The Air Force Standard Analysis Toolkit (AFSAT)

Survivability & Vulnerability Impacts on Mission and Campaign Outcomes: The Role of the AFSAT [accepted for WG 9]

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Survivability & Vulnerability Impacts on Mission and Campaign Outcomes: The Role of the AFSAT

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Outline

- AFSAT
- SURVIAC
- Engineering & Engagement Level Analysis for Survivability & Vulnerability (S&V)
- S&V Impacts on Mission Level Analysis
- S&V Impacts on Campaign Level Analysis
- Consistent Scenarios, CONOPS, and Approach
- AFSAT Value Added
The Air Force Standard Analysis Toolkit (AFSAT)

- Foundational set of AF analytic community (AFAC) accepted modeling and simulation (M&S) tools
  - Stand-alone, data driven constructive simulations
  - User picked, well understood, formally evaluated (stamp of approval)
  - Use of AFSAT tools encouraged

- Goals
  - Improve consistency and quality of AF analyses
  - Standardize model management, configuration management, VV&A, etc. *best practices* across the AF analytic community
  - Provide framework for analytic M&S capability investments

- Oversight
  - AFAC Steering Group provides direction and guidance
  - AFSAA/SAA – executive agent
  - Subject Matter Expert model managers (MM) responsible for individual models
Background: Why Created?
Answering the Questions Without an Analysis Toolkit

Numerous Analysis Tools
- Campaign
- Mission
- Engagement
- Engineering
- Specialty Models

Issues
- Non-Defendable
- Non-Standard
- Duplicative

HUNDREDS OF ENGINEERING MODELS

Analysis

Data Standards
Accreditation
VV&A
AF Analyses Benefits
Life cycle costs lowered via reduced duplication of capability via enabling reuse
Results analytically more consistent
DoD sponsored Information Analysis Center (IAC)

DoD’s institution for collecting, analyzing, and disseminating scientific and technical information (STI) related to all aspects of survivability and lethality for aircraft, ground vehicles, ships and spacecraft, to conventional homeland security threats including chemical, biological, directed energy, and non–lethal weapons.

Contractor operated, DoD sponsored service available to all government and industry users to provide studies, analyses, data gathering, and other operational, and logistics requirements related to survivability and lethality technologies.

Includes maintenance and distribution of approved set of models and simulations used to evaluate survivability and vulnerability.
AFSAT and SURVIAC M&S

How are they related?

SURVIAC

AFSAT

Engagement Level Models

AIRADE
ALARM
BLUEMAX
BRL-CAD
COVART
DIME
FATEPEN
FASTGEN
IVIEW
LELAWS
TRACES

JSEM
BRAWLER
MIL-AASPEM
RADGUNS
ESAMS
TRAP

MOSAIC
SHAZAM
JTEAM

Integrity - Service - Excellence
Aircraft Survivability
Where the Rubber Meets the Road

Work backwards—understand the physics and effects
Survivability & Vulnerability
Engineering & Engagement Level Analysis

- Discrete Events
- Engagement-Level
- Stochastic Tools
- Impact of:
  - Tactics
  - Countermeasures
  - Stealth
  - Weapons Technology
  - Sensors
Terminal effectiveness of fragmenting munitions

3D terminal-encounter simulation
  Last few milliseconds (fuzing/warhead interaction)

Calculates aerial target kill by threat missile (Pkss)

Accounts For Major Damage Mechanisms
  Direct Hit
  External Blast
  Warhead Frag

Sample Tools You May Encounter
  SHAZAM
  MECA
  SESTEM
  SCAN
  SCANMOD
  JSEM
  AJEM
I n t e g r i t y  -  S e r v i c e  -  E x c e l l e n c e

Engineering-Level
Summary

HUNDREDS OF ENGINEERING MODELS

DR. ROBERT BALL, Naval Postgraduate School
Engagement-Level
Aggregating Engineering-Level to Few-v-Few
Engagement-Level

Surface-to-Air Missile

- Endgame
  - Fuzing
  - Blast
  - Fragmentation

- Target Aircraft
  - Flight Path
  - Observables (RF, EO)
  - Countermeasures (RF, EO)
  - Vulnerable Areas
  - Blast Contours

- Missile
  - Aerodynamics
  - Guidance and Control

- Ground Station
  - Detection
  - Launch
  - Target Tracking
  - ECCM

Sample Tools You May Encounter

ESAMS
DISAMS
(special case)
JTEAM

Terrain Characteristics
- Terrain Masking
- Clutter/Multipath
Engagement-Level

Few-v-Few Summary

SHAZAM JSEM MECCA BRAWLER AASPEM MIL-AASPEM 2
TRAP TEAM HELIPAC ESAMS TRACES MOSAIC GTSIMS RADGUNS
Threat Fighter Sim ASP SCARE PACES/MARCS DISAMS HAVEDEM MOSAIC
LTM DREAM LELAWS DIME SABISEL Q6DOF TACARM JAM SCAN JMEM
SPAM IMARS GTSIMS ARENA STICKBOMB GENESIS Specialty Models Contractor Models

HUNDREDS OF ENGINEERING MODELS
Survivability & Vulnerability: Impacts on Mission Level Analysis

- Airlift Capability
- Tanker Deploy/Employ Requirements
- Logistics Flow

- Discrete Events
- Mission-Level
- Stochastic Tools
- Impact of:
  - CONOPS
  - Tactics
  - C4ISR
  - Sensors
  - TMD
ESAMS, RADGUNS and JTEAM

Input to EADSIM & Suppressor

ESAMS

- ESAMS Version 2.8
- F-22 4012
- F-35 235-1.1
- All aspect/altitudes

OUTPUT:
- Pk of blue platforms vs. SAMs and AAA
- Engagement Level Study
- SA-10/20 RCS sensitivity

RADGUNS TEAM

EADSIM

Suppressor
Mission-Level

Many-on-Many

Sample Tools You May Encounter

EADSIM
SUPPRESSOR
JIMM
Mission-Level
Many-v-Many Summary

HUNDREDS OF ENGINEERING MODELS

SUPPRESSOR SWEG EADSIM ADSIM STRAPEM STRIKER ATCOM FORCES MADPAS NABEM SPECT8 CIMUL8 SPEED88 ADEM COMMANDER COMO-T EADTB FLAMES

SHAZAM JSEM MECCA BRAWLER AASPEM MIL-AASPEM 2 TRAP TEAM HELIPAC ESAMS TRACES MOSAIC GTSIMS RADGUNS Threat Fighter Sim ASP SCARE PACES/MARCS DISAMS HAVEDEM MOSAIC LTM DREAM LELAWS DIME SABSEL Q6DOF TACARM JAM SCAN JMEM SPAM IMARS GTSIMS ARENA STICKBOMB GENESIS Specialty Models Contractor Models
Survivability & Vulnerability: Impacts on Campaign Level Analysis

- Deterministic
- Campaign Level
- Joint/ISR
- Quick Look

- Stochastic
- Campaign Level
- Joint/ISR/Logistics
- Air/Sea/Gnd

- Optimized Linear
- Air Campaign
- TOA Constrained
- Days, Attrition

- Optimized Linear
- ISR Assets vs. reqs
- TOA Constrained
- Time, Cost
EADSIM

Input to THUNDER & CFAM

Output to EADSIM:
• Air-Air Pk
• Weapons Effects
• Surface-Air Pk

Output to Campaign:
• Encounter rate data
• Attrition rate data
• Weapon expenditure data

Mission Level Study:
• Engagement Vulnerability zones

• 2001 RT-2 MSFD
• 2001 RT-4 MSFD

Brawler
ESAMS
RADGUNS TEAM
EADSIM

Thunder VH
CFAM

Input to THUNDER & CFAM
S&V Impact Analysis
Consistent Scenario, CONOPS & Data Set

To answer high level questions to show the impact of S&V, Analyst must use
- Same scenario
- CONOPS
- Data sets for all levels of M&S and data generation.
Campaign Level Summary

HUNDREDS OF ENGINEERING MODELS

THUNDER, CFAM, LCOM, MASS, SPAAT

SUPPRESSOR, JIMM, EADSIM, SEAS, SMAT

BRAWLER, GIANT, RADGUNS, SHAZAM, MIL-AASPEM 2, JSEM

TRAP, J-TEAM, ESAMS, MOSAIC, GTSIMS

HUNDREDS OF ENGINEERING MODELS
AFSAT Value Added

Summary

- AF Analytic Community approved set of M&S
- Ability to demonstrate S&V impacts at mission and campaign levels

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