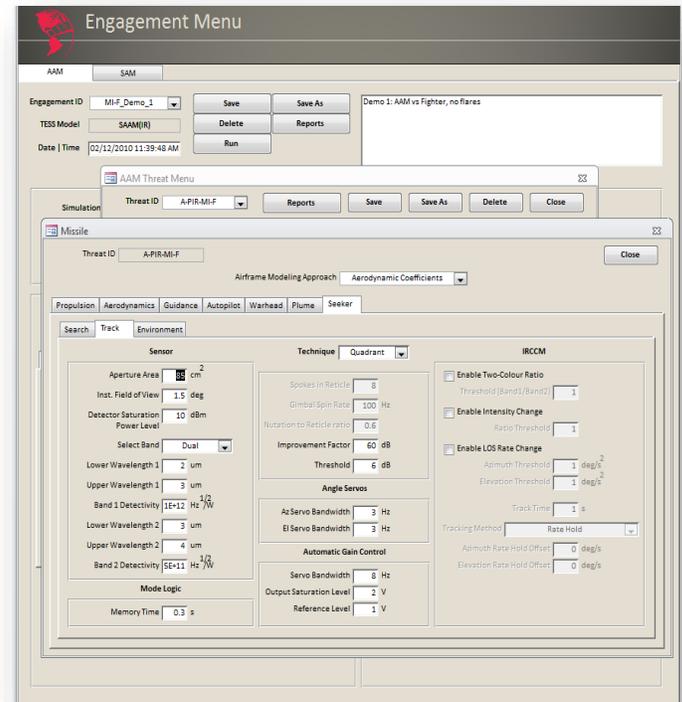


TACTICAL ENGAGEMENT SIMULATION SOFTWARE – TESS™ Modeling and simulation based tools for electronic attack and protection development

Overview

The Tactical Engagement Simulation Software (TESS) Air RF is a family of physics-based simulation products modeling closed-loop engagements and interactions between a target platform (fixed or rotary wing) and two radar-guided missiles. The maneuvering target aircraft can deploy chaff, towed decoys and/or use its coherent DRFM-based on-board jammer to defend itself from incoming threats. In long range engagements, a mid-course estimation option optimizes the missile's flight path to achieve maximum range. TESS products simulate all phases of an engagement from missile launch, target acquisition and tracking, countermeasure deployment and end-game intercept. Measures of effectiveness such as miss distance, probability of kill and probability of survival are computed at the end of each simulation run. TESS products are built in the MATLAB/Simulink environment and with its available source code, users can review, inspect and modify any of the underlying models and algorithms. A front-end database allows the user to define and store data libraries of Targets, Countermeasures and Threats. A programmable batch runner is included for executing batch runs (Monte Carlo) of simulated tactical engagements.



TESS Master Interface

Technical Description

There are five different members of the TESS Air RF family:

SAM(CG)/AAA - Command Guided Surface-to-Air Missiles and Anti-Aircraft Artillery is an integrated engagement simulation between one or two radar controlled anti-aircraft guns or command guided surface-to-air missiles and a target aircraft. The TTR is a non-coherent pulse radar. ECMs can be applied individually or in user-defined combinations against the TTR's search, acquisition and tracking modes. The simulation's missile tracking radar and CG link operate ideally and are unaffected by the target's countermeasures. The AAA uses a collision point estimation processor.

SAM(CG-TWS) - Command Guided Surface-to-Air Missiles with Track-While-Scan Radar is an integrated engagement simulation between a track-while-scan radar, two commanded guided SAMs and a target aircraft. The TTR is a non-coherent pulse radar. ECMs can be applied individually or in user-defined combinations against the TTR's search, acquisition and tracking modes. The simulation's missile tracking radar and CG link operate ideally and are unaffected by the target's countermeasures.

SAAM(SA) - Semi-Active Homing Surface-to-Air and Air-to-Air Missiles with Non-Coherent Target Tracking Radar is an integrated engagement simulation between one or two semi-active homing surface-to-air or air-to-air missiles and a target aircraft. ECMs can be applied individually or in user-defined combinations against the TTR and/or the missile's seeker in their search, acquisition and tracking modes. The missile guidance is provided by PN guidance. The missile system includes a non-coherent TTR, a coherent CW TIR, and a missile with a CW Doppler homing seeker.

SAAM(SA/TVM) - Semi-Active Homing Surface-to-Air, Air-to-Air and Surface-to-Air Track-Via-Missile Missiles with a Coherent Pulse Doppler Target Tracking Radar is an integrated engagement simulation between one or two semi-active homing surface-to-air, air-to-air or surface-to-air track-via-missile missiles and a target aircraft. ECMs can be applied individually or in combinations against the TTR and/or the missile's seeker in their search, acquisition and tracking modes. The missile guidance is provided by PN guidance with TTR command override. The missile system includes a coherent pulse Doppler or FM-CW TTR, a coherent CW TIR, and a missile with a CW Doppler homing seeker.

SAAM(APD) - Active Pulse Doppler Homing Surface-to-Air and Air-to-Air Missiles is an integrated engagement simulation between one or two surface-to-air or air-to-air active pulse Doppler homing missiles and a target aircraft. ECMs can be applied individually or in combinations against each of the search, acquisition and track modes of the missile seeker. The missile guidance is provided by PN. The missiles operate autonomously after launch from a ground-based or airborne launch platform.

Target Modeling

- Configure the target as a military or civilian aircraft.
- Set the target's initial position, orientation and velocity.
- Specify the target's evasive maneuvers using acceleration commands and timings.
- Import existing RCS data or generate lookup tables from 3D CAD objects using the built-in RCS prediction tool.

RF Countermeasure Modeling

- Select chaff, towed RF decoys and/or an RF jammer to protect the target aircraft.
- Customize the chaff deployment timing sequence, bloom and decay time constants, as well as the decent rate.
- Model the chaff RCS as a point or distributed target with customizable scintillation.
- Specify towed decoy parameters such as towline length, turn-on/off time, transmit power and efficiency, system gain and AM correlation time.
- Operate the towed decoy in either pulse repeater or CW noise jammer modes.
- Characterize the RF jammer by its transmit power, antenna beamwidth, efficiency and beamshape, RF delays, system gains, source separation, and side-lobe power level reduction.
- Run Doppler noise, false targets, swept AM, cross-eye, cross-pol and FM jamming programs
- Employ the various RF countermeasure techniques individually or in combination against all search, acquisition and track modes of the missile seeker.

Environment Modeling

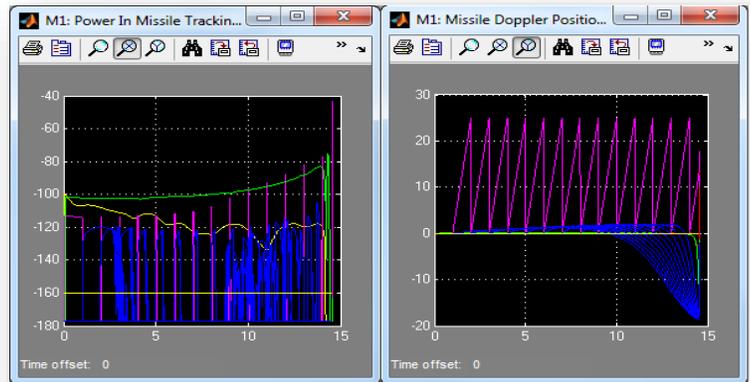
- Simulate both receive and transmit environmental effects such as propagation losses, Doppler shifts and phase delays.
- Represent the ground-clutter model with selectable terrain types and RCS correlation times.

Simulation Outputs

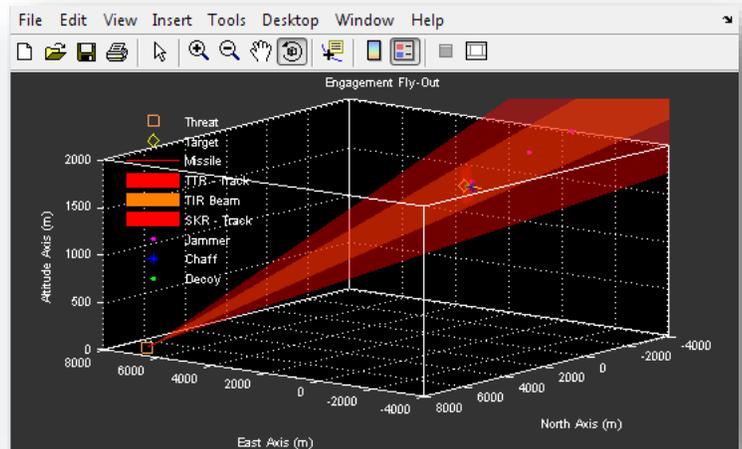
- View 3D trajectory plots and dozens of default scopes such as radar power density, jammer power, seeker rates, seeker modes and missile body acceleration.
- Record missile fly-outs for replay or further analysis.

Threat System Modeling

- Define each Threat Systems' initial launch position, maneuvers and timing.
- Model the missile body dynamics by transfer function representations or using aerodynamic tables generated from 3rd party software such as MISSILE DATCOM.
- Characterize other subsystems such as guidance, autopilot, propulsion, warhead and seeker types (Monopulse, SWC, LORO).
- Characterize the TIR/TTR radar transmitter and antenna parameters with frequency, power, pulse width, PRI, peak pulse power, antenna diameter.
- Characterize the TTR radar receiver search and track modes with range, angle, Doppler and E CCM parameter



Typical TESS Output Scopes



TESS 3D Trajectory Plot

TESS™ APPLICATIONS

Electronic Attack Development

Conduct research, development, testing and optimization of countermeasure techniques, deployment parameters and mode sequences in relation to particular threat characteristics in a wide range of tactical engagement geometries.

Threat Weapon Analysis

Analyze and characterize the performance and susceptibilities of threat weapons and subsystems. Reverse engineer threat characterization parameters in relation to tracking, guidance and aerodynamic performance factors.

Electronic Protection Development

Conduct research, development, and testing of electronic countermeasure-countermeasure techniques in relation to many types of countermeasures, both on-board and off-board, and a wide range of tactical engagement geometries.

EW Operational Support

Support the programming of operational equipment by developing effective tactical programs and data loads in relation to specific threats, engagement geometries and tactics.

Lab and Range Testing

Optimize and validate platform survivability in laboratory and field trial environments through trials planning supported by inexpensive but high fidelity software simulation trials. Carry out after-test results analysis to support trial documentation and report generation.