Council of the
ISLES OF SCILLY

St. Mary's Airport
GNSS RNAV Instrument Approaches Runway 09/14
Impact Assessment

1) Objective

The objective of this document is to identify and assess the possible impact of the introduction of GNSS Approaches for Runways 09 & 14 on the local communities and environment.

2) Current Procedures

Runways 09 and 14 are currently visual only approaches, this means that if an aircraft wishes to approach IFR they must either make a visual approach if the weather conditional allow it, or make in instrument approach to runway 27 or 32 and visually manoeuvre for the required runway.

By convention aircraft inbound for runway 09 usually join Downwind Left-hand and traffic joining for runway 14 usually join on a Left Base.

Due to the prevailing winds on the islands runways 27 and 32 are used the majority of the time;

	2015				2016			
	Runway 27	**Runway 32**	**Runway 09**	**Runway 14**	**Runway 27**	**Runway 32**	**Runway 09**	**Runway 14**
Runway usage	23%	37%	12%	28%	21%	38%	10%	31%
Combined	60%		40%		59%		41%	

It is worth noting that Runway 14/32 is longer that Runway 09/27, many aircraft will elect to take the longer runway even if it is not the most into wind.

3) New Procedures

In line with St. Mary's runway characteristics, the GNSS IAP's to be provided, have been designed in accordance with ICAO Doc. 8168 (Pans-OPS) for aircraft in Approach Speed Category A with the following approach types:

- LNAV – Lateral navigation procedures equivalent to a GNSS Non Precision Approach that can be flown by aircraft equipped with a standard (TSO/ETSO 129) GPS receiver.

- LPV – Localiser Precision Vertical procedures which provide both lateral and vertical Navigation that is presented as an "ILS type" of indication in an aircraft equipped with an SBAS receiver. (TSO/ETSO 145/146). LPV procedures can only be supported by augmented GNSS in accordance with the ICAO Satellite Based Augmentation System (SBAS), which in the European Union is provided by the European Geostationary Navigation Overlay Service (EGNOS)

The procedures have been prepared by Davidson Ltd for LNAV and LPV minima with 3.5 degree vertical path angles, harmonized with the existing PAPIs with a Reference Datum Height (Threshold Crossing Height) of 40' in accordance with ICAO 8168, Part 3 Section 2, Chapter 6, Para 6.2 b.

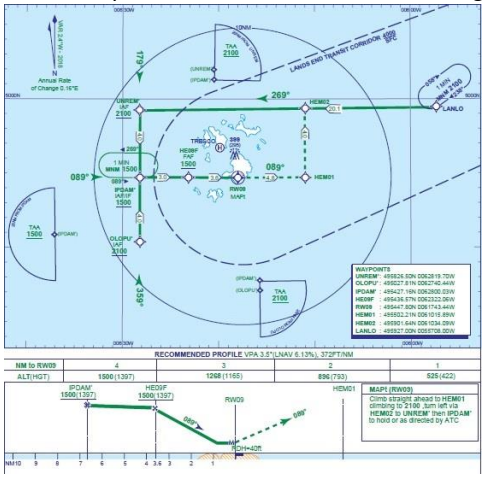
The 3.5 degree approach was a deliberate design choice to maintain aircraft height on approach, this is of particular importance as the AIP notifies that "Turbulence and/or windshear may affect the final half mile of approaches to all runways."

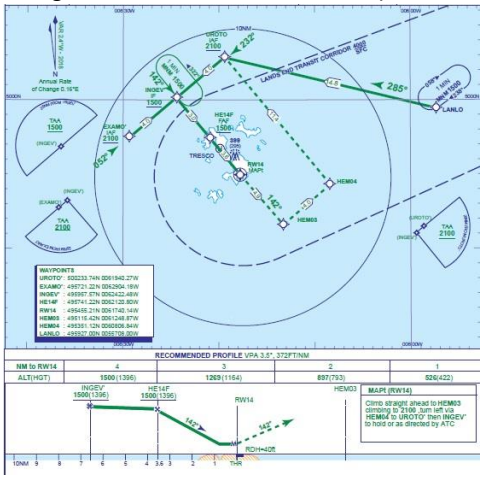
The St. Mary's runways are considered to be Non Precision Instrument (with limitations) and therefore the minimum possible OCH for any LPV to a Non-Precision runway will be limited to 300' (LPV system minima + 50')

The 300' Minimum OCH for runways 09 & 14 appear to offer limited benefit compared to LNAV IAP's however, the LPV approaches will provide geometric vertical guidance with integrity facilitating a stabilized approach. It is also expected that the operators calculated visibility requirements will be lower for the LPV than for the LNAV procedures.

The missed approach for all procedures is to turn back to the Initial Approach Fix (IAF) and then follow the Initial Segment to hold at the Intermediate Fix (IF) of the active runway. All missed approach holds are located over the sea.

Proposed GNSS RNAV Procedure images (revised following CAA initial review comments):



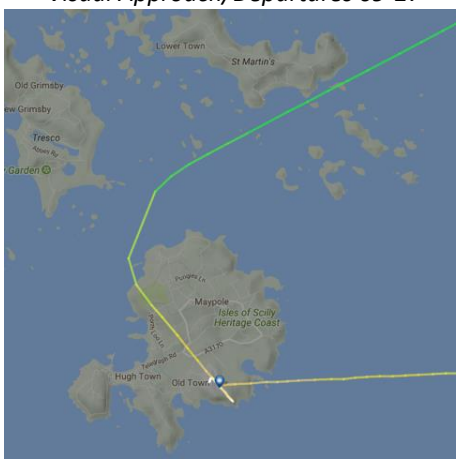


4) Visual Approach and RNAV Comparison

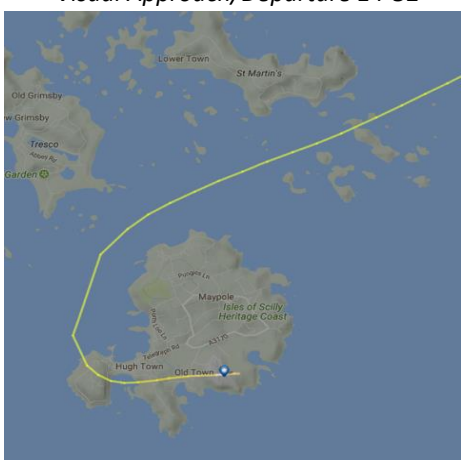
4.1 The proposed runway 09 GNSS procedure retains the Left Downwind shape, but is exaggerated, this results in increased track miles but also means that the approach does not overfly any off the islands except for St Mary's during the final 1.2 nm. This increase in track miles will also make it unlikely that aircraft will wish to fly the GNSS procedure if they are in VMC.

4.2 The Runway 14 approach is similarly widened out, this ensures that the islands are overflown as little as possible on the approach and also results in the increased track miles.

Visual Approach/Departures 09-27



Visual Approach/Departure 14-32



4.3 RNAV Arrival and Approach to MDH/DH

Runway	LNAV OCH (Feet)	LPV OCH (Feet)
09	327	300
14	546	300

The OCH of the GNSS procedures are considered to provide a high level of safety as;

- The LNAV and LPV Approach procedures ensure that the aircraft is aligned with the runway at Decision Height (DH).
- The LPV IAPs provide vertical guidance allowing a stabilized approach.

Note: *The accuracy of the approach to runway 14 and missed approach for runway 32 will increase safety in the vicinity of the Tower obstruction of 399 ft amsl at the north/north west end of the Island of St. Mary's, compared to visual approaches in marginal weather conditions.*

All MDH/DH for Runway 09 are over the sea. Runway 14 approaches overfly the western side of the Island of Tresco, which consists of the Tresco Abbey Gardens.

4.4 Undershoot Events

There is no history of undershoot events at St. Mary's Airport and the GNSS instrument approaches and recent runway improvements will reduce the probability of undershoot occurrence compared to the existing NDB Non-Precision Instrument approaches.

With the GNSS IAPs, there is a significant Visual Phase between DH/MDH to the runway threshold during which the improved aerodrome marking and lighting, in particular PAPIs aligned with the GNSS approach, Green threshold bars, runway edge lighting and white Strobescopic Runway Threshold Indicator Lights will provide the necessary visual guidance to the runway threshold.

The GNSS IAPs will, in the case of an LNAV approach, provide lateral guidance aligned with the runway heading facilitating a CDFA approach down to the MDH and in the case of an LPV approach, 3 dimensional guidance will be provided facilitating a stabilized approach, thereby minimizing significant aircraft positioning within the visual phase of the landing.

5. Environment Impact

a. Noise

Twin-Otter readings were taken in the morning when the surface wind was 010 degrees at 6 knots. An average background noise reading of 42dBA was recorded.

The Islander readings were taken in the afternoon when the surface wind was 180 degrees at 2 knots. An average background noise reading of 45dBA was recorded.

The results were:

Aircraft Type:	**500ft Pass**	**750ft Pass**	**1,000ft Pass**
Twin-Otter (DHC6)	68.0 dBA	65.6 dBA	61.7 dBA
Islander (BN2P)	66.4 dBA	63.6 dBA	61.4 dBA

To put these results in to context, 68 dBA is a similar sound to a dishwasher (63-66 dBA) or standing near a road (70 dBA). (www.noisehelp.com)

6 Benefits of the RNAV IAPs.

The improved performance of the proposed RNAV approaches contribute to improved safety and improved operating minima in poor weather conditions.

a. RNAV Increased Safety

The following factors contribute to improved levels of safety

- LNAV - Aircraft will be aligned with Runway
- LPV - Aircraft will be stabilized at higher altitude aligned with runway and harmonized with the PAPI visual guidance.
- Human Factors - Lower pilot workload as the pilot does not have to correct for wind drift and knowing that runway and lighting will be directly ahead.

b. Improved Service Regularity

The RNAV approaches will improve the regularity of the vital air services into St Mary's through:

- Stabilized approaches precisely positioning the aircraft at Decision Height providing a higher probability of a successful landing.
- RNAV approaches have an improved Decision Height, potentially reducing the numbers of cancelled flights.

7 Conclusion

From the comparison of the new RNAV and the existing Visual Approach Procedures presented in section 4, it is shown that ***there are only small differences in the approach tracks***.

The implementation of the RNAV approaches has no significant impact on emissions as the prevailing winds mean that aircraft will opt for runways 27 and 32 for most of the time, and the emissions from any GNSS Approaches will be offset by the fact that previously aircraft have been maneuvering from one of the existing approaches anyway. The stabilized approach for the LPV approaches may allow the aircraft to be flown with lower power settings which would also contribute to lower overall emissions than currently experienced.