Panel: Future Directions in Space IT

SMC-IT Conference 2003

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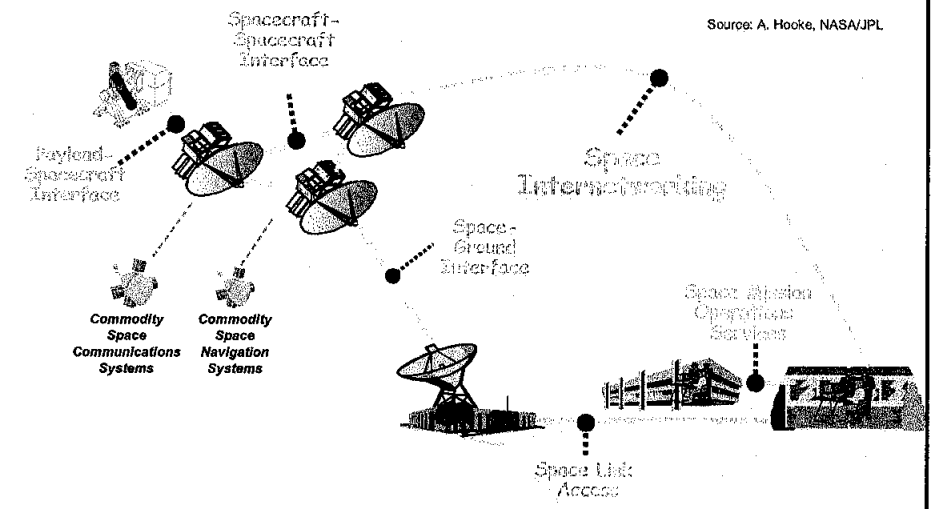
Overview

- Three Space and Ground IT domains of NASA interest
  - Deep Space Exploration
  - National Security
  - Air Transportation
- Comments/Observations...

Deep Space Exploration

Space Communications Context



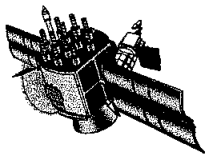
More efficient use of space sensors and resources...

Simplified user access...

National Security and Space

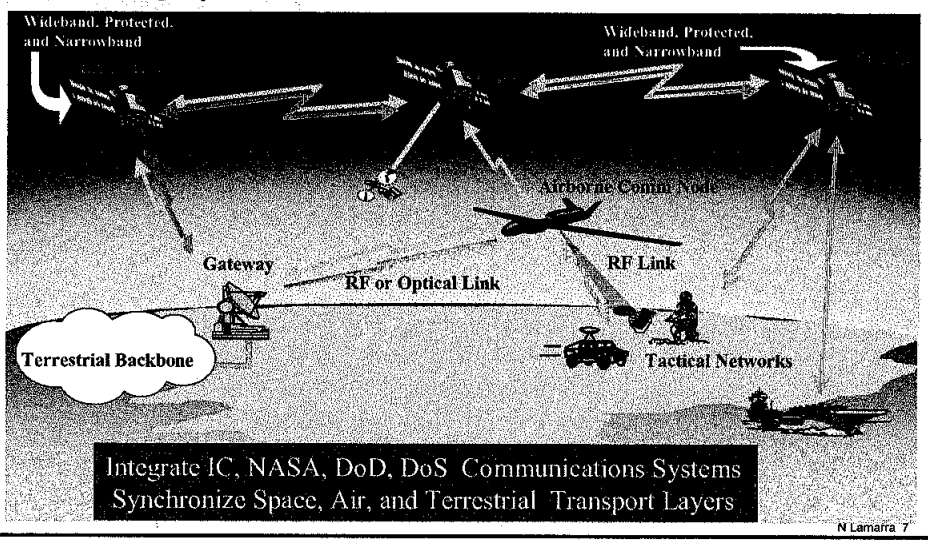
NSSA Communications Architecture Vision

- Develop an integrated Space, Air, and Terrestrial Communications Architecture that supports all National Security Users, all information domains, and all levels of classification
  - Eliminate communications stovepipes
  - Eliminate capacity and connectivity as a mission constraint
  - Reallocate resources dynamically
  - Reduce funding burden on individual agencies and departments
- For DoD:
  - Improved reachback and greater capacity
  - Better connectivity during enroute, early entry, and offensive operations
  - Reduced strategic lift and manpower
  - Improved joint allied and interagency interoperability
- For the IC:
  - Better connectivity for collection
  - Improved dissemination for last tactical mile
- For NASA:
  - Space station and shuttle accessible communications, earth sciences sensor
  - Higher capacity than commercial can currently provide
- For DoS:
  - Improved embassy connectivity



NSSA Communications Architecture Scope

Options Being Explored



Integrate IC, NASA, DoD, DoS Communications Systems
Synchronize Space, Air, and Terrestrial Transport Layers

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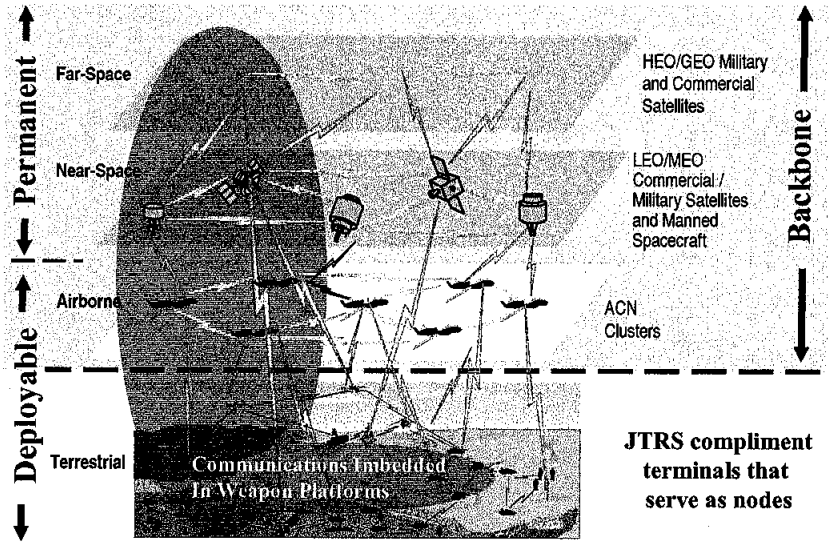
3 Layers - One Coherent Seamless Network



JTRS compliment terminals that serve as nodes

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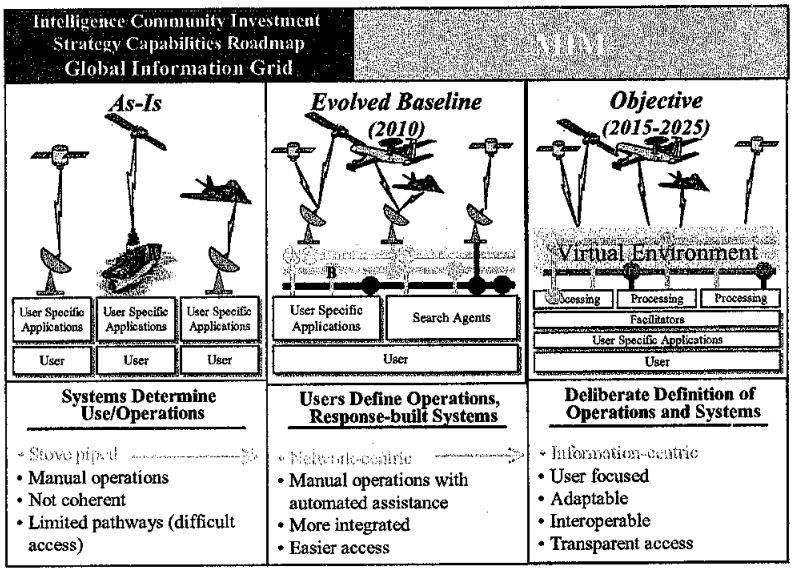
Mission Information Mgt (MIM) Architecture Scope - Timeframe



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Federal Aviation Administration (FAA) and NASA

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Status of Air Traffic Management

Current Limitations

- Non-integrated pieces of a whole
- Independent performing computers
- Limited computing capabilities
- Centralized mainframe computer architecture performed from multiple globally remote facilities
- Functionally robust set of distributed communications, command, control, navigation, and surveillance and planning

Challenges

- Change from completely independent functioning systems into a distributed design architecture
- Implementation of a true integrated systems design architecture
- Integration of a scalable system-wide information management system for real-time decision-making that is extendable to accommodate future demand for air transportation
- Integrated system-level picture of the past, present, and planned state of the air transportation system to serve as a common basis for improved decision-making and a more safe and secure operation

Vision

- Wide-spread real-time distribution of NAS data
- Elimination of redundancies
- Integrated system of systems architecture

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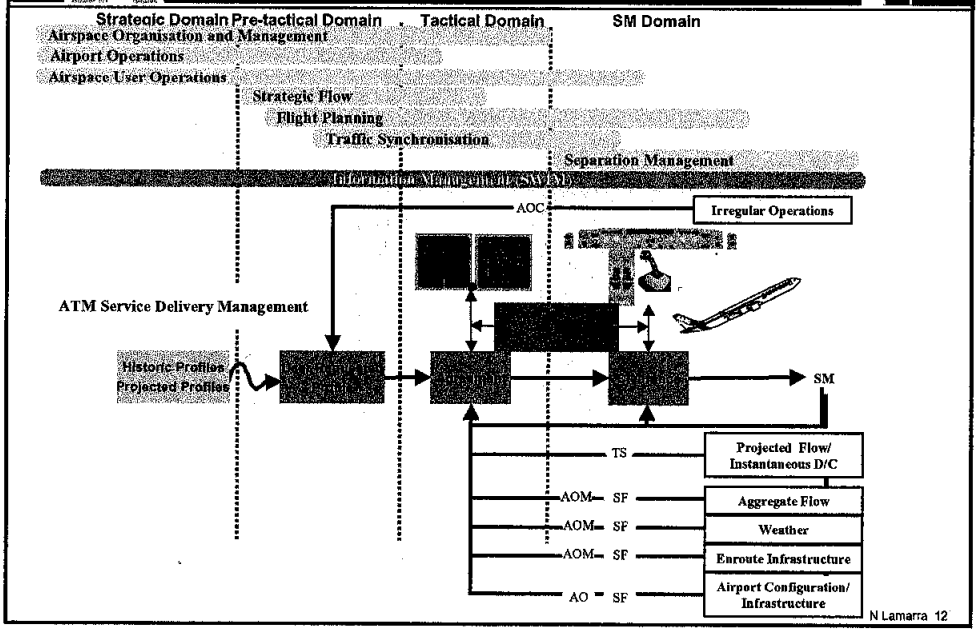
Solution Approach: SWIM



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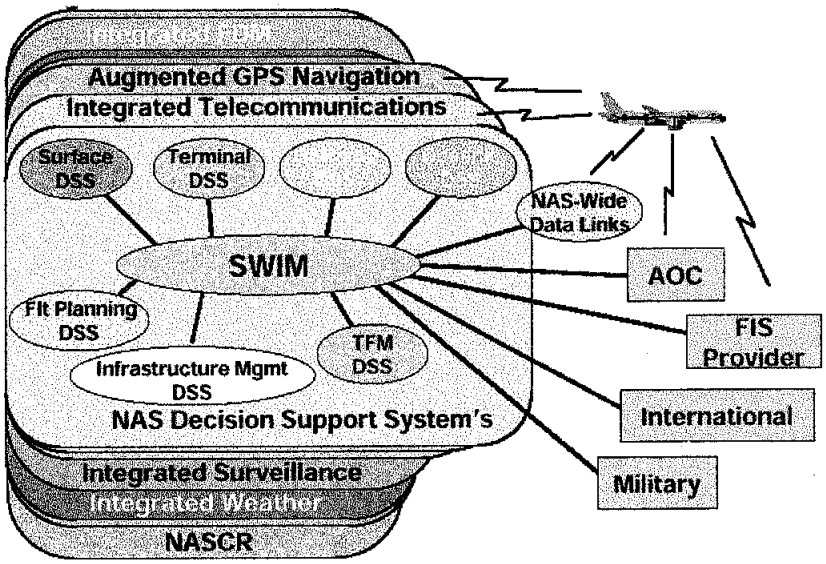
Systems View of the Future CONOPs



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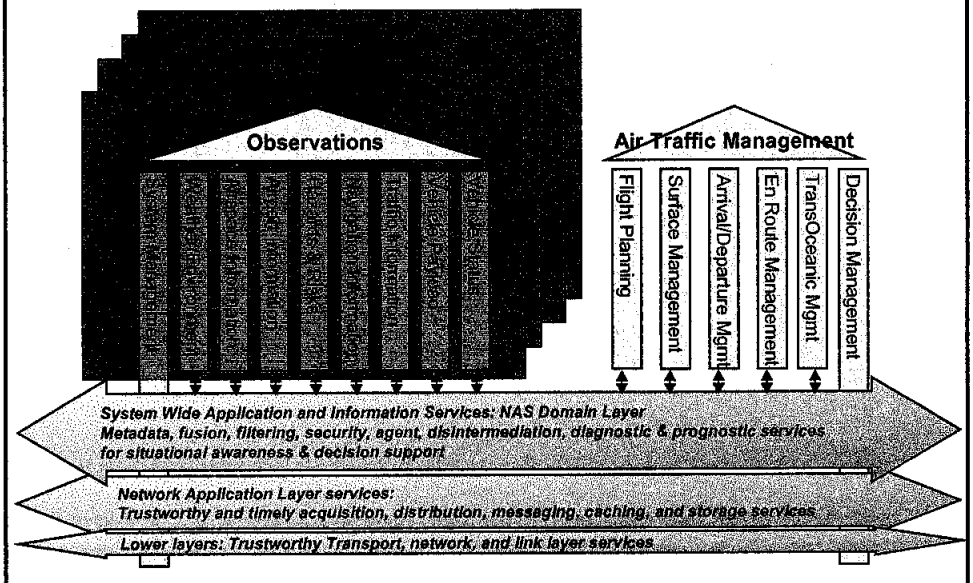
Vision of Future National Airspace System



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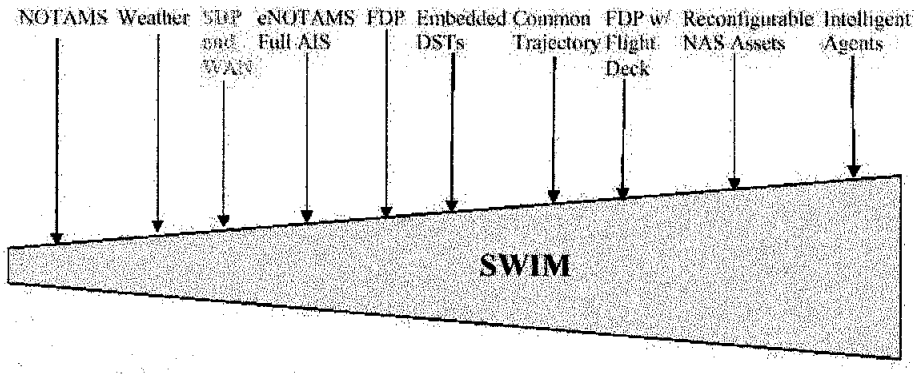
Evolution of SWIM in Concept



NASA Interest: T-SWIM

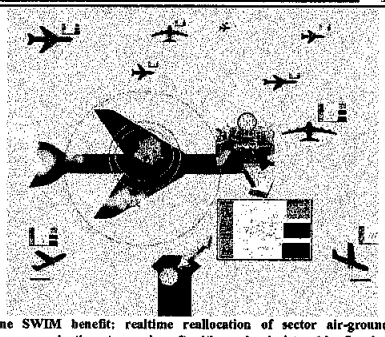
Objectives:

To develop technology to provide:

- Flexibility in reassignment of airspace and infrastructure resources
  - Information at system-level... rather than at every subsystem
  - Security integrity mgmt. for data communications
  - Cost effective and integrated NAS information delivery
- Real-time access to NAS info as needed

Tasks:

- Reqts and Architecture
  - System studies to define requirements, IT architecture, gaps and benefits
- Technology Maturation
  - Develop NAS information mgmt tools
  - Develop SWIM system support tools
- Proof of Concept and Test
  - Tech. integration and simulations
  - Testing and verification, handover



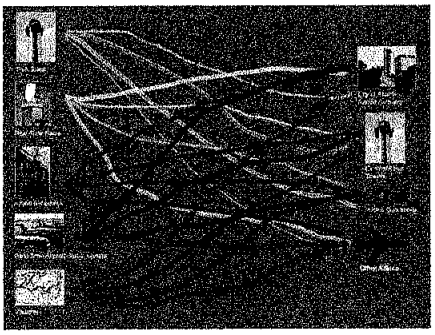
One SWIM benefit: realtime reallocation of sector air-ground communications to an aircraft with mechanical trouble, flagging to ATC and operations.

Justification:

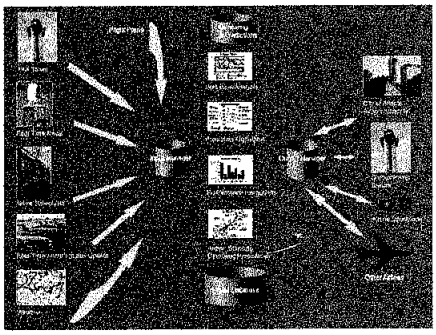
- FAA and RTCA's NAS Concept of Operations identified future need for info sharing between collaborative decision makers
- NAS information distribution inadequate
- Information updates not timely
- NAS information kept in inconsistent standalone databases

T-SWIM Benefits - Real-time data sharing

Today without SWIM:
One-to-one ad-hoc connections, not enough standardization, difficult to maintain, inflexible



Future with SWIM:
Improved real-time coordination, open standards, easy maintainability, flexible



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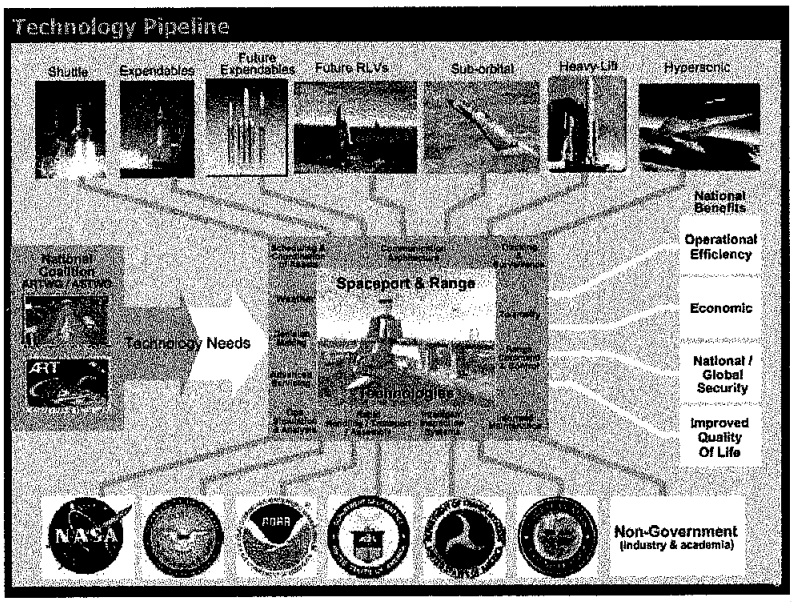
KSC: Spaceport & Range Technologies



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Comments/Observations...

Some Cross-Domain IT Themes

- Data Accessibility
  - Location, Access control, QoS, Bandwidth, ...
- Information Extraction & Integration
  - How to fuse sensors, sources
  - Integration of Space and Ground
  - Semantics and Ontologies
- Information Analysis
  - Situation Awareness (SA)
  - Decision Support Systems (DSS)
- Automation
  - Increased robustness/flexibility, reduced ops cost
  - Optimization
- Agents
  - Intelligent Assistant to Human Operator
  - Tactical (e.g., Course-of-Action); Strategic (e.g., data mining)
- Autonomy
  - Reasoning, Planning, Adaptability, Agent Negotiation

Computational Power

...Information Architecture that is *Evolving, Enabling*