Canada-Italy: Arctic Science and Technology Collaboration Workshop
IDS Ingegneria Dei Sistemi is headquartered in Pisa (Italy) with offices in six countries (Italy, UK, Brazil, Canada, USA and Australia) and around 500 employees worldwide with experience and expertise in the most sophisticated technologies. IDS's roots date back to 1980; over the past 30 years the company has evolved and grown without losing its tradition. Today, IDS is a world leading provider of high-tech solutions in selected niche AirNavigation, defense and civil market sectors.
The FPDO has been recognized by the Italian CAA (ENAC) for conventional and RNAV Instrument Flight Procedure design using ICAO, TERPS and TP308 criteria. The FPDO, operating through its company expertise leveraging the specialist from the North American subsidiary, has reached a tremendous workload regime of more than 150 procedures designed per month, i.e. around 1800 per year. The quality system applied on the workflows, together with the robustness of the tools and the competencies of the personnel ensure the total reliability of the results. ICAO has endorsed IDS as a qualified instrument flight procedure design organization.
Long before the jet age, commercial aircraft were flying through the Arctic Circle. After the successful voyages of Richard Byrd and Umberto Nobile in 1926, the feasibility of polar aviation was demonstrated in actual practice.

Nowadays, commercial traffic, connecting Europe, North America and Asia through the north polar routes is a routine.

Flying direct paths between many of North American and Asian cities also decreases the environmental threats of greenhouse gases emissions, which are now one of the major concerns of the Arctic States.
Polar air corridors refer to aircraft routes lying across the uninhabited polar ice cap region, 78 degrees north from the northern latitude what includes areas of northern part of Alaska and most of Siberia.

Cross-polar air corridors bring new opportunities for both commercial and private travel markets. Transpolar aviation reduces the burn of fuel by making the travel time shorter what lowers the cost of trans-polar air operations.

In 2001, Arctic States adopted policy letter, Guidance for Polar Operations, which outlined a number of specific requirements for polar flight operations, including cold weather conditions, special communication capabilities, fuel freeze strategy, evacuation and recovery plans for abandoned passengers and special monitoring requirements as the aircraft operating in the Arctic rely almost exclusively on satellite communications.
Opening of new and improving strategies on already used air traffic routes offer possibilities to reach various locations in the northern hemisphere in easy and cost efficient way.

Advanced transportation technology increases the importance of airships for trade and economic development.

There are 676 airports currently maintained around the Arctic and majority of them is situated in Alaska, United States. There are 79 airports in Arctic Canada, 71 in Russia, 62 in Denmark (Greenland and Faroe Islands), 56 in Norwegian Arctic including Svalbard, 55 in Finland, 35 in Sweden and close to 20 in Iceland.
Polar Route Highlights

- Polar flights up 5.3%
- Overall Arctic High Traffic up 2.9%
- Expansion of User Preferred Routes
- Arctic Airspace changes
- AID-C Planning
- SAT ADS-B Support

Source: Nav Canada
Polar ATC-Constraints

The control of cross-polar routes is presently shared by Anchorage ARTCC, Reykjavik, Murmansk, Magadan and Edmonton ACCs. Capacity on these routes is severely limited due to the variation of longitudinal separation minima from one ACC to the next (30 Km to 15 minutes) and the additional 10-minutes window imposed by Anchorage ARTCC.

**LONGITUDINAL**
- 15 minutes
- 10 minutes identical tracks
- Less than 10 minutes identical tracks
  - Different speeds

**Lateral**
- 30 miles each side of track

Capacity limits to overcome
Magnetic North Pole. When you approach the magnetic North Pole, horizontal magnetic influences decrease and vertical magnetic influences increase to a point where the compass is no longer reliable (the magnetic pole is below the aircraft);

Within about 250 miles of the magnetic pole, all aircraft magnetic compasses will be useless

Communications
There is some VHF radio coverage, denoted on en route charts. Satellite communication (SATCOM) voice may be used as a back-up to communicate with ARINC Radio and in non-routine situations to establish direct pilot-controller voice communications

High frequency (HF) voice has been considered the primary communications medium in the North Polar Area.
It is recognized that SATCOM may not be available for short periods during flight over the North Pole, particularly when operating on some designated polar routes. Communication capability with HF radios may also be affected during periods of solar flare activity.

Transmitting by way of satellite while on the ground is generally reliable. Although, line of sight issues may still arise due to surrounding terrain and man made structures because the Inmarsat satellites are in an equatorial geostationary orbit. In flight, the curvature of the Earth is a concern only at latitudes greater than 70° North or South. Except at these high latitudes, satellite coverage while in flight is seamless.

Because INMARSAT satellites are in geostationary orbits over the equator, the curvature of the earth limits their use at the poles. It is said that SATCOM is available for voice and datalink up to 82°N.
Magnetic Variation

Conventional magnetic compasses sense magnetic direction by detecting the horizontal component of the earth's magnetic field. Since this horizontal component vanishes near the magnetic poles, magnetic compasses are highly unreliable and unusable in an area approximately 1,000 NM from each magnetic pole.

Within these areas, air navigation tasks are further complicated by very rapid changes in magnetic variation over small distances.

For example, when flying between the magnetic North Pole and the true North Pole, a heading of true North results in a magnetic heading of South (a magnetic variation of 180 degrees).
Convergence of the Meridians

Since these major Areas of Magnetic Unreliability (AMUs) occur near the earth's geographic poles, the convergence of the meridians also presents additional directional complications. When flying "great circle" courses at latitudes greater than 67 degrees, convergence of the meridians can create rapid changes in true headings and true courses with small changes in aircraft position.

As a result, relatively small errors in determining the aircraft's actual position can produce very large errors in determining the proper heading to fly and maintain the assigned flight path.
**Temperature Issue**

**Tropopause Height**
The tropopause at the poles is lower than at the equator; that means the altitudes where most polar-capable aircraft cruise is warmer. Knowing this, altitude selection may not be straightforward.

**Surface Temperatures**
Because of the extended flight duration and the prevalence of very cold air masses on the polar routes, the potential exists for fuel temperatures to approach the freezing point.

*If a descent into lower altitudes is required, fuel freezing and other aircraft systems limitations can become issues.*

The Jet A fuel specification limits the freezing point to a maximum of –40°C; the Jet A-1 limit is –47°C maximum.
Polar Radiation

Space radiation on the ground is very low, but increases significantly with altitude. At 30,000 to 40,000 feet, the typical altitude of a jetliner, exposure on a typical flight is still considered safe – less than a chest X-ray.

Flights in the Polar Region at typical business jet operating altitudes are well above the tropopause where much of the atmospheric protection from solar storms is lost, increasing crew and passenger exposure to solar radiation.
Big steps and investments have been made in order to improve Navigation support systems coverage by the introduction of CPDLC, ADS-B stations, ADS-C stations and the enhancements of the SATCOM voice.

The goal of the long term CONOPS is to further exploit technology to improve service, based on a positive business case. Decisions on specific elements of the long term CONOPS will have to await assessment of service and demand after the near and medium term CONOPS are implemented.
Need For Technology

Just as GPS is the preferred navigation system for remote and oceanic airspace, SATCOM avoids the need for ground stations in areas where installation is very difficult and costly. Current SATCOM via geostationary (GEO) satellites does not serve polar areas, but systems like Iridium, which use Low Earth Orbit (LEO) satellites, overcome coverage problems.

Resolution of the SATCOM shadow may allow for future expansion of RNP-4 airspace with reduced 30nm longitudinal and 30nm lateral separation, in an automated system.
Aireon LLC is a joint venture between Iridium Communications, NAV CANADA, ENAV (Italian ANSP), the Irish Aviation Authority and Naviair, with support from the U.S. Federal Aviation Administration (FAA).

Through a transformational space-based ADS-B solution, Aireon will provide aircraft tracking data that makes it possible to extend next-generation coverage across the entire planet (Pole Included), enabling the first truly global air transport traffic management and surveillance system, and a full range of value-added applications.
The End

Plz do not fly too many airplanes over my house