Headquarters U.S. Air Force

Air Force Standard Analysis Toolkit and Analysis Approach

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**Abstract:**

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Outline

- AFSAT Description
  - What is it?
  - Why Created?
  - Approach used to develop AFSAT?
  - Process used for M&S tool to enter AFSAT?

- SURVIAC Description

- Relationship between AFSAT and SURVIAC

- Ex. Analysis approach using AFSAT/SURVIAC tools

- Summary
**AFSAT Description**

**What is it?**

- 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

*Integrity - Service - Excellence*
AFSAT Description

Why Created?

Numerous Analysis Tools
Campaign
Mission
Engagement
Engineering
Specialty Models

Issues
Non-Defendable
Non-Standard
Duplicative

Mandates
Data Standards
Accreditation
VV&A

Analysis

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
AF Analyses Benefits
Life cycle costs lowered via reduced duplication of capability via enabling reuse
Results analytically more consistent
AFSAT Description

Entry Process per AFI 16-1003

Model Sponsor

Nominate Model for AFSAT

AFSAT Manager

Request MPSP

Submit MPSP

AFSAT Manager

Evaluate MPSP & Brief Results

AFAC SG

Reject Model or AFSAT Manager

Commission MET

AFSAT Manager

Organize MET

MET

Evaluate Model & Brief Results

AFAC SG

Model Sponsor

Model Sponsor

Evaluation Feedback

MET

Brief Evaluation

AFAC SG

Model Entry Decision

Model Sponsor
SURVIAC Description
Survivability/Vulnerability IAC

- 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

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
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
Engineering-Level Summary

HUNDREDS OF ENGINEERING MODELS

Integrity - Service - Excellence

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

Sample Tools You May Encounter

ESAMS
DISAMS
(special case)
JTEAM

Missile
- Aerodynamics
- Guidance and Control

Endgame
- Fuzing
- Blast
- Fragmentation

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

Ground Station
- Detection
- Launch
- Target Tracking
- ECCM

Terrain Characteristics
- Terrain Masking
- Clutter/Multipath

CAPT JONATHAN FITTON, 453EWS/EWC
Engagement-Level

Few-v-Few Summary

HUNDREDS OF ENGINEERING MODELS

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

DR. ROBERT BALL, Naval Postgraduate School
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

RADGUNS
TEAM

- 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

EADSIM

Suppressor
Mission-Level
Many-on-Many

Sample Tools You May Encounter
EADSIM
SUPPRESSOR
JIMM
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 LELEAWS 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

- 2001 RT-2 MSFD
- 2001 RT-4 MSFD

Output to Campaign:
- Encounter rate data
- Attrition rate data
- Weapon expenditure data
- Engagement Vulnerability zones

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

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.

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
AFSAT Value Added

Summary

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

AFSAT POC
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Back Up Slides
Capability-Based Decisions
Key Enablers

- Integrity - Service - Excellence

- Analysis
- Simulation
- Modeling
- Exercises
- Wargames
- Experimentation
- DT&E and OT&E
- Battlelabs
- Combat Operations Lessons Learned

TIMELY
INFORMED
DECISIONS
AF M&S Management Structure

AF Council
AF Board
AF Group
Panels (Information Superiority)

AF Corp Structure

AF M&S Community

Technical/Operational Priorities/Funding

Integrity - Service - Excellence