

# Next Generation Air Transportation System



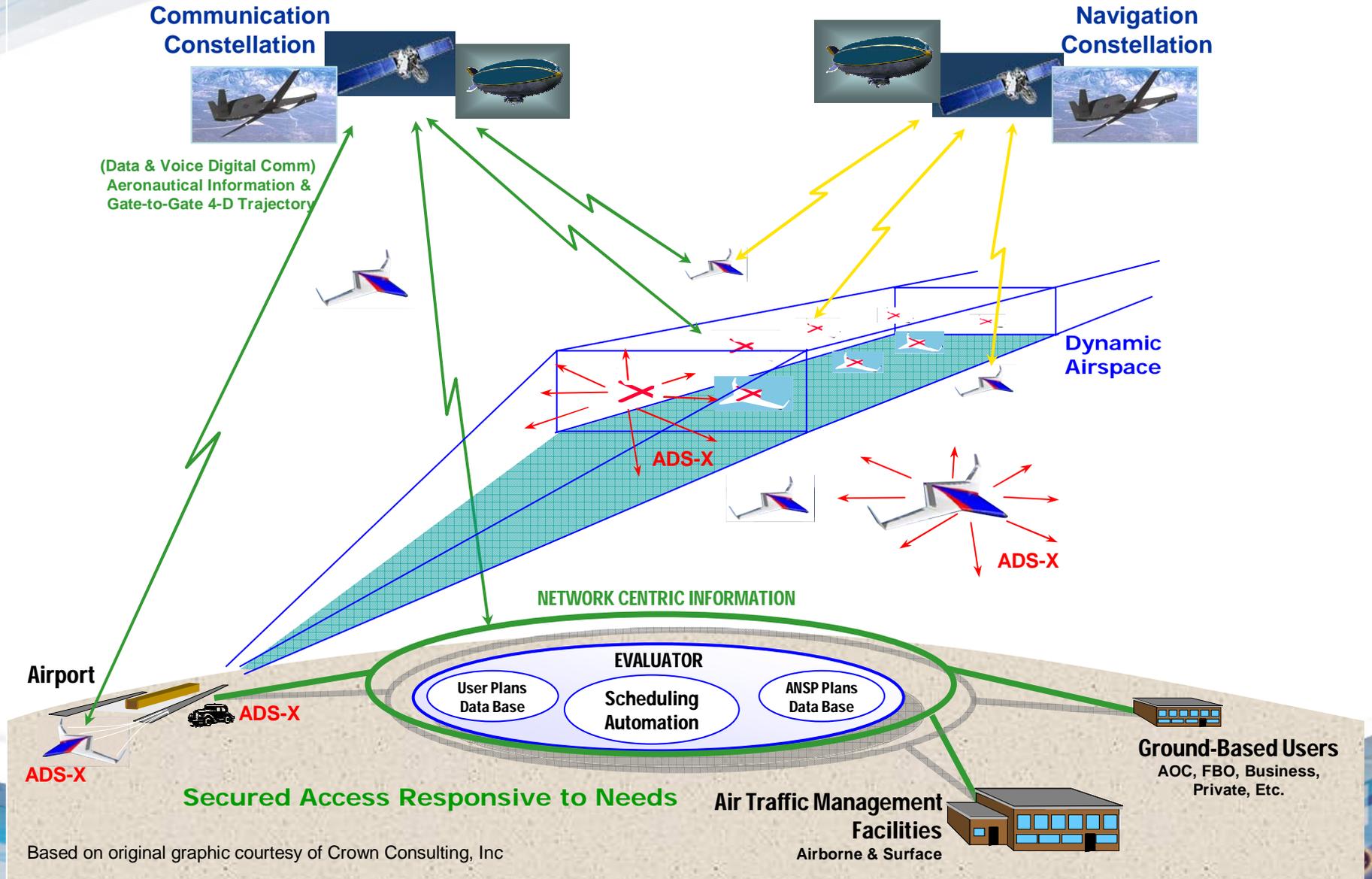
# ***2025 NGATS Capabilities***

## **"Block to Block"**

- *Global Secure Access to Net Centric Information*
- *Airborne Information Web*
- *Broad-Area Precision Navigation*
- *Required Total System Performance – Equip for Service*
- *4D Trajectory Management*
- *Dynamic Airspace Configuration*
- *Seamless Weather Assimilation Into Decision Loops*
- *Equivalent Visual Operations*
- *Super Density Operations*



# "Block to Block" Concept: Selected Elements



Based on original graphic courtesy of Crown Consulting, Inc

## *Capability: Global Secure Access to Net Centric Information*

### **“Shared Situational Awareness”**

- Real-time free-flow of information
- Push/pull processes to relevant NGATS communities of interest
- Meld inputs from private, commercial, & gov't sources
- Network-enabled operations
- Common awareness of on-going day-to-day operations, events, and crises
- Secured according to needs and priorities



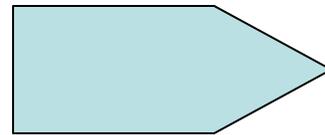
# Net-Centric Operations

*"It's about the Users"*

## From

- Info supplier dominated
- Owner pushes controlled info
- Sequential info flow

**Gather, Process, Use, Disseminate**



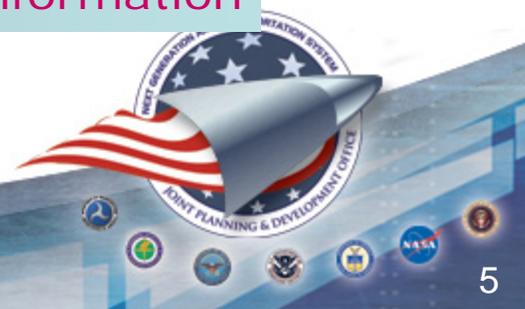
## To

- User (consumer) dominates
- Owner posts info for appropriate classes of users
- Parallel information flow

**Gather, Post, Process, Use**

## Net Centricity Payoffs

- Faster Decision Making
- Increased Collaboration
- Better Decisions based on access to more information



# Shared Situational Awareness: Major Themes

- **“See”**

**System of systems** layering, integrating aerospace surveillance

- **“Comprehend”**

**Standardized** interagency and industry policies, procedures, processes and info sharing

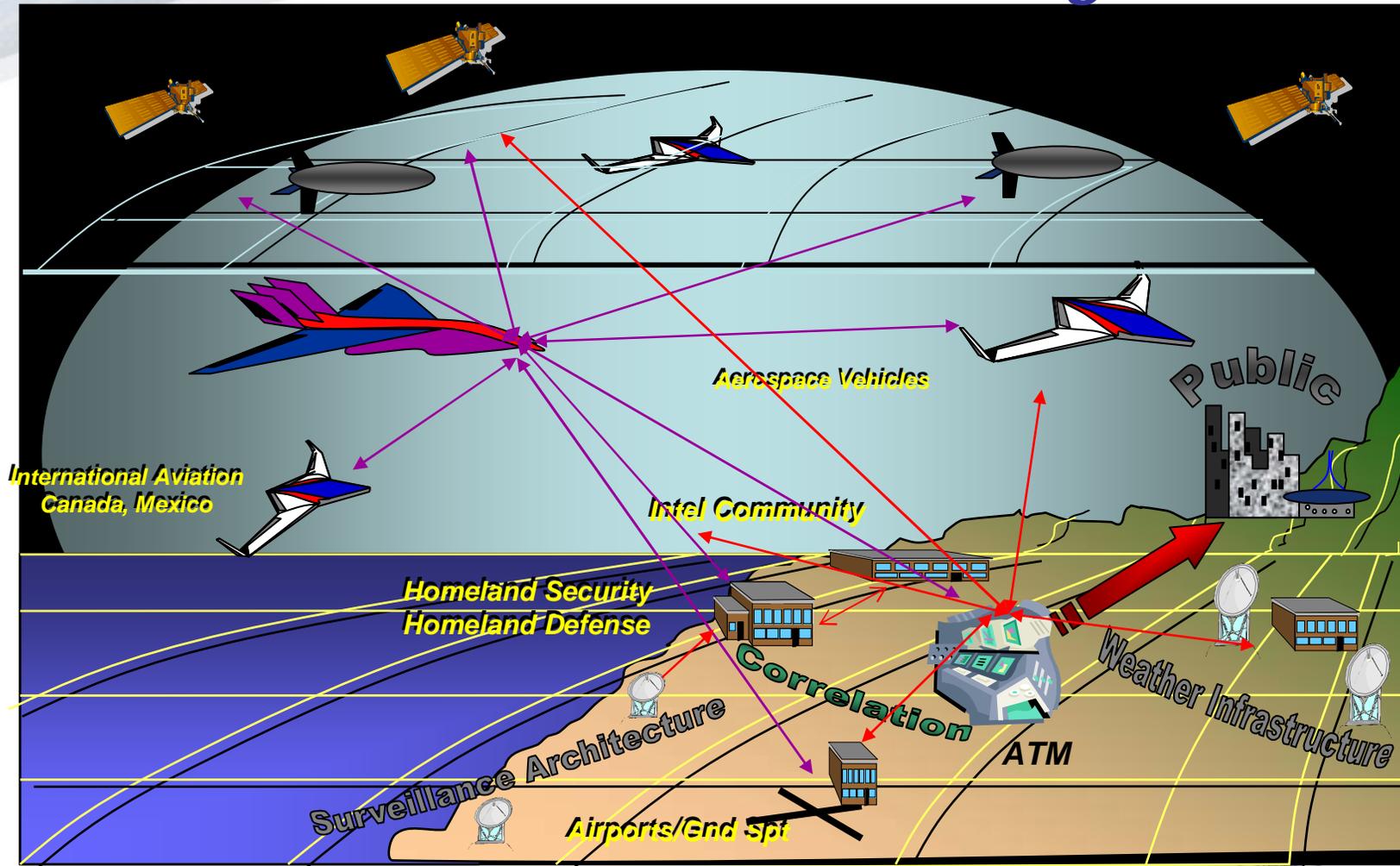
- **“Enable Action”**

**Broadband-like** access throughout system



# NGATS Information Sharing

Next Generation Air Transportation System  
Joint Planning and Development Office



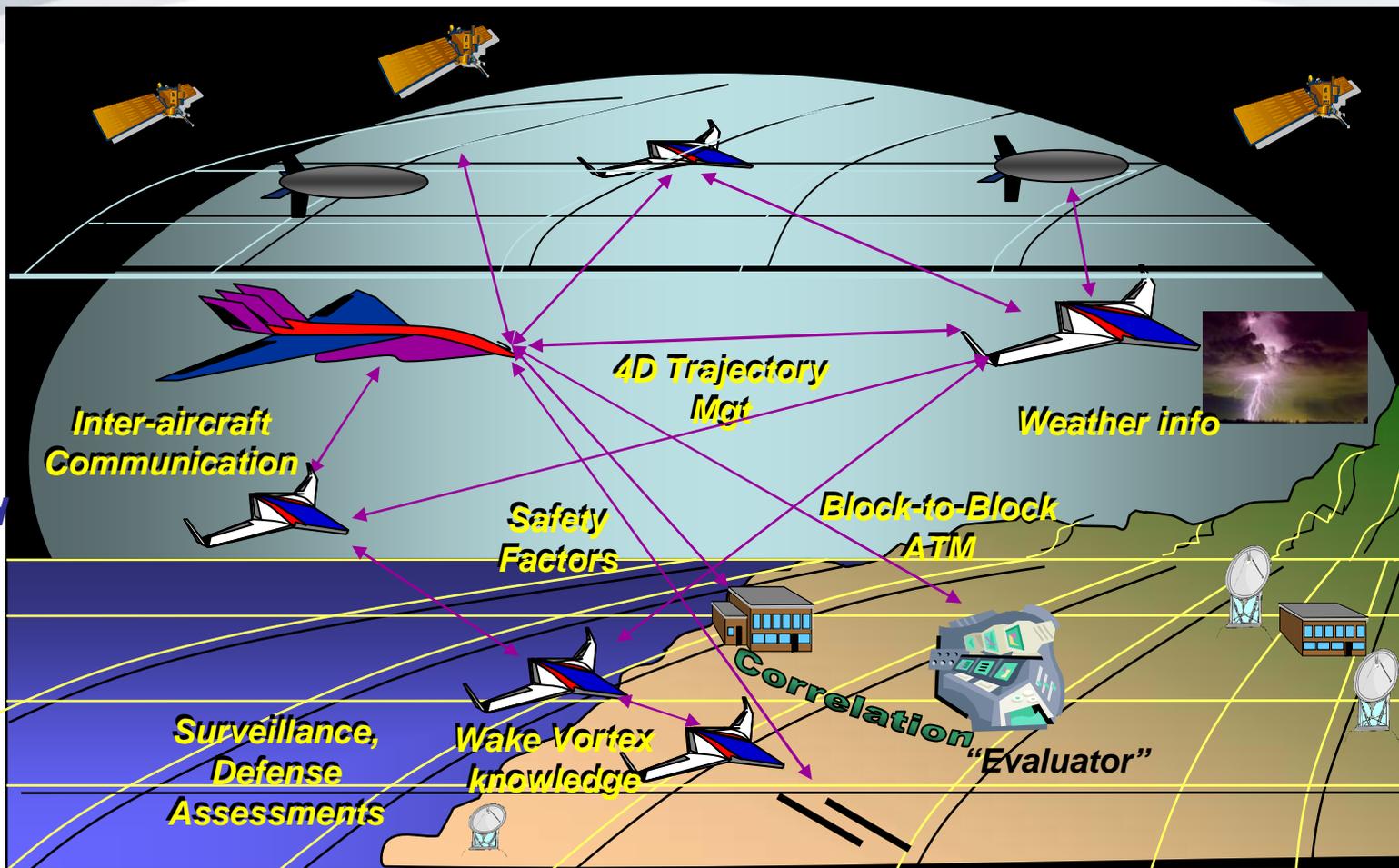
## 2025 Assumptions

- Sufficient bandwidth exists
- Sufficient infrastructure
- Broad-Area Precision navigation
- Tailored, secured according to needs of users
- "Push/Pull" information sharing via NEO

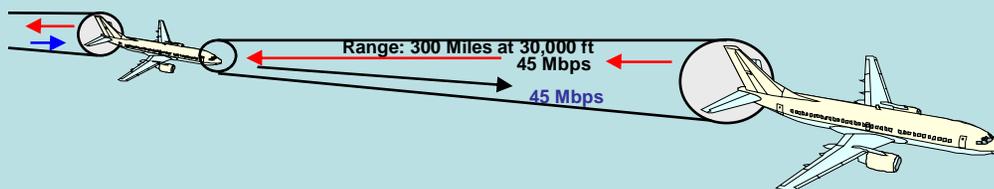


# NGATS Airborne Web

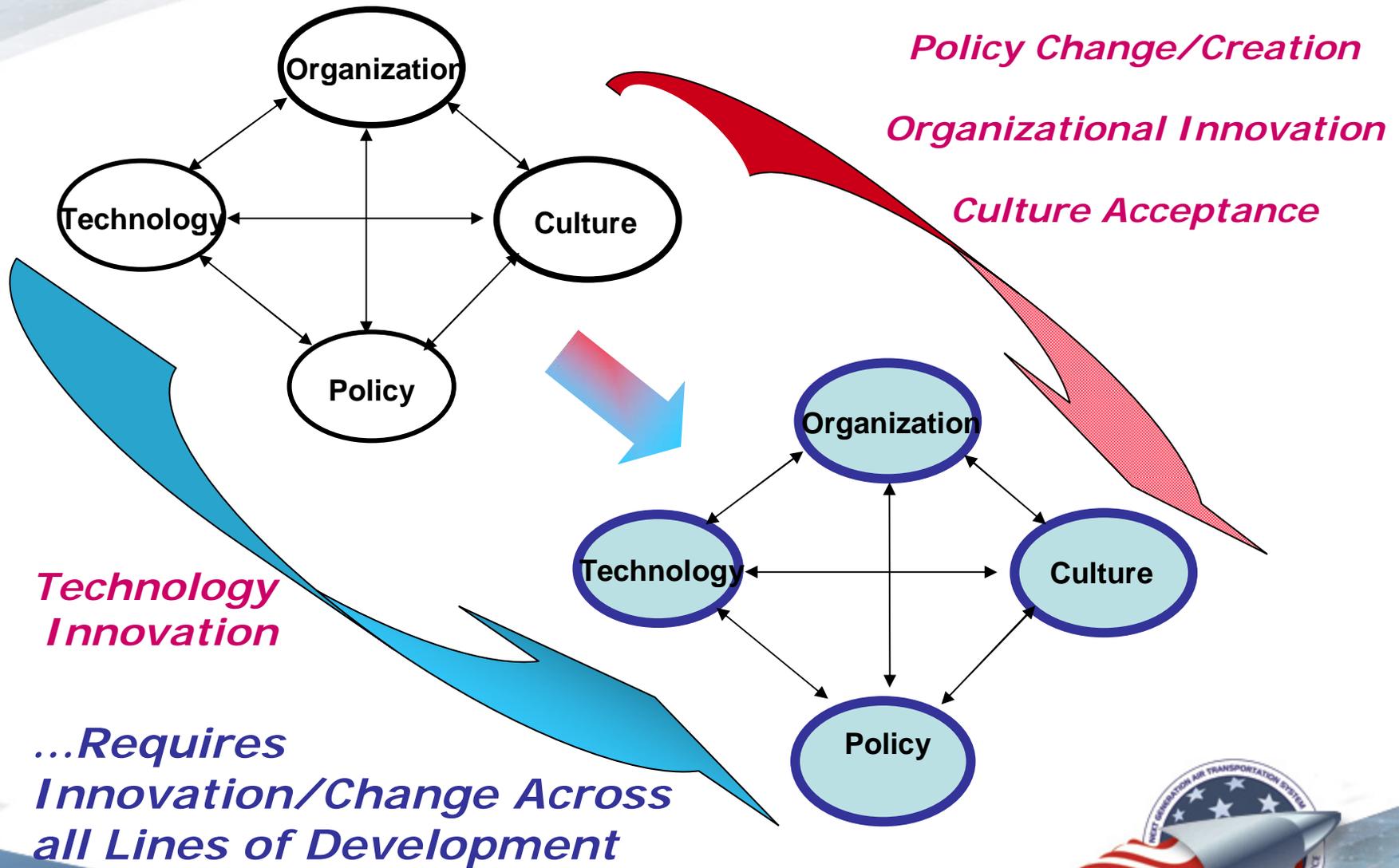
- Broad-area broadband
- Data & Voice
- Surveillance
- Secured
- Responsive
- User-tailored



Broadband communications over 1000 times as fast as standard 64K satellite service, operating at a small fraction of the cost.



# Implementing Network Enabled Capabilities



*Technology Innovation*

*Policy Change/Creation*

*Organizational Innovation*

*Culture Acceptance*

*...Requires Innovation/Change Across all Lines of Development*



## Capability: Broad-Area Precision Navigation

- Navigation performance sufficient to enable precision approaches (CAT-I/II/III)
  - Minimal/zero ground-based aids at any "air portal"
  - CAT-II without local augmentation, CAT-III with low-cost local augmentation
  - "Air portal"-specific, vice runway-specific
- Broad Area to Global Availability of Nav Services
  - Meeting appropriate requirements for accuracy, integrity and continuity
- Divests current ground-based systems of landing/navigation aids
- Reduction/elimination of runway lighting, markings



# Capability: Required Total System Performance\*: Equip For Service

- **Multiple, differentiated service levels**

- Provides choice to users depending on needs
- Required Communication, Navigation and Surveillance performance
- Other categories of performance as needed



- **Temporal Flexibility, Responsiveness**

- Varies from area to area, in terms of airspace and "air portal" surfaces
- Varies with time as needs dictate
- Preference established based on user capability/equipage/training etc.



- **"Contracts" aligning services between users and providers**

- Developed cooperatively by service providers and their users
- "Guarantees" prior to flight commencement



\*Ref Policy Fact Sheet: "Performance-Based Operations and Services"

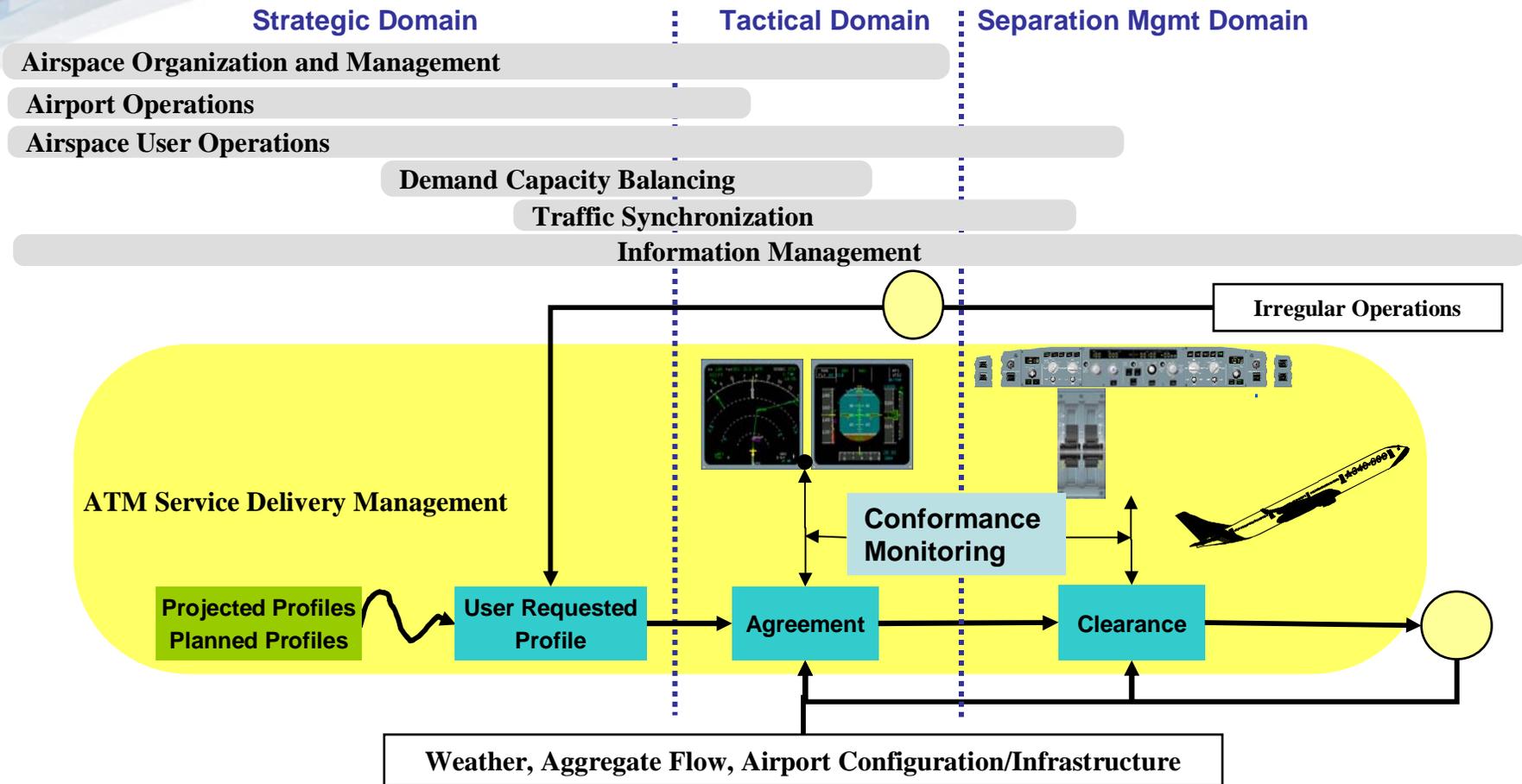


## *Capability: 4-D Trajectory Mgt*

- Users have 4D trajectories which are the basis for planning and execution over multiple time horizons
  - Trajectory definition is “block-to-block” (includes airport surface operations)
- 4D trajectories exchanged among users and ATM service provider using “Airborne Web” (previously described)
- Separation Assurance/Management performed using current aircraft states and intent as defined by “active” 4D trajectory
- Strategic Traffic Management performed using 4D trajectories that include probabilistic information
- Where appropriate, “4D contracts” exist between users and the ATM service provider
  - Contracts imply commitment(s) by both parties
  - Contracts are renegotiable “on the fly” at initiation of either party



# Management-by-Trajectory



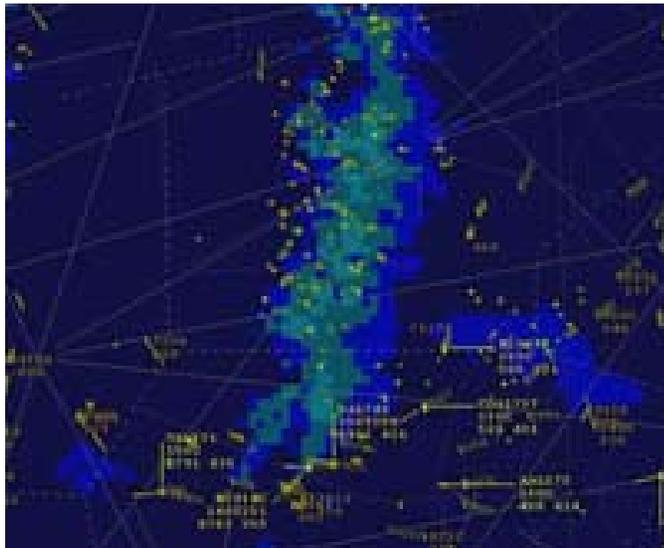
Key Issues are functional allocation between:

- automation and humans
- aircraft operators and 'central' service provider



## *Capability: National Dynamic Airspace*

### 4D Global Information System:



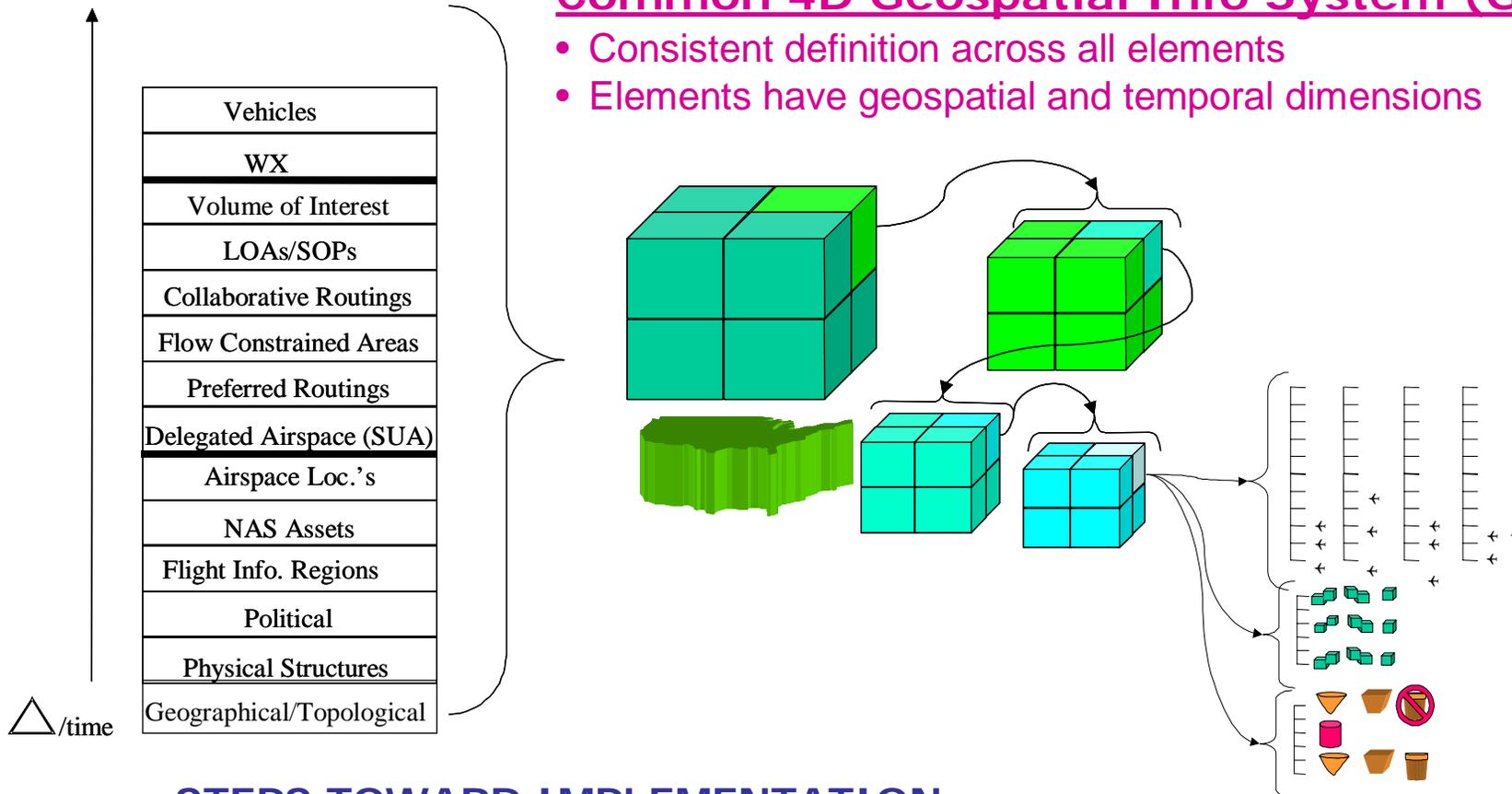
- Airspace configuration driven by
  - User needs
  - National Security Requirements
  - Safety
  - Overall efficiency of operations
- Reconfigurable hourly
- Single mechanism for implementing Special Use Airspace, TFR's, etc
  - Maximizes airspace access to all
  - National security needs prioritized
- Temporal implementation of high-density, high demand corridors, etc



# Dynamic Airspace Configuration

## Common 4D Geospatial Info System (GIS)

- Consistent definition across all elements
- Elements have geospatial and temporal dimensions



## STEPS TOWARD IMPLEMENTATION...

- Set standard GIS format & access method
- Establish method as core SSA capability



# "Evaluator"

- Requires trajectory management and dynamic airspace capabilities -- yet key to utilizing those capabilities
- Users "post"/update desired 4D trajectories in common system that continuously evaluates mutual compatibility
- Integrates/communicates weather, security, environmental, safety & other information
- Predicts potential "over demand" situations
- Works across all time horizons from +330 days prior to flight up to separation management (20 minutes or less)
- Supports distributed decision-making environment where players have clear, agreed-to roles and rules of engagement



# Capability: Seamless Weather Assimilation Into Decision Loops

- **NGATS Weather Information Network (NWIN)**
  - Observation from many sensors, feeding multiple forecast models, fused into single national database
  - Capable of dynamic update rates of a minute or less
- **NWIN supports “push/pull” information sharing**
- **Seamlessly assimilated into NGATS “decision loops”**
  - Total integration via machine-to-machine transfer
  - Critical decision system time scales using both probabilistic and deterministic weather information
  - Optimized to maximize available weather-favorable airspace to the NAS
  - Terminal weather impacts including ground/ramp operations



## Capability: Equivalent Visual Operations

- Enable aircraft to perform **"equivalent visual"** operations in non-visual conditions
- ATM providers delegate **"maintain separation"** responsibility to aircraft operators
  - Greater freedom of independent operations in non-visual conditions to converging and closely-spaced parallel runways
  - Reduced in-trail spacing during flight
  - Timely, high fidelity information on nearby aircraft, weather, etc.
- System-wide availability at all "air portals"
  - Airborne separation assurance and cost-effective sequencing automation in IMC at non-towered, non-radar airports (requires ADS-B)
  - Affordable capabilities and procedures enabling low visibility air & ground movements (down to CAT-II/III)



## Capability: Super Density Airports

- **Maximized runway capacity**
  - Reduced arrival/departure spacing for single runways
  - Reduced arrival/departure spacing for closely-spaced parallel runways
  - Equivalent Visual capability
  - Predictable detection/integration of wake vortex hazards
- **Reduce Runway Occupancy Time**
  - Aircraft energy management during rollout coupled with optimum turnoff selection
  - Situational awareness of “nearby” surface traffic and intent for high-speed turnoff
- **Simultaneous operations on single runway**
  - Multiple aircraft operate on a single runway when sufficient “separation” exists
  - High-update rate surveillance info available to all aircraft



# NGATS 2025: Realizing Capabilities...

CAPABILITY	MEANS
Global Secure Access to Net-centric Information	Policy changes; standards adoption; research; technology
Airborne Information and Surveillance Web	Airborne-based info sharing constellation
Broad-Area Precision Navigation	GPS III + aircraft augmentation + ?
Required Total System Performance <i>"Equip for Service"</i>	New policy and regulatory framework, including publication of preferences
4D Trajectory Assessment & Management	Modernization & Research ( <i>"Evaluator"</i> )
Dynamic Airspace Configuration	NAS Information in Common 4D GIS; Cultural change
Seamless Weather Assimilation Into Decision Loops	Research; Policy changes; agency synchronization
Equivalent visual Operations	Cultural change; Research + Fully capable ADS-B
Super Density Operations	Cultural change; Research + Modernization ADS-B(full); Implementation of SATS project technologies/procedures

