FEDERAL AVIATION ADMINISTRATION

FLIGHT OPERATIONS, SIMULATION, and ANALYSIS BRANCH, AFS-440
Oklahoma City, OK, USA

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Airspace Simulation and Analysis for TERPS (Terminal Procedures)

Dr. David N. Lankford

What is ASAT?

A multifaceted computer tool for aviation related simulations and safety evaluations

Partnerships with Industry & Government (1)

- **NASA (AILS, AVOSS, SATS)**
- **Boeing (Aircraft models)**
- **Bell, Sikorsky (and Eurocopter) (Helicopter models)**
- **Smiths (FMS software)**
- **Air Traffic Simulation, Inc (simulation software & automation tools)**

Partnerships with Industry & Government (2)

- **University of Central Oklahoma (Research programs)**
- **University of Oklahoma (GPS flight tests)**
- **Airlines (American, Continental, United, Delta, etc.)**
- **Airports (SFO, DFW/DAL, ORD, etc.)**
- **FAA (AVN, AT, AND, ASY, ASC, etc.)**

What has ASAT been used for?

ASAT Projects

- MPAP (PRM)
- St. Louis
- San Francisco
- Philadelphia
- DFW/Dallas
- Juneau
- John F. Kennedy
- Denver
- Newark
- Boston
- Detroit
- SOIA
- 250 Kts Departures
- Ghosting (CRDA)
- FMS/MA
- AILS (NASA)
- Wake Vortex
- GPS/WAAS/LAAS
- RNP/RNAV
- OFZ/NLA
- LAHSO
- Cleveland
- …Others (many…)

ASAT technical presentation.

Shahar Ladecky, ATSI

How does ASAT do it? (1)

ASAT consists of various high fidelity models representing each component of given real life scenarios such as:

- Aircraft
  - Flight Dynamics
  - Propulsion/Performance
  - Wake Turbulence (AVOSS)
  - On board Avionics

How does ASAT do it? (2)

- Geographical/Geodetic
  - Digital Terrain Elevation Data (DTED)
  - Obstacles
- Environmental
  - Standard Atmosphere
  - Non-Standard Atmosphere
  - Measured Wind and Temperature Gradients Data

How does ASAT do it? (3)

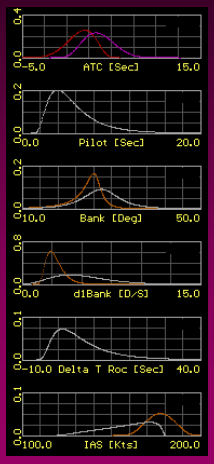
- Navigation Ground Systems
- Surveillance
  - PRM
  - ASR-9
  - ARSR
  - TCAS
  - ADS-B

How does ASAT do it? (4)

- Human Factors
  - Pilot
  - ATC

How does ASAT do it? (5)

- ③ Sample Statistical Variables (only a few are listed!):
  - Human:
    - Pilot
    - Controller
  - Operational
  - Procedural
  - Aircraft Performance
  - Environment
  - …

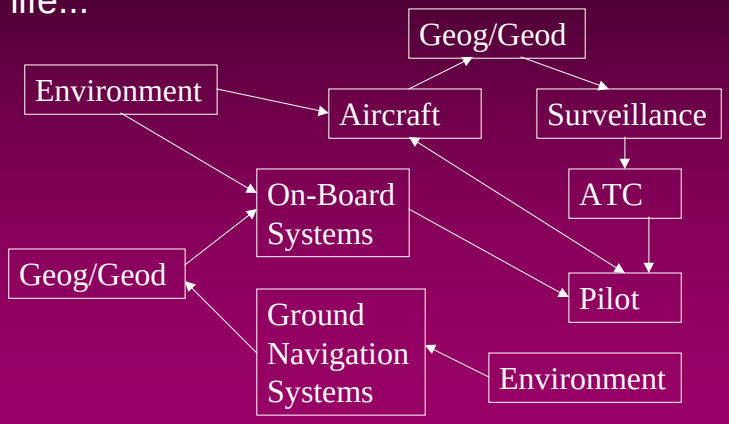


How does ASAT do it? (6)

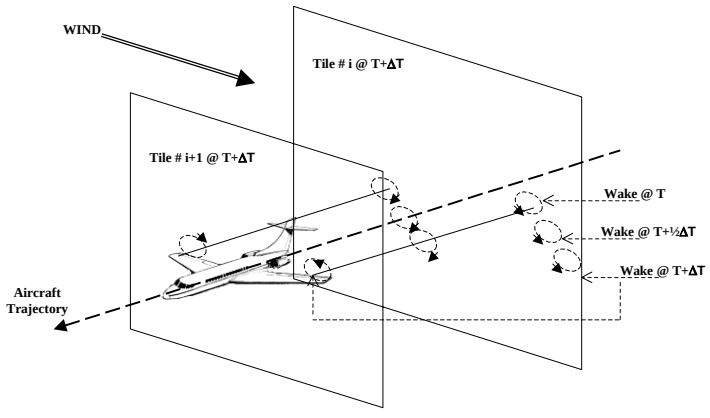
- The high-fidelity models use high fidelity data representing a wide range of operational aspects.

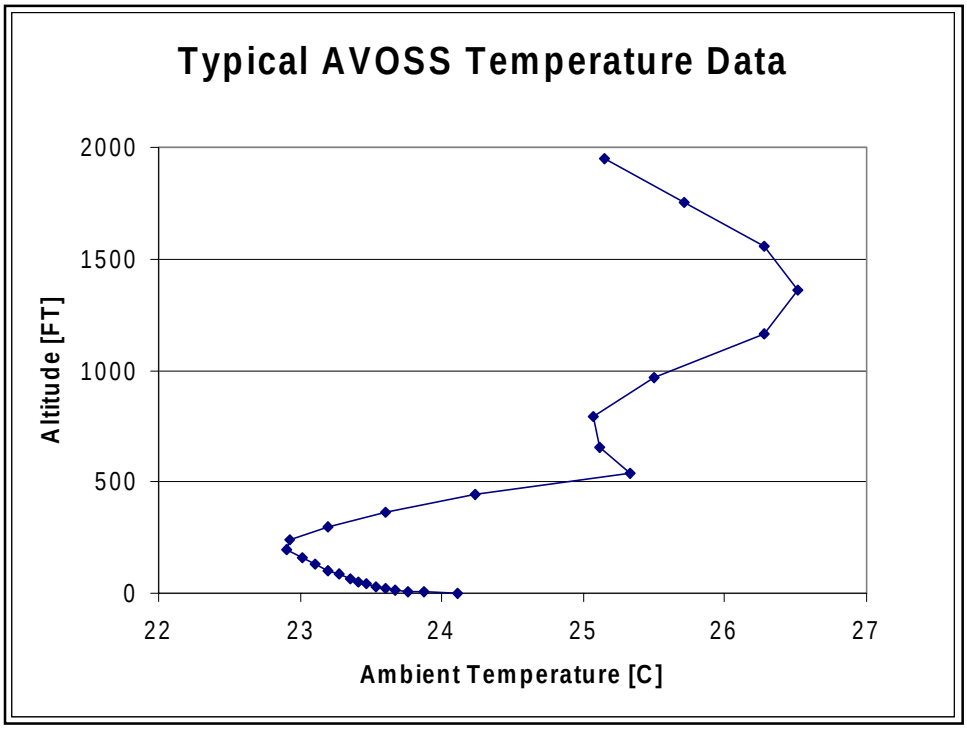
How does ASAT do it? *(7)*

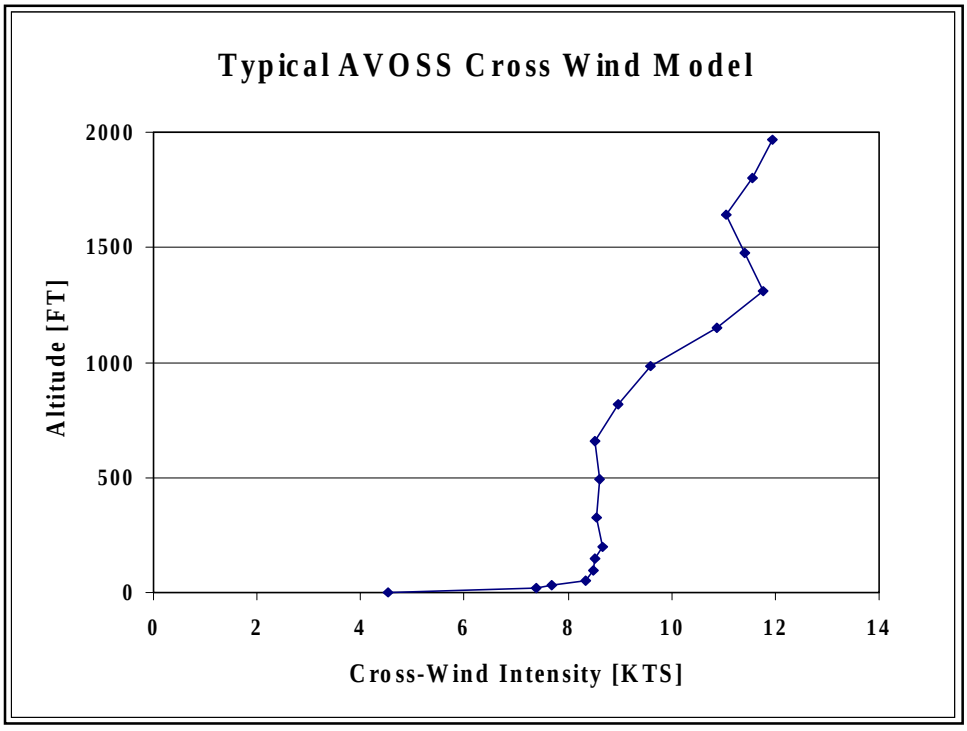
Models interact with each other like in real life...



AVOSS Implementation




Typical AVOSS Temperature Data
2000
1500
1000
500
0
Altitude [FT]
22
23
24
25
26
27
Ambient Temperature [C]


Typical AVOSS Cross Wind Model
2000
1500
1000
500
0
Altitude [FT]
0
2
4
6
8
10
12
14
Cross-Wind Intensity [KTS]

How does ASAT do it? *(7)*

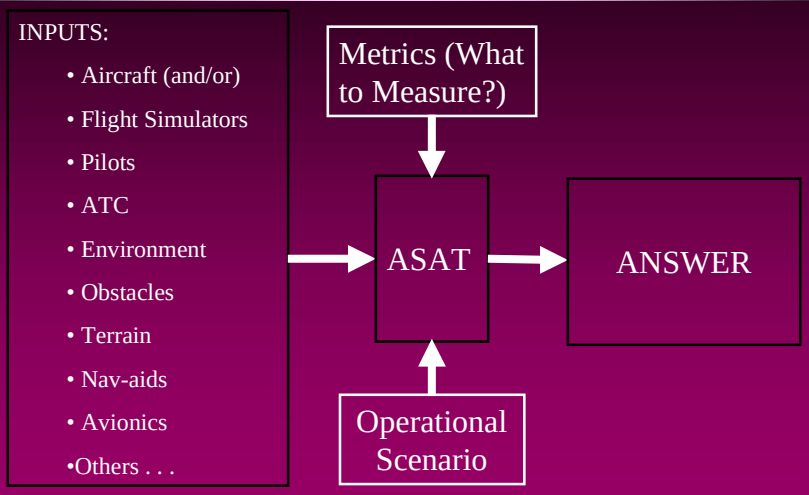
…and to summarize…

ASAT: The Bottom Line...

ASAT will give us an educated answer about:

What happens
Where does it happen
How Much happens
How Often it happens and
When does it happen

or in a simple way...

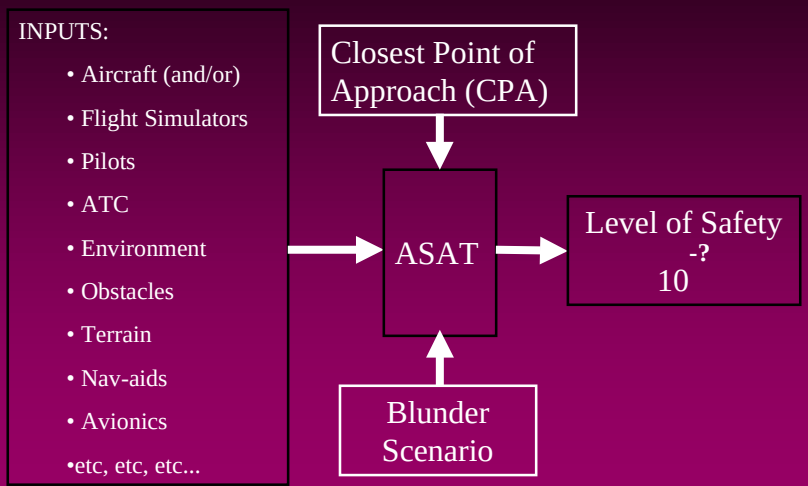


ASAT: Versatile Implementation

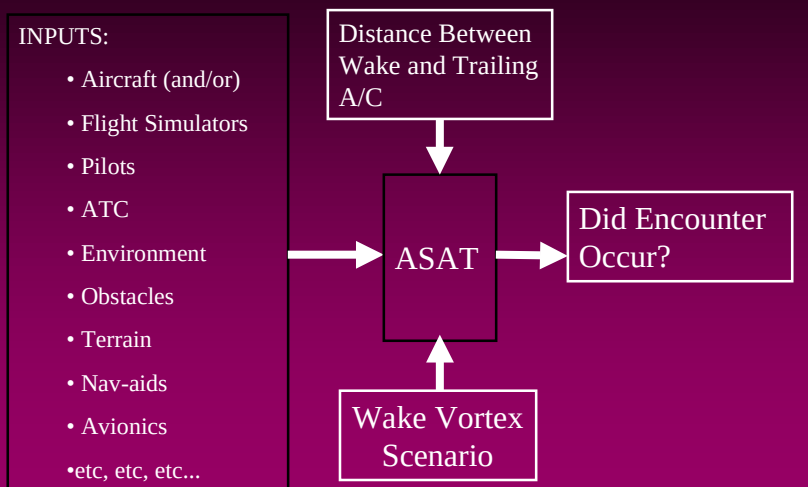
ASAT can provide answers in two ways namely;

- **Deterministic: does a particular event of interest occur?**
- **Statistical: what is the probability of an event to occur or**

Risk of Mid-Air Collision (NMAC)



Risk of Wake Vortex Encounter

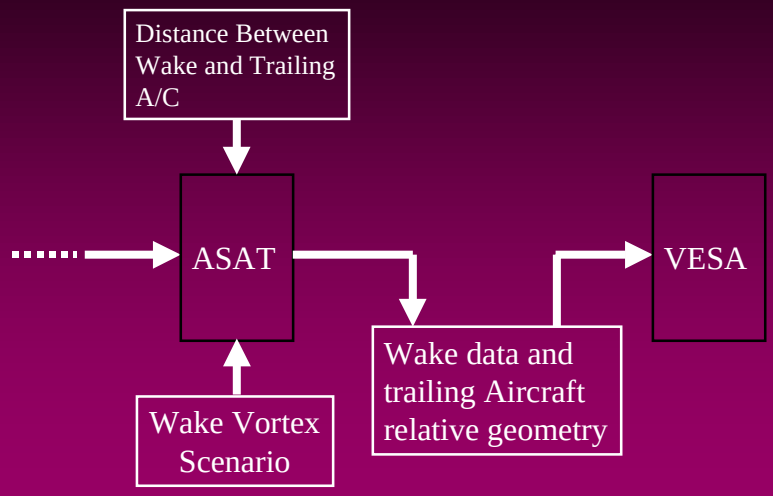


ASAT: A380 Study Case (1)

ASAT can determine wake vortex encounter geometry and wake vortex strength (Γ).

ASAT's output has been costomized to facilitate easy data transfer to Airbus' VESA analysis tool.

ASAT: A380 Study Case (2)



ASATAVIA

Demonstration

(ASAT-AVOSS-SOIA Tool)