SatNav News

FAA Navigation Programs AJM-32
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Alaska Innovates with WAAS LPV to Water

Sport and fishing lodge, Prince of Wales Island, Alaska

There is an old saying that necessity is the mother of invention, well, in Alaska necessity breeds innovation as with the first Wide Area Augmentation System (WAAS) Localizer Performance with Vertical Guidance (LPV) to water. Scott and Nani Van Valin have been operating a sport-fishing lodge on Prince of Wales Island, Alaska for the past 34 years. About 15 years ago, they thought transporting people in and out of the lodge could be done more efficiently. So, they purchased one Cessna Caravan floatplane to provide transportation. Out of that one plane, grew an airline, Island Air Express, with six WAAS-equipped aircraft that connect to Alaska Airlines in Ketchikan. It eventually expanded beyond the lodge growing into an established scheduled air carrier operating between Klawock (on Prince of Wales Island) and Ketchikan. It's not just about getting people to Ketchikan and the fishing lodge, they also haul 1.4 million pounds of mail and cargo and have additional destinations.

While an expansive WAAS route network exists for aircraft landing on traditional paved runways in Alaska, seaplane operations still required operating in Visual Flight Rules (VFR) due to the lack of IFR procedures for seaplane bases. Instrument Procedures to seaplane bases do exist and the FAA even maintains working examples, however; they are not based on WAAS technology and therefore have high weather minimums (or a requirement to visually obtain the runway environment). In Alaska the persistent low clouds would have prevented the development of an effective traditional procedure.

Scott was undeterred and knew he could transport passengers better and safer. That's when he contacted Alec Seybold of Flight Tech Engineering. Seybold's company specializes in using advanced technology applications to develop procedures to challenging or underserved airport environments. On a cold day during the offseason, they met at the lodge to survey the area and to discuss the weather challenges when an idea came to life. While a traditional procedure was not possible, the narrow aircraft containment areas of the WAAS LPV design could be the perfect tool to improve access. While this had never been done before, they both agreed to support the research and development to implement a WAAS LPV approach to water. As Scott says, "it's the best idea I've heard yet" because the whole reason he started the airline was to service the lodge. Up until June of 2021 it was all VFR flying to the lodge. Southeast Alaska has some of the worst weather on the planet, which can create reliability issues for the guests to the lodge who are there for only three days on their fishing trips. Most guests will plan their trip a year out, and if just one day is cut off, the disruption can have a ripple effect to the whole operation. From this meeting, the 'LPV to water' was born out of the necessity to give safe and reliable service to Scott's guests.

Scott Van Valin (left) and Alec Seybold

Scott says his pilots can take off from Ketchikan, talk to Anchorage Center (ARTCC) and get cleared for the El Capitan approach from the enroute environment, flying the procedure right down to the missed approach point, which is located over water. The entire route is pre-programmed in the aircraft's onboard navigation system and all the guesswork and uncertainty of VFR operations has been mitigated. "This is a reason why we promote IFR" says Scott of the reliability and safety the WAAS LPV approach has provided his airline. "We have invested in extensive avionics upgrades to support WAAS capabilities and built on that by implementing great IFR procedures with the El Capitan approach and departures...and more planned for the future," says Van Valin. For him, equipment upgrades and new capabilities enable the ability to fly better procedures, which means higher safety and reliability.

> "...it's the best idea I've heard yet"

Flight deck of Island Air Express Cessna Caravan enroute

Island Air Express Cessna Caravan at dock

Alec Seybold echoes the sentiment that it took a little bit of innovation to get past some of the hurdles required to develop an LPV procedure to water. In the past, these types of designs had only been implemented to traditional runways or heliports. It was a group effort between the FAA's Flight Procedures and Airspace group, his engineers, and Scott's company, but the end product was worth the time and effort. In Alaska, there are many variables that pilots are dealing with, weather being the main one, and in this case the changing tide level conditions added another twist. A pivotal point in making these procedures happen is the fact that WAAS LPV approaches are geographic based, meaning they are on a fixed path in space as opposed to being solely dependent on traditional barometric step-down altitudes. Alec also adds in designing the procedure, it utilized more advanced concepts such as short, coupled turns tailored to the slower moving aircraft to navigate through terrain. This allowed them to design for the shortest legs possible, reducing fuel consumption and time spent in poor weather, ultimately a better passenger experience.

Scott knows the new procedure will pay off. He believes based on his limited use from last year that they will be able to get into the lodge with a reliability rate that's around 95% now, where it was closer to 75% without the special procedure. Adding that he has a substantial amount of maintenance and fuel savings across his fleet based on reduced flight time. In no time he knows we will cover his cost for designing procedure. "In the long run it's better for the traveling public and safer for everybody," stated Van Valin. Let's just say he's happy with the continuous innovation enabled by WAAS.

- Amy Trevisan, FAA AJM-32/NAVTACII

Island Air Express Cessna Caravan departure

LPV Implementation at Air France;

A step closer towards full PBN Operations

Reprint from EGNOS BULLETIN Issue 38, Spring'22 Edition

Credits:Air France

Air France is one of the largest airlines in Europe, with an ever-increasing number of annual flights and city pairs possibilities. Over the years, the Operator has expanded its fleet to almost 200 aircraft, including new-generation units such as the A220 and A350. ESSP talked with Laurent Puzenat, CNS Project Manager (Flight Operations) at Air France, to discuss the LPV implementation status on their fleet, the future intended modifications and other specific topics of interest for aviation stakeholders.

> "Every new unit must have SBAS implemented so that LPV procedures can be performed"

In total, more than 200 aircraft comprise the current Air France fleet. These include 19 LPV capable units: 6 A220s and 13 A350s, and they expect to receive 21 more by the end of the year. Although A220s come with LPV capability as a standard function, the operator is to specifically choose the A350s' LPV capability as an option. When pilots started flying the first LPV procedures, they confirmed that EGNOS approaches were highly stable, reliable and easy to operate, to the extent that this is the preferred type of approach, if available.

Only minor modifications to the training syllabus to pilots were required to obtain the Operational Approval (OA) to fly LPV procedures, as these are designed to be similar to ILS approaches. All in all, pilots are taught the basics of SBAS, LPV, charts and how to read the indicators on the Primary Flight Display (PFD).

From an Airline perspective, getting the OA for the A350s and A220s was extremely easy, as the solution came fully integrated into the cockpit. Therefore, no particular effort had to be made towards documentation or certification. However, they foresee that this could change if a retrofit solution is implemented, as it may require further changes.

For the rest of the fleet: they are looking forward to implementing LPV on those aircraft that have or will have a solution available in the market. In this regard, they are eagerly awaiting a Supplemental Type Certificate (STC) or a Service Bulletin (SB) for the B777, the B787.

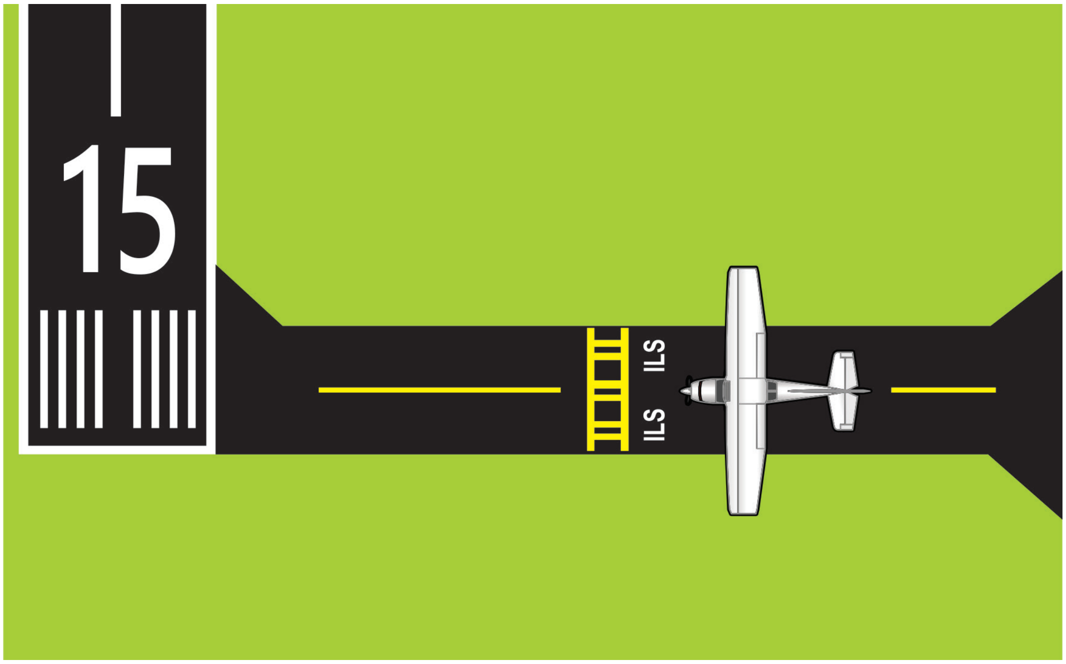
Regarding LPV capability in future aircraft, Air France has a clear policy: every new unit must have SBAS implemented so that LPV procedures can be performed. This motto came about after analysing the benefits of its implementation and understanding the specific constraints that affect Airlines. In fact, one of the major arguments that lead Air France to request LPV on every new aircraft order is the publication of the PBN IR regulation, as it lays out that Operators will use PBN as a standard means of navigation by 2030. SBAS LPV installation allows better minima, provides safety benefits compared to LNAV/ VNAV barometric approaches and will benefit from SBAS future deployments, such as Africa. Air France believes SBAS LPV will be installed as a primary function on every new aircraft and not as an option.

> “SBAS LPV installation allows better minima, provides safety benefits compared to LNAV/ VNAV barometric approaches and will benefit from SBAS future deployments”

Moreover, aircraft flying to the US must comply with the US mandate on ADS-B Out, which can be easily met if SBAS is implemented onboard. It is noteworthy that implementing an SBAS receiver enables the “SBAS NAV” capability, ensuring the transponder will broadcast a more accurate position solution. However, to perform LPV approaches, the Multi-Mode Receiver (MMR) would also have to be properly connected to a suitable Flight Management Computer (FMC) and have a Navigation Database (ND) to allow performing LPV approaches. Although these capabilities can be acquired in separated steps – first “SBAS NAV” and then “LPV” – it is more cost efficient to implement both at once.

The future of Air France concerning EGNOS is promising. They are working towards a full-fleet implementation on their aircraft, and almost 40% of their destinations already have some EGNOS based procedure published, allowing for reduced fuel and CO2 emissions. We will be following up on their implementation process!

Benefits of no ILS critical areas defined

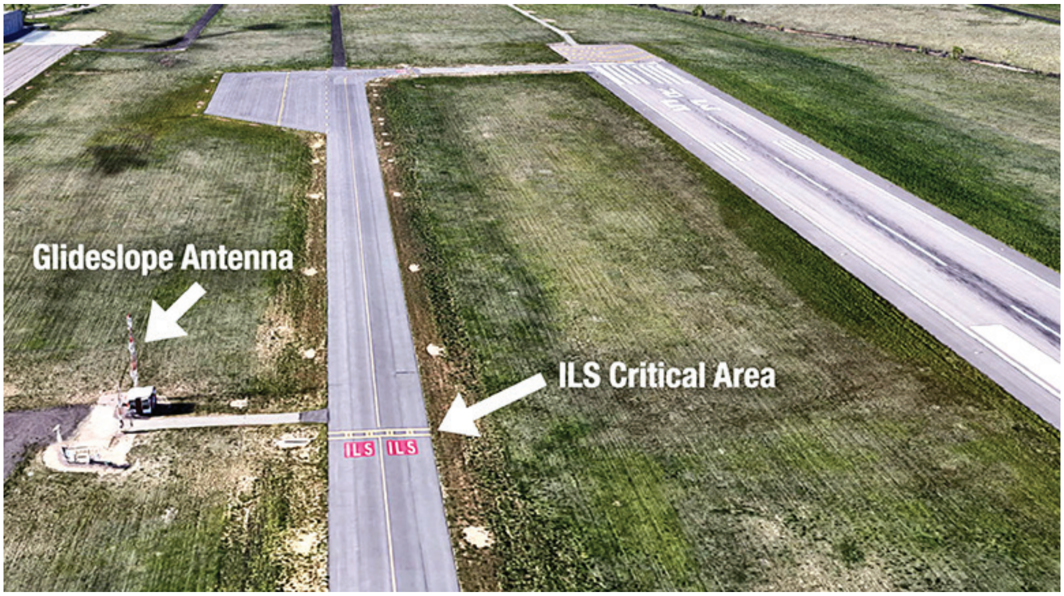


ILS critical area

The Instrument Landing System (ILS) has been a stalwart for vertically-guided approaches since World War II. The U.S. has over 1000 ILS installations in service—but the U.S. has over 5000 instrument capable runways. Since vertically-guided approaches have been shown to improve safety during instrument and night landings, one of the goals of the WAAS program is to provide vertical guidance to all instrument runways than can qualify for a vertically guided approach. This is usually done with a WAAS LPV approach, which often have the same landing minima as ILS. But LPVs have other benefits over ILS in simplifying operations at airports.

ILS uses a Very High Frequency (VHF) signal called the localizer for horizontal guidance. The localizer antenna is typically located about 1000 ft past the departure end of the ILS runway—broadcasting up the approach path to arriving aircraft. The localizer signal is sensitive to big metal objects—like airplanes—that can interfere with the signal. For example, if a metal vehicle is in the critical area, the ILS beam can be deflected from the runway centerline. A few years ago, a Boeing B747 was landing using ILS Autoland and another aircraft was over the critical area. The deflection of the ILS beam caused the B747 to depart the runway on landing rollout. Fortunately, the B747 captain did a go around—but the airplane travelled several thousand feet in the grass between the runway and a taxiway full of airliners before it got airborne again. A really close call.

To avoid incidents like the above, the area around the localizer antenna is designated as a "critical area," and no metal vehicles (airplanes, ground vehicles, etc.) are allowed in the critical areas during low-visibility operations



ILS critical area and Glideslope antenna

when the ILS is being used to land. This means that some taxiways and parts of runways cannot be used when an aircraft is flying an ILS. The picture above shows an ILS Hold Line that will keep aircraft out of the ILS critical area. During good weather, this is not necessary, but during bad weather, ILS critical areas reduce the taxiway infrastructure and complicate air traffic control (ATC) instructions and aircraft taxi. Many airports are designed so that the taxiways avoid the ILS critical areas, but many airports have taxi restrictions when aircraft are using the ILS. Also, the ILS glide slope uses an Ultra High Frequency (UHF) signal that also requires a critical area near the glide slope antenna, which is located off to the side of the approach end of the runway. Similar restrictions are imposed by ATC on the glide slope critical areas. The picture below shows an ILS critical area—the entire taxiway past the ILS hold line is not usable and must be clear when an aircraft is using the ILS in poor weather.

ILS critical area from the cockpit

However, GPS- and WAAS-based approaches such as LPV, LNAV/VNAV and RNP do not suffer from interference with airplanes and vehicles—so no critical areas are required for these approaches. This is especially important at airports with no control tower to manage the ILS critical areas, but it is also important at towered airports to reduce ATC instructions and complexity.

Thus, in addition to improving access and safety with vertically-guided instrument approaches, GPS- and WAAS-based approaches can also simplify airport ground operations.

- Vince Massimini, NAVTACII/DSc, CFI, CFII

Your WAAS Story

. . . We're collecting testimonials about the benefits of Wide Area Augmentation System (WAAS) navigation from users. If you are a pilot, passenger, airport manager, controller, dispatcher, airline employee, or are involved in aviation in any capacity - whether you fly fixed-wing or vertical flight aircraft - we want to hear from you! Please send your stories and contact information to Amy Trevisan at: amy.ctr.trevisan@faa.gov

DFS Declares Global Debut of GBAS CAT II Operations at Frankfurt Airport

Reprint from *Avionics International* by Woodrow Bellamy III, July 26, 2022

An A380 lands at Frankfurt Airport in Germany, where DFS is now supporting GBAS CAT II approaches and landings. (Photo courtesy of DFS)

Airlines that fly to Frankfurt Airport can now use the Ground Based Augmentation System (GBAS) deployed there for category II (CAT II) landings, making it the world's first airport to support GBAS CAT II operations, according to DFS, the German air navigation service provider (ANSP).

DFS first deployed GBAS at Frankfurt in 2014, and airlines have been able to use the digital precision landing system since then—under good visibility or CAT I conditions. Now, thanks to an upgrade made to the GBAS station deployed at Frankfurt by DFS, airlines for the first time can use GBAS even in poor weather conditions.

GBAS is a technology that the Federal Aviation Administration describes as a ground-based station that is tasked with correcting the Global Positioning System (GPS) signals used by aircraft within the vicinity of an airport to "improve the accuracy of, and provide integrity for, these aircrafts' GPS navigational position." The GBAS system deployed in Frankfurt, Honeywell's SmartPath, supports up to 48 different approach combinations to various runways from a single ground station.

In emailed statements provided to Avionics International, Olaf Weber, GBAS product manager for DFS, said that the German ANSP demonstrated the feasibility of GLS (GBAS Landing System) approaches and landings down to CAT II under a collaboration with Lufthansa and Airbus as part of a Single European Sky ATM Research (SESAR) project called "Demonstration of Runway Enhanced Approaches Made with Satellite Navigation" (DREAMS). An upgrade made to the GBAS station allowed DFS to publish the GLS CAT II procedures with "3° and 3.2° glideslope," according to Weber.

GBAS technology is also less expensive to maintain and operate compared to the traditional Instrument Landing Systems (ILS) used at most airports, mainly because it requires an individual ILS for each runway. That compares to GBAS which requires one ground station that features four GPS antennas, a computer, and a VHS transmitter capable of managing approaches and landings for every runway at the airport.

"A major challenge for differential GPS systems like GBAS is their sensitivity to spatial de-correlation due to variation in ionosphere delay between aircraft and the GBAS ground station. Therefore, DFS has integrated an [satellite based augmentation system] SBAS receiver to the GBAS ground station," Weber said. "By adding an SBAS receiver to the GBAS ground station, it allows the station to make use of the navigational service EGNOS regarding ionospheric corrections and assures specific continuity requirements. In this way, the station supports CAT II operations based on amplified CAT I (GAST C) equipment."

In order to fly the GBAS landings at Frankfurt or any airport that features GBAS ground stations, an aircraft needs to be equipped with a Multi-Mode Receiver (MMR), which Weber says most new in-production Boeing models feature already. Still, the number of aircraft properly equipped to fly GBAS landings at Frankfurt is relatively low.

According to ICAO, some of the main benefits derived from using GBAS for airlines include fuel savings, noise reduction, and more flexible flight paths for approaches and landings.

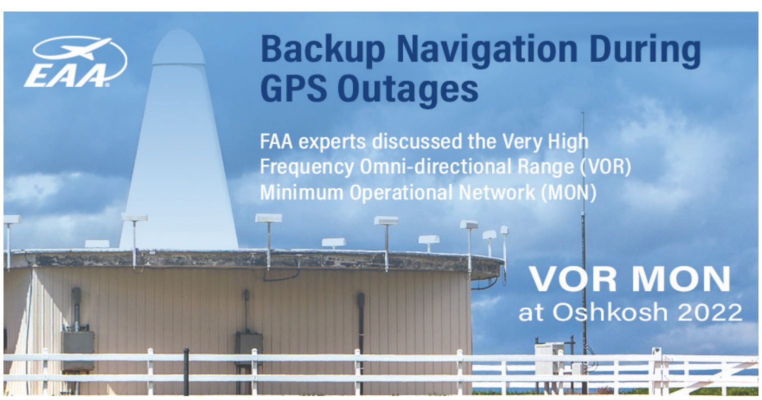
"The current GBAS equipage rate at Frankfurt Airport is about 10 percent," he said, adding that "It is the world's first GBAS CAT II service. Airlines, ANSPs and manufacturers have been collaborating on a worldwide scale. SESAR and the FAA's NextGen programmes are working towards replacing ILS with ground-based augmentation systems."

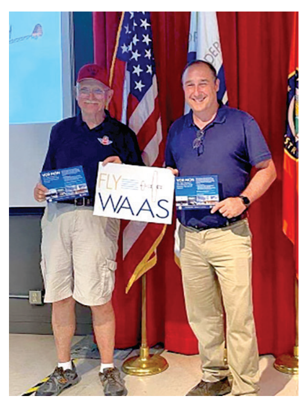
The GBAS antenna at Frankfurt Airport. "A lot of Boeing models are already equipped and approved for the GLS CAT II service. Airbus is currently working on approval for its aircraft types." - Olaf Weber, GBAS Product Manager, DFS.

DFMC SBAS Standards Development Update

With approval of the Dual Frequency Multiple Constellation (DFMC) Satellite based Augmentation System (SBAS) Standards and Recommended Practices (SARPs) by the Navigation Systems Panel in November 2020, the focus for standards development has shifted to RTCA and EUROCAE. RTCA and EUROCAE are working together to develop a joint Minimum Operational Performance Standard (MOPS) for DFMC SBAS airborne equipment. Members of RTCA and EUROCAE have continued to work throughout the pandemic. However collaborative work time is limited when connecting virtually with contributors spread over multiple time zones. Recently several members were able to meet in person, with meetings at RTCA in Washington DC in March (left), in Toulouse in May (not pictured), and at EUROACE in Paris in July (right). While the working group is making progress, several more meetings are planned to mature the MOPS.

VOR MON at Oshkosh 2022





FAA experts, Vince Massimini (left) and Rick Niles

Did You Know . . .

In 2021 the FAA initiated the FAA Alaska Aviation Safety Initiative (FAASI) in response to a National Transportation Safety Board (NTSB) recommendation and tasking by FAA Administrator Steve Dickson. The outcome of the 2021 effort is an inventory of existing safety efforts, stakeholder feedback, and 11 recommendations to improve aviation safety in Alaska. The FAA is focusing on meaningful safety enhancements in the near-term and laying the groundwork for mid-term safety enhancements.

Recommendation 2.3 is to develop strategies to address GPS resiliency in Alaska. The ATO Program Management organization of the FAA along with Enterprise Services and Navigation Programs and input from AVS will develop a GPS resiliency plan for Alaska navigation accounting for potential loss interference of GPS or WAAS signals.

To read the FAASI Roadmap and see steps the FAA is taking to improve safety in Alaska, follow these links:

- FAASI Roadmap
- FAA Alaska Aviation Safety Initiative Final Report | Federal Aviation Administration

The SatNav News is produced by the Navigation Programs AJM-32 branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Global Positioning System (GPS), the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS).

Satellite Navigation Approach Procedures

WAAS

The charts below reflect the continuing growth of satellite-based approach procedures. For more detailed information about satellite-based instrument approach procedures, please visit our GPS/WAAS Approach Procedures web page. *http://www.faa.gov/about/office_org/ headquarters_offices/ato/service_units/techops/navservices/gnss/ approaches/ index.cfm*

As of 7/14/2022 there are:

4,092 LPVs

1,989 airports served

1,224 are non-ILS airports

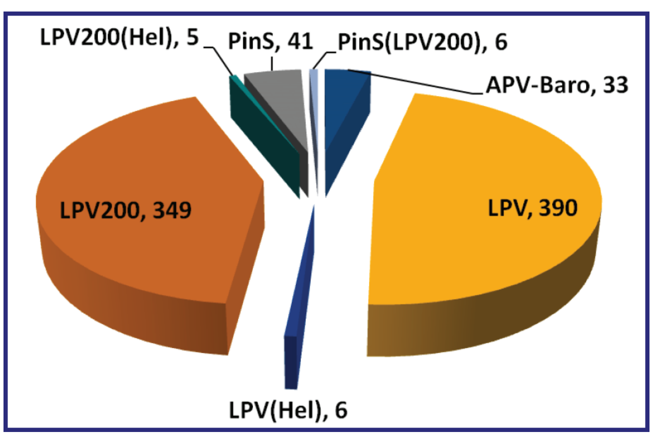
726 LPs

531 airports served

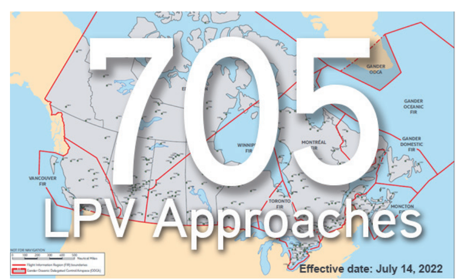
432 are non-ILS airports

EGNOS

The number of LPVs in Europe is also growing. The chart below shows LPV procedures in Europe as of June 16, 2022. https://egnos-user-support.essp-sas.eu/new_egnos_ops/news-events/egnos-bulletin



Canada



Numbers provided by NAV CANADA
as of July 14, 2022
(click for map)

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