

Air Force Research Laboratory

Integrity - Service - Excellence

Future Development for WebTAS

*Predictive Awareness & Network-Centric Analysis for
Collaborative Intel Assessment (PANACIA) ATD*



U.S. AIR FORCE

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17-Aug-04



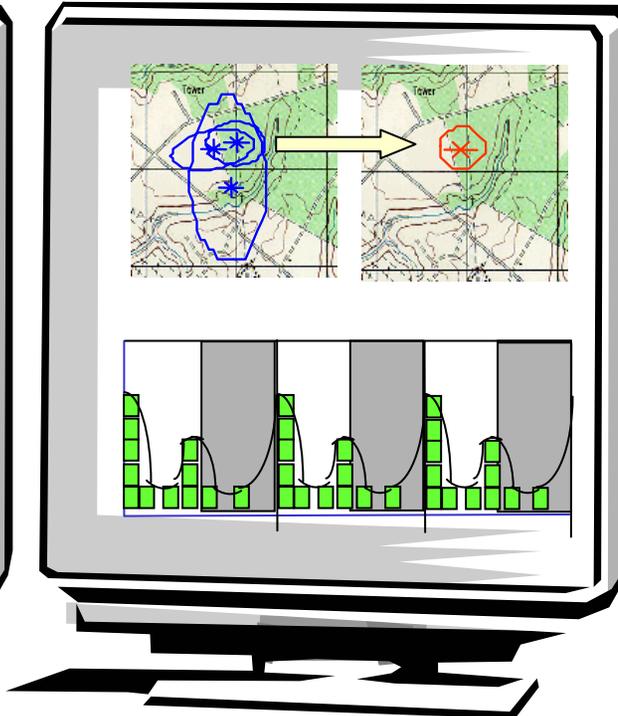
Current Situation



- ◆ No single current multi-INT Fusion System operational within DOD to support multiple users
 - ◆ GMTI & ELINT Tracking Systems exist, but separate
 - ◆ SIGINT Fusion for location / ID, but at *unit level* (squad ↑) and *limited to IADs focus*
 - ◆ Multi-INT Fusion for tracking / ID at *equipment level* (individual targets) but not fielded
- ◆ No automatic capability to predict intent
 - ◆ WebTAS - Knowledge-Base Reasoning – *limited to manual model generation*



Track to Track Fusion



Emitter Correlation
& Profiling



Web-based Temporal
Analysis System

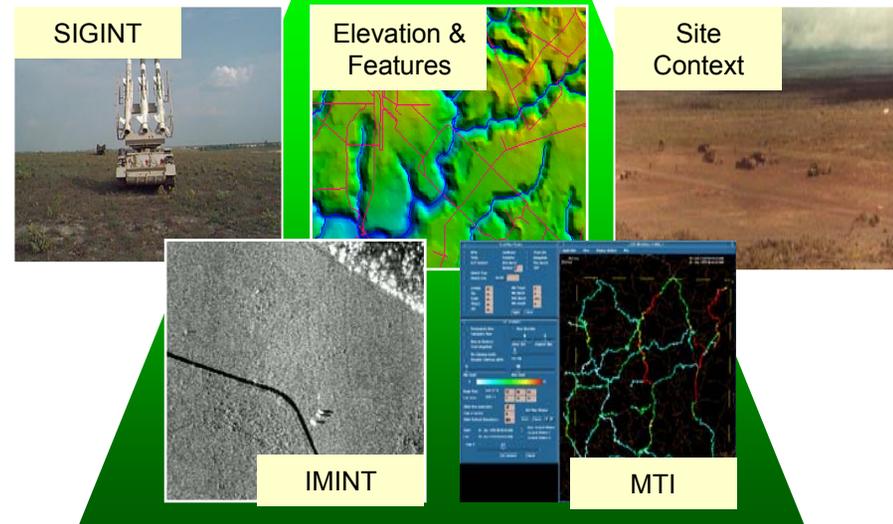
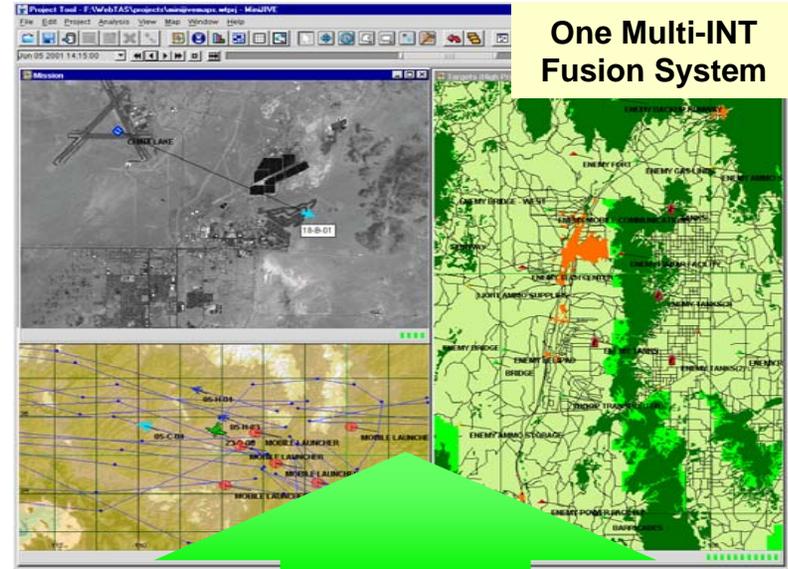


Vision



One Multi-INT Fusion System

- ◆ Integrate best analysis, correlation & fusion systems into *one complementary* operator-focused multi-INT fusion *system*
- ◆ *Consolidate* fusion capabilities (i.e. *unit-level* approach, *equipment-level* tracking/ID approach) together to track/ID both objects & units on the battlefield
- ◆ *Automate predictive battlespace analysis (PBA)* by adding knowledge discovery, pattern learning, and graph matching techniques & automate WebTAS knowledge-based reasoning (K-PASA models)
- ◆ *Field as one standard integrated system* (architecture, display) with *modifiable configurations* (projects) per Operator role
- ◆ *Configurable* to support *multiple missions*
- ◆ Prepare *prototype* for *immediate operational fielding* (training, testing, security)

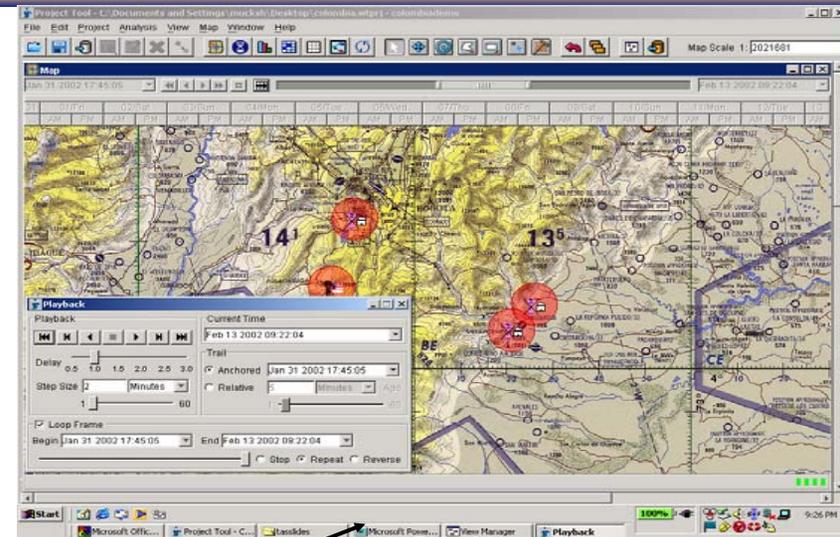




Example Functionality



- ◆ Integrate a Multi-INT Fusion System
- ◆ Accept feeds - National/Tactical Systems
 - ◆ Ground Moving Target Indicator (GMTI)
 - ◆ Predator Motion Video Clips (VMTI)
 - ◆ Electronics Intelligence (ELINT)
 - ◆ Communications Intelligence (COMINT)
 - ◆ Unattended Ground Sensors (UGS)
 - ◆ Imagery Intelligence (IMINT) Reports
 - ◆ Human Intelligence (HUMINT) Reports
 - ◆ Others – Multispectral...
- ◆ Interoperate with other AOC Sub-systems
 - ◆ M2M interface with A2IPB - Consume Products
 - ◆ Display Products - COA, NAI, & TAI
 - ◆ Development of WebTAS Red COA Models
 - ◆ Trip Wires, Watch Boxes, Alerts
 - ◆ M2M interface with Collection Manager
 - ◆ ISR Reasoning and Data Requests
 - ◆ Reason on Current Data & Prepare ISR Collection Requests
- ◆ Demonstrated Initial Functionality at JEFX 04



VMTI

GMTI

ELINT

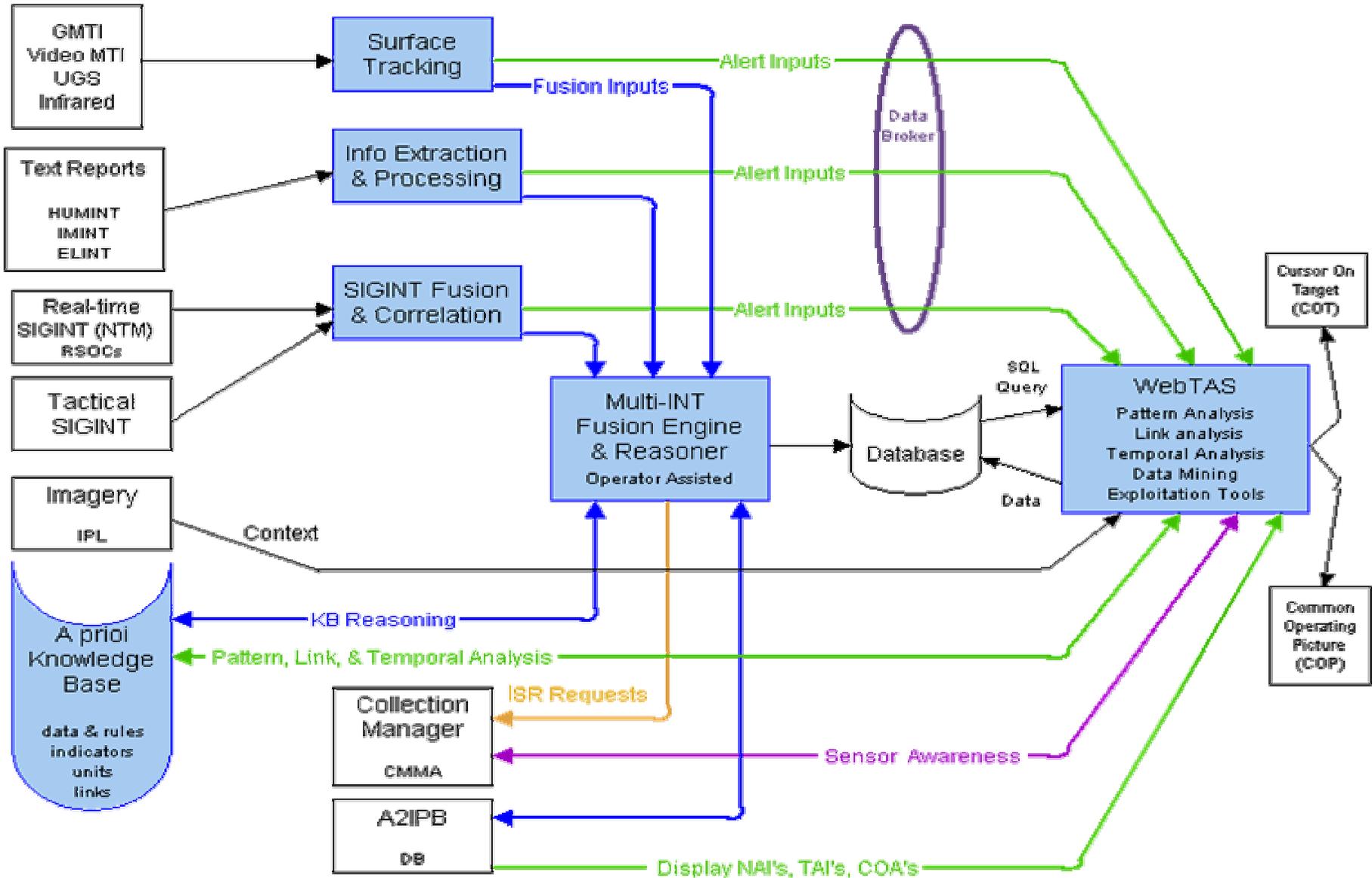
RED COA,
TAI, NAI

HUMINT
IMINT

- ◆ Provide Collaborative Tools
 - ◆ Knowledge-Sharing beyond Internet Chat
 - ◆ Drag & Drop data between Users
 - ◆ Share Screens or Widgets to Dynamically Explain Concepts



Future Systems Overview





User-Focused Spiral Capabilities



- ◆ Future Enhancements will be **Capabilites-Based** and **Operator-Focused**
- ◆ **Four** distinct **spiral deliveries** of capabilities will be delivered and integrated into operational sites every 9 months
- ◆ Focus on providing integrated, operator-focused, multi-intelligence fusion system that can **ingest data** from **multiple ISR sensors & Intel sources**
- ◆ Focus on providing **Situational Assessment Tools** that can be adapted to a variety of missions including at a minimum the monitoring & alerting of: (1) **IADS**; (2) **SCUDs**; (3) **CSAR**; (4) **Terrorists**; and (5) **Force on Force**
- ◆ Early Spirals Currently in Planning Stages – Site Visits in Next 4 Months
 - ◆ Spiral 1 – Integrated Air Defense Systems (IADS) at PACAF
 - ◆ Spiral 2 – Capabilities TBD at CENTCOM
- ◆ ***You, the user, are invited to participate in the design of each spiral***
 - ◆ **On-site Delivery**, Installation, Integration, **Experimentation & Testing**
 - ◆ Here is Your **Opportunity** to Share Your Likes / Dislikes
 - ◆ **User Feedback Will Be Incorporated Back** into the **Next Spiral**



Spiral 1

Analyst Support Architecture (ASA) & WebTAS

Air Defense Order of Battle (ADOB)

- Referred to as the “model”
- Presents correlation/event detection results

Collector Reporting Characteristics (CRC)

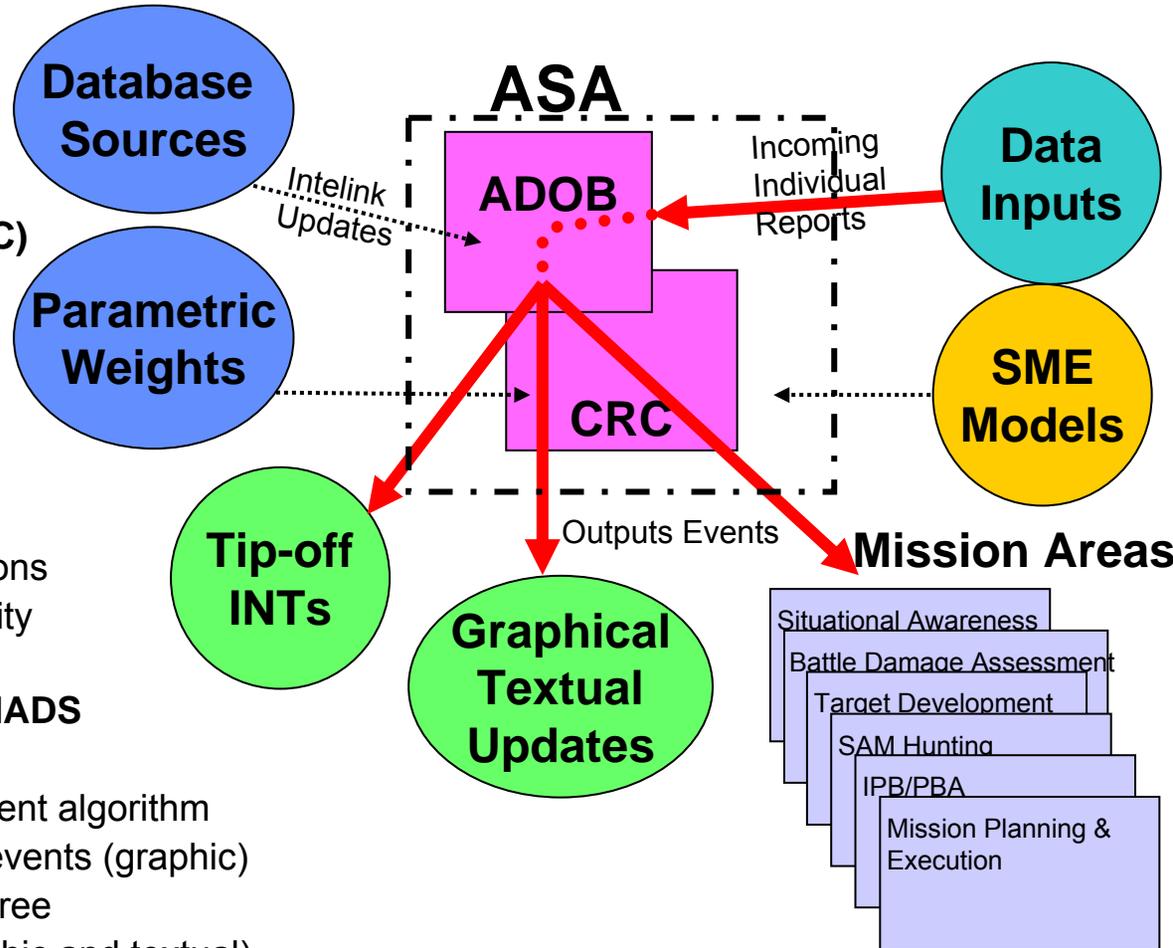
- Weights ELINT data coming through ASA models
- Parameter/Mode Mapping

Integrated Air Defense System (IADS) Analysis Monitor

- Can implement various types of applications
- Not exclusive to IADS analysis functionality

Uses “a priori” knowledge of adversary IADS

- Gleans tactically significant events
- Reduces location uncertainty by refinement algorithm
- Reports operational impact of detected events (graphic)
- Provides data drill-down option for pedigree
- Displays events in context of IADS (graphic and textual)
- Allows data manipulation with numerous interactive tools



“Articulating knowledge from data...”



Transition Plans



- ◆ Program provides a way-ahead for realistic transition of fusion technology to field
- ◆ Intel Analysts mutual interest in WebTAS, ASA, & multi-INT capabilities
- ◆ Five initial types of users identified for DCGS & AOC; possibly more
 - ◆ *DGS analyst for cross-cueing*
 - ◆ *Analyst on Combat Ops floor for prosecuting TCTs*
 - ◆ *Combat Assessment Operators that perform BDA and EBO*
 - ◆ *Analysts within ACF Cell that monitor current situations*
 - ◆ *WebTAS Users*

Primary Users - AOC

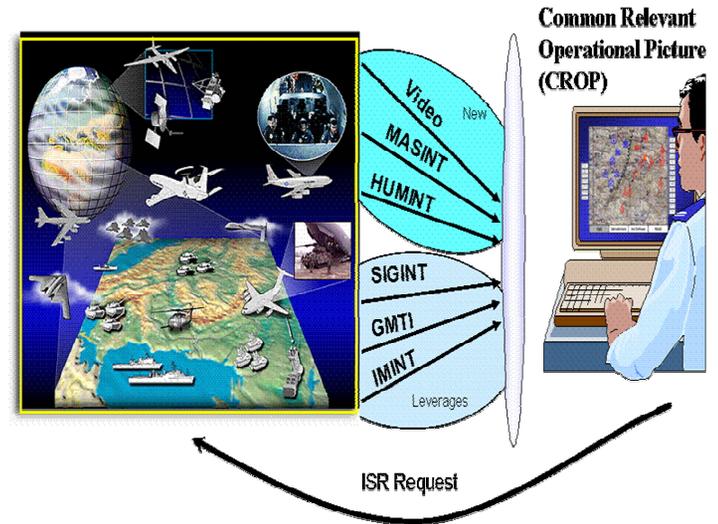
- Numbered Air Forces
- USAFE, PACAF
- AFSOC, AFSPC

Secondary Users

- Unified Commands
- Army
- Navy

Applicable Systems

- AF Global Command and Control System (GCCS)
- USAF Distributed Common Ground Station (DCGS)
- Joint Theater Battle Management Core Systems (TBMCS)





Backups





Analysis, Correlation & Fusion Candidates



- ◆ Intelligence Fusion System (IFS)
- ◆ Air Force Fusion Tool Kit (AF2TK)
- ◆ Analyst Support Architecture (ASA)
- ◆ All-source Track & ID Fusion (ATIF)
- ◆ Automated Target Data Fusion (ATDF)
- ◆ Advanced Fusion Work Station (AFWS)
- ◆ Moving Target Indicator eXploitation (MTIX)
- ◆ Network Centric Collaborative Targeting (NCCT)
- ◆ Global-Net Centric Surveillance & Targeting (GNCST)
- ◆ Web-enabled Temporal Analysis System (WebTAS)
- ◆ Threat HUMINT Reporting, Evaluation, Analysis and Display System (THREADS)
- ◆ Fusion, Optimization, and eXploitation (FOX)
- ◆ Fusion of Spectral and ELINT (FUSE)
- ◆ Dynamic Tactical Targeting (DTT)
- ◆ Fusion for EBO (FEBO)
- ◆ Wargoddess
- ◆ others

Many candidates are duplicative or complimentary – it is our intent to stay current with the capabilities & maturity of each of these

PBA

Need to ensure we incorporate the appropriate technologies as they mature and provide a Warfighter Capability



User Requirements (AFC2ISRC/IN & AF/XOI)



- ◆ *One baseline with multiple configurations* for each specific app or user; customizable / tailorable interface (GUI) and templates (apps, algorithms, rules, pre-canned queries) depending on Intel Analyst specialty (1N0, 1N4, etc) or current project (specific theater TAI or NAI) that an Intel Analyst may be currently assigned to monitor
- ◆ *Consolidation of software functions* and where-ever possible reduced hardware footprint (server consolidation) should be continuously sought - via standardization of client systems which in turn allows more capability per workstation at lower cost
- ◆ *Combine* user-pertinent information from outputs of *existing fusion programs* (ie, TUT IFS, ASA/PICSTER, etc) into *one cohesive & viewable fusion system*, so that the user can best understand its relevance
- ◆ Fully utilize data types from all available sensors such that they add value to the COP; Ensure that specific data types are used for specific IA specialties or projects
- ◆ *Weather affects* should be easily presentable such as current and projected cloud cover; weather, ISR assets, and targets to be synchronized in time to serve optimal collection opportunities for ISR management; examine current situation & provide capability to “*forward the clock*” with *estimate of weather*, possible target locations/existence, and probable location of friendly ISR assets
- ◆ System should *focus on* providing warfighter with *intelligence capabilities* rather than implementing specific fusion technologies; user experience, opinion, and evaluation of spiral deliveries of fusion applications will be sought to fine-tune end-user intelligence capabilities



User Input / Advocacy & Relationships



AFC2ISRC/IN & AF/XOI

- ♦ Maj Mike Fowler & MSgt Pat Berry AFC2ISRC/IN and TSgt Lenval Logan AF/XOI
- ♦ Users provided *OIF lessons learned* to shape ATD concept
- ♦ Demonstrate usability within AOC and DCGS: (1) DGS analyst for cross-cueing; (2) Analyst on Combat Ops floor for prosecuting TCTs; (3) Combat Assessment Operators that perform BDA & EBO; and (4) Analysts within ACF Cell that monitor current situations
- ♦ List of *prioritized requirements* for more cohesive multi-INT fusion system to be *jointly worked* with *AFC2ISRC/IN, AF/XOI, & primary user SME's*

AFC2ISRC/DO

- ♦ Col Rudolph recommendations
 - ♦ focus on *intel duty officers & targeteers in combat ops cell* rather than TCTs
 - ♦ look at interfacing with WEEMC (already joint) so as not to be standalone
 - ♦ use in coalition environment, perhaps high & low side
 - ♦ consider blending into existing programs like A2IPB from a hardware perspective

ESC/SR & ESC/AC

- ♦ Planned *near-term coordination with ESC/SR & ESC/AC* to discuss mutual cooperation & technology transition for both AF-DCGS and AOC

NRO

- ♦ Coordination with NRO/DDMS to discuss *ASA & THREADS* development, technology insertion, leveraging of resources, and technology transition
- ♦ Draft *MOA* for joint AFRL/NRO program, NRO to provide resources for integration

AFRL

- ♦ *Plans to work more closely with AFRL/HE and other AFRL/IF technology areas: (i.e. Knowledge Discovery, Effects Based Operations)*



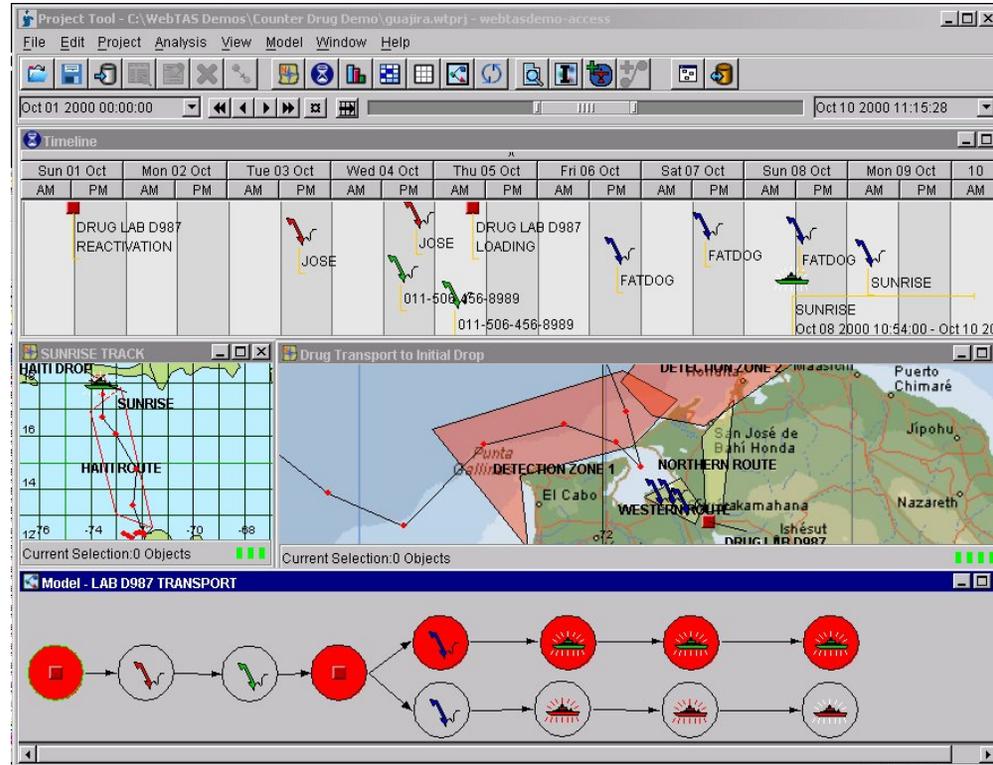
Example Functionality

WebTAS Capabilities



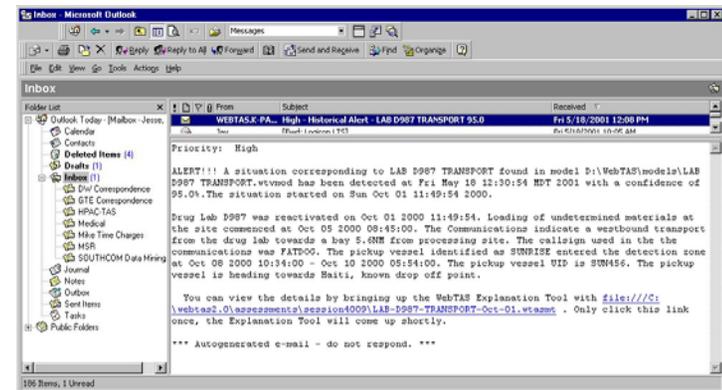
WebTAS tools support 5 key areas:

- *Multi-source data integration* by supporting seamless access to multiple external data sources
- *On-the-fly database creation* to support evolving data collection and archival requirements
- *Data analysis & visualization tools* that support situation awareness, project management, scenario playback, historical analysis, and pattern discovery
- *Pattern analysis* including historical data mining and near real-time situation alerting & prediction of upcoming events
- *Web-enabling & presentation* of data to provide browser-based access, collaboration, visualization & web publishing



Situation Alerting and Predictive Analysis

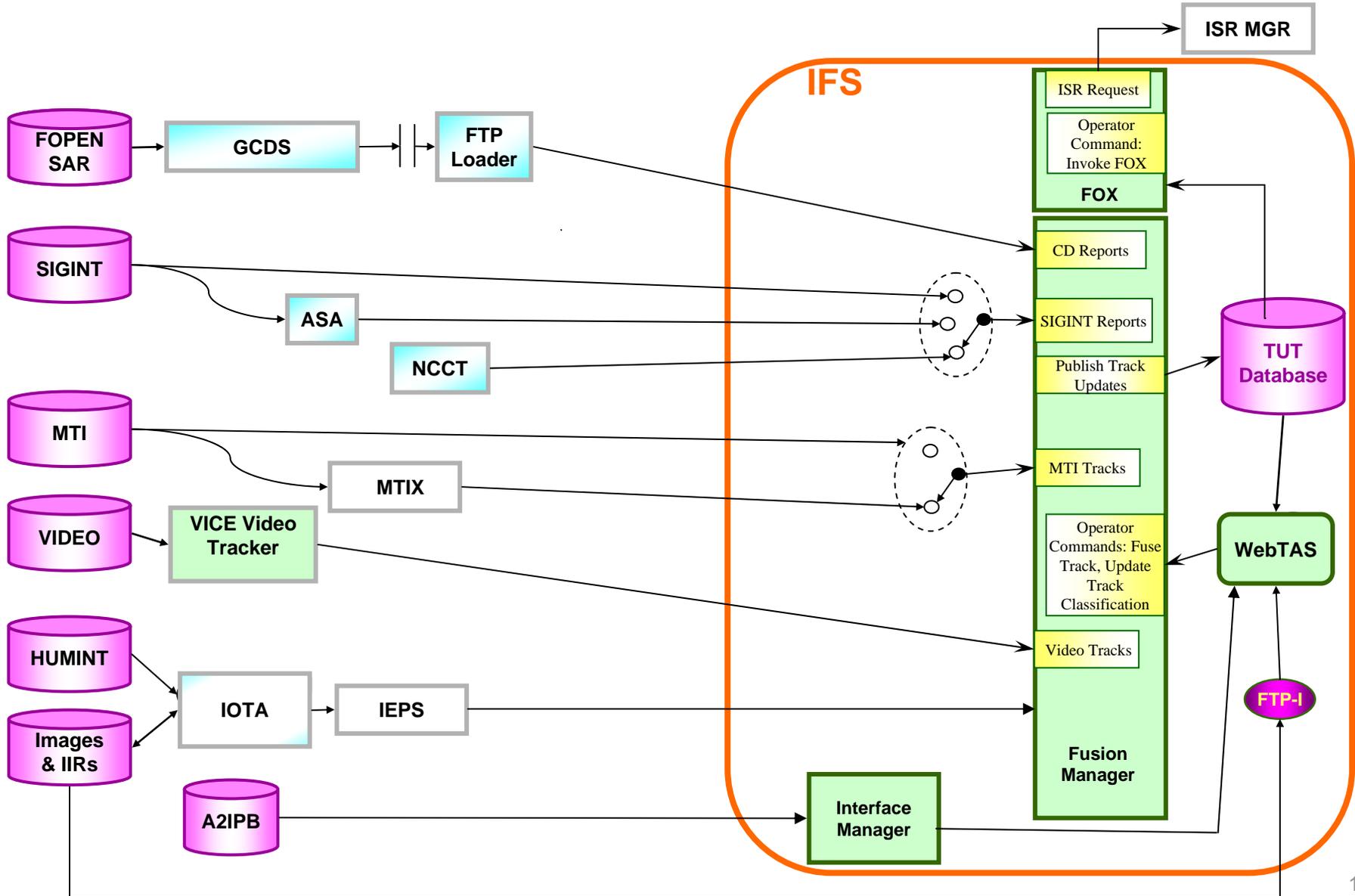
- The correlation engine allows analysts to subscribe to situations of interest and receive notification as they unfold and predictions of possible future events
- Explanation tools to walk an analyst through the reasoning behind an assessment or an alert





Example Functionality

AF2TK Spiral 4 Functional Flow – JEFX04





PANACIA

A closer look



- ◆ **P**redictive Battlespace Awareness - M2M interface & normalized knowledge-base to improve exchange between the PBA Pillars (IPB; Target Development; ISR Strategy, Planning & Execution; & Assessment)
- ◆ **A**dvanced/Mature Fusion Engines (GMTI, SIGINT, HUMINT, IMINT, MASINT, IPB)
- ◆ **N**etwork-centricity - JBI Web Services - Publish and Subscribe – NCES, XML
- ◆ **A**dvanced Reasoning Engines – support spatial, temporal & link analysis tools to aide user assessments
- ◆ **C**ollaborative Tools - Include collaborative knowledge sharing capability and ability to collaborate beyond existing Internet Relay Chat (IRC) capabilities - Include ability to drag & drop aggregates of track data between users on LAN/WAN, share screens or widgets to dynamically explain concepts
- ◆ **I**ntegrated System - seamless integration & standard infrastructure clients (where possible) - M2M Interfaces but maintain human-in-the-loop (HIL) checkpoints – reduced data latency & reduced software/hardware footprint
- ◆ **A**utomate Hypothesis Generation and Integrate Natural Language Processing (NLP) to improve usability of free text data from HUMINT, IMINT or UGS

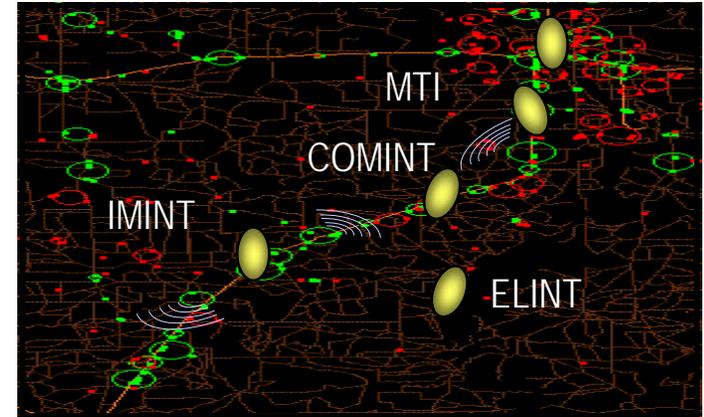
You can't do dynamic planning and dynamic execution without fusion



Functional Requirements



- ◆ Provide multi-sensor exploitation & multi-INT fusion for ISR / Intel Analysts
- ◆ Fuse Tracks using the following data sources:
 - ◆ SIGINT (ELINT, COMINT, PROFORMA)
 - ◆ GMTI (MTIX)
 - ◆ VMTI (Video Tracks, Image Chips)
 - ◆ HUMINT (Reports)
 - ◆ IIRs (Reports, Imagery)
 - ◆ IPB Data, Weather, a priori knowledge
 - ◆ Other future sensors (FOPEN CD, Spectral, UGS)
- ◆ Demonstrate usability within AOC and DCGS:
 - ◆ *DGS analyst for cross-cueing*
 - ◆ *Analyst on Combat Ops floor for prosecuting TCTs*
 - ◆ *Combat Assessment Operators that perform BDA and EBO*
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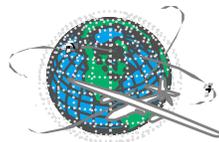
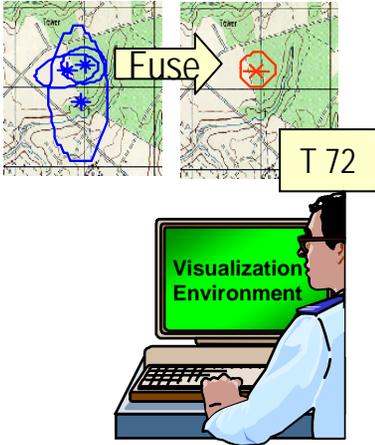




Predictive Awareness & Network-Centric Analysis for Collaborative Intel Assessment

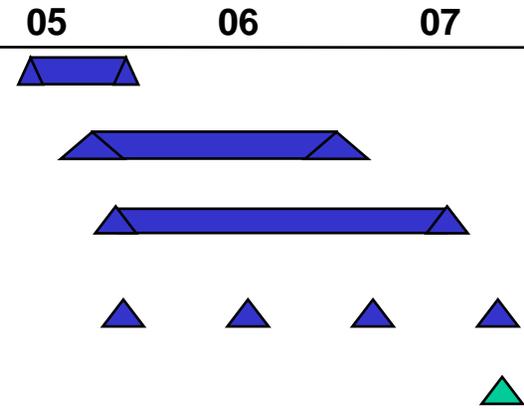


FOUO



Technology Investment Schedule

- Architecture design
- Fusion component development
- Fusion control integration
- Warfighter evaluation/experiments
- Technology Availability Date



Description	Benefits to the War Fighter
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Integrate best analysis, correlation & fusion systems into *one* operator-focused multi-INT fusion system

- A list of *prioritized requirements* for more cohesive multi-INT fusion system being *jointly* worked with *AFC2ISRC/IN & AF/XOI*
- Incorporates *OIF lessons learned* and JEFX 04 lessons learned
- Integrate existing/new fusion components to extend data usability
 - Multiple intelligence domains leads to accuracy improvement
 - Synergizes otherwise disparate pieces into actionable info
- Fusion requirements focus and drive ISR tasking & processing
 - Needs of the warfighter clearly articulated to ISR systems
 - Quantifiable feedback of value of ISR derived information
- New Fusion strategy development tool
 - Focused on the needs of the operator to complete mission
- Designed for multiple transition points with single system
 - Minimal modification required to host in DCGS or AOC
 - Approach to cross-int data manipulation eases transition

Technology

- Leverage / Mature multi-INT fusion capability (ASA, WebTAS, TUT IFS or like)
- Adaptive integration methodology and scalable footprint
- Maturation of models for IADS monitoring capability
- Development of knowledge bases & reasoning models for non-IADS TCTs
- Fusion-Info-Needs linkage to ISR mgmt & tasking
- Fusion strategy development based on operator functional requirements

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POMing being worked by AFC2ISRC