

# GNSS Aviation Applications

UN/China/ESA Training on the  
Use and Application of GNSS

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# Aviation Navigation Evolution

- **International Civil Aviation Organization (ICAO) Structure For Future Air Navigation Is Global Navigation Satellite System (GNSS) Capability**
- **Components Of GNSS:**
  - Satellite Position, Velocity, and Time Constellation(s)
    - Global Positioning Systems (GPS), U.S. - Operational
    - GLONASS, Russian Federation - Not Operationally Usable
    - Galileo, European Union - Not Operational
  - Augmentation Systems
    - Aircraft Based Augmentation Systems (ABAS)
    - Satellite Based Augmentation Systems (SBAS)
    - Ground Based Augmentation Systems (GBAS)
    - GNSS Regional Augmentation Systems (GRAS)



# GNSS

- **Using GPS Today, Immediate Implementation Of GNSS In Aviation Is Possible**
  - Performance Based Operations: Utilizing All GNSS Capabilities Of The Aircraft To The Fullest Extent Possible
  - Area Navigation (RNAV): Flying Efficient Direct Routings
  - Instrument Approaches To All Runway Ends Without The Need For Most the Ground Navigation Equipment
    - Non-precision Only. No Vertical Guidance
    - High End Aircraft Can Provide Vertical Guidance Through Aircraft Based Barometric-Vertical Navigation (VNAV)
  - GNSS Based Required Navigation Performance (RNP)
    - Precise Navigation Capability
    - Permits Efficient Operations In Terrain Constrained Or Congested Airspace



# GNSS In United States

- **U.S. Has Approved Use of GPS For Aircraft Navigation For Over A Decade**
- **FAA GNSS Activities**
  - Participates In Management Of GPS To Insure Aviation Requirements Are Sustained
  - Working With Other U.S. Federal Government Agencies To Insure Modernization of GPS Improves Aviation Capabilities
  - Implementing RNP
  - Commissioned the FAA's GNSS SBAS
    - Wide Area Augmentation System (WAAS)
  - Continuing Development Of the GNSS GBAS
    - Local Area Augmentation System (LAAS)
  - Committed To Performance Based National Airspace System



# Moving To a Performance Based NAS

- **FAA's Goal Is To Design An Integrated, Performance Based National Airspace System That Can Meet The Needs Of Tomorrow And Satisfy ICAO's Vision Of A Safe, Secure, And Seamless International Air Transportation System**



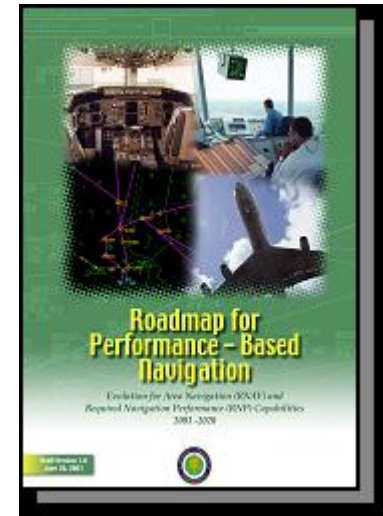
# What Is “Performance-Based” Navigation?

- **An End-to-End Air Transportation System Based On Performance Standards Rather Than Specific Technologies Or Equipment**
  - Area Navigation (RNAV)
  - Required Navigation Performance (RNP)
- **Recognizes The Ability Of Modern Aircraft To Operate Safely And Efficiently Using A Variety Of On-Board Systems and External Signals**



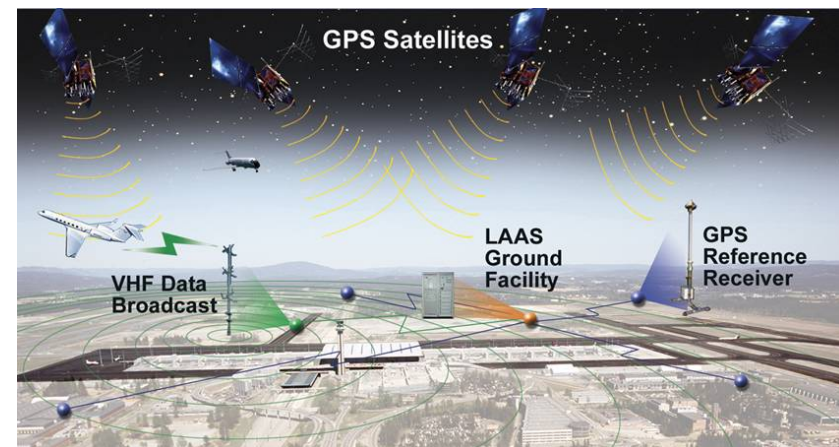
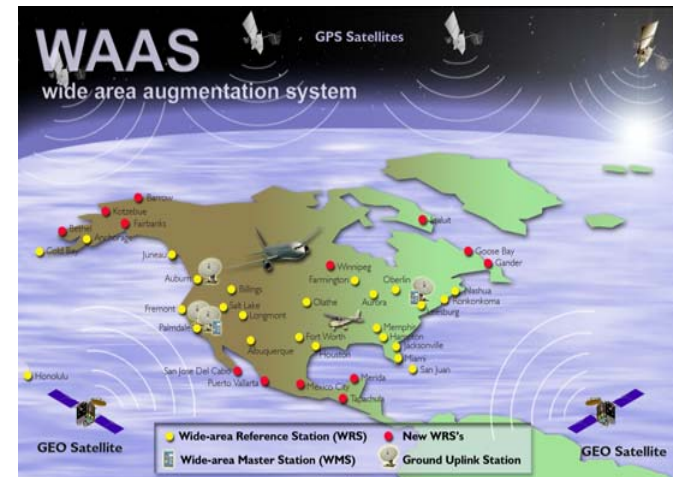
# FAA Roadmap for Performance-Based Navigation

- **Divided into three planning periods**
  - Near-term 2003 to 2006
    - Implementation of public RNAV and RNP procedures in all phases of flight
    - Development of enabling criteria and guidance for more advanced RNAV and RNP operations
  - Mid-term 2007 to 2012
    - RNAV becomes the predominant means of navigation in the NAS
    - Removal of some ground-based navaids as a result of increasing number of RNP procedures
    - Advanced navigation capability enables improvements in airspace design based on applicable route spacing, separation minima, new sectors and terminal airspace structures
  - Far-term 2013 to 2020
    - Application of RNP becomes mandatory in some airspace
    - Significant capacity and efficiency gains through airspace restructuring
    - Minimal operational network of ground-based navaids used as a backup



# FAA Satellite Navigation Programs

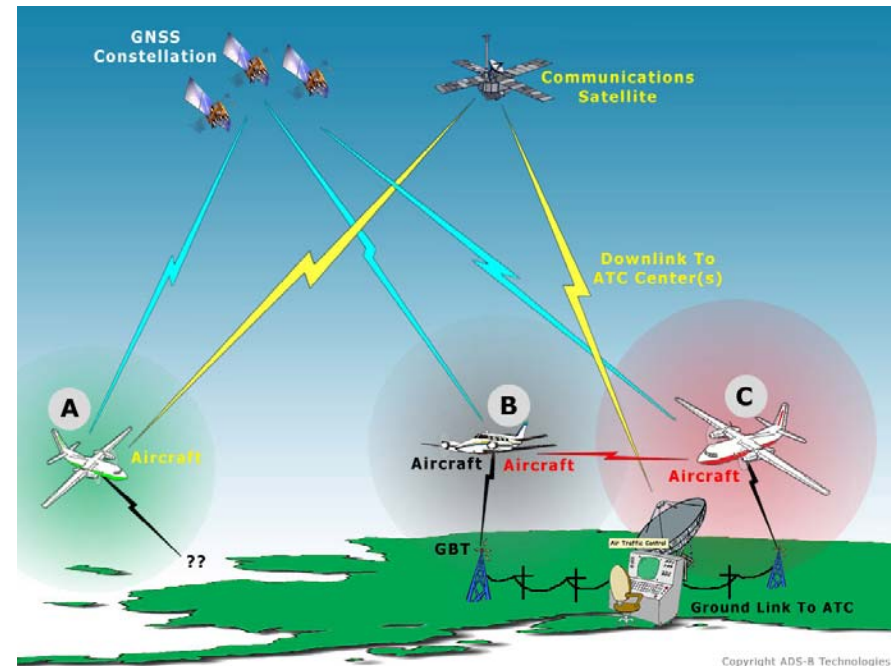
- **Stand-alone Global Positioning System (GPS) with Certified Avionics**
- **Augmented GPS**
  - FAA's Wide Area Augmentation System (WAAS)
  - FAA's Local Area Augmentation System (LAAS)



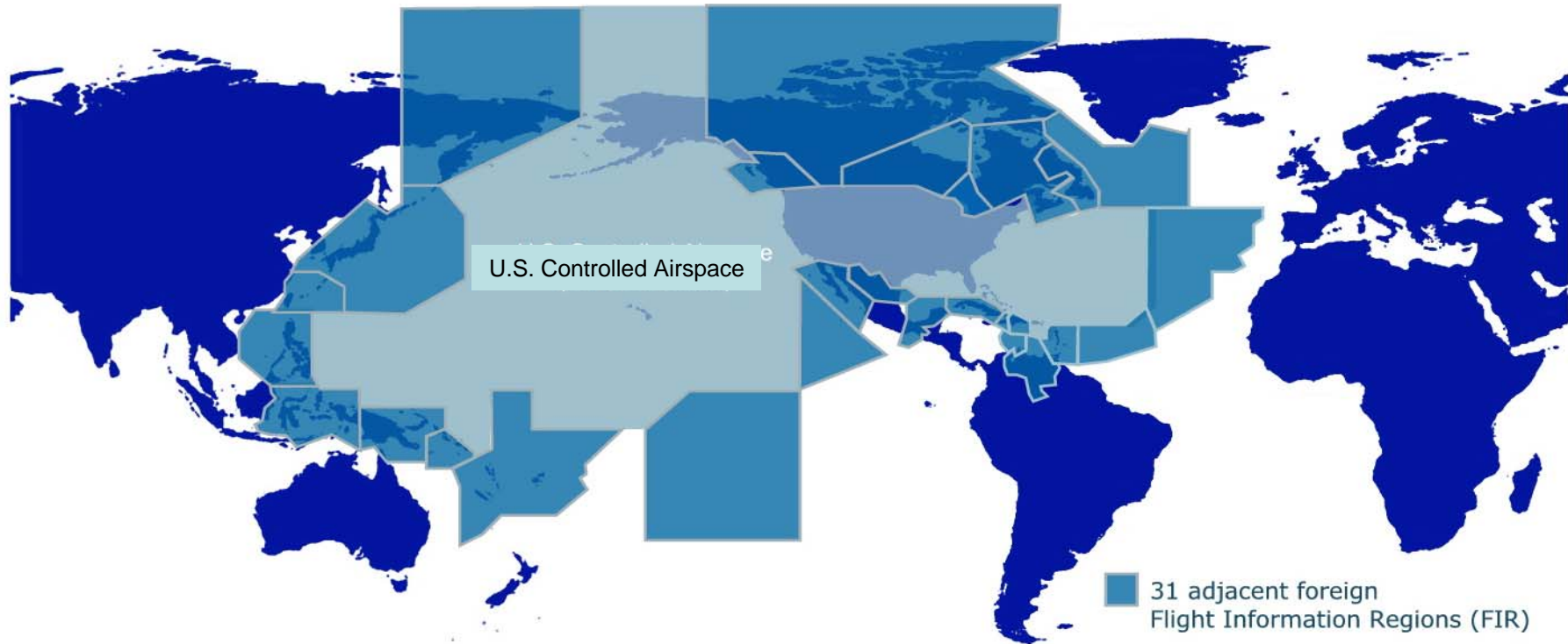


# Automatic Dependent Surveillance (ADS-B)

- **Safety Benefits**
  - Improved situational awareness both in the aircraft and ATC
  - Reduced runway incursions through the use of surface surveillance and navigation
  - Search and rescue
  - New services in non-radar airspace enabling access to airports
- **Operational Efficiency/Capacity Benefits**
  - Higher air traffic throughput due to reduced separation
  - Optimized flight levels and routes
  - More efficient airline dispatch and control



# Int'l Cooperation... A Necessity



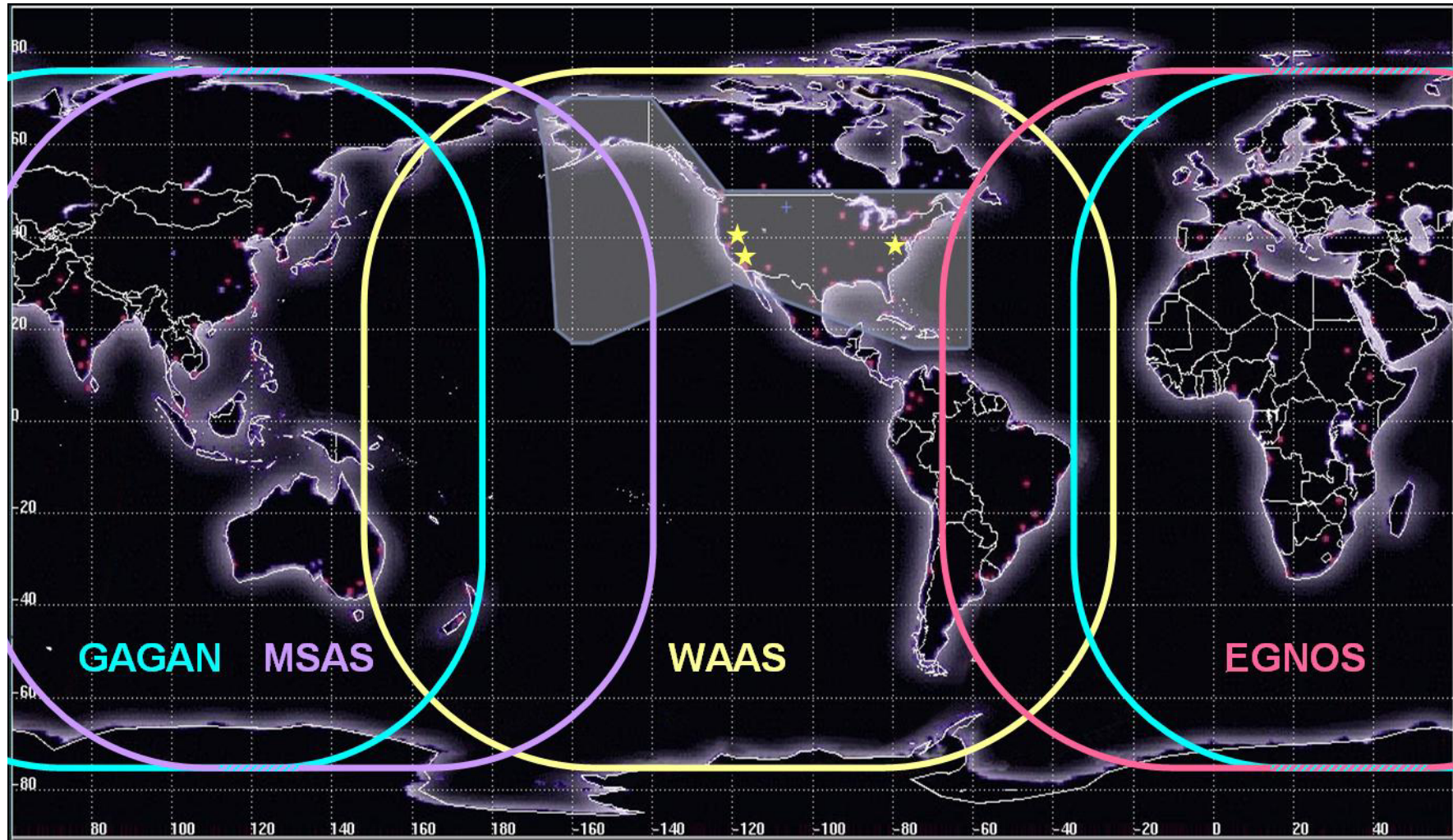
- **U.S. Assigned Airspace Equals 77 million Square Kilometers**



# GPS Aviation Ops Approvals



# International SBAS Coverage



# Backup Slides

## Additional GNSS-Based Applications



Federal Aviation  
Administration



# GNSS Location Based Services

- **Cargo Fleet Tracking**
  - Improves safety and security
- **Fleet Control/Dispatch**
  - Fuel savings
  - Improves asset management
- **Emergency Operations**
  - Reduces response times
  - Reduces injury & property loss
- **Road Maintenance**
- **In Vehicle Navigation**
  - Accurate position determination
  - Reduces air pollution



# GNSS Positive Train Control

- Situational Awareness
- Enhances safety
  - Reduces accidents
- Increases capacity and efficiency
  - Closer train spacing reduces investments
  - Reduces fuel consumption
- Rapid rail structure and condition mapping
  - Improves maintenance capability



# GNSS Maritime Applications

- Large ships, fishing & recreation boats
- Harbor entrance and approach
  - Regardless of visibility
- Hydrographic Survey
- Buoy Positioning, etc.





# GNSS Recreation Applications

- Explore anywhere in the world
  - Without getting lost or eaten!
- Your favorite fishing spot
  - Every time
- Try Geocaching
  - GPS treasure hunting



ESCAPE 3

## Global game of hide and seek

TOOTHPIECE, CAMERA AND... GPS!  
CRAIG MALIN reports on a zesty way to see the world

There are over 100 million geocachers in the world. They are everywhere in their own way, but they've all found a way to see the world. They've found a way to see the world without getting lost or eaten!

**HOW TO ENJOY GEOCACHING**

There are three ways to enjoy geocaching: tracking, caching, and geocaching. Tracking is when you follow a trail of caches. Caching is when you hide a cache. Geocaching is when you find a cache.

**SUNBEKA** A geocacher is discovered in a savanna landscape.

Did you know? As of this week, there were an estimated 160,620 active caches recorded in 214 countries.

