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Original title on 712 A/B:  The Air Force Standard Analysis Toolkit (AFSAT)

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

Presented in (input and Bold one): (WG 9, CG___, Special Session ___, Poster, Demo, or Tutorial):

This presentation is believed to be:
UNCLASSIFIED AND APPROVED FOR PUBLIC RELEASE
1. REPORT DATE 21 JUN 2005
2. REPORT TYPE N/A
3. DATES COVERED -

4. TITLE AND SUBTITLE
Survivability & Vulnerability Impacts on Mission and Campaign Outcomes: The Role of the AFSAT

5a. CONTRACT NUMBER
5b. GRANT NUMBER
5c. PROGRAM ELEMENT NUMBER
5d. PROJECT NUMBER
5e. TASK NUMBER
5f. WORK UNIT NUMBER

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AFSAA/SAAT 1570 Air Force Pentagon Washington, DC 20330-1570

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSOR/MONITOR’S ACRONYM(S)

11. SPONSOR/MONITOR’S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:
   a. REPORT unclassified
   b. ABSTRACT unclassified
   c. THIS PAGE unclassified

17. LIMITATION OF ABSTRACT SAR

18. NUMBER OF PAGES 24

19a. NAME OF RESPONSIBLE PERSON

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18
Survivability & Vulnerability Impacts on Mission and Campaign Outcomes: The Role of the AFSAT

Sharon Nichols
George Crowder (Ctr)
AFSAA/SAAT
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

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
SURVIAC
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

AFSAT

JSEM
BRAWLER
MIL-AASPEM
RADGUNS
ESAMS
TRAP

SURVIAC

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

MOSAIC
SHAZAM
JTEAM
Aircraft Survivability
Where the Rubber Meets the Road

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

- TRAP
- MIL AASPEM II
- Brawler
- ESAMS
- RADGUNS TEAM

- Discrete Events
- Engagement-Level
- Stochastic Tools
- Impact of:
  - Tactics
  - Countermeasures
  - Stealth
  - Weapons Technology
  - Sensors
Engineering-Level

The Munitions: Endgame

- 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

Surface-to-Air Missile

Sample Tools You May Encounter

ESAMS
DISAMS
(special case)
JTEAM

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

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

• 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
Measurement-Level
Many-on-Many

Sample Tools
You May Encounter
EADSIM
SUPPRESSOR
JIMM

EADSIM
18
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

Integrity - Service - Excellence

DR. ROBERT BALL, Naval Postgraduate School
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

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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