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# Technologies for Cleaner, Quieter Air Traffic Operations

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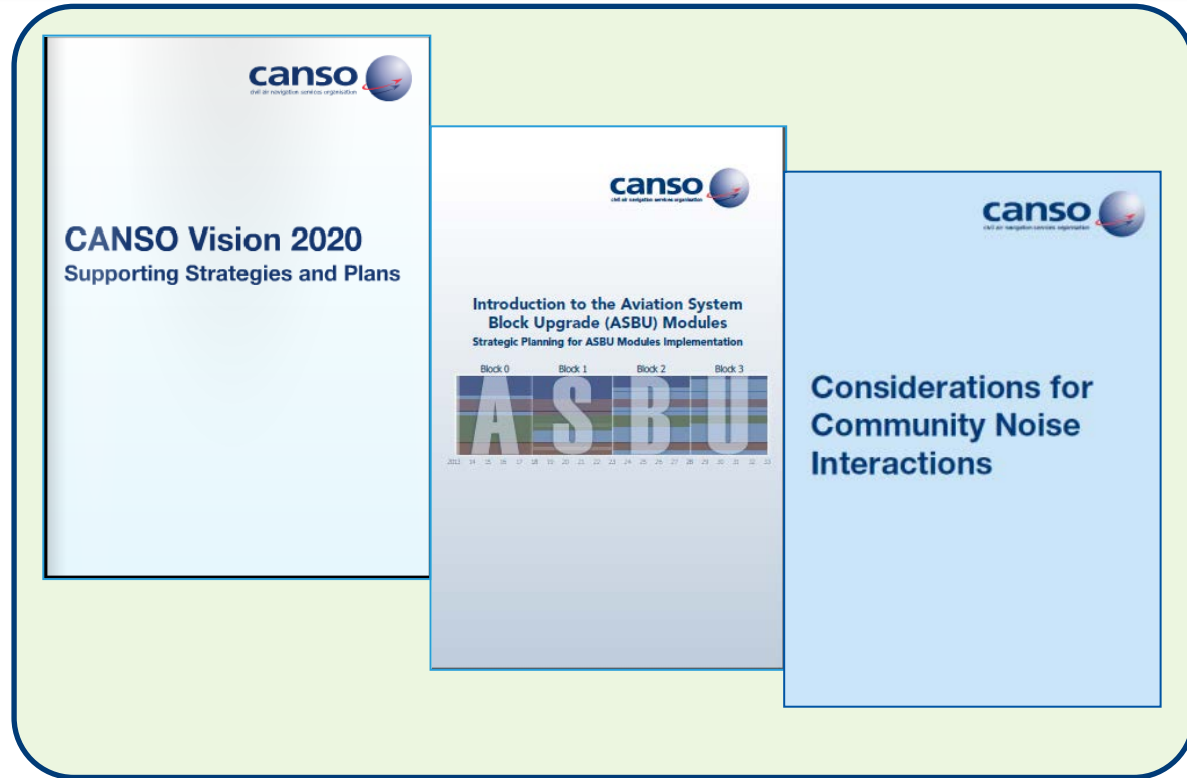
ICAO HQ, Montréal, Canada

9 – 10 SEPTEMBER 2014



## Civil Air Navigation Services Organization

- Transform global ATM performance
- Operations Standing Committee
  - Share ATM best practices
  - Help ANSPs understand ASBU
- Environment Workgroup
  - Understand and help limit aviation's environmental footprint
  - Share efficiency and noise reduction metrics/methods



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**CANSO Vision 2020**  
Supporting Strategies and Plans

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**Introduction to the Aviation System  
Block Upgrade (ASBU) Modules  
Strategic Planning for ASBU Modules Implementation**

Block 0    Block 1    Block 2    Block 3

**ASBU**

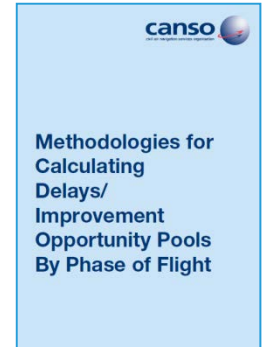
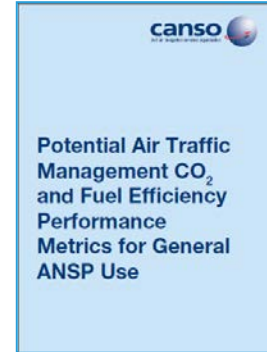
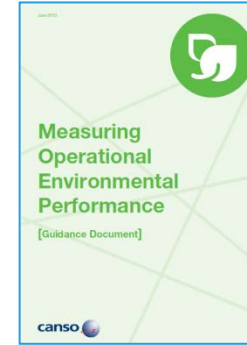
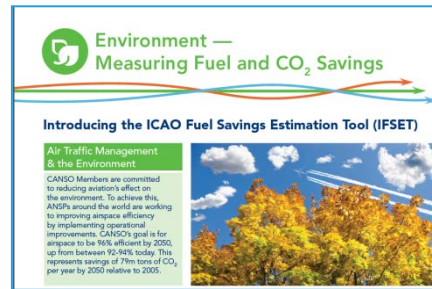
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**Considerations for  
Community Noise  
Interactions**



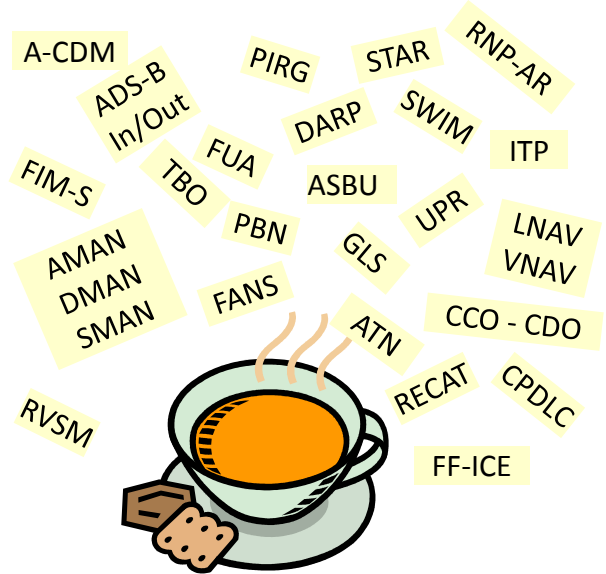
## CANSO Environment Workgroup

- Publications and activities promoting environmental stewardship
- ATM (Operational) Efficiency
- Metrics and methods to evaluate inefficiencies
- Community noise mitigation
- Best practices workshops





# The alphabet soup of Technology & Operations





# We know the objective

- Getting across the Chasm
  - Aviation System Block Upgrades
  - Existing and new technology
  - Coordination and Collaboration
    - Research, trials, integration
    - Harmonization, sharing
- New airspace/airport operations





## The future is being built

- New operations today – better use of existing technologies
  - Performance Based Navigation
  - Datalink
  - ADS-B Out/In
  - New ground automation
- New operations tomorrow
  - Advanced landing systems
  - New ADS-B Out/ In applications
  - Advanced Datalink for procedure approval coordination
  - Wide-band shared data

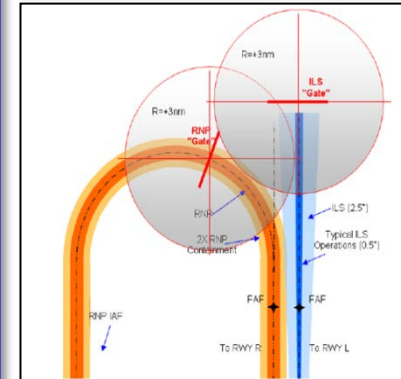
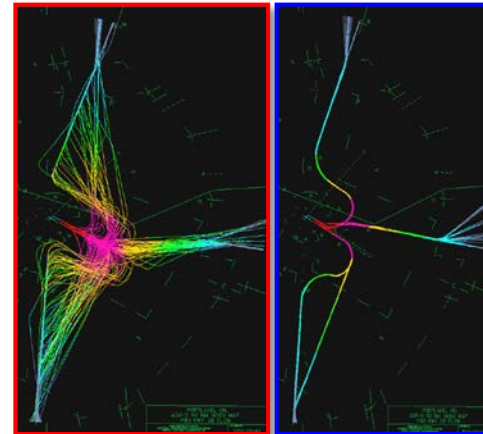
Improved Operations	<b>Airspace</b>			
	Increased efficiency RNP-based separation	Shared real-time weather information SWIM Sharing	Flight Deck Sequencing and Interval Management	Long-range Traffic Flow Management
	Reduced oceanic separation in trial procedures	Improved planning e-NOTAMS SUA availability Constraint Collaboration	Airborne reroutes via datalink	Optimal flight paths/re-routes Collaborative 4D Trajectory Optimization
	<b>Airport</b>			
	Continuous Climb Descent	RNP to xLS	Integrated Wake Vortex and capacity mgt. GLS – multi-glide slope	
	Datalink Departure Clearances	RECAT I	RECAT II	Data driven collaborative decision making
	AMAN DMAN	SMAN	Integrated AMAN/DMAN/SMAN	Data link tailored arrivals
Technology	<b>Communication &amp; Data Exchange</b>			
	Datalink FANS-2/B	Ku Band Satcom Broadband IP	Digital Voice	Datalink FANS-3/C New Datalink Capabilities
	<b>Navigation</b>			
	GLS Cat I	SBAS GLS Cat II/III	Multi Freq / Constellation GNSS	Global Cat I from Space
		On Board Real-time EVS/SVS Efficiency	Autonomous Taxi Advanced RTA	GNSS Backup System
	<b>Surveillance</b>			
ADS-B Out	Flight Deck Interval Management-Spacing	Satellite ADS-B		
ADS-B In/CDTI	Surface Indication & Alerting	Advanced ADS-B In Applications		
<b>System Wide Information</b>				
Commercial Connections	Flight Data Publications	Ku Band Satcom	Airplane Access to SWIM Ka Band Satcom	Shared Trajectory & Surveillance Info
<b>2015</b>	<b>2020</b>	<b>2025</b>		

Modified from Boeing concept for ATM evolution. Used with permission.



# Airport Operations

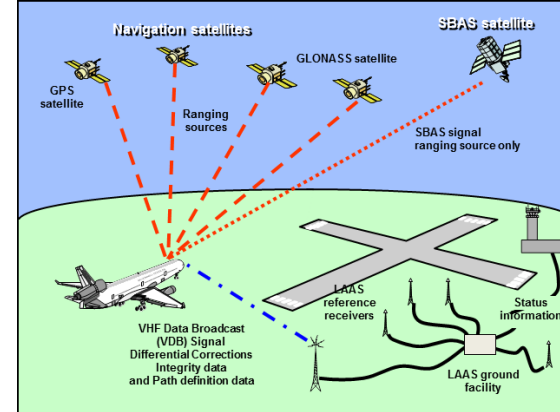
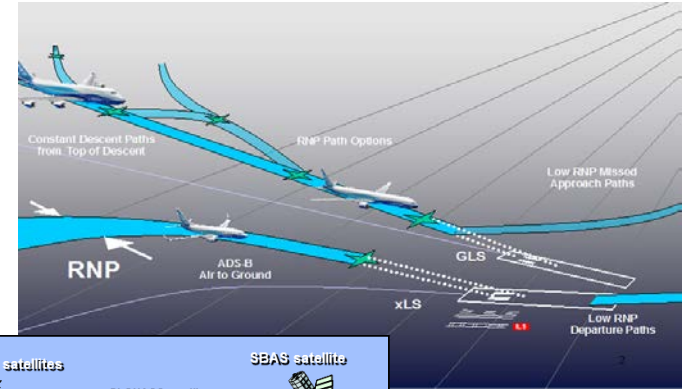
- RNAV/RNP Technology
- Improved arrival management (sequencing and spacing)
- RNP-AR (RNP-established)
- Independent precision approaches to closely spaced parallel runways
- ADS-B Out/In
- Reduced track miles/fuel burn





## Global Navigation Satellite Landing System (GLS)

- Multiple constellation capability
  - GPS, GLONASS, Galileo, BeiDou
  - New multi-mode receiver on airplanes
- SBAS/WAAS
  - Satellite Based Augmentation System
  - Wide Area Augmentation System
- GBAS/LAAS
  - Ground Based Augmentation System
  - Local Area Augmentation System
- RNP to xLS (ILS, GLS, LPV/SLS)
- GLS – Cat I, II , III

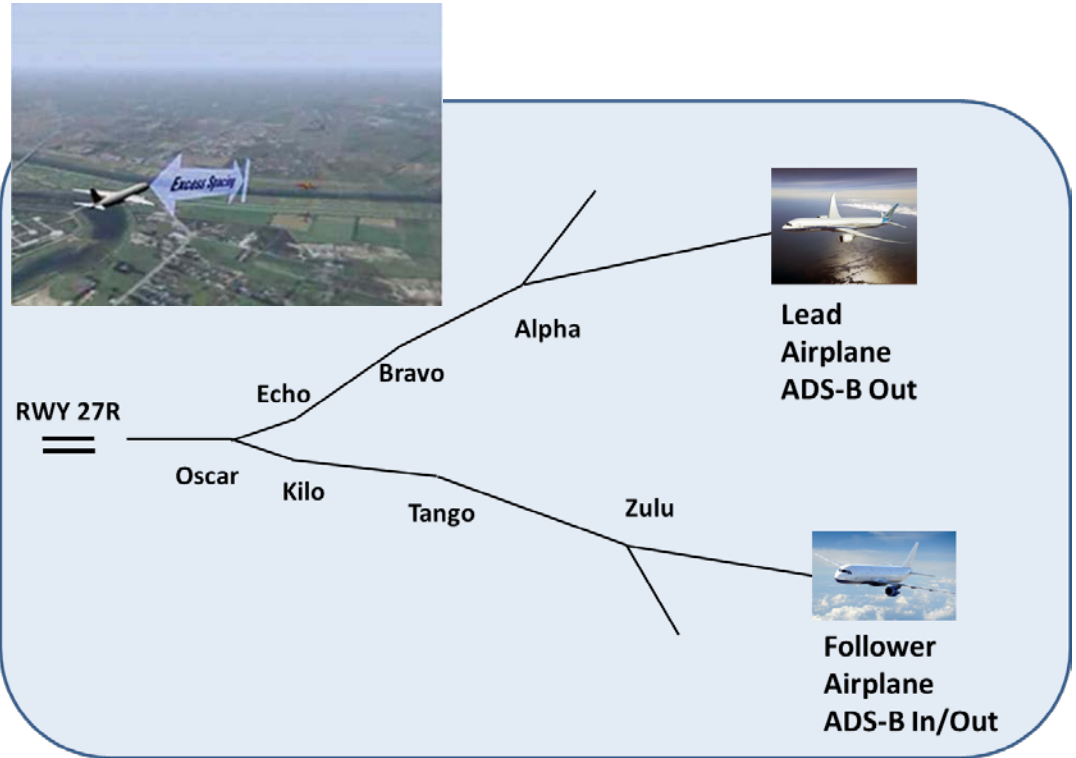






## Flight Interval Management - Spacing

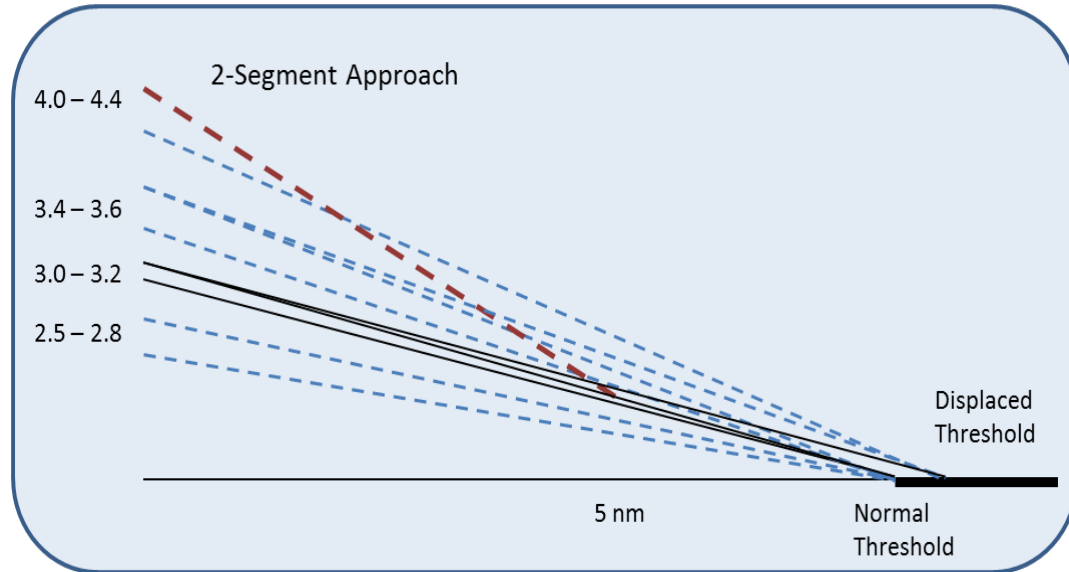
- Enhance arrival efficiency at busy airports
- Ground automation for sequencing and prediction
- Airplane Technologies:
  - ADS-B Out
  - ADS-B In
  - Flight deck displays
  - Speed control



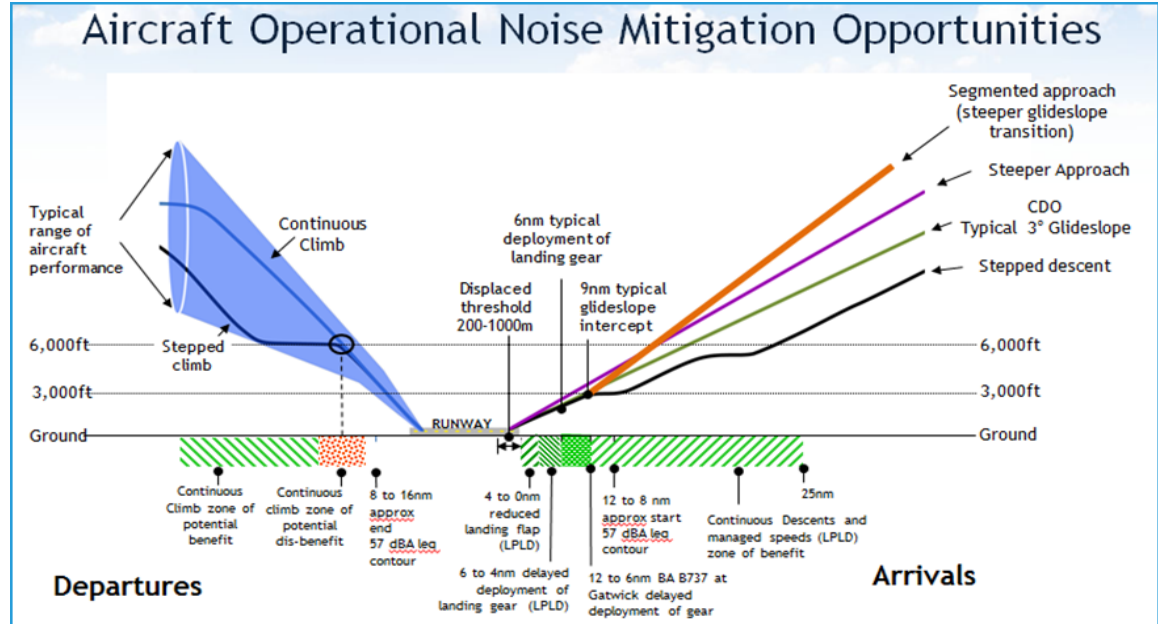
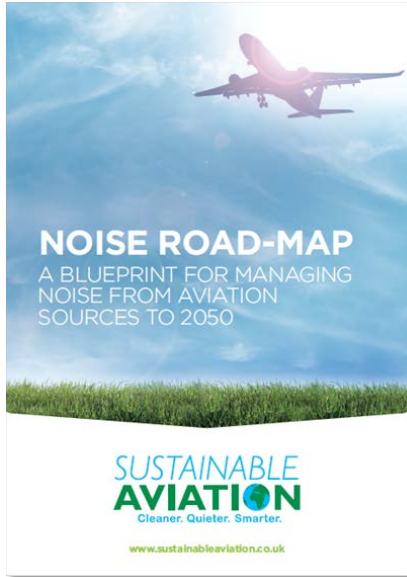


## Capacity Enhancement and Noise Reduction

- **GBAS/SBAS technology**
  - Multiple published approaches
  - Variations for hot/cold days
  - Wake vortex mitigation
    - *Parallel runways*
    - *Displaced threshold*
- **Community Noise Reduction**
  - Slightly increased descent angles
  - 2-Segment Approaches
  - Displaced Threshold



Concept derived from presentation at International GBAS Working Group 15 by Dubai Air Navigation Services (June 2014).



## Efficiency and Noise Reduction



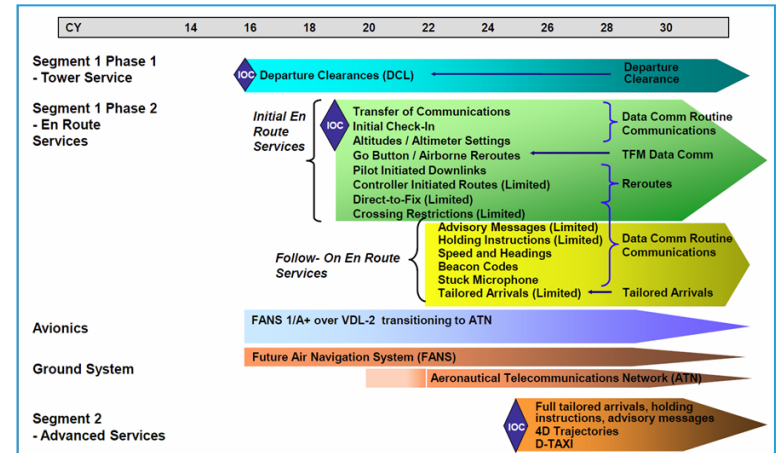
# Other Technologies/Concepts

## ➤ Advanced data link – digital data exchange

- Departure Clearance
- Weather re-routes (detailed)
- Tailored Arrival Clearance
- Trajectory coordination and updates
- Long range arrival coordination
- Airplane/airplane negotiation
- Local conditions exchange: weather, turbulence, new winds...

## ➤ Collaborative Trajectories

- Wake Vortex Surfing, (“Flying like geese”)
- Military trials, MARSAs
- Increased traffic density with significant fuel savings



FAA briefing to airlines – Air/ground Data comm.



## Collaboration for Operational Efficiency Acceleration

- Research Sharing
- Technology demonstrations
- Coordinated Trials
- Best Practices
- Fulfilling ASBU intent





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Thank you