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Atlantic Airways: Introduction of RNP AR 0.1 Operations

Atlantic Airways, the national carrier of the remote Faroe Islands, last year became the first airline in Europe to introduce RNP AR 0.1 (Required Navigation Performance – Authorisation Required) satellite-based approach and take-off operations. Joen Remmer and Stan Abbott look at the implementation of the system and its impact on safety, crew workload and regularity.

RNP AR operations arrived at Atlantic Airways with the delivery of the airline's first Airbus A319 in March 2012, following a period of close cooperation and intensive development in partnership with Airbus subsidiary, QuoVadis **(fig. 1)**.

Figure 1
Atlantic Airways took delivery of its first A319 on March 22nd 2012. CEO Magni Arge, centre, and (far left) Captain Jóhan í Niðristovu.

RNP AR 0.1 operations were permitted from Day One of Atlantic Airways' Airbus operation by the Danish Aviation authorities, which went on to grant full unrestricted approval, including significantly reduced operating minima, after a period of detailed monitoring.

RNP AR 0.1 has, since its introduction, achieved significant savings for the airline -- both in day-to-day operating costs (due to more fuel-efficient approach and take-off patterns) and through very significantly reducing the incidence of weather-related diversions to Vágar's nearest alternates, all which are an hour's flying time away in Norway, Iceland or Scotland.

Perhaps even more important (though harder to measure in cash terms) is the very real improvement in operational safety. This is not to say that the airline's operations prior to RNP AR 0.1 were "unsafe": simply that, in the highly safety-conscious environment of commercial aviation, the system makes Atlantic Airways' operations in an area of challenging weather and terrain even safer still.

By applying RNP AR 0.1 procedures, Atlantic Airways has been able to convert the implicit skills and knowledge of its pilots, built up over years of operation in their chal-

lenging environment, into explicit procedures programmed in the aircraft FMS. Automated flight is more often used where manual flight was required previously, leaving the pilots with more mental capacity to monitor the safe progress of the flight, and with more alertness to intervene, if unacceptable deviations develop.

To understand the very particular challenges that Atlantic Airways faces in its day-to-day operations demands first of all a short history lesson.

The Faroe Islands comprise an archipelago of 18 individual islands, 17 of them inhabited. Originally volcanic, the islands meet the full fury of the North Atlantic with precipitous cliffs, including one that rises more than 800 metres sheer and is claimed to be the highest in all of Europe.

In this mountainous landscape, the occupying British forces built a short airstrip during the last war, in the very west of the islands, on a saddle between areas of high land. The strip was in close proximity to both Sörvagur, which was a good harbour for vessels to operate to and from all year round, as well as to the lake on which Catalina flying boat operations were based **(fig. 2)**.

After the war, the strip remained unused until the 1960s, when it reopened to commercial traffic. However, its location and runway alignment have posed significant challenges ever since.

Pilots have required above-average skills and handling capabilities, thanks to the combination of the short runway (just 1,250 metres), only having non-precision approach aids, fairly high minima, surrounding topography allowing only narrow and offset approach paths, and the prevailing weather conditions that are typified by strong winds, violent wind shears, rotors, and much cloud and precipitation.

Indeed, the airport has, since its reopening seen two fatal accidents, both of which occurred during approaches in difficult meteorological conditions. Neither incident involved Atlantic Airways, which began its operations in 1988. As a consequence of findings that were published some time after the most recent incident (a turbulence-related fatal accident involving a Danish Air Force Gulfstream III in 1996), the Danish authorities imposed new safety rules that now include closure of the airport in certain wind strengths and directions.

As a consequence of the various challenges, Atlantic Airways' regularity has often been poor, especially in winter. In 2011 alone Atlantic Airways had more than 50 weather-related cancellations or diversions. Needless to say, this is a financial burden for the airline, and an inconvenience for Faroese industry and the public, who are so dependent on the life-line air service to and from mainland Europe.

When the Faroese Government launched a runway extension programme some years ago, Atlantic Airways immediately started to investigate what operational improvements could be achieved through this. Not only would a longer runway (now 1,799 metres) cater for a larger and more modern aircraft type than the then fleet of BAe 146 and AVRO RJs, but any opportunity to improve the safety and regularity level had to be examined. The choice was for the Airbus A319 **(fig. 3)**.

"We had investigated various conventional means of improving the accessibility of the airport in adverse weather conditions, but none proved successful," explains A319 Captain Jóhan í Niðristovu. "But we had learned an interesting lesson when we introduced the AVRO RJ fleet on top of our existing BAe 146 fleet: that new technology, such as improvements to the autopilot, could also reduce workload, raise safety levels and have a positive effect on regularity. So when we first learned about RNP, we realised that new technology, rather than conventional, would be the right focus."

Atlantic Airways soon learned that, even though RNP AR had been successfully implemented around the world, there was no previous application of RNP AR with low RNP value (below 0.3nm) in Europe. The first challenge was therefore to bring together the various stakeholders, that is Vágar Airport, the Danish aviation authorities and Airbus. There are very few RNP AR design providers and Atlantic Airways decided to team up with QuoVadis for obvious reasons: its close relationship with the manufacturer of the A319 that the airline had procured, and its record of very successful RNP design projects around the world.

Figure 2
A view of the Sørvágsfjord, which leads to runway 12 at Vágar.

Figure 3
Airbus on take-off from Vágar.

Early studies revealed that RNP 0.3 (which is the "basic" precision used in public procedures) would not offer any advantage over the localiser approaches in terms of minima. Atlantic Airways therefore decided to construct and get authorisation for RNP AR procedures at the highest possible precision, 0.1, so as to take the best possible advantage of this technology. The 0.1 value means that the aircraft's position is accurate to a variation of no more than 0.1 nautical miles.

The roadmap was agreed with the Danish authorities in the spring of 2011, the kick-off meeting for the implementation project followed in June, and the authorisation to start the RNP AR operation was obtained the day before the first commercial flight with the new A319 on March 28 last year.

The development period of about eight months was a challenging time of intense collaboration between all parties. On the one hand, Atlantic Airways had to ensure that what was designed would truly be beneficial for the airline, in terms of increasing safety levels and regularity, and on the other that the project would be in perfect compliance with relevant ICAO guidelines and EASA regulations.

As for the design work, Captain í Niðristovu, continues: "To meet our primary objectives – enhanced safety and improved regularity and a secondary objective of reduced fuel burn – it was crucial for the airline that its implicit knowledge of operating on Vágar was carefully combined with the explicit knowledge of QuoVadis on the A319 and RNP AR capability, so as to achieve the best result."

Several design meetings took place, at which experienced Atlantic Airways captains worked closely with procedure designers from QuoVadis to define the most desirable trajectories for various weather conditions. Exploiting a technology that offers so much flexibility (like turns after the Final Approach Fix) required careful attention to the key value-makers: avoiding known areas of strong turbulence and shears (generally associated with strong winds in certain directions that give rise to significant turbulence in the lee of sea cliffs and mountains), getting a better alignment with the runway on a short final and obtaining the lowest possible Obstacle Clearance Height (fig. 4).

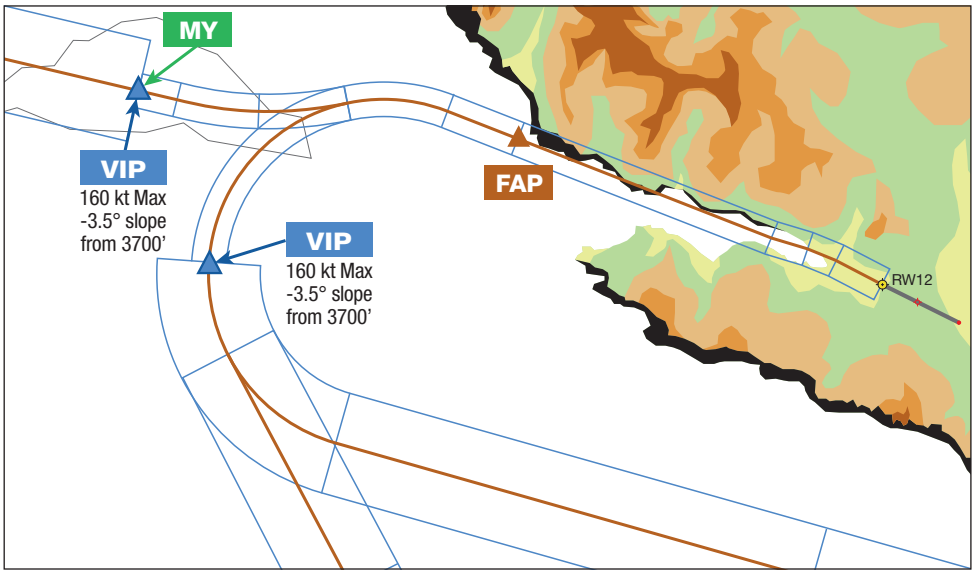

Figure 4
RNP AR trajectories for rwy12. Three intermediate approach tracks leading to the same final approach. The blue lines indicated the trajectory boundary, which is 0.1NM from the Vertical Intercept Point and inwards.

When the principal trajectories were sketched, QuoVadis started to detail and fine-tune the design, and conduct thorough simulator testing of each procedure. One aim was to ensure that no false Ground Proximity Warning System (GPWS) alerts would occur when flying the procedures, another to verify the correct track-keeping capability of the autopilot in dimensioning wind conditions. The design and testing activities were ongoing from August 2011 right up to January 2012.

The formal validation was demonstrated in front of the Danish CAA. All procedures were validated in both an A319 engineering simulator (that uses real aircraft systems) and a full flight training simulator with realistic Vágar scenery. And finally, a demonstration flight without passengers was performed at Vágar, flying all the RNP procedures in good weather conditions (fig. 5).

Figure 5
Vágar simulator scenery. The RNP AR training was given in a full flight simulator with very detailed scenery of Vágar.

Already, after a month of operation, Atlantic Airways was seeing its vision realised, with crews confident that RNP AR was giving them precision approach-like capabilities and advantages in a place where precision approach by conventional means was impossible to implement for both runways. And, in that short time, it was already clear that diversions had been avoided. “The increase in safety level is tangible, because the peak workload is over when the final approach starts and so, much more attention is given to monitoring the approach parameters,” said Captain í Niðristovu at the time. “And the avoidance of conventional procedure turns is saving us precious litres of fuel on almost every flight.”

One other key element in the successful introduction of RNP AR was crew training. In November 2011, three captains from Atlantic Airways joined an intensive three-month line training programme with Air New Zealand, which operates the A320 family and has RNP AR procedures at several destinations. All four crews in the first round of Atlantic Airways Airbus training, as well as additional line training instructors, received tailored Vágar RNP AR training at the Airbus training academy in Toulouse shortly before entry into service.

Atlantic Airways’ unusual choice of the 27,000lb thrust-rated CFM56-5B7/P engines for the A319, was also linked to the RNP AR capability. The very powerful engines ensure the best possible one-engine-inoperative missed approach climb gradient, an important factor in obtaining the lowest possible Obstacle Clearance Height of 250 feet AGL. And the airline installed a Head-Up Display on its first A319, in anticipation of its upgrade for use during RNP AR operations, to further reduce the workload of the pilot in poor visibility.

One year on, Atlantic Airways can instance more than a dozen diversions avoided and is confident that the investment in RNP AR capability will provide a long-lasting improvement in its operation to and from the Faroe Islands, securing the return on investment, thanks to the high impact on safety levels and regularity.

The airline’s work in pioneering RNP-AR 0.1 in Europe was recognised by industry peers when the airline received the European Regions Airline Association’s Airline of the Year (Bronze) Award in September 2012.

Full and unrestricted approval for the RNP AR system followed soon afterwards from the Danish CAA and Sámal P Danielsen, Director Flight Operations, said: “We are delighted to receive full and unrestricted approval for our proprietary RNP operating system after a successful trial period of operating at higher minima, during which every procedure flown was post-analysed for accuracy and integrity.” **(fig. 6)**

Figure 6
The RNP trajectory on the A319 Navigation Display leading to runway 12 at Vágar. Notice the lateral and vertical deviation indicators (L/DEV and V/DEV) on the Primary Flight Display.

The approval is proprietary to Atlantic Airways and therefore the operating minima are not published or publicised, although they are significantly below those achievable by using Vágar Airport’s own recently commissioned ILS system.

Magni Arge, Chief Executive, added: "Atlantic Airways may not be the largest airline in Europe but we are very proud to be the first airline in Europe to introduce this Performance-Based Navigation System. I am delighted too that the Danish aviation authorities have been ready to work with Atlantic Airways and QuoVadis. Their final approval of our proprietary system has been great news for our customers and for everyone who has worked hard to achieve this.”

Safety First

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A350 XWB
First flight of A350 XWB at Toulouse-Blagnac Airport

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