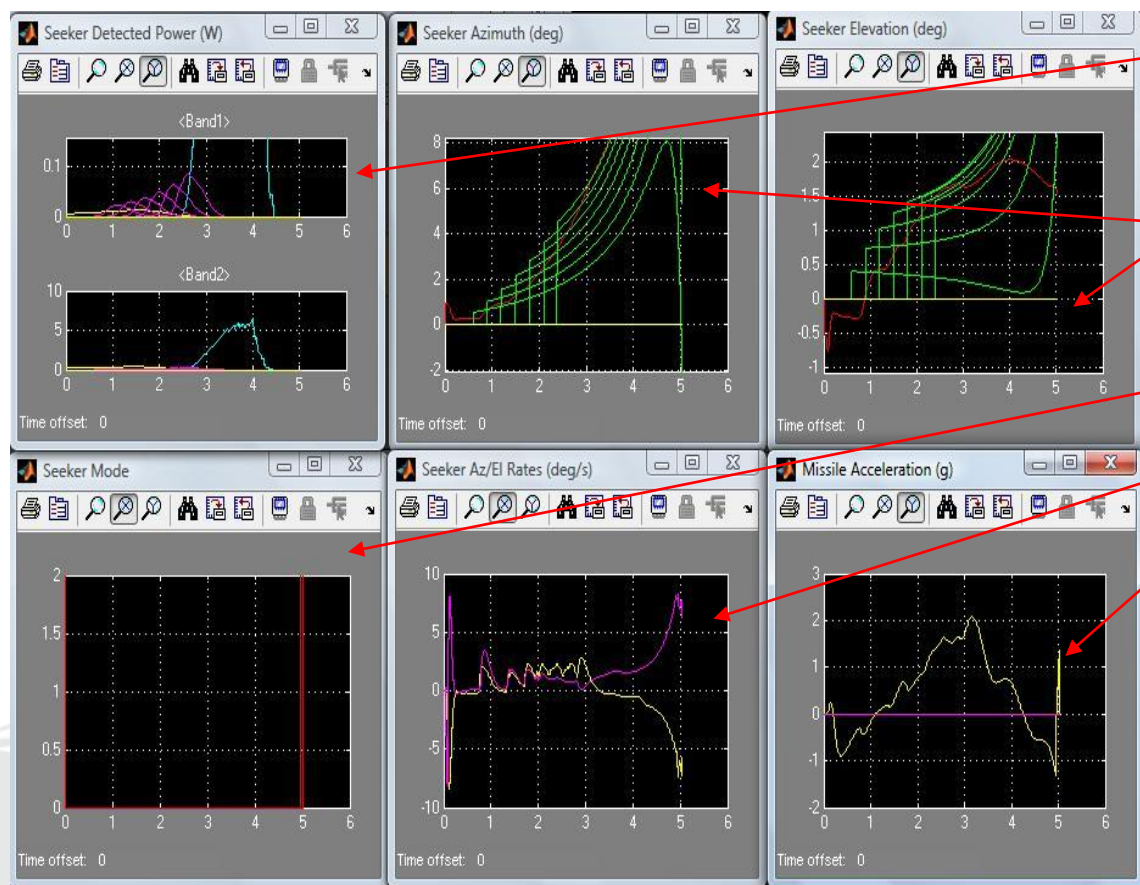
- Virtual Reality display shows missile viewpoint as Seduction decoy is deployed
- Seduction Decoys (magenta) and the target ship are visible

Demo 2 – Seduction - Engagement Output



- Simulated IR Scene in each of Seeker Bands
- Binary /Threshold Views of each Seeker Bands
- Detected object(s) above threshold (green)
- Tracked object (red)
- Image intensity relative to peak intensity in both bands

Demo 2 – Seduction - Engagement Output



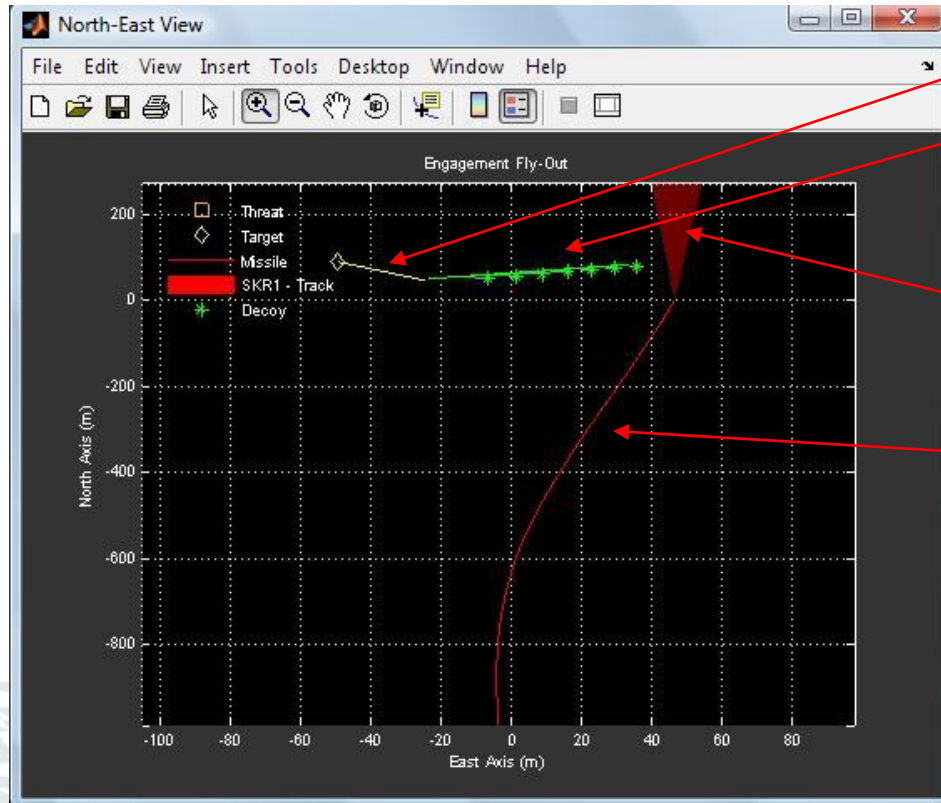
Target ship (yellow), Walk-off Decoys (magenta), and Keeper Decoy (cyan) radiating in Band 1 and Band 2

Seeker (red) tracking first the ship (yellow), walk-off decoys (green) and finally keeper decoy (green) in azimuth and elevation

Seeker initially in Search Mode (2), then track (0) and back to search (2)

Seeker azimuth (yellow) and elevation angular (magenta) velocity
Missile Lateral (yellow) and Normal (magenta) Acceleration. Elevation homing is disabled, therefore no maneuvering in elevation

Demo 2 – Seduction - Engagement Output



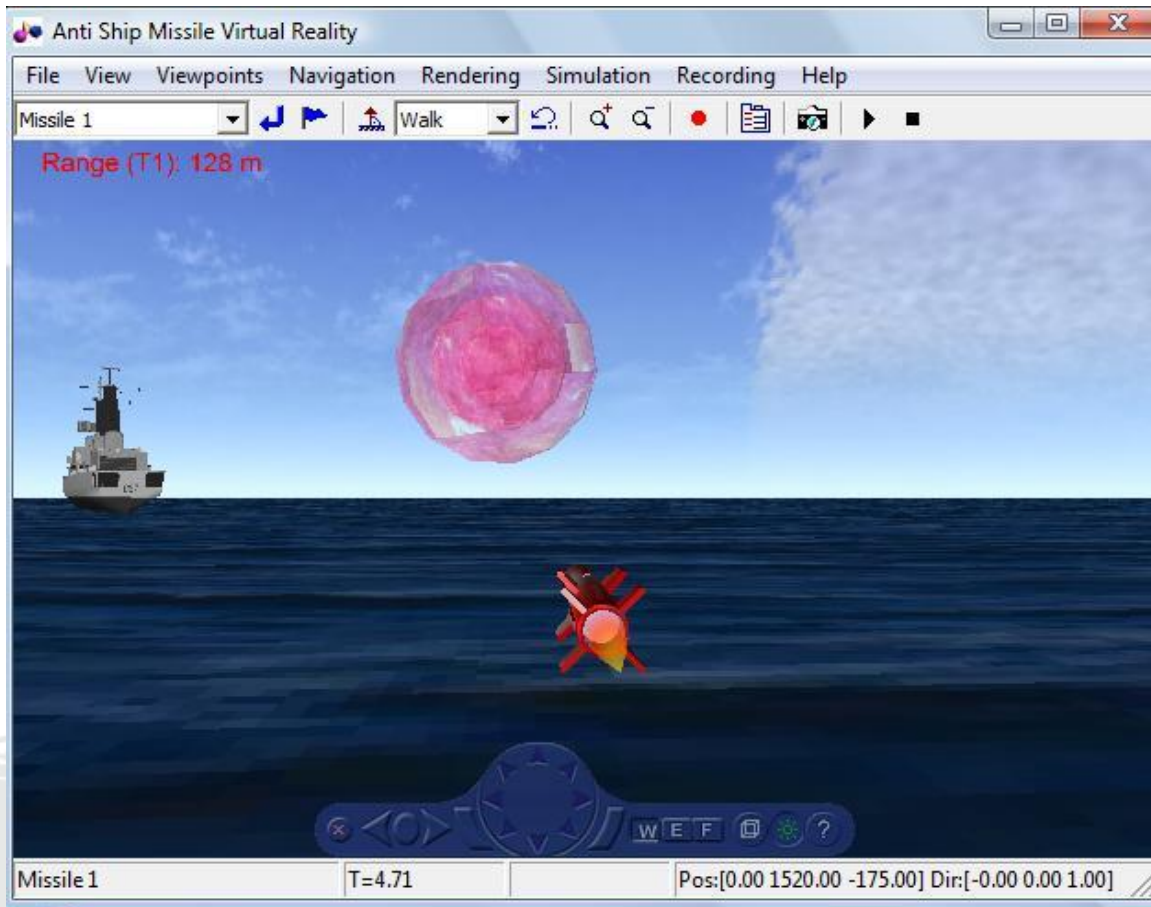
Ship trajectory

Seduction decoy (6 walk-offs and 1 keeper)

Missile seeker field of view

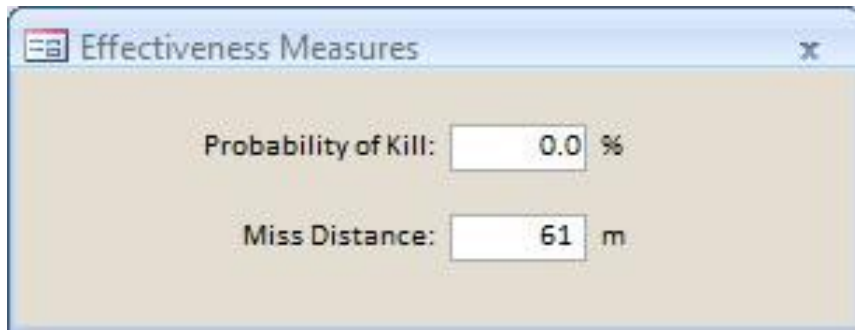
Missile trajectory

Demo 2 – Seduction - Engagement Output



- Virtual Reality display shows missile closing in on Seduction (Keeper) Decoy

Demo 2 – Seduction - Engagement Output



The screenshot shows a window titled "Effectiveness Measures" with a close button (X) in the top right corner. The window contains two data points:

Probability of Kill:	0.0 %
Miss Distance:	61 m

- Probability of Kill = 0 %
- Missile to Target
Platform miss distance =
61 meters