



NASA Aerospace Technology Enterprise Small Aircraft Transportation System

Program Overview



The Golden Rule



The Golden Rule of the information age is:

TIME IS GOLD

During this age we will live in:

HUBLOCK & GRIDLOCK

If you save me time:

I WILL GIVE YOU GOLD

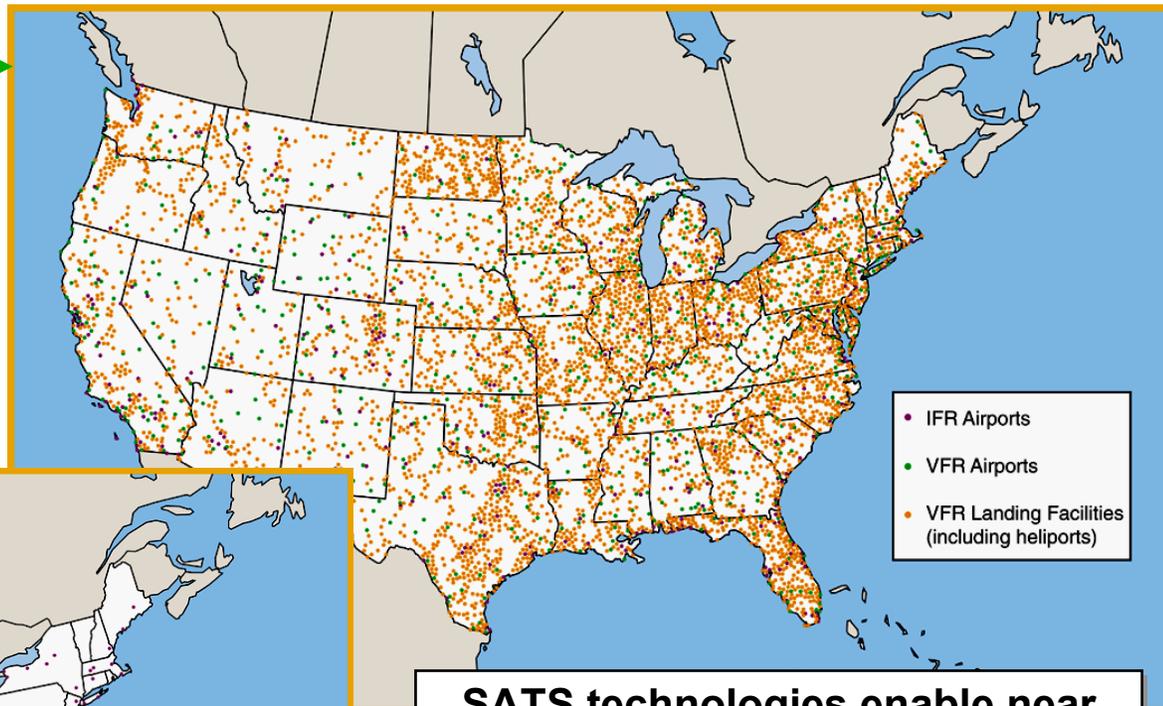


We Have an Abundance of Airspace

But Not By Using Today's IFR System!



**Expanded Accessibility
to several times
more destinations**



SATS technologies enable near all-weather accessibility to 5,400 public-use landing facilities.

Of 5,400 public-use airports, only 715 (13%) have precision instrument approaches (ILS)

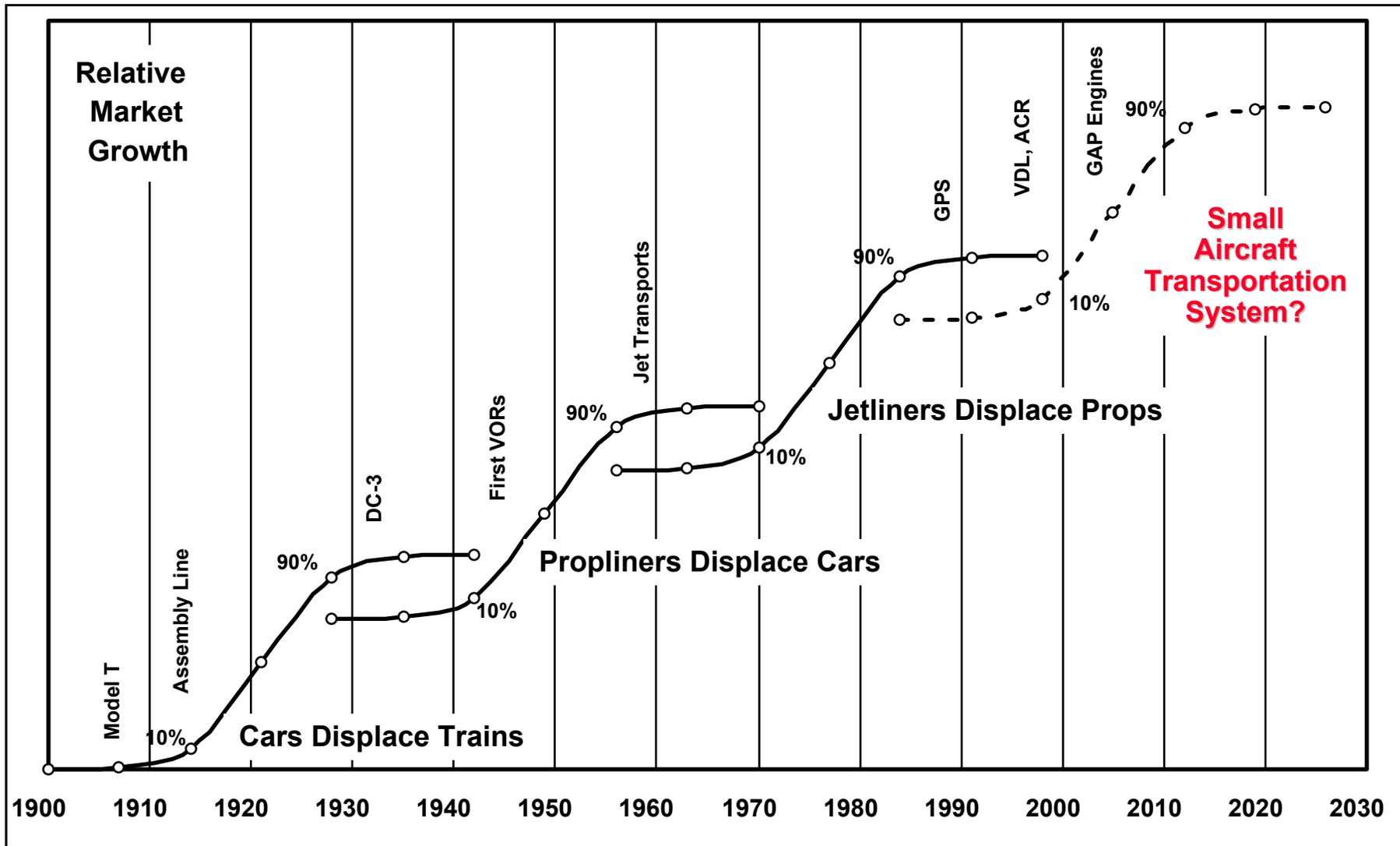


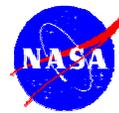
(R)evolutions in Higher Speed Travel

What is Next? More Speed to More Destinations

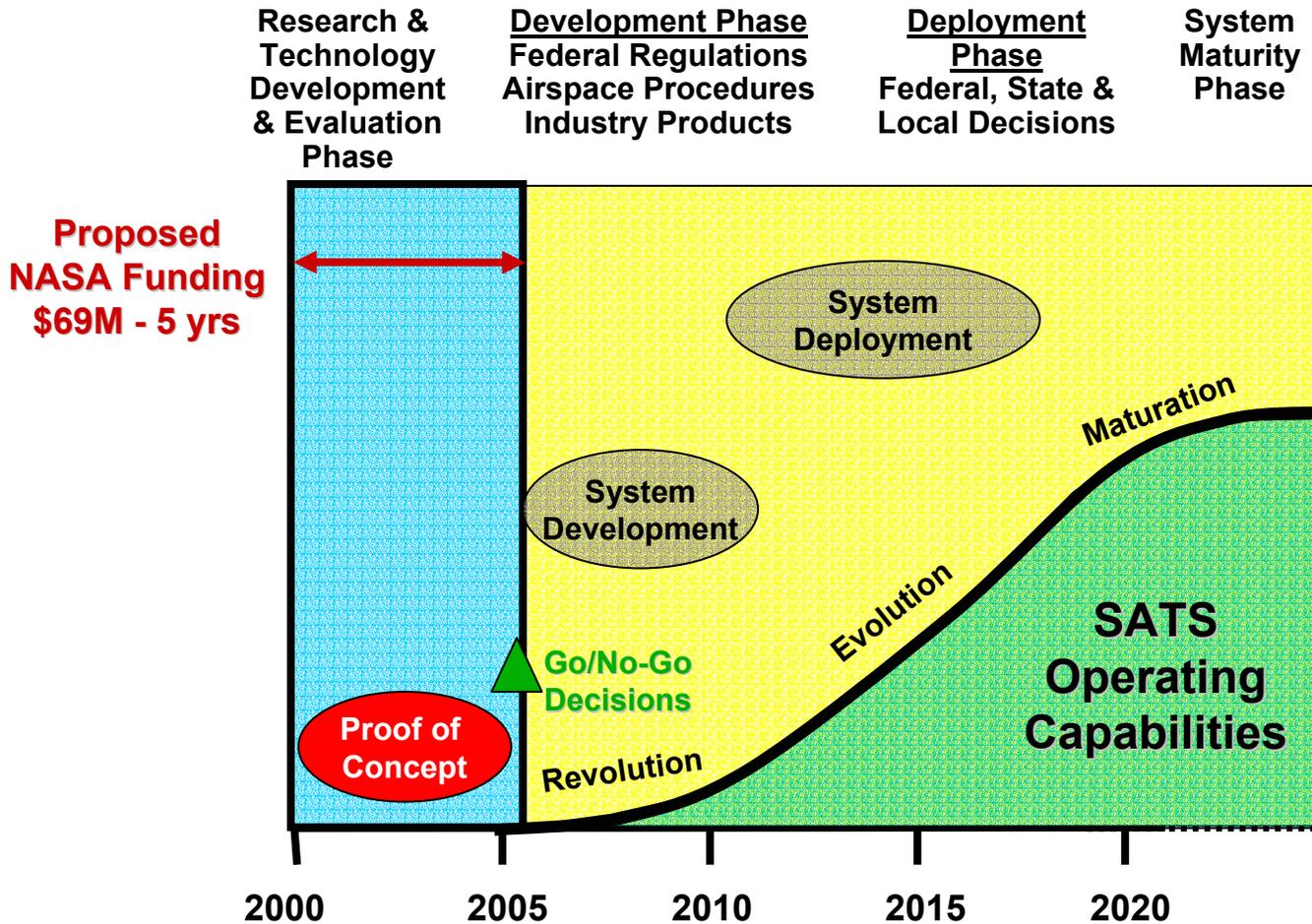


The "Atomic Structure" of Business Innovation Cycles



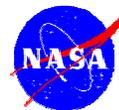


First Step Is To "Prove SATS Works"



Proposed NASA Technology Demonstration:

- Deliver experimental-based technical basis for national decisions
- Deliver analytical-based proof that SATS is a viable transportation alternative



NASA SATS 5 Year Program



Premise: Reduced Intercity Travel Time is Proportional to Accessibility

5 Year Goal

Demonstrate key airborne technologies for precise guided accessibility in small aircraft in near all weather conditions to virtually any small airport** in nonradar, nontowered airspace*

Objectives (NAS Benefits)

Higher-Volume Operations in Non-Radar Airspace at Non-Towered Facilities <i>(Expansion of Capacity)</i>	Lower Landing Minimums at Minimally-Equipped Landing Facilities <i>(Cost of Expansion)</i>	Increase Single Crew Safety & Mission Reliability to Two-Crew Levels <i>(Greater Throughput)</i>	Enroute Procedures & Systems for Integrated Fleet Operations <i>(Reduced Ground Holds)</i>
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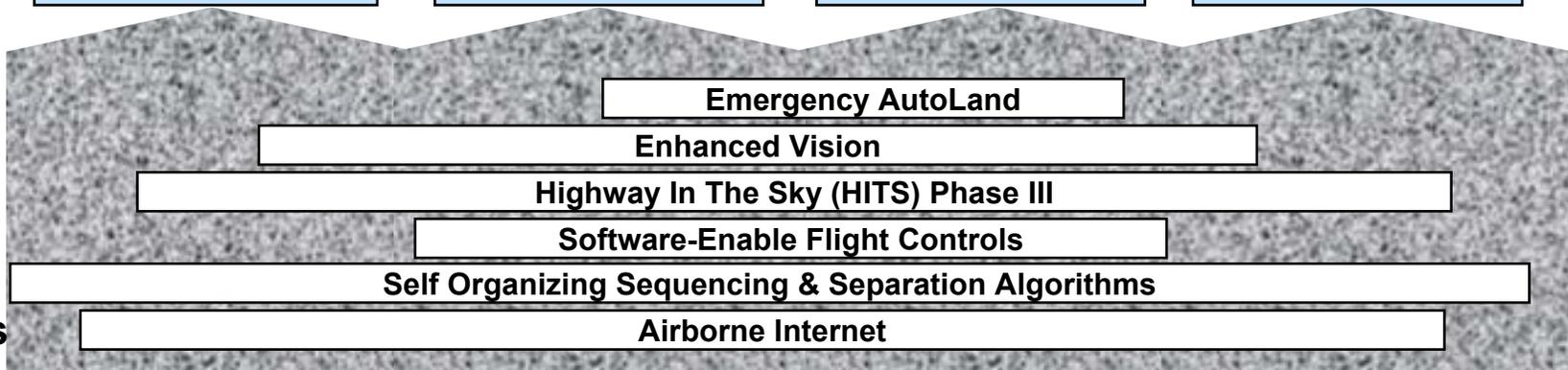
Technical Challenges & Issues

Technology/System Integration	Economic Viability	Level of: Automation vs. Training	Validation of Complex Software	Systems Integrity
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Approach

Virtual VMC	High Density Operations	Systems Analysis & Assessment	Integrated Systems Demonstrations
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Enabling Technologies



* FAR Part 23, < 6,000 lb & 12,500 lb GTW compliant to AC23.1309 & 1311

** Non-Part 139, 3,000 to 5,000 Feet

*** Minimum Success Requirement



SATS Research Delivers

Higher-Volume Operations

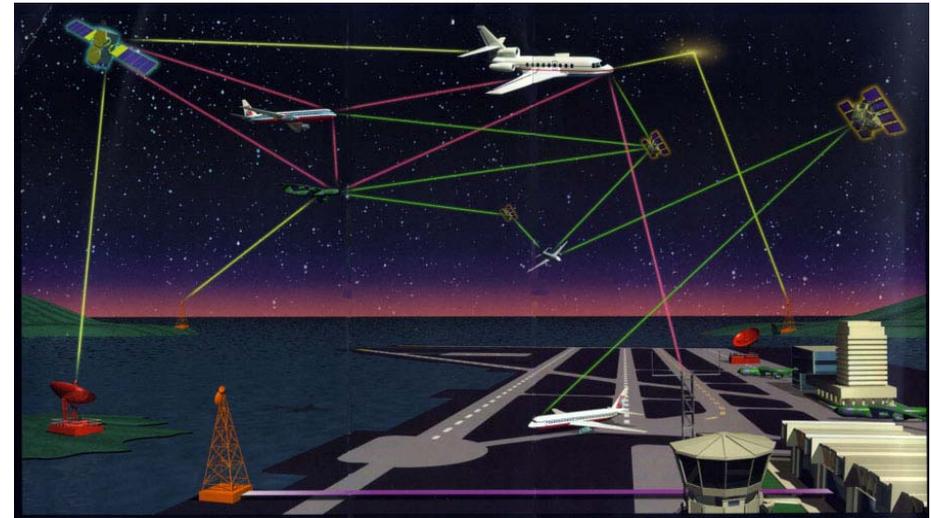


Simultaneous operations by multiple aircraft in non-radar airspace at and around small non-towered airports can create increased capacity at virtually any landing site in the nation.

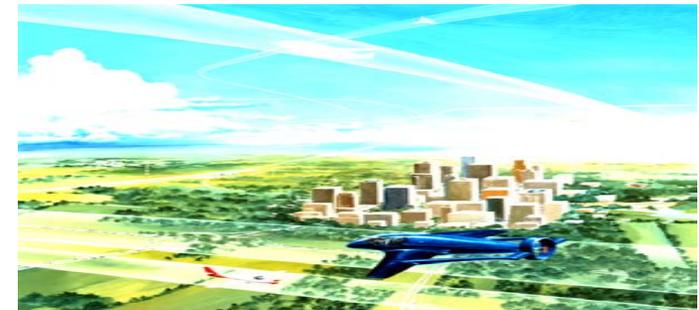
Outcome: Increased NAS Capacity

Key Enabling Technologies:

- Airborne internet communication standards and protocols for client-server communications and functional allocations
- Algorithms for self-sequencing and separation
- Enhanced (Artificial/Synthetic) Vision



Courtesy of Rockwell Collins





SATS Research Delivers

Lower Landing Minimums



Highway in the Sky graphical flightpath guidance with enhanced vision can create near all-weather access to any touchdown zone at any landing facility while avoiding:

- Land acquisition costs
- Approach lighting costs
- Ground-based precision guidance systems (ILS) costs
- Radar and control tower infrastructure costs

Outcome: Reduced Cost of NAS Expansion

Key Enabling Technologies:

- Enhanced (Artificial/Synthetic) Vision
- Highway-In-The-Sky 4D Guidance
- Software-Enabled Controls (Envelope Limiting, simplified attitude/speed coupling)
- Emergency Autoland

Runway Protection Zone (RPZ)

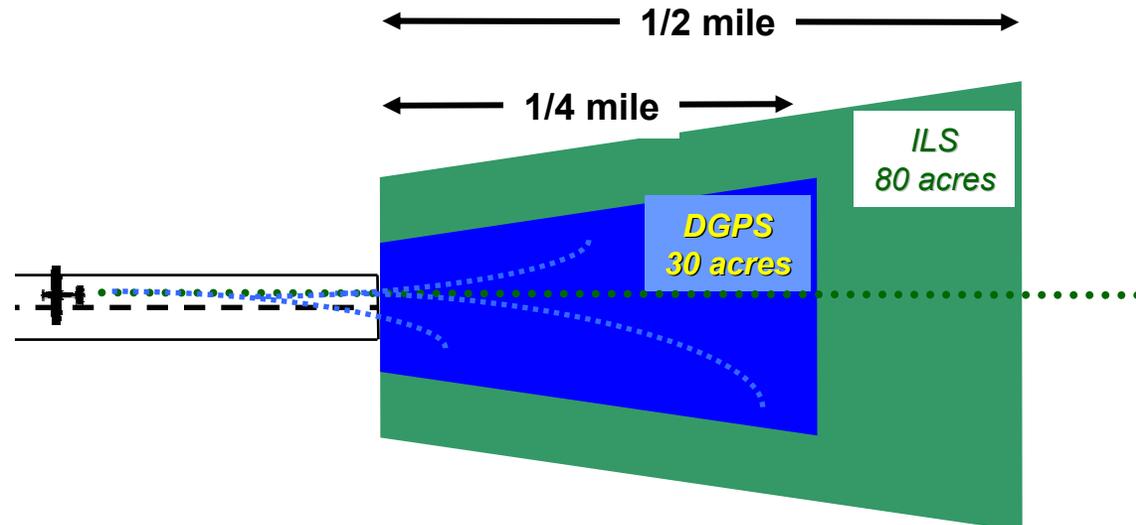


Figure 9



SATS Research Delivers

Increased Single Crew Safety and Mission Reliability

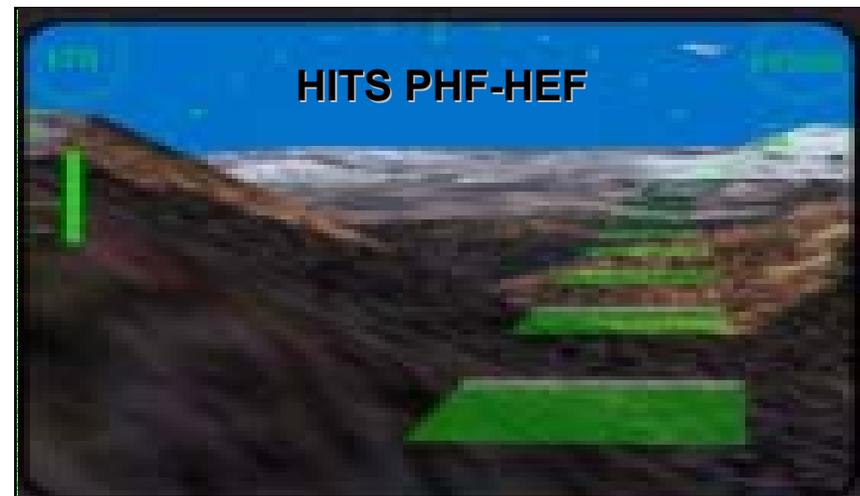


Human-aided automation will provide intuitive, easy to follow flight path guidance superimposed on a depiction of the outside world. Software enabled flight controls and flight planning will increase single-crew operational safety and mission reliability to two-crew levels.

Outcome: Increased NAS Throughput

Key Enabling Technologies:

- Enhanced (Artificial/Synthetic) Vision
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SATS Research Delivers

Integrated Fleet Operations

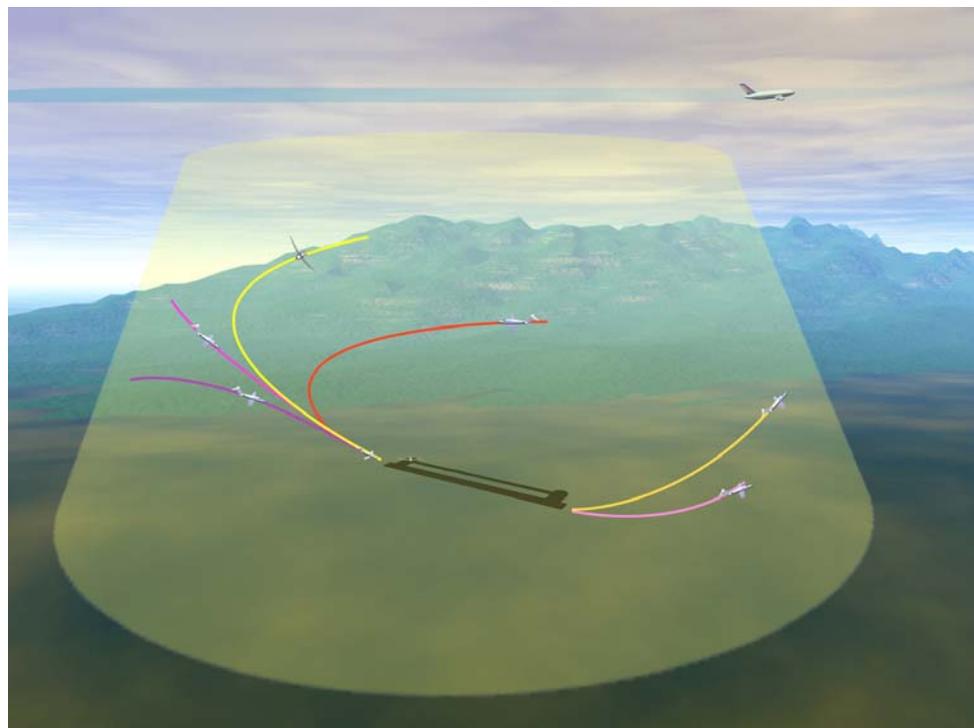


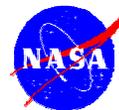
Automated air traffic management systems designed to facilitate operations at non-towered airports and in non-radar airspace can enable integration of SATS equipped aircraft into the higher en-route air traffic flows and controlled terminal airspace.

Outcome: Reduced Ground Holds

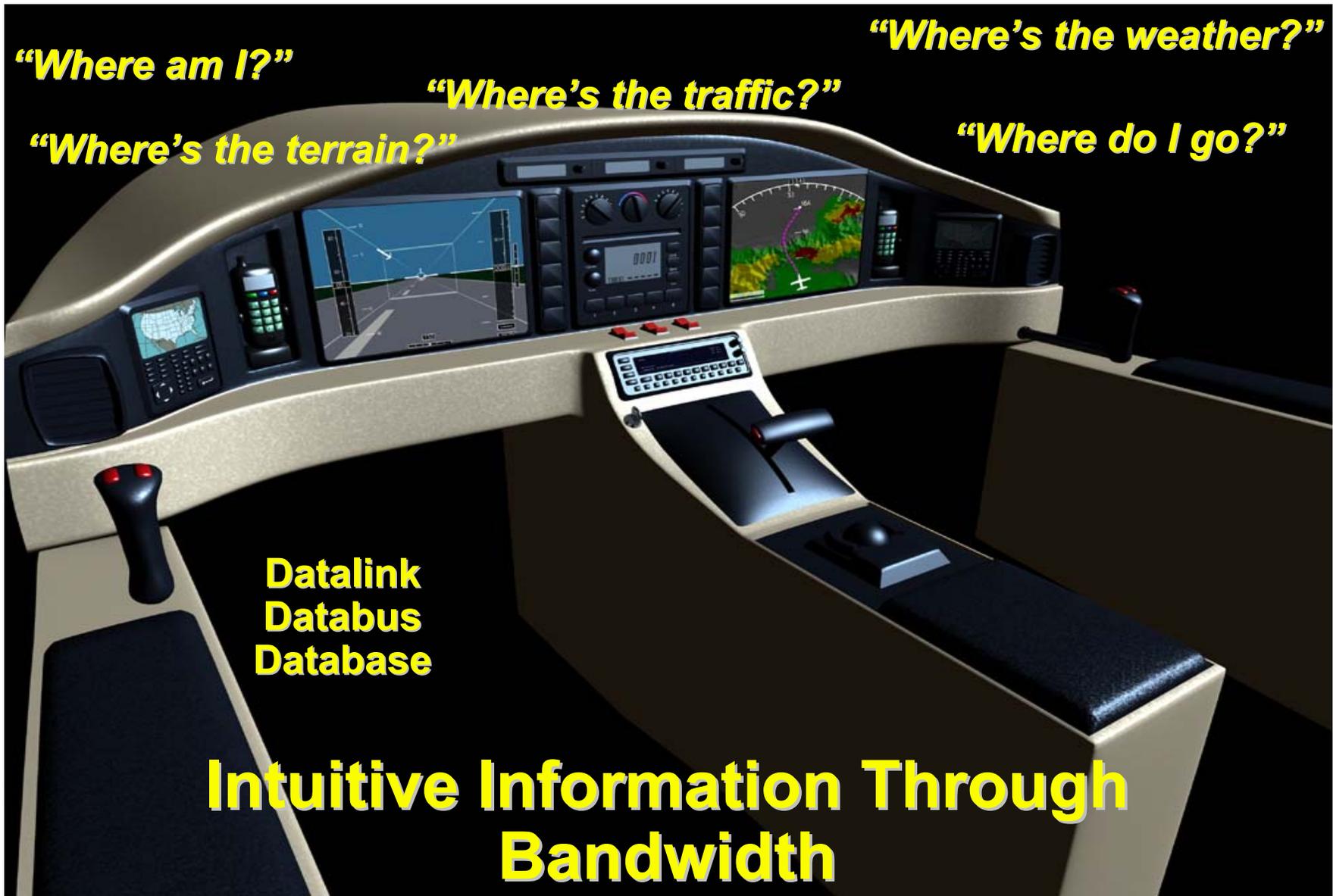
Key Enabling Technologies:

- Airborne internet communication standards and protocols for client-server communications and functional allocations
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The Bandwidth Revolution in the Cockpit



“Where am I?”

“Where’s the traffic?”

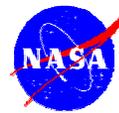
“Where’s the weather?”

“Where’s the terrain?”

“Where do I go?”

**Datalink
Databus
Database**

**Intuitive Information Through
Bandwidth**

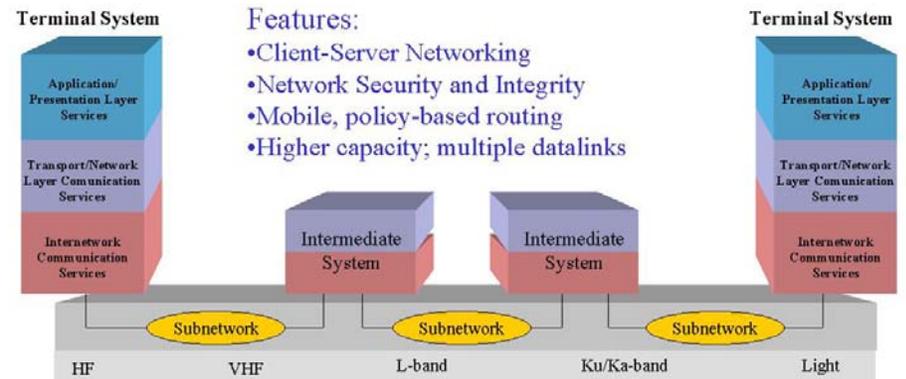
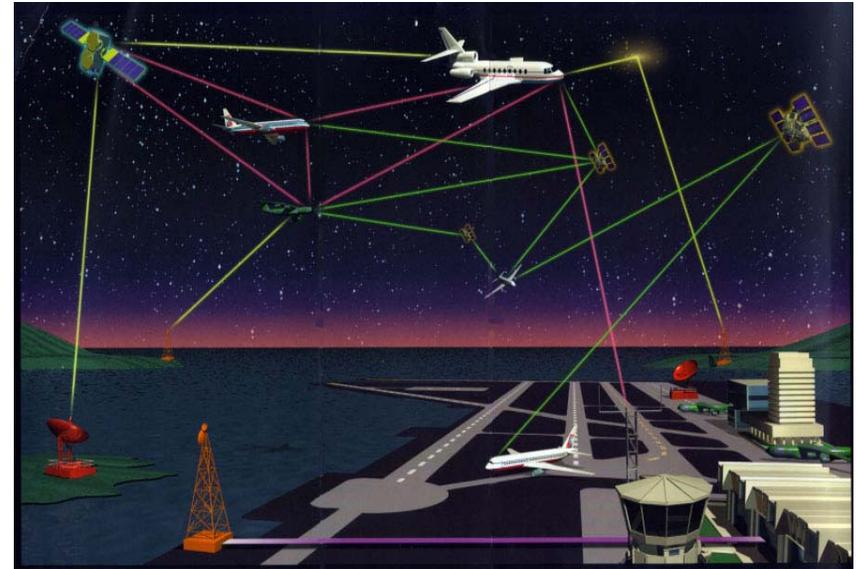


SATS Enabling Technologies

Airborne Internet



- A communications architecture that delivers aviation information services in an Internet-like manner
 - Aircraft and ground facilities will be interconnected nodes on a high-speed digital communications network.
 - System architecture based on open standards and protocols.
- A network management system that provides:
 - Mobile and policy-based routing
 - Service priority communications
 - Interface to onboard aircraft subnet(s)
 - Complimentary ground interfaces
 - Secure network communications
 - Point-to-point, point-to-multipoint, and broadcast addressing
- A communications management system for integrating multiple CNS datalinks and sensors.

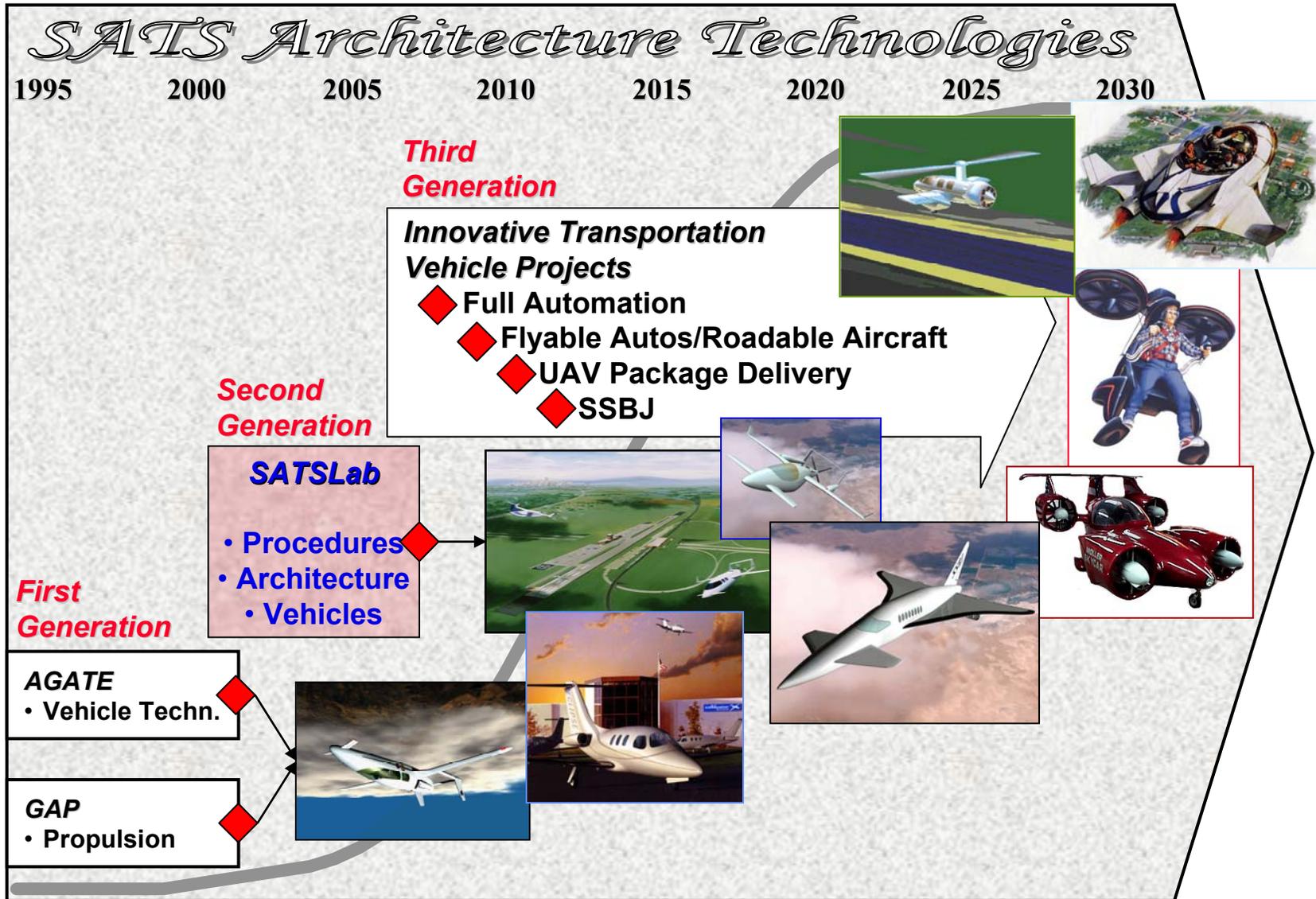




Transportation System Innovations



Vehicle-Centric Architecture-Based Revolutions





SATS Research Outcomes

- **Increased NAS Capacity**
- **Reduced Cost of NAS Expansion**
- **Increased NAS Throughput**
- **Shorter Doorstep-to-Destination Times**