



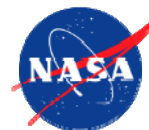
Unmanned Aerial Systems (UAS): Evolving Trends

NEXTGEN

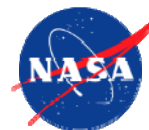
Parimal Kopardekar, Ph.D.

Principal Investigator, UAS Traffic Management
Manager, Safe Autonomous System Operations Project

Parimal.H.Kopardekar@nasa.gov



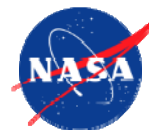
Civilian Applications



Applications

- Public safety: search and rescue
- Firefighting
- Disaster relief
- Media
- Precision agriculture
- Deliveries

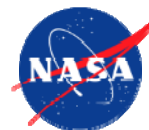




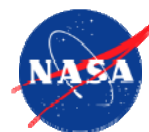
Applications

- Science missions
- Inspection: Rail, power lines, etc.
- Humanitarian
- Science



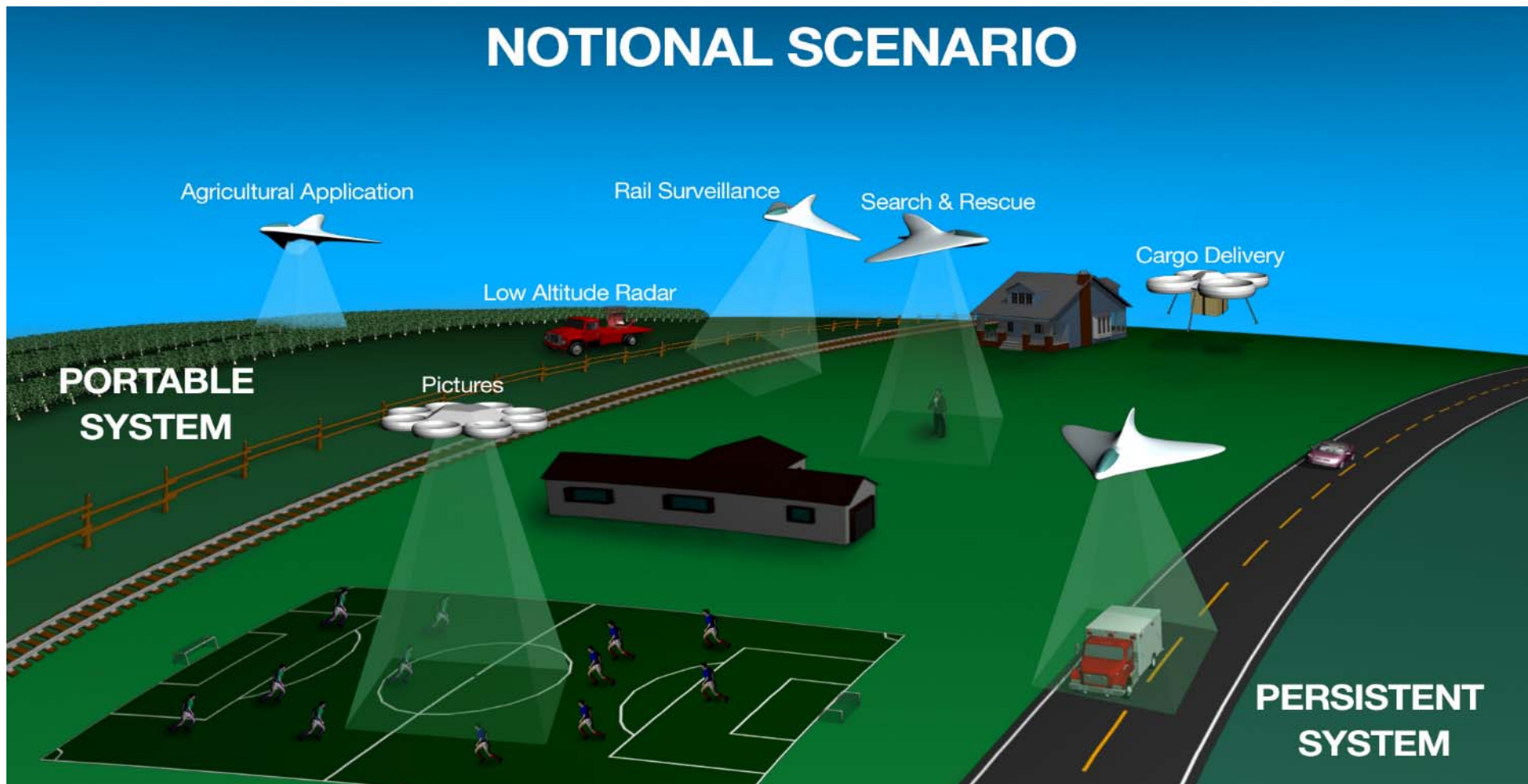


Missing Link: Safe and secure integration

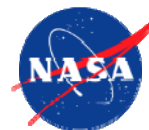


Unmanned Aerial System Applications

NOTIONAL SCENARIO



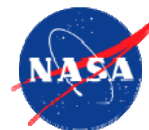
- **Near-term Goal** – Enable initial low-altitude airspace and UAS operations with demonstrated safety as early as possible, within 5 years
- **Long-term Goal** – Accommodate increased UAS operations with highest safety, efficiency, and capacity as much autonomously as possible (10-15 years)



UTM Design Functionality

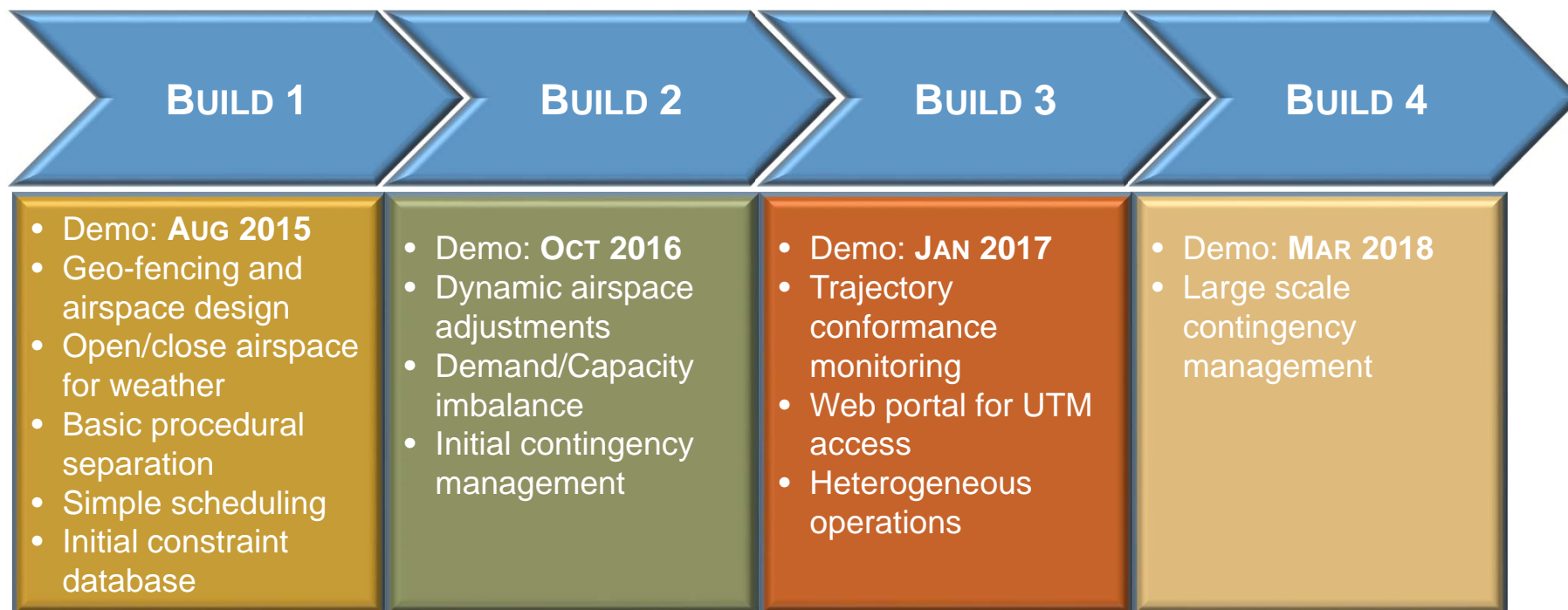
- Cloud-based architecture
- UAS operations will be safer if a UTM system is available to support the functions associated with
 - Airspace management and geo-fencing
 - Weather and severe wind integration
 - Predict and manage congestion
 - Terrain and man-made objects database and avoidance
 - Maintain safe separation
 - Allow only authenticated operations

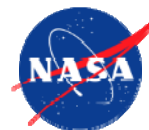
- Analogy: Self driving or person driving a car does not eliminate roads, traffic lights, and rules
- Missing: Infrastructure to support operations at lower altitudes



Schedule

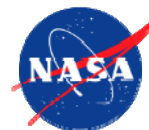
- UTM research and development driven by various “Builds”
- Each Build adds more services and capabilities



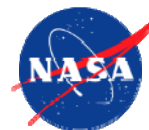


Protecting Airports, Key Assets, and Homeland





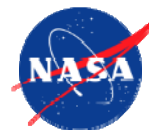
Business Models



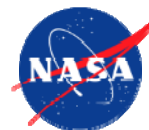
Consideration of Business Models

- Single service provider: government entity
- Single service provider: non-government entity
- Multiple service providers: state/local government entities
 - Need to be connected and compatible
- Multiple service providers: non-government entities
 - Need to be connected and compatible

Regulator has a key role in certifying UTM system and operations



Opportunity: Vehicles Assessments



NuSTAR: Idea under consideration

- National UAS Standardized Testing and Recording (NuSTAR)
- Parallel: Underwriter's Laboratory, Consumer Reports, JD Powers
- Credible test bed and scenarios
 - Urban, rural, atmospheric conditions (e.g., fog, smog, rain, wind)
 - Simulated pets
- Data oriented rating, acceptance, and assurance
- Support UAS manufacturers, consumers, FAA, insurance companies, and public at large through objective assessments
- Initial feedback from industry members has been positive

SAVE THE DATE

UAS Traffic Management (UTM) Convention **July 28-30, 2015** **NASA Ames Research Center**

We are entering a new era of aviation where unmanned aerial systems (UAS) will be used for new commercial and civil applications. UASs will be remotely piloted and fully autonomous. Their safe and effective integration into the national airspace is a critical requirement for achieving their true potential.

Join NASA in exploring the future direction of these unmanned systems and how technology and policies can keep pace with these emerging opportunities. This three-day convention aims to bring together a broad audience of government and civilian representatives, industry, and academia to discuss, understand, and define the UAS impact and challenges ahead.

Convention Themes

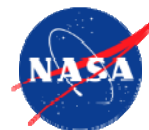
- Discuss policy issues, including privacy, safety, and security
- Examine strategies for low-altitude traffic management
- Learn about different autonomous aircraft platforms and future technology needs
- Identify future markets and missions for UAS operations.

Collaborative Format

Through keynote and plenary addresses, participants will gain an appreciation of what industry and authorities need for future integration of unmanned flight systems. Invited speakers will provide a vision of the possible, and breakout sessions will offer time to share requirements, opportunities, challenges, and solutions. In addition, NASA will host an open forum where experts can exchange ideas, and public comment will help define future goals to ensure UAS safety and acceptance into everyday applications. Exhibit space will be available, and demonstrations will showcase current UAS technology capabilities to attendees.

Audience

- Those exploring UASs for commercial and public service opportunities
- UAS technology suppliers and developers
- UAS operators
- Local, state, and federal entities
- Insurance companies and authorities
- Venture capitalists
- Researchers from government and academia
- Any interested members of the general public



Summary

- Many economic opportunities
- Applications and use
- Airspace management support
- Portable and persistent system
- Homeland protection
- Vehicle testing