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ADS-B via Low Earth Orbiting Satellites Benefits Assessment

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NAM/CAR ANI/WG/1
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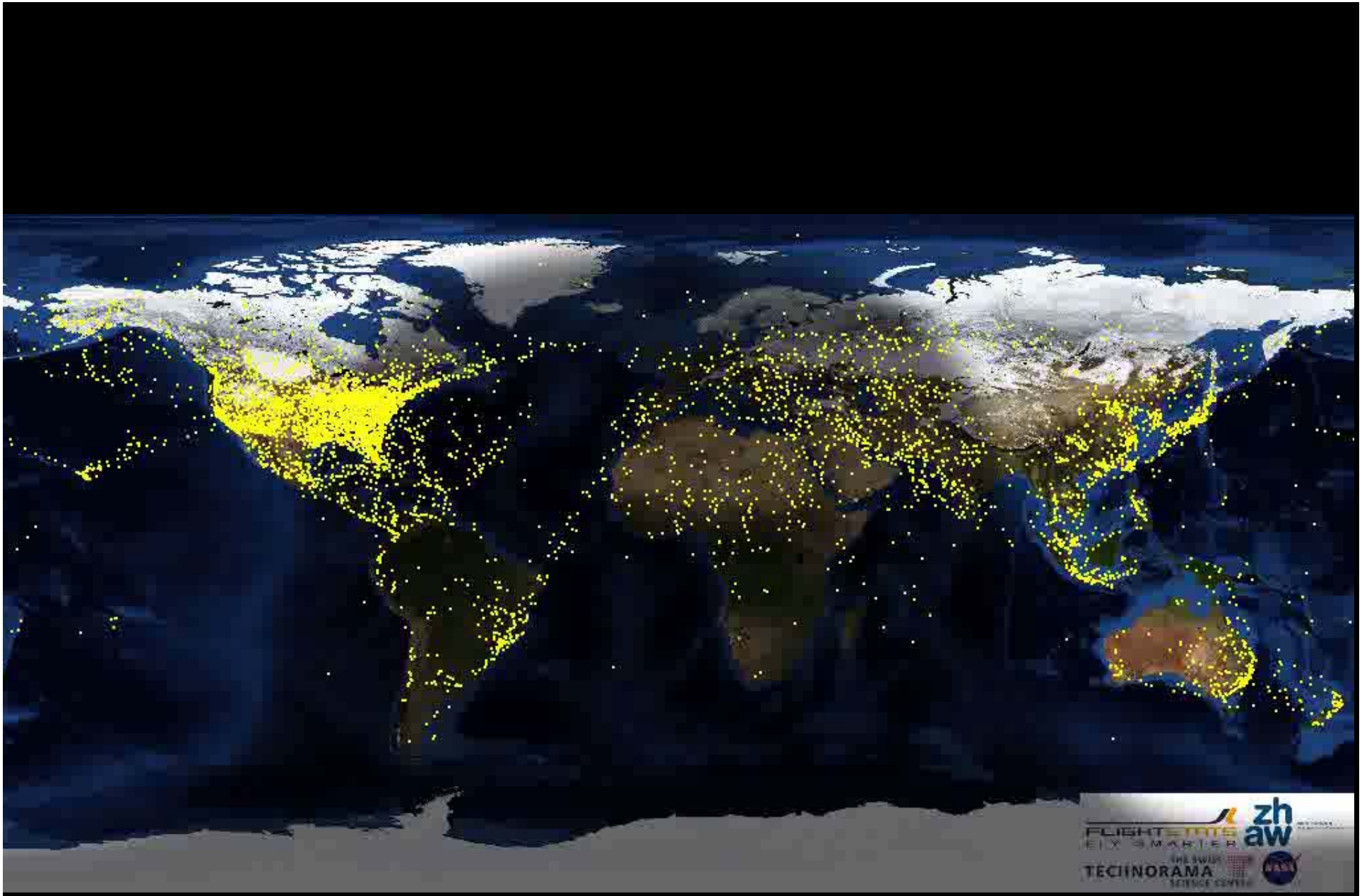
SERVING A WORLD IN MOTION

Aireon LLC is a joint venture between NAV CANADA and Iridium to finance, develop, deploy and operate a global solution for tracking and monitoring aircraft anywhere in the world by using space-based ADS-B receivers

Goal

To reduce aircraft separation minima through ADS-B (out) via global Low Earth Orbiting (LEO) Satellites



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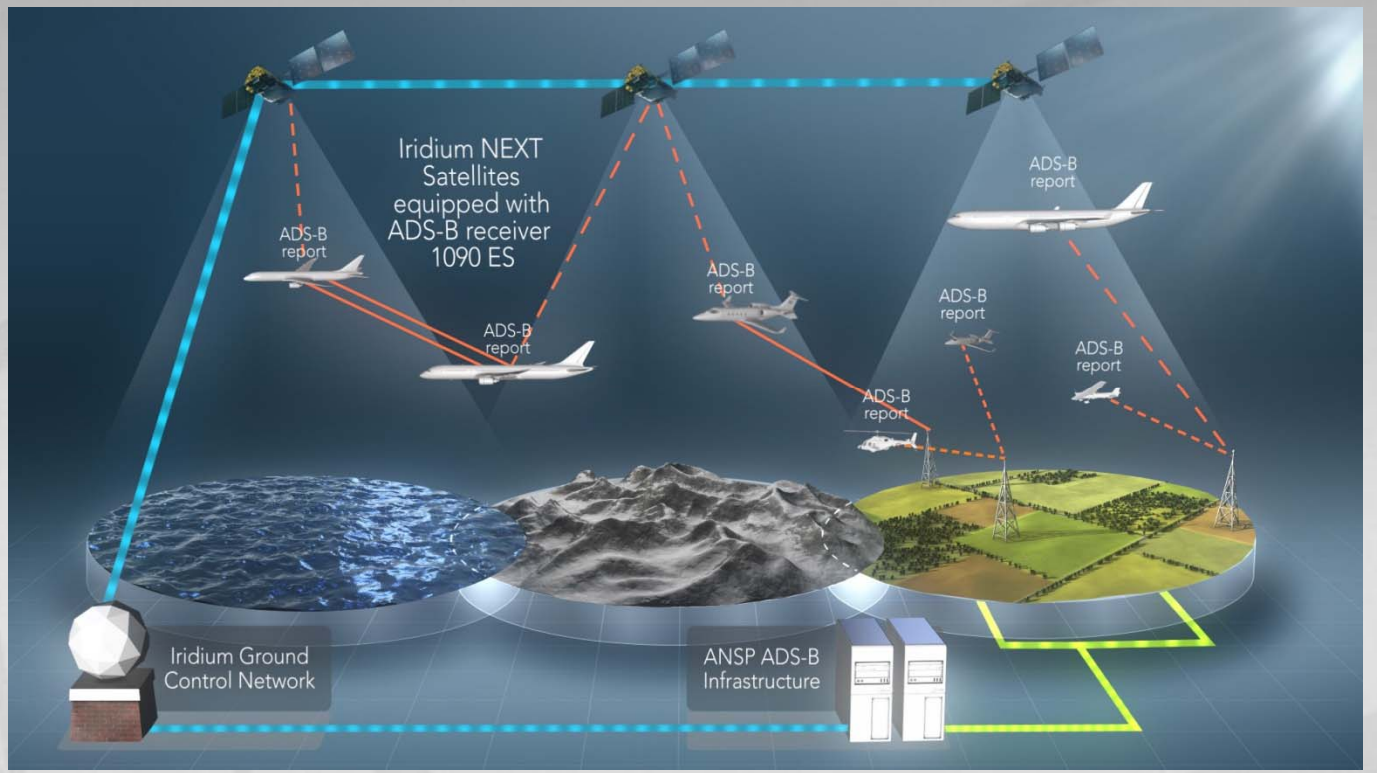
Space Based ADS-B – Concept of Operation



- Current ADS-B systems are terrestrial based, leaving oceanic and remote airspace without any ADS-B coverage
- Global space-based ADS-B can only be achieved through a low latency interlinked LEO satellite system
  - Delivers true pole-to-pole coverage, with near real-time delivery of “ADS-B Out” data
  - No additional aircraft equipage by using 1090 ES

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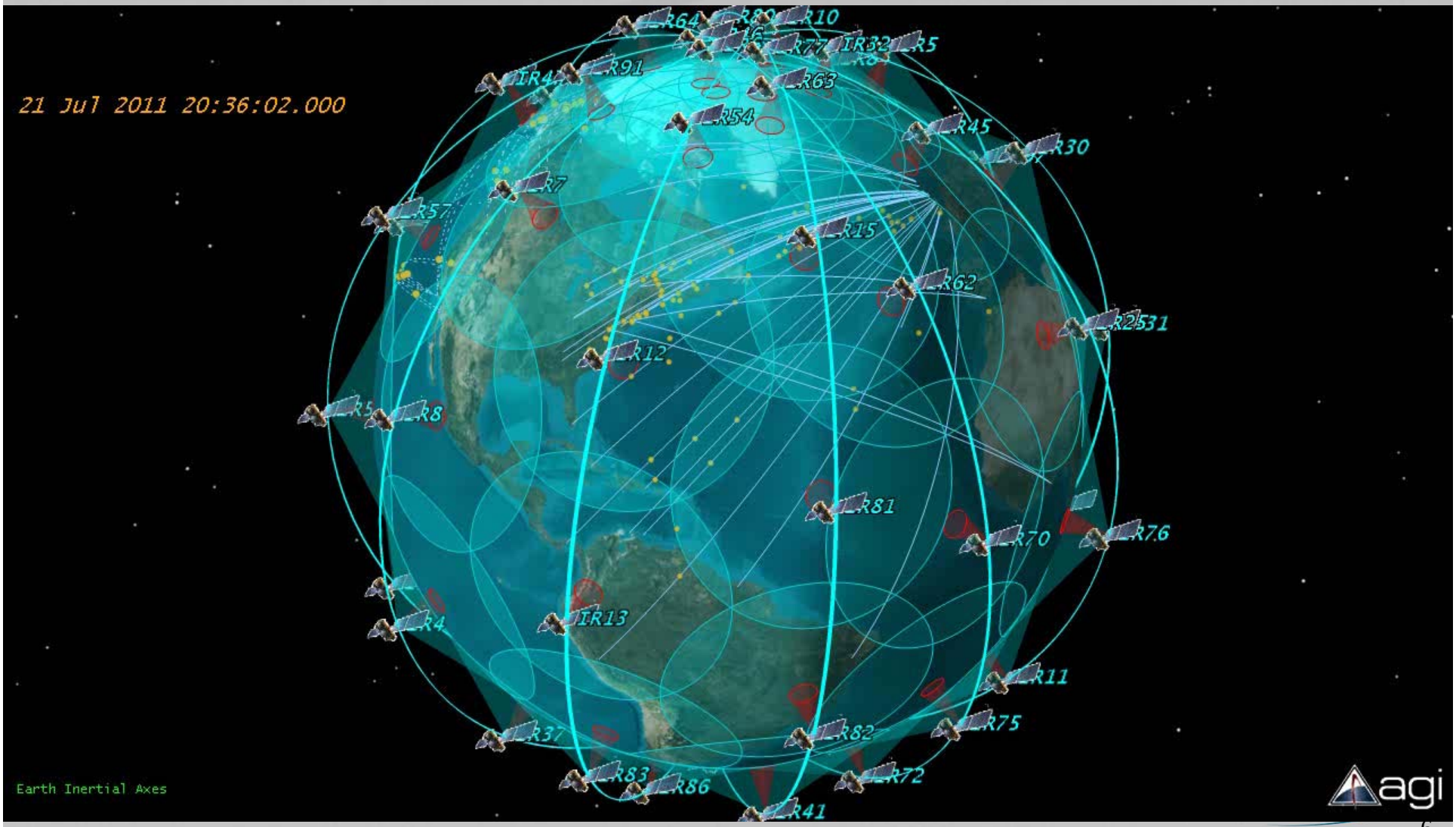
Coverage Everywhere

Space-qualified ADS-B receiver payloads will be hosted on Iridium NEXT, a constellation of 66 cross-linked LEO satellites



Initial focus on the NAT Region

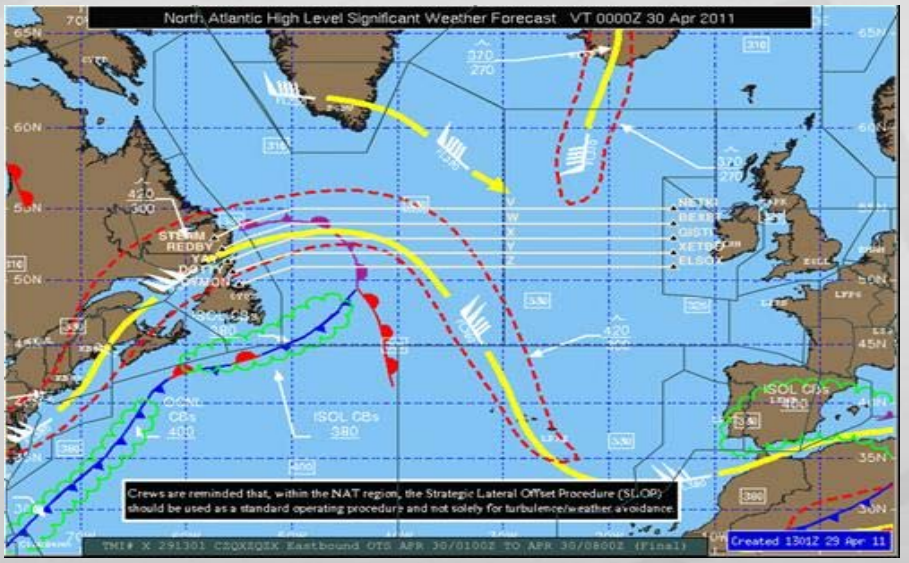
- **1,000** flights per day (1,300 peak summer day)
- **350,000** commercial flights per year
- **+23,000** military & GA flights per year

- **85%** of the flights are already ADS-B equipped
- **67%** of flights are Data Link (FANS 1/A) equipped
- **67%** are capable and use Controller Pilot Data Link Communications (CPDLC)

Oceanic Operating Environment

The current operating environment is largely structured and not flexible

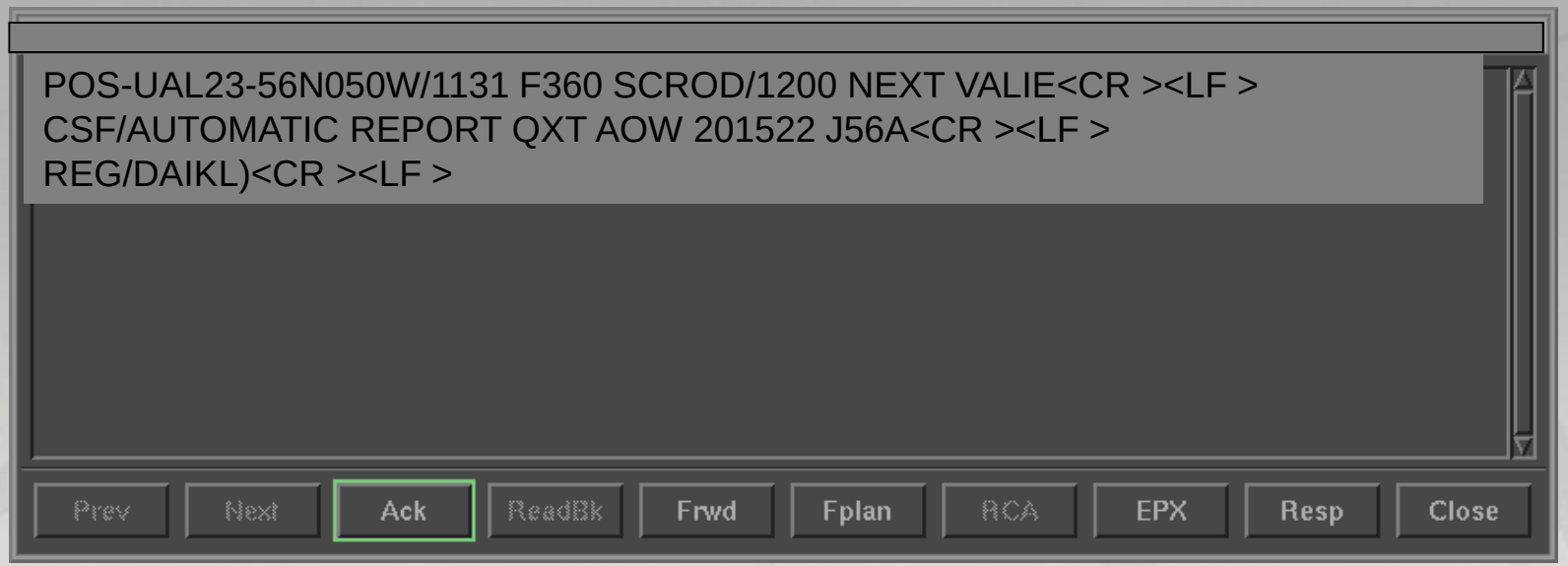
Current Track Structure



Great Circle Routes

Communications

- Presently over 60% of the flights on the NAT use CPDLC communications for clearances and change requests
- The remainder use HF voice via Flight Service Stations



Benefits of Data Link

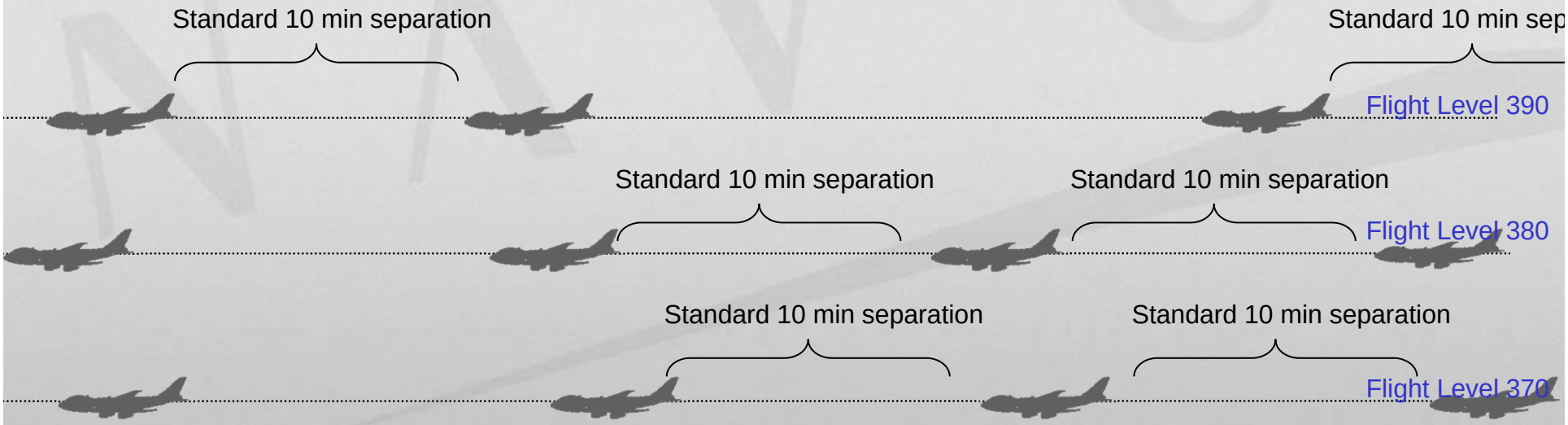
- Electronic processing is fast and accurate
- Messages are clear
- Pre-defined messages avoid ambiguity
- Aircraft avionics automatically send position reports to flight data processing systems

Surveillance and Data Link Communications Benefits

- More efficient flight levels and trajectories
- Greater flexibility in responding to changing conditions (e.g. turbulence, weather and customer schedules)
- Enhanced safety

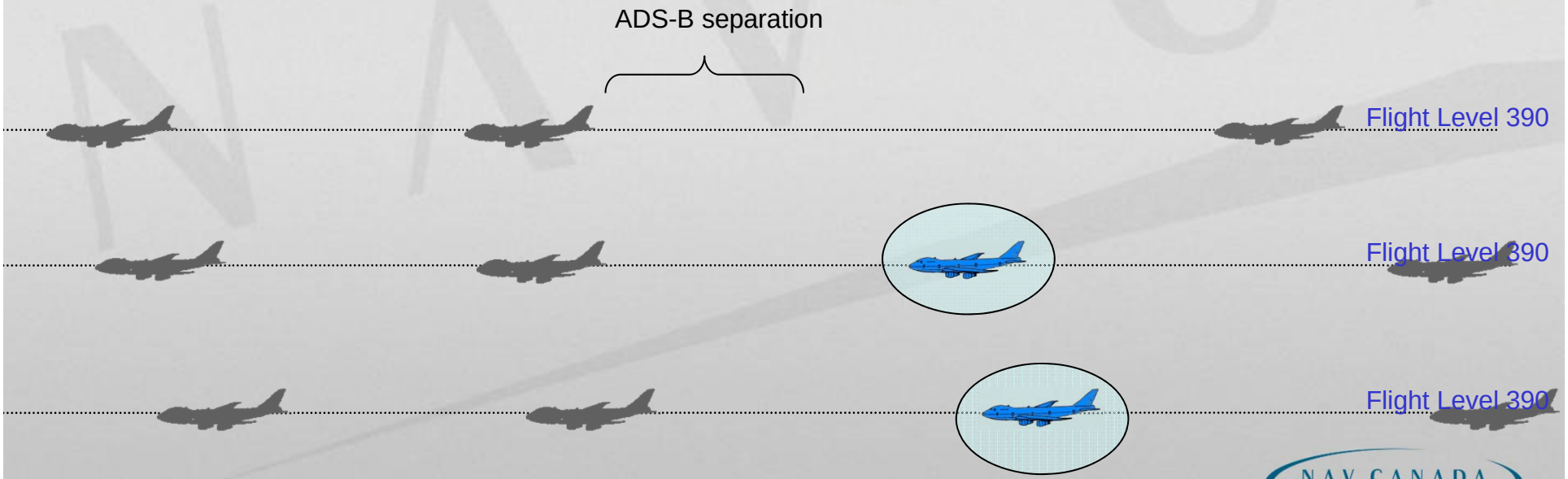
Current Flight Trajectory

The current longitudinal separation minima (10 minutes) limits the number of aircraft that can obtain a better flight level



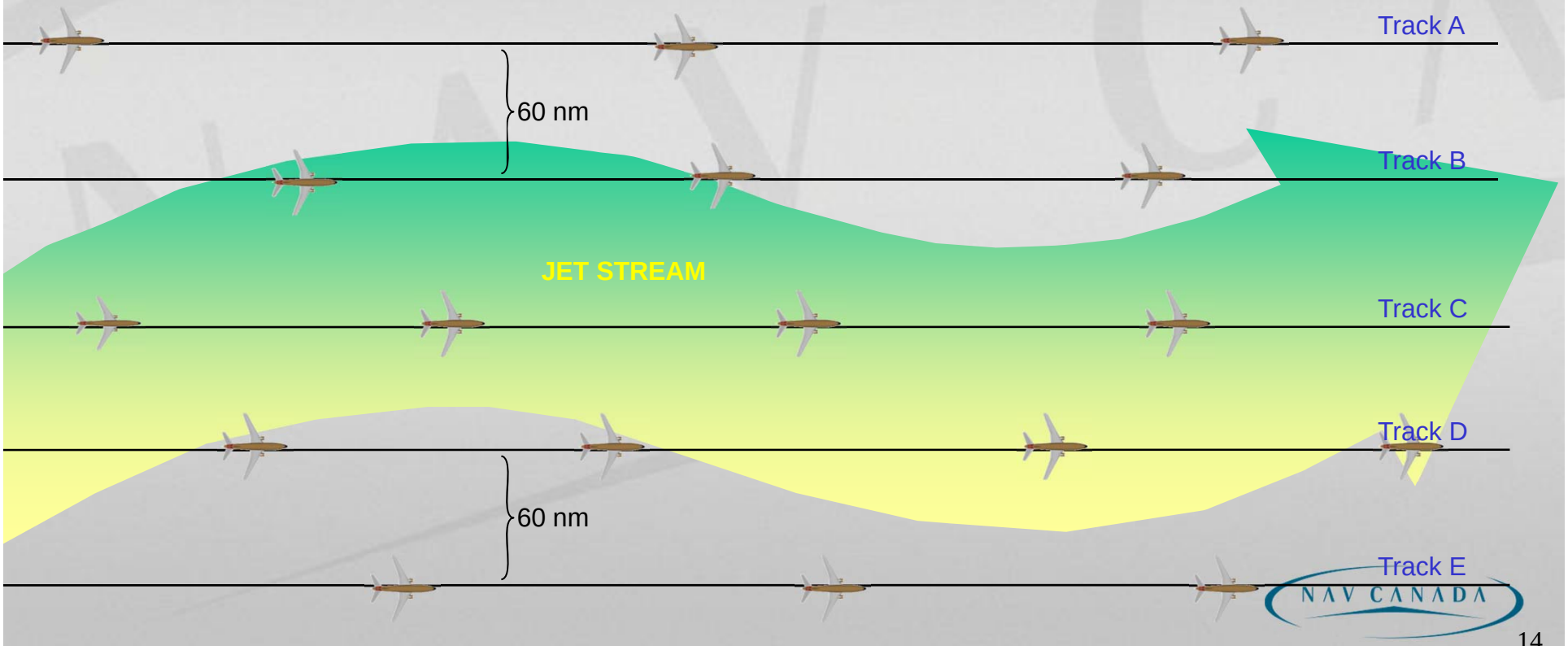
Flight Trajectory With ADS-B

ADS-B will improve the opportunities for aircraft to climb to a better flight level, resulting in fuel burn savings



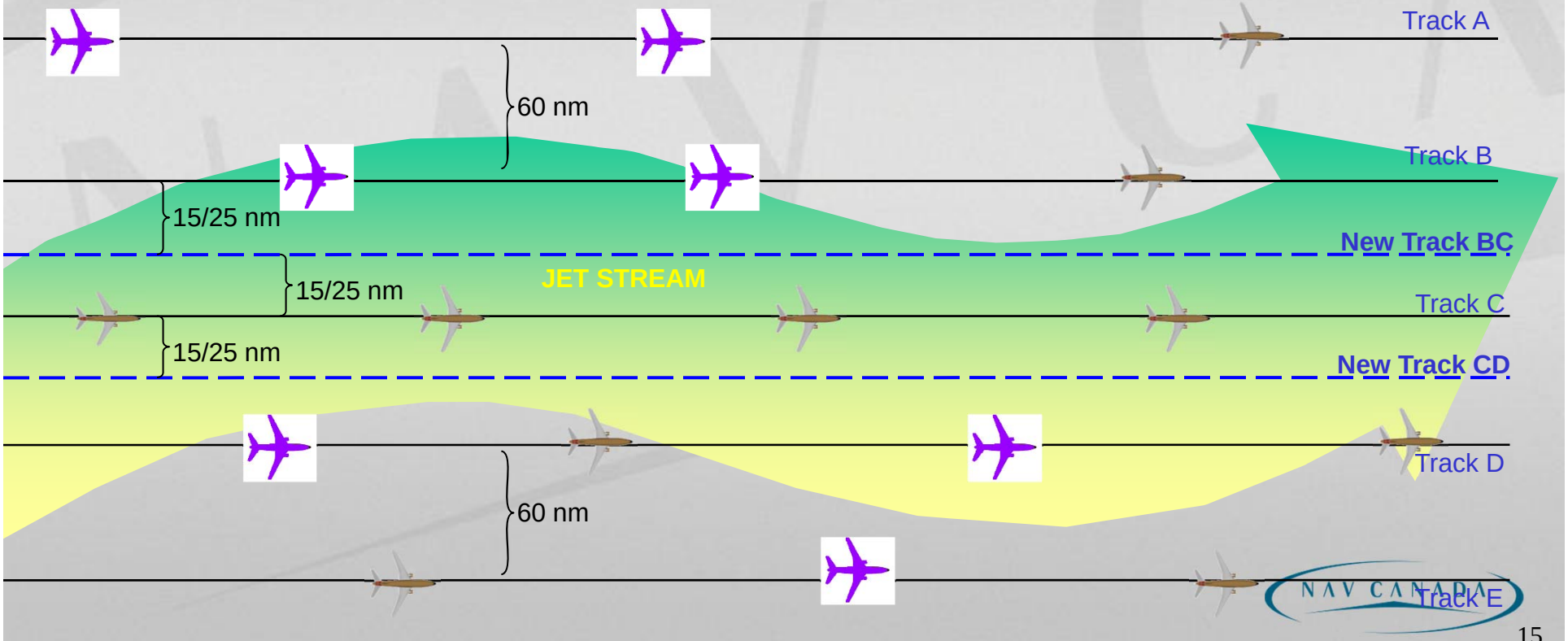
Current Routing

The current lateral separation minima (60 NM) limits the number of aircraft on the preferred wind tracks



Routing with ADS-B

ADS-B will support reduced lateral separation minima, allowing more aircraft to fly a greater portion on the better wind tracks



LEO ADS-B Benefits Assessment

Determine the 2018 (1st year) fuel burn, based on simulation of 600 flights:

1. Base Case with RLongSM & RLatSM
2. ADS-B Case: 15NM longitudinal & 30NM lateral separation
3. Compare the Base Case and ADS-B fuel results
4. Determine the net fuel savings per flight

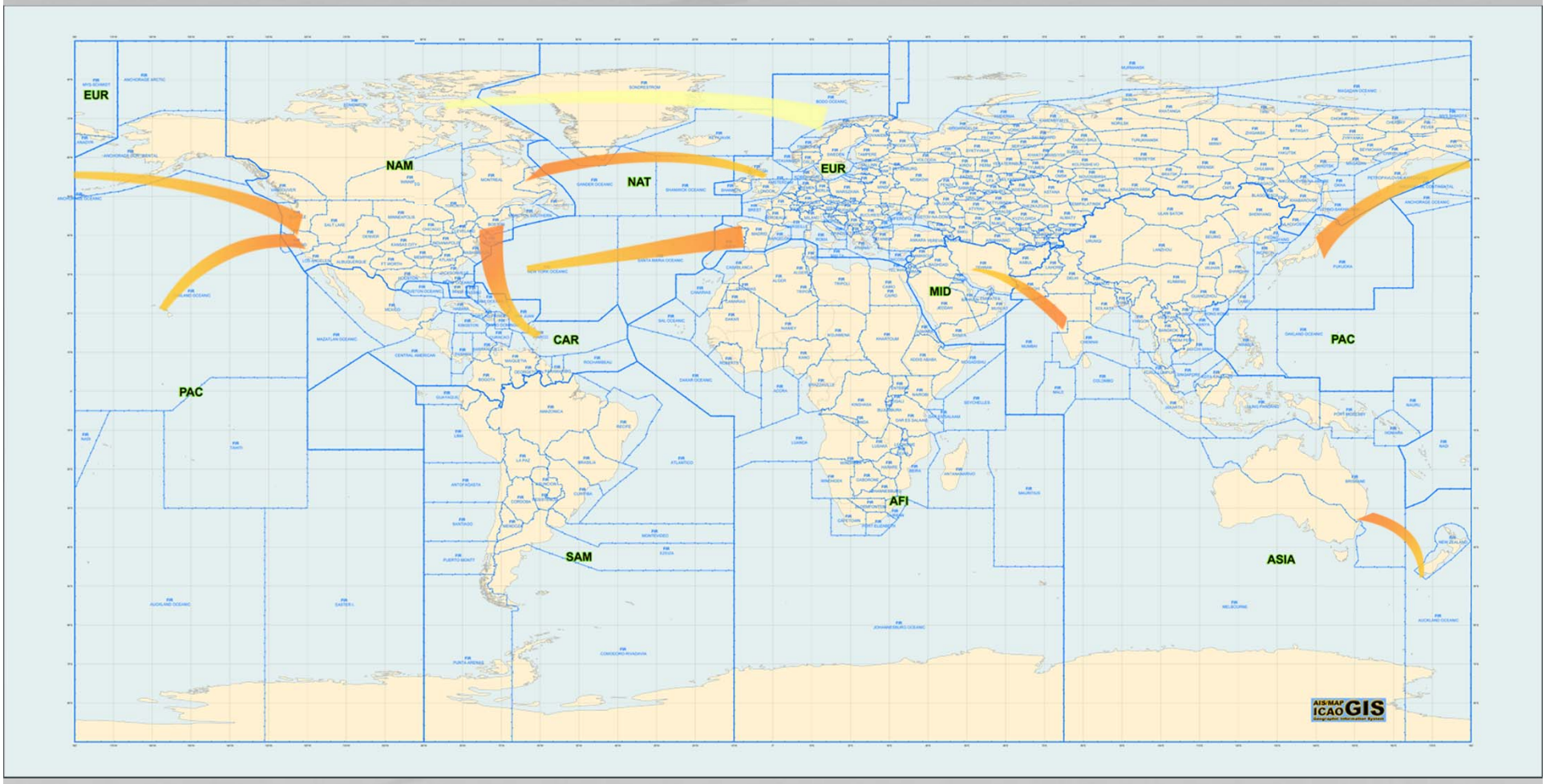
LEO ADS-B Benefits Assessment
Approach & Assumptions

- The Total Airspace and Airport Modeller (TAAM)–fast time simulation tool was used to calculate fuel
- Based on June 2012 OTS traffic
- Included wind forecasts from the National Oceanic and Atmospheric Administration (NOAA)
- 2018: all aircraft Data Link capable and 90% ADS-B
- 2018: aircraft mix adjusted to retire B747-400s , replace some B767s with 787s
- Fuel computed for Oceanic airspace only, although benefits could accrue beyond.

Annual Gander/Shanwick Benefits

- A fuel savings of 450 litres was estimated per NAT flight after a thorough and conservative assessment of ADS-B benefits. 600 flights were simulated
- Consistent with IATA members' savings from the variable speed/Flight Level ENGAGE project
- Represents less than 2% of the ocean portion of fuel for a transatlantic ADS-B flight (450/26,000 litres)
- Year one benefits estimated at $127 million for 2018

Global Oceanic ADS-B Benefits



Value for Airlines

- **Billions in Fuel Savings**
  by being allowed to climb to more optimal altitudes and use more efficient routes
- **Return on ADS-B Investment**
  with no additional aircraft equipage costs required
- **Operational Efficiencies**
  including optimized flight paths, altitudes, airspeeds and jet stream use
- **Reduced Emissions**
  through fuel consumption optimization, a key benefit in a potential cap and trade world
- **Enhanced Safety**
  by eliminating service gaps over areas with limited infrastructure or coverage
- **Global Harmonization**
  of different next-generation ATM operating procedures and systems

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Aireon ADS-B System Benefits

Safety

- ADS-B provides near real time aircraft position information
- Improves situational awareness, conflict detection and reaction/resolution
- Aircraft would have more flexibility in emergency situations
- Provides ADS-B surveillance source separate from the communications (CPDLC) network sources
- More complete and accurate reporting of aviation occurrences, allowing better management of safety risk and better support of the Safety Management System

Aireon ADS-B System Benefits

Environmental/Efficiency

- More efficient “domestic-like” flight trajectories in oceanic airspace
- More predictable airline cost planning
- Climb/Descend and vary speed to chase wind push and avoid headwinds
- Improve opposite direction and crossing traffic profiles
- Significant worldwide reductions in greenhouse gas (GHG) emissions and carbon footprint

A Strong Relationship with IATA

- International Advisory Committee being formed
  - Eight member committee (1 IATA; 4 airlines appointed by IATA; 3 ANSPs)
  - Will ensure needs of airlines and ANSPs are considered
  - Provide transparency to Aireon customers
  - Build global support for Aireon for regulatory process
  - Provide periodic briefings on program status, operational implementation, benefits analysis, pricing structures, global deployment and regulatory status
  - Enable Aireon to obtain feedback, guidance and non-binding recommendations from the Committee

Regulatory support

- States support of ICAO Air Navigation Conference Recommendation 1/9 to the Assembly which states:

Recommendation 1/9 –Space-based automatic dependent surveillance — broadcast

That ICAO:

- support the inclusion in the GANP, development and adoption of space-based automatic dependent surveillance — broadcast surveillance as a surveillance enabler;
- develop Standards and Recommended Practices and guidance material to support space-based automatic dependent surveillance — broadcast as appropriate; and
- facilitate needed interactions among stakeholders, if necessary, to support this technology.

- Canada's written commitment to support the ADS-B Space-Based initiative
- Continuous briefings on progress to other State and industry representatives on Regulatory aspect


Thank you