Space-Based VHF

NAT 2026 Vision Workshop, 24 April 2026

Andrew Yang, NAV CANADA

Serving a world in motion
navcanada.ca

NAV CANADA

Agenda

1. Concept & Context
2. How it works
3. Integration & Challenges
4. Key players & Status
5. Conclusion

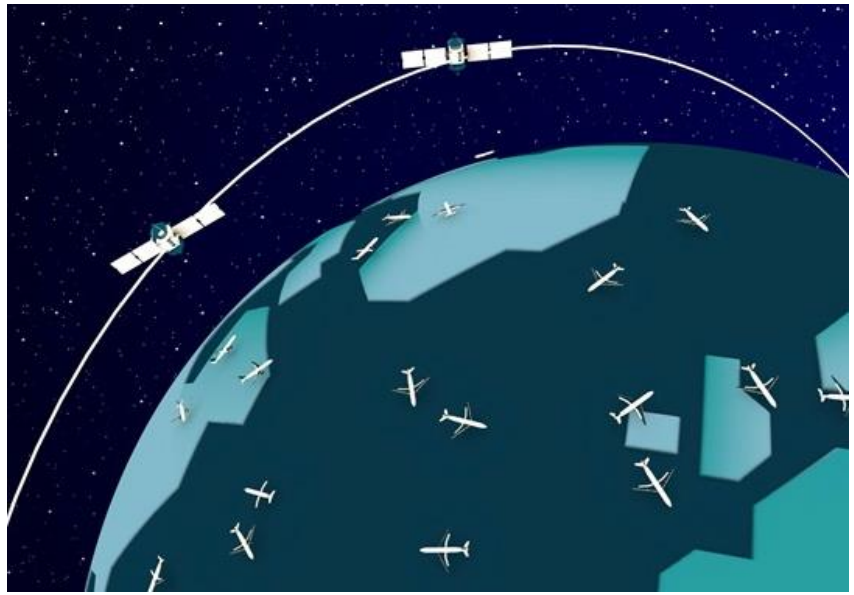
1

Concept & Context

Definition & benefits

What is SB-VHF?

- Aircraft operating in remote regions and oceanic areas will communicate with ATS using a satellite network.
- Aircraft and satellites will communicate on the aeronautical VHF band.
- Includes VHF voice (AM) and VHF data (VDLm2).



What are the benefits?

- Support ATM & flight ops by complementing space-based ADS-B (SB-ADS-B).
- May be able to minimize separation between aircraft where desired and improve overall traffic capacity.
- May be able to Improve aircraft efficiency by maximising use of preferred routes, reducing time, fuel, and CO2 emissions.
- Use existing aircraft radios without any modification.
- Could allow for reduced HF equipage for aircraft.

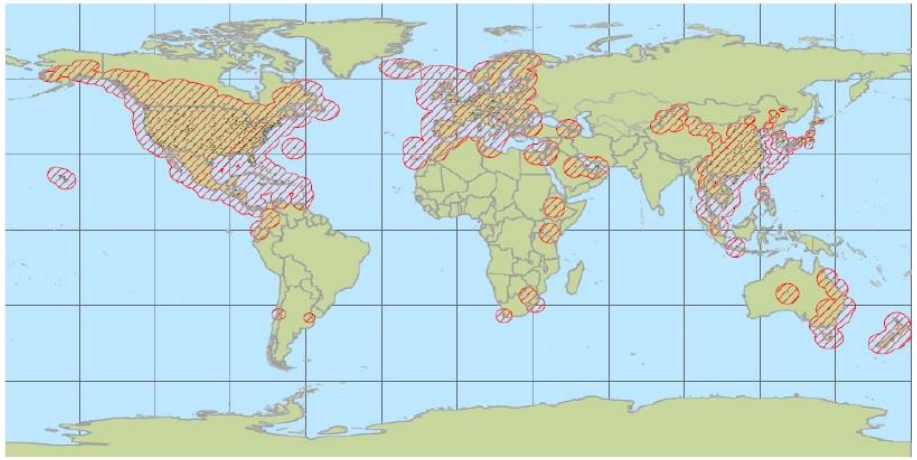
Limitations of terrestrial VHF

NAV CANADA's voice VHF coverage:

- Most of Canada, including remote regions.
- Very limited in oceanic areas.

Global data VHF (VDLm2) coverage:

- Provided by SITA and Collins (ARINC).
- Very limited in remote regions.
- Very limited in oceanic areas.
- ACARS - slightly better coverage.



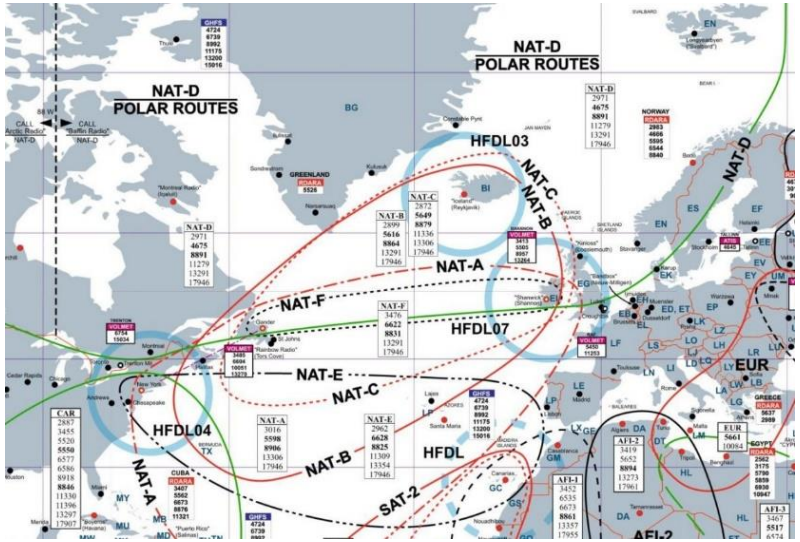
Limitations of existing long-range systems

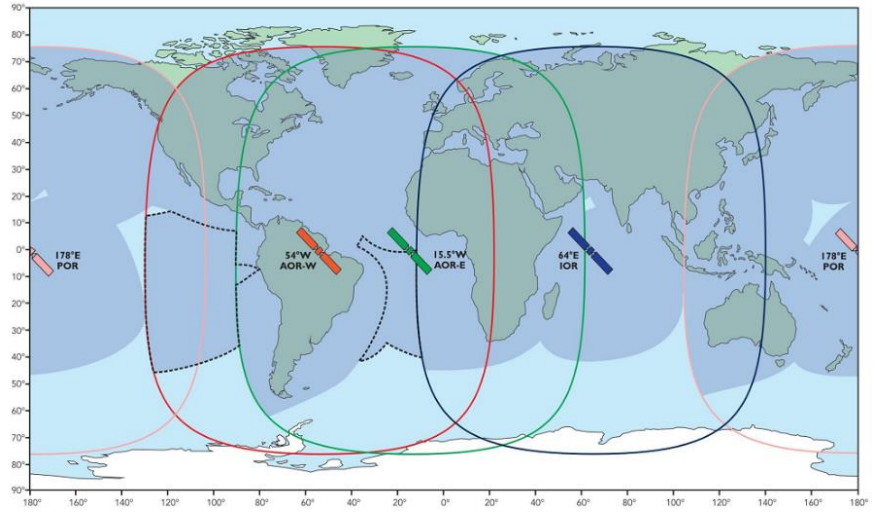
Long-range systems:

- HF voice (2.85 – 23.25 MHz).
- Satellite voice (L-band).
- HF data for ACARS (too congested & slow for aviation)
- Satellite data for Controller–Pilot Data Link Communications (CPDLC).

Common limitation:

- Not meeting performance requirements for reduced aircraft separation.
  - Data latency
  - Voice call delay





2

How it works

System concept

Coverage:

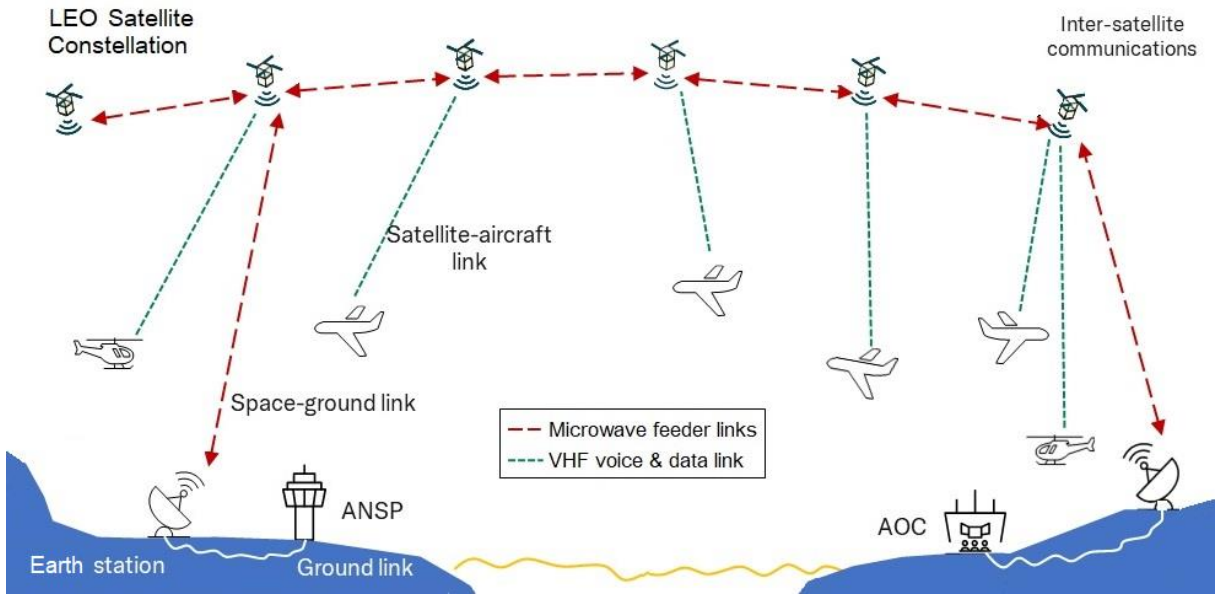
- Low Earth Orbit (LEO) satellites cover the entire planet, orbiting between 340 and 800 Km height.
- About a few hundred satellites needed for this.

Frequency bands:

- Microwave links used between satellites, and for satellite to ground (“feeder links”).
- VHF used only between aircraft and nearest satellite.
- Minimises use of scarce VHF bandwidth.

Each satellite:

- Covers a small circular area (2000-3000 Km diameter).
- Exchanges VHF voice and data traffic with aircraft in view.
- Converts VHF traffic to/from microwave frequencies (for feeder links).
- Is seen as a ground station by all aircraft in view.



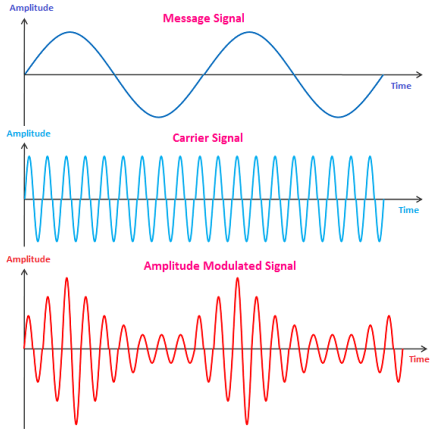
VHF technologies

Key reminder:

- No need to modify aircraft equipment.

AM radio for voice:

- (-) Legacy, less efficient use of power and bandwidth.
- (+) Still valid and effective and often primary means of communication



VDLm2 for data:

- (+) Higher data rate than ACARS (31.5 vs. 2.4 Kbps).
- (+) Not dominated by aircraft operator traffic like ACARS is.
- (+) Already installed on most long-range aircraft.

3

Integration & Challenges

Integration - Voice

ANSPs - Oceanic sectors will have VHF

- SB-VHF will appear to operators as new radio sites (“frequencies”) covering very large sectors (to be defined).
- As satellites orbit from one sector to another, they switch VHF frequencies so that an operator using a certain frequency will always reach its assigned sector.
- In other words, operators will perceive “virtual” sectors with fixed boundaries.

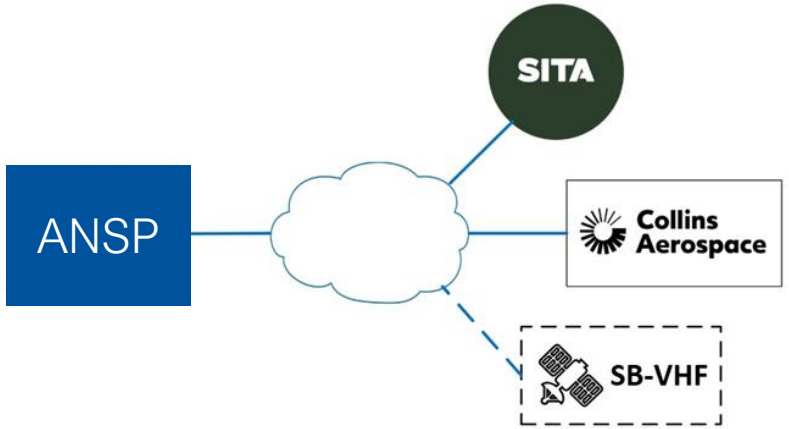
Aircraft – Similar to overland flight

- Zero changes to aircraft HW or SW.
- Possible changes to Flight Management System (FMS) database for new voice frequencies; this is done regularly.
- Voice comms will be more reliable and immediate.
- Operational procedures and flight publications will evolve to benefit.

Integration – Datalink

ANSPs –Augmented or new Communication Service Providers

- Most likely scenario is that SITA and/or Collins handle SB-VDLm2 integration internally and simply offer larger coverage areas.
- One or more SB-VHF providers may also offer SB-VDLm2 service directly.



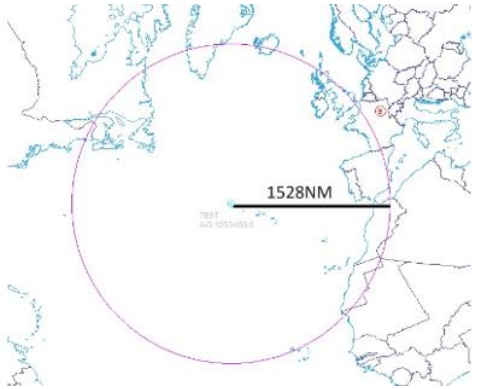
Aircraft – Similar to overland flight

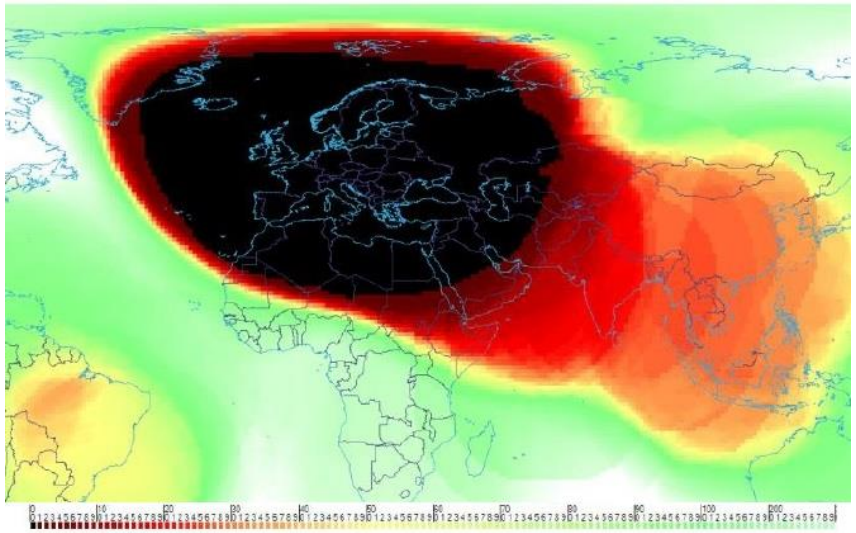
- Possible changes to FMS database for new datalink frequencies.
- CPDLC over SB-VDLm2 may be used increasingly to communicate with ATC.

Challenges - Voice

Scarcity of frequencies for SB-VHF

- Satellites have a direct line of sight to a very large number of VHF ground radios; none of their frequencies can be used without interference when not properly coordinated.
- Major problem over NAT due to frequency congestion in Europe; see heat map on the right.
  - Orbit height of 600 Km assumed, no data from Canada or USA.
  - Satellites over black areas have zero voice channels available.
- Frequencies will have to be “vacated” for SB-VHF in congested regions.
- ICAO is already developing frequency coordination procedures at the regional and inter-regional level.





4

Key players & Status

Key players

Startical

- Spanish consortium - INDRA group and national ANSP.
- Will use LEO satellites orbiting at 600 Km altitude.
- Services will include SB-ADS-B and SB-VHF

Skykraft

- Australian consortium - satellite company and national ANSP.
- Will use LEO satellites orbiting at 380 and 800 Km altitude.
- Services will include SB-ADS-B and SB-VHF

Aireon

- International consortium - Iridium and multiple ANSPs including NAV CANADA.
- Newcomer to SB-VHF but well established in SB-ADSB.
- New constellation will include SB-ADS-B and SB-VHF

Status

Key players

- **Startical** - Conducted full end-to-end system tests with satellites in 2025.
- **Skykraft** - Launched several test satellites in 2025.
- **Aireon** - No tests yet, launch schedule unknown.
- Overall, deployment not expected before 2030.

Regulators

- **ICAO** - Actively developing SARPs (Annex 10 Vol III and V) and SB-VHF Manual (Doc 10228) Expected applicability Nov 2028.
- **National Administrations** - Slowly adapting to authorise SB-VHF in their respective territories.
- **ITU-R** (UN agency) – All work completed, SB-VHF authorised at the international level in 2023.

5

Conclusion

Key takeaways

SB-VHF enables reduced aircraft separation in remote & oceanic areas.

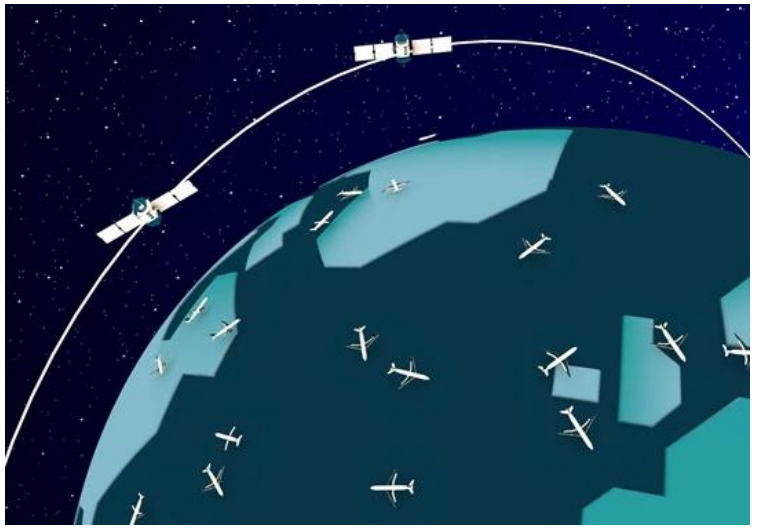
- Provides both VHF voice and VDLm2.
- Complements SB-ADS-B.

SB-VHF requires minimal change to existing systems.

- No changes to aircraft.
- Minimal changes to ANSPs (relative to other options).

SB-VHF is quickly becoming a reality.

- International regulations adapting, standards being developed.
- Three consortiums developing systems; some close to deployment.
- There are some technical challenges, but they are being addressed.



Thank you.

Questions?