HIGHTECH

No more airliners flying blind

Ottawa company's software gives pilots fast maps

BY MARLENE ORTON

Picture a movie camera catching the image of a giant airliner. The audience is shown a pilot preparing for descent and heading toward the airport. The cockpit display is lit, revealing a 3D graphic image of all "way" points, including speed, distance, bearing, details of the runway configuration ahead and other nearby obstacles such as microwave towers.

These are among the visual elements of an aeronautical instrument procedure used by military and civilian pilots around the world. Developing the software to design these airport and runway approaches, departures and en-route information used by pilots is the expertise of Air Navigation Data. The small but vibrant Ottawa company, with fewer than a dozen software engineers, has built an international reputation in this market niche.

"The object of the instrument procedure is, for all intents and purposes, obstacle avoidance," says John Ainsworth, company owner, president and CEO. "We create a map with directions for the pilot to fly," taking into account such elements as the required clearance from an obstruction, aircraft capability and airport configuration. The computer helps design the optimum instrument procedure or map the pilot will use to find the runway in poor weather conditions.

Formed in 1988 primarily as a consulting organization, Air Navigation Data hit its stride in 1998 when Mr. Ainsworth exploited opportunities with the U.S. military declassification of the Global Positioning System (GPS). The network of 24 U.S. military satellites that circle the globe twice a day, transmitting information to earth-based receivers, was declassified in the 1980s, allowing civilian use. The technology has taken off commercially, especially over the last three years.

WAYNE CUDDINGTON, THE OTTAWA CITIZEN

Building an airport approach path with Air Navigation Data's software 'typically takes about 15 minutes' instead of days with a manual system, company CEO John Ainsworth says. 'The productivity enhancements are fairly significant.'

Air Navigation Data provides software applications giving aeronautical chart producers the ability to calculate their positions by computer. "So rather than measuring things on maps and charts, we provide them with a mathematical routine — an algorithm — that they can run on a computer," says Mr. Ainsworth.

The company's first major software package, Pathfinder, was developed to create instrument approach procedures and airspace design, and remains widely used today. Pathfinder includes a mapping feature to show aeronautical data that has been calculated with the geodesic calculator, which basically takes into account variations in the shape and area of the earth. The database in Pathfinder also provides full browse, editing and printing features.

A second, far more sophisticated package, Final Approach, was developed to provide instrument procedure design based on criteria required by both the International Civil Aviation Authority known as PANS-OPS and the U.S. Federal Aviation Authority's TERPS. A designer can create regulated instrument procedures within minutes in an onboard computer for airport approaches, departures and en-route information all provided in 3D display.

Final Approach includes digital terrain information in both 2D and 3D models, which provides aeronautical data such as runway position and man-made obstructions such as television antennas. All the information is blended so an accurate instrument procedure is set up, ready for descent and approach to an airport.

"If an airport is fogged in completely, the aircraft navigates with reference to GPS or the ground- based navigational system. The pilot uses an instrument procedure to position the airplane in relation to 3D space and in relation to the ground-based system. Based on the map the pilot will navigate to the runway."

"It is an incredibly complex process," Mr. Ainsworth says. "By the way, most of the world still does this manually." Building an approach manually usually takes five to 10 days, he says. "Using Final Approach it typically takes about 15 minutes. The productivity enhancements are fairly significant."

A private company, Air Navigation Data prefers to shield its financial and intellectual assets to protect its very tight market niche. An estimated 90 per cent of the company's business is conducted outside the country.

Air Navigation Data's clients are civil aviation authorities, aviation regulators and military organizations. In Canada, customers are the Department of National Defence, Transport Canada and Nav Canada, the national company that provides air traffic control and flight and aeronautical information at Canadian airports.

Transport Canada, which oversees Nav Canada, uses Final Approach to ensure the company performs its role properly and to make sure the system is safe, Mr. Ainsworth says. DND assesses instrument procedures in all areas involving Canadian military flights.

"This is particularly important when the prime minister travels. When former prime minister Jean Chrétien was in Johannesburg, all the instrument procedures going into Johannesburg were checked by the Canadian military on Final Approach. Because Canada is in charge of the airport at Kabul, Final Approach was used to develop procedures going into Kabul. It is a global tool. It is not restricted geographically."

Air Navigation Data relies on R&D to maintain its edge. One new project underway involves a test program with DND's helicopter search and rescue program in conjunction with the National Research Council's aviation experts. Flight trials began last autumn over the hilly Gatineau terrain testing a software package that allows a helicopter pilot engaged in search and rescue to design an instrument procedure based on the position of an Emergency Locator Transmission (ELT). The ELT signals its position from the black box that all aircraft must carry. The signal is picked up by satellite and is another example of GPS technology.

GPS works similar to sonar technology and other transponder units based on triangulating information. The GPS receiver compares the time a signal is transmitted by a satellite with the time it is received. The time difference tells the GPS receiver how far away the satellite is. Distance measurements from several satellites allow the receiver to map the signal position. GPS information or geospacial data is generally displayed on a map or a Geographic Information System known as GIS. GIS is the software used to display the data. GPS is the means to collect the data.

The NRC-DND and Air Navigation Data testing involves the rapid preparation of an instrument procedure within minutes as the pilot approaches an ELT. Data from the satellite is immediately fed into the onboard computer, which quickly builds a map of the surrounding terrain including obstacles such as antennas and buildings.

"If an airplane has crashed and it's in a valley, that increases the complexity dramatically," says Mr. Ainsworth. "If it's out in the open, you can actually descend in and around high ground. The system could be used anywhere in the world where you need to get to a location and are hampered by bad weather." Further flight trials resume in the spring with software modifications, he adds.

Air Navigation Data is also engaged in research and development to accommodate changes by air navigation authorities to allow the gradual implementation of a Required Navigational Performance. This is a satellite-based navigation system that allows a precision approach to airport runways. The first such passenger flight was tested in San Francisco last winter as a means of both improving air traffic flow and allowing more planes to fly closer together.

"We have to start developing criteria for our computer system to develop RNP procedures," Mr. Ainsworth says. "We also have to increase the use of satellite imagery in the application of RNP."