



The Evolving SPEAR Testbed at AFRL

2005 ISIS / KASSPER Conference

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Walter Szczepanski
Black River Systems Co., Inc.**



Overview



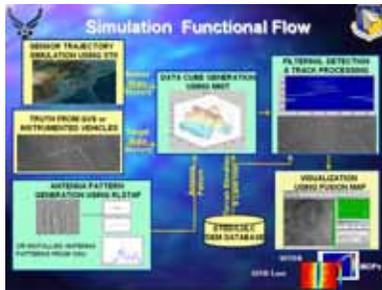
- **Evolution of SPEAR**
- **Current Applications of SPEAR**
- **Capabilities of SPEAR**
- **Future Initiatives**
- **Submissions and Use of the SPEAR Testbed**



SPEAR EVOLUTION



Integration of Tools to Support End-to-End Processing



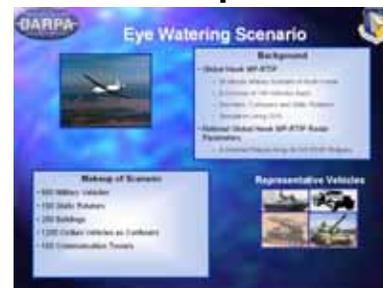
Sensor/Target Simulation
Antenna Pattern Generation
Data Cube Generation
STAP & CFAR Algorithms
Knowledge Sources
Tracking Tools
Visualization Tools

Notional Global Hawk MP-RTIP Model



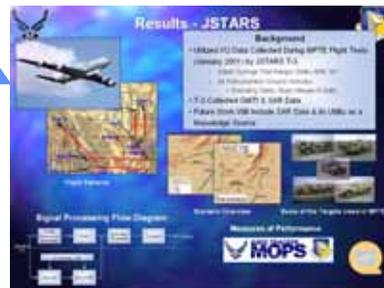
Data Cube Generation
KA- CFAR & Multi-Pass Processing

Eye Watering Scenario Development



Transition to ISL for Data Cube Generation

JSTARS Model Development



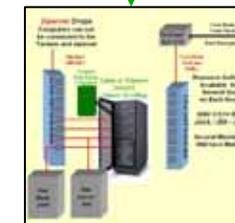
Flight 385 & 386 MPTE Data & Simulated Data
KA-CFAR Experiments

KASSPER Data Set Processing



KA Experiments
KASSPER Algorithm Integration

Common SPEAR Interface



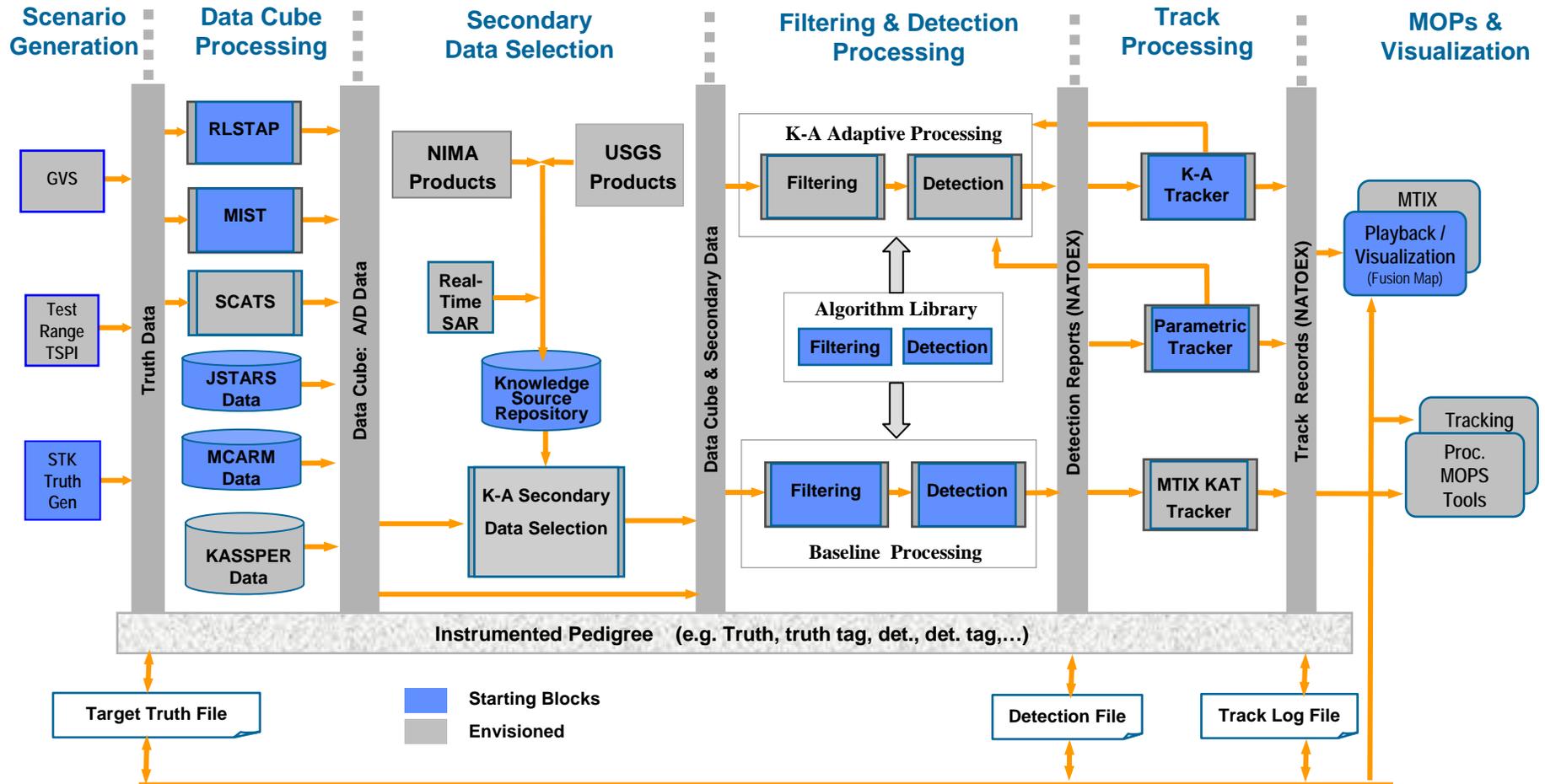
Existing & Emerging AF Platforms



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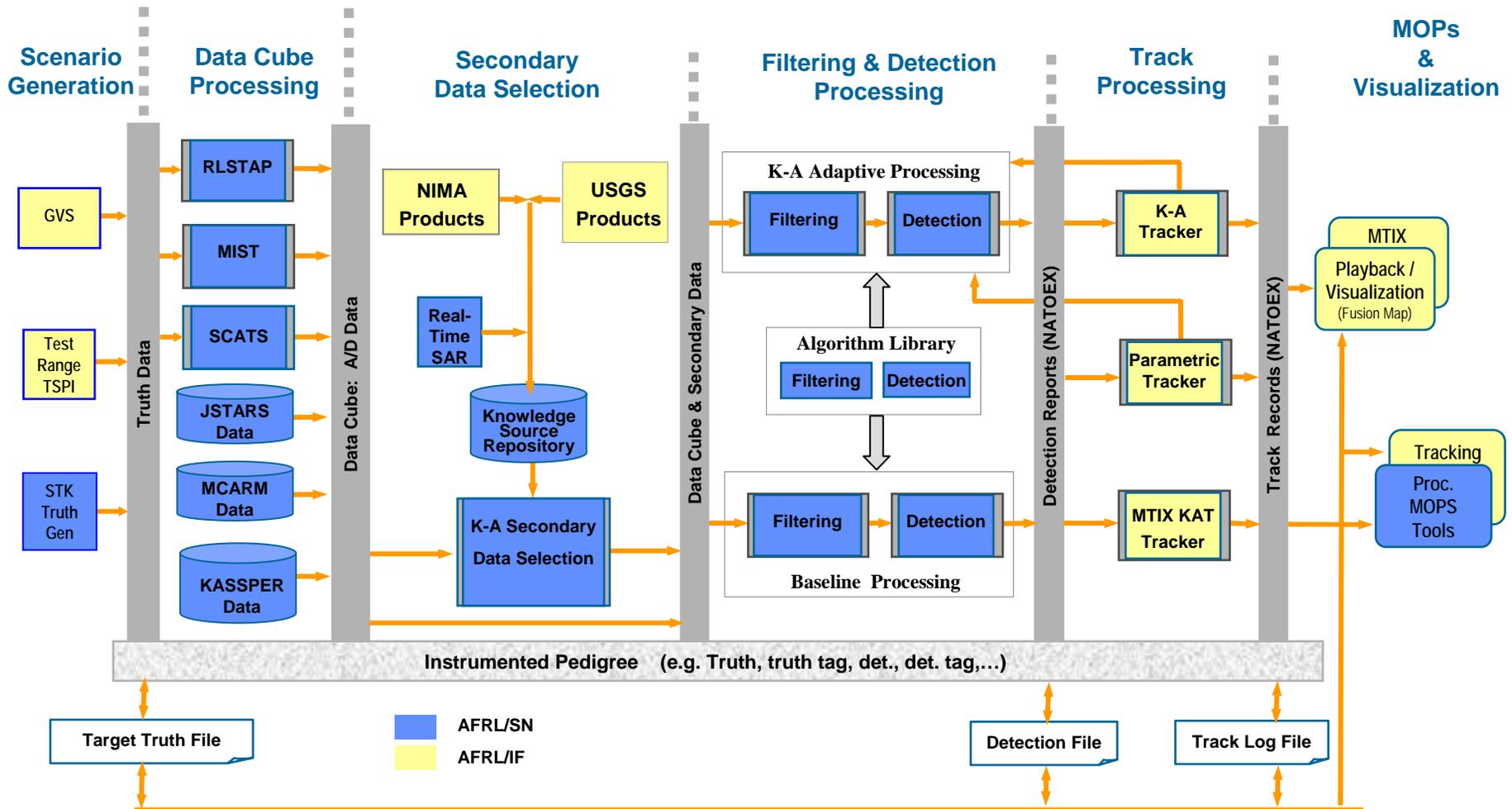
Evolving SPEAR Testbed



SPEAR supports end to end processing from target simulation, through data cube generation, filtering, detection processing and tracking.



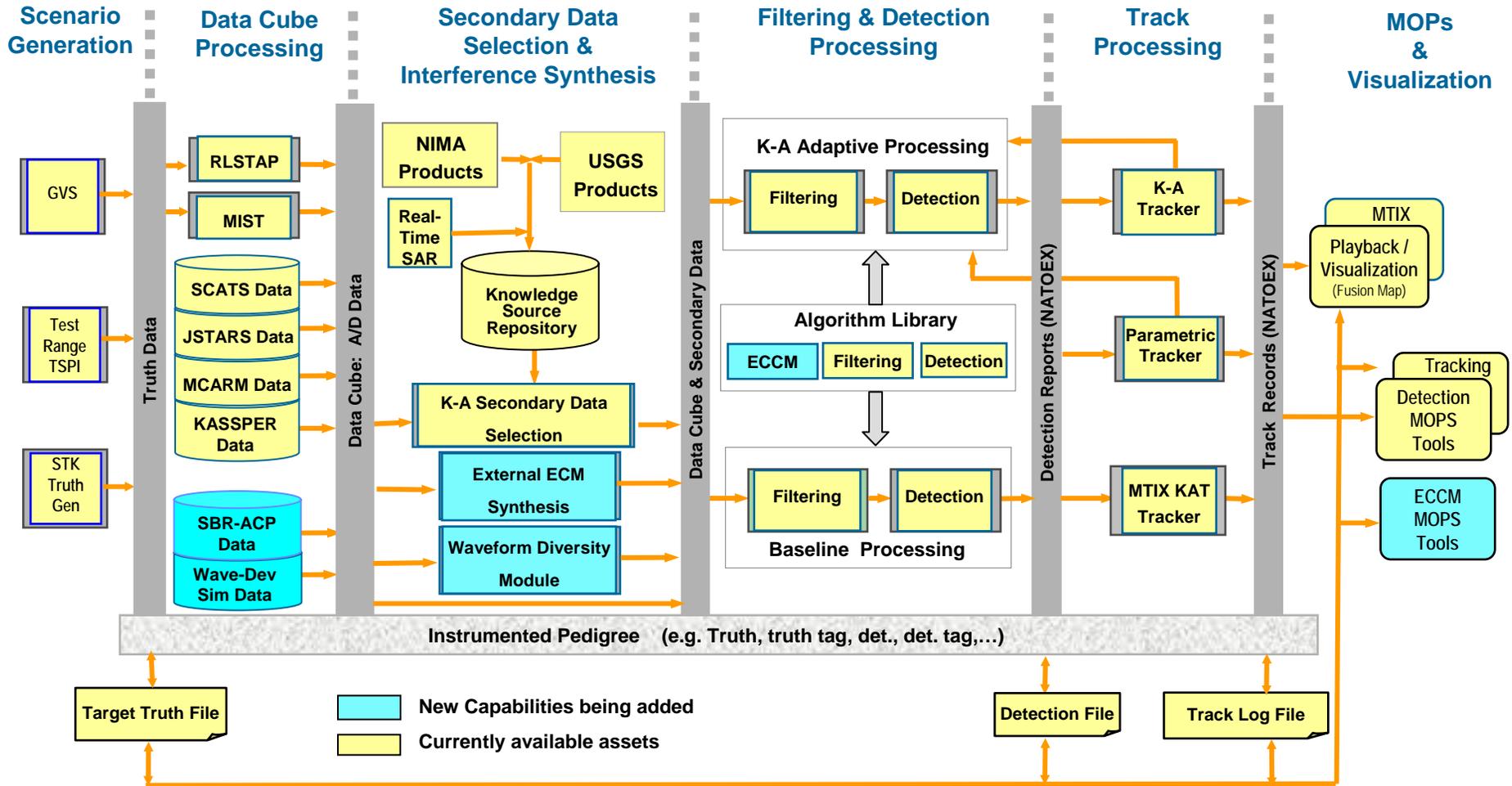
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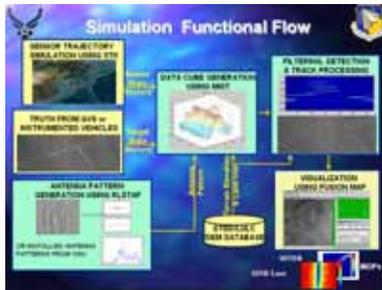
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SPEAR EVOLUTION



Integration of Tools to Support End-to-End Processing



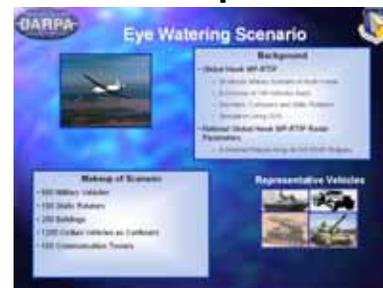
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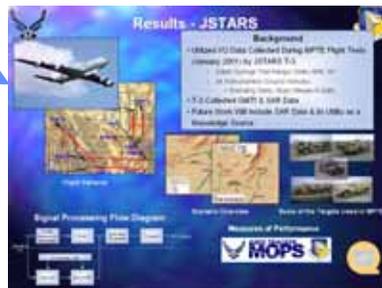
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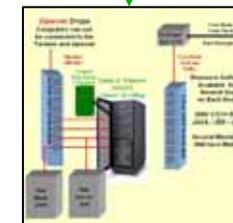
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Existing & Emerging AF Platforms



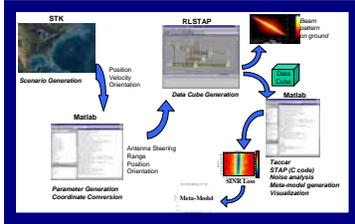
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SPEAR Applications



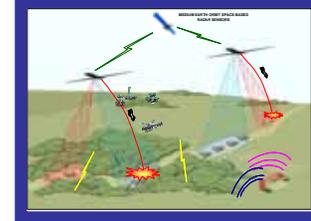
META Models for SBR



Bistatic MEO SBR



STAP for Monostatic SBR



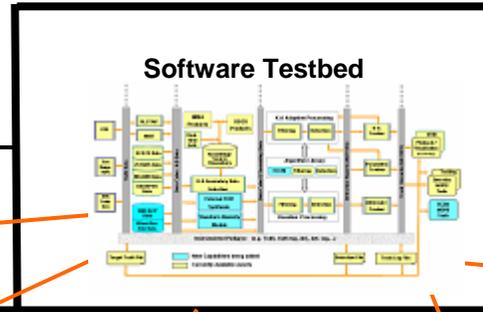
MC2A Investigations



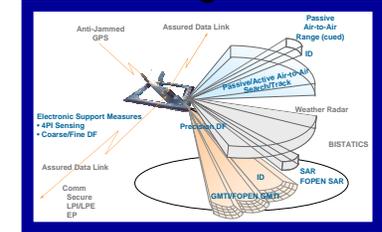
RADARSAT/BAC-111 Bistatic Simulation



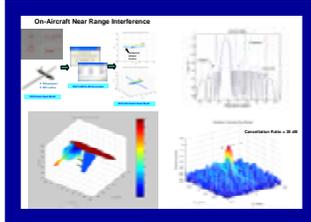
SPEAR Facility



Sensor Manager Simulation



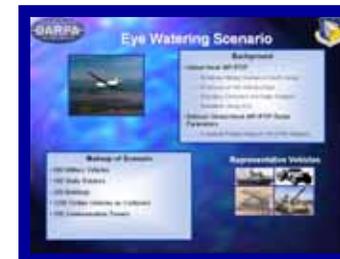
ECCM for Proliferated Multi-Mode Jamming



J-UCAS XTRA GMTI INVESTIGATION USING EWS

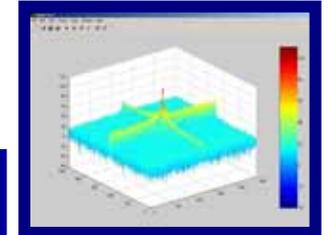


ISIS Concept Development & Performance Eval



EWS Processing and Evaluations

GD SBR/HYDRA Data Processing





Current Capabilities



- **Antenna Pattern Generation**

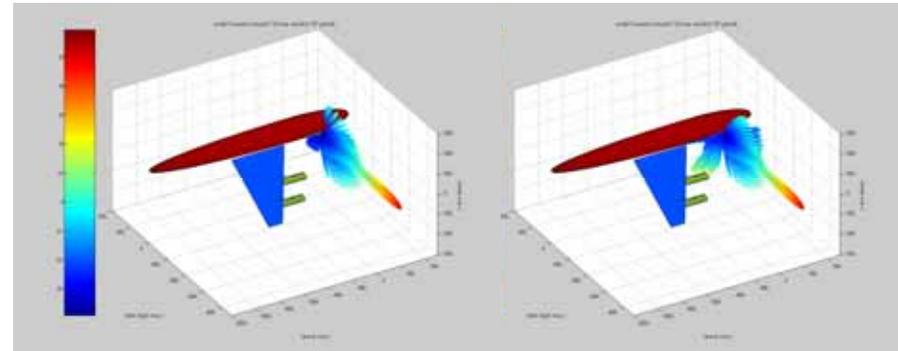
- Aircraft Effects
- Conformal Arrays

- **Data Set Generation**

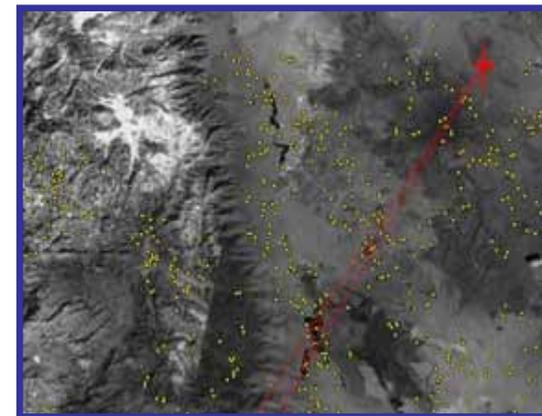
- MIST & RLSTAP

- **Data Set Processing**

- JSTARS
- MIST (Global Hawk)
- KASSPER Data Sets
- Eye Watering Scenario
- SBR Airborne Collection Program



NEC BSC Basic Scattering Code

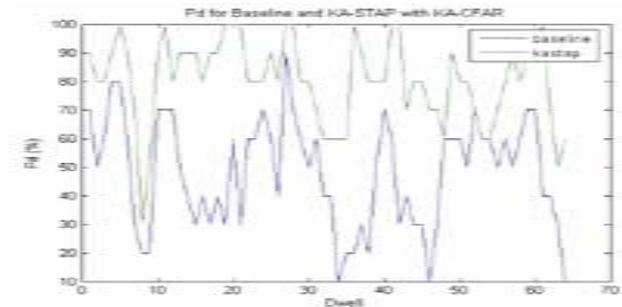




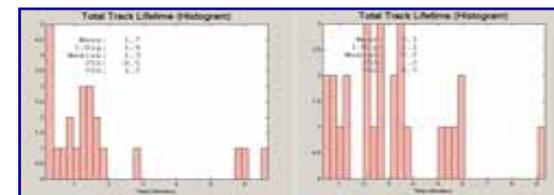
Current Capabilities



- **Algorithm Evaluation**
 - In-House Algorithms
 - Conventional Processing
 - Knowledge Aided Processing
 - KASSPER Deliveries
- **Measures of Performance**
 - Signal Processing (graphical & quantitative)
 - Tracking Analysis (IFEA Fusion Lab)
- **Variable Fidelity Simulations**
- **Unclassified Remote Access**
 - Direct Connect & SMTP Client



Pd Improved from 48% to 80% with Use of KA-STAP & KA_CFAR



Maximum Track Life Increased from 6 minutes to 9 minutes



Future Initiatives



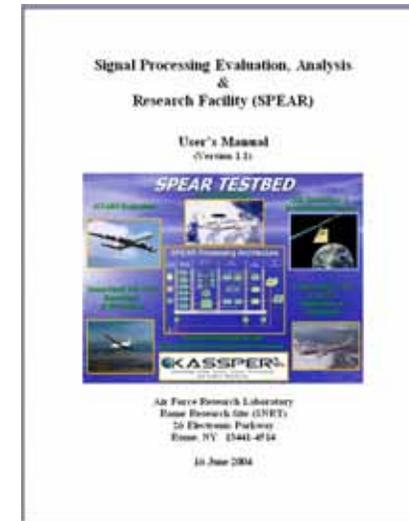
- **Classified SIPRNET Access**
- **ECM/ECCM Simulation & Evaluations**
- **Waveform Diversity Capability**
- **Counter-Terrorism / Counter-Insurgency (CT/CI)**
- **ISR Sensor Concepts (e.g. Space Based Radar, Sensor Craft)**
- **ISIS / Near-Space Airships**
- **Other Suggestions**



SPEAR Submissions

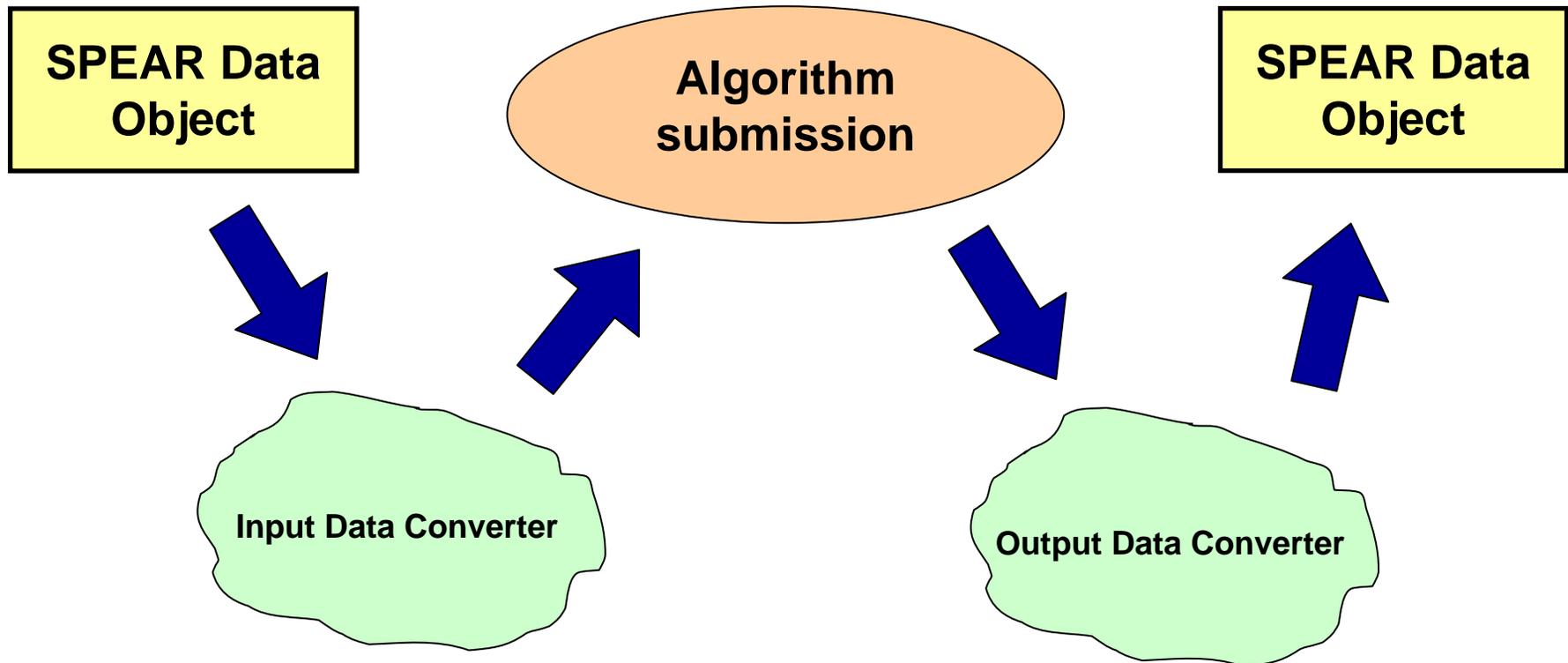


- **Current ICD & User's Manual Available**
- **Algorithm Submission**
 - MATLAB based
 - Access control information
 - Documentation
 - Sample data to test functionality
- **Data Sets & Knowledge Sources**
 - Documentation
 - Access Control Information





Integration Process



Assigns values to algorithm specific variable names from the values in the SPEAR data object

Adds the algorithms output data to the SPEAR Data Object



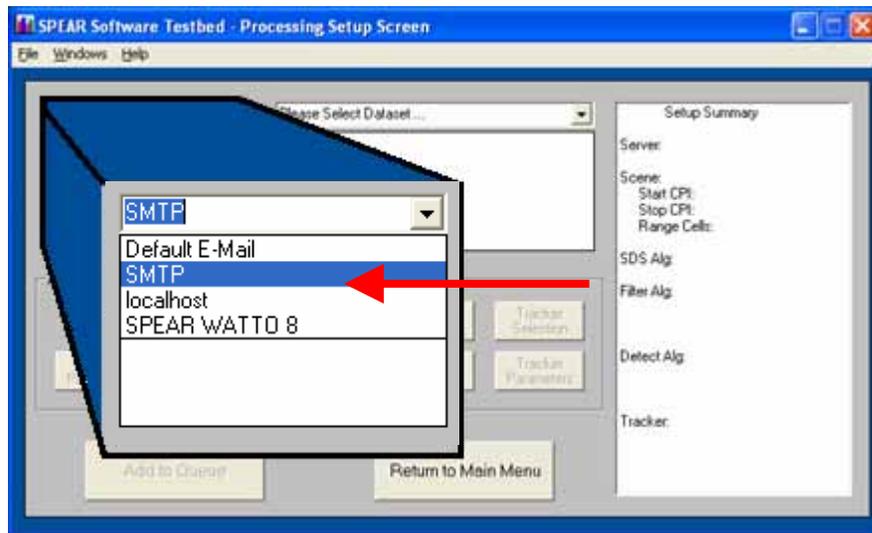
SPEAR Remote Access



- **Obtain a Copy of the SPEAR GUI**
 - Email your Name, Phone, Company, Program, Intended Use, and a desired username to SPEAR.Testbed@rl.af.mil
 - GUI is made in C#, therefore the .NET framework will need to be installed on the user's system (taken care of by installer package).



SPEAR Remote Access



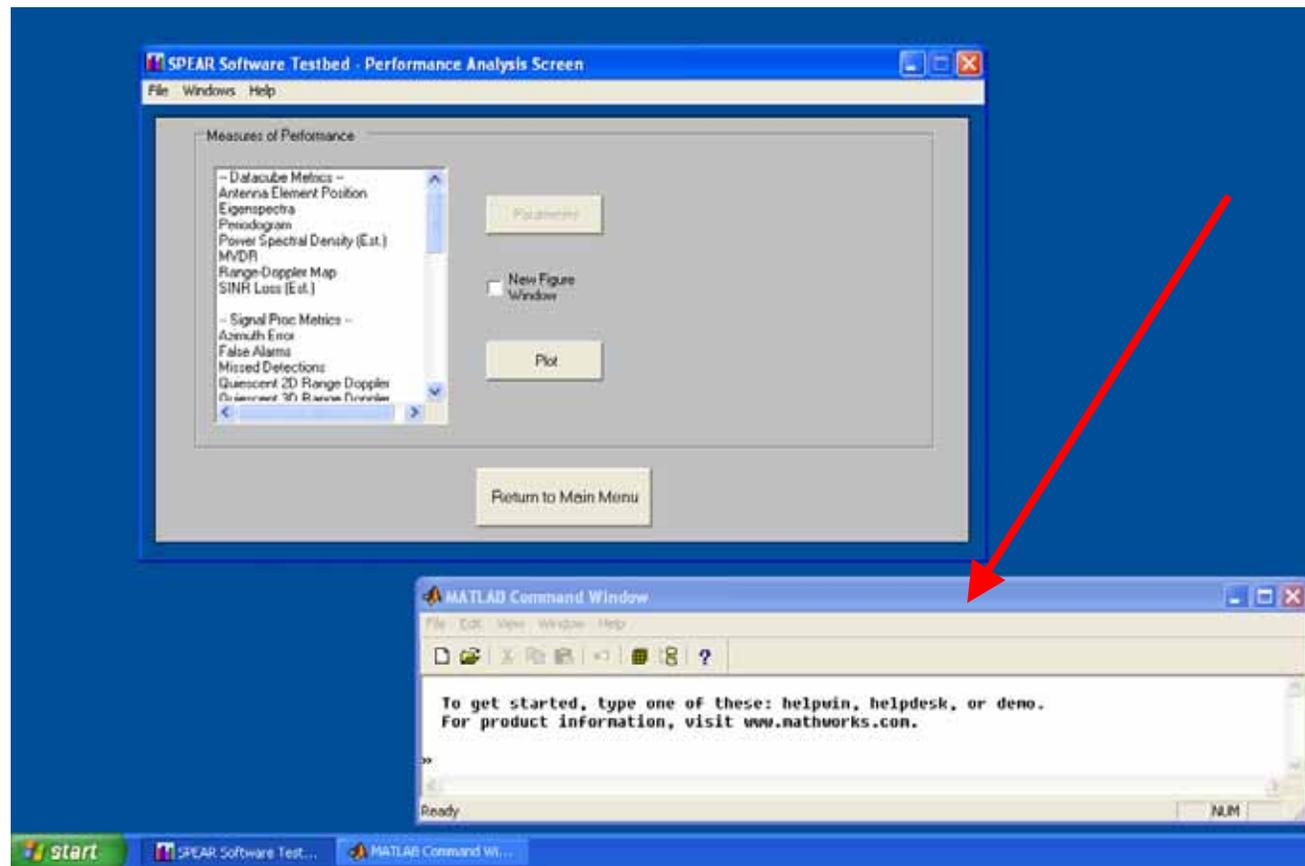
- **Currently remote users will need to submit all processing configurations via the SMTP server and results will be returned by email.**



SPEAR Remote Access



- Processing Analysis makes use of the MATLAB engine therefore you will need MATLAB 6.5 or later.





Use of the SPEAR Testbed v1.2

Demonstration



Contact Information



- For more information on obtaining ...
 - Eye Watering Scenario
 - GUI Installer, Updates, Username & Password
 - Website Access
 - <https://128.132.42.102/SPEAR/>

SPEAR.Testbed@rl.af.mil

Todd Cushman **cushmant@rl.af.mil**

Mark Novak **novakm@rl.af.mil**



Summary



- **Evolution of SPEAR**
- **Current Applications of SPEAR**
- **Capabilities of SPEAR**
- **Future Initiatives**
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Tomorrow ...



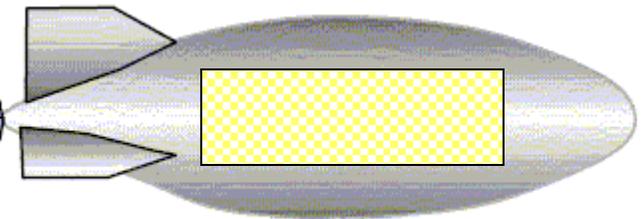
Global Hawk



Scenario Summary

- 30 Minute Military Scenario in North Korea
- 6 Convoys of 100 Military Vehicles Each
- 300 Buildings and Towers
- 1200 Civilian Vehicles as Confusers
- Extremely Rugged Terrain

ISIS



Global Hawk

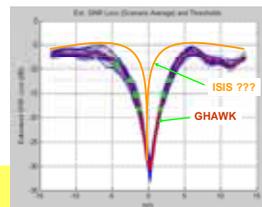
- Notional Global Hawk MP-RTIP Radar Parameters
- 8 Channel Phased Array
- Data Cubes Generated by ISL Using SCATS
- Initial Set of 100 Data Cubes Available for KASSPER Algorithm Evaluation
- Future Work – Conformal Antenna Experiments



ISIS

- Notional ISIS Architecture
- Initial Rectangular Array Configuration
- Extend to Conformal and Alternate Antenna Configurations
- Data Cubes Can Be Generated Using SPEAR Capabilities
- Augment EWS With Dismounts

MOPs



Questions Being Addressed

- KASSPER Architecture & Algorithm Comparisons
- Notional MP-RTIP Performance Predictions

Questions Which Can Be Addressed

- Applicability of KASSPER Technology
- MDV in Extremely Heterogenous Clutter Conditions
- Performance of Different Antenna Configurations
- Potential Benefit of Conformal Antennas
- MDV Degradation Due to Errors in Platform/Antenna Compensation