AIR TRAFFIC MANAGEMENT FOR TILTROTORS QUESTIONS AND ANSWERS

Issue 2

Introduction

The history of aviation has seen many technologies developed and matured by the military prior to their introduction into commercial service such as jet propulsion, fly-by-wire flight controls and composite primary structures. Today tiltrotor technology follows a similar path, having been successfully demonstrated by the military for over 10 years in the Bell Boeing V-22, the Leonardo Helicopters AW609 is on the verge of civil certification for commercial use.

As the speed, range, and VTOL capability of the V-22 tiltrotor has revolutionized military missions like combat search and rescue, medical evacuation, and long-range ship to shore transportation, so too will the AW609 in commercial SAR, EMS, and offshore oil and gas transportation.

The AW609's use in civil operations will enable true point to point travel and help reduce congestion at busy airports.

As the technology and operational regulations are on the horizon[1], some questions, remarks or concerns may arise within the Air Traffic Management (ATM) community on how to integrate tiltrotor activities into usual aircraft management and on how to interact with tiltrotor flights. This joint document between Leonardo Helicopters and the Italian Air Traffic Controllers Association ANACNA aims to provide answers to these points.

From a Gate-to-Gate perspective this Q&A sheet is divided into the different flight phases:
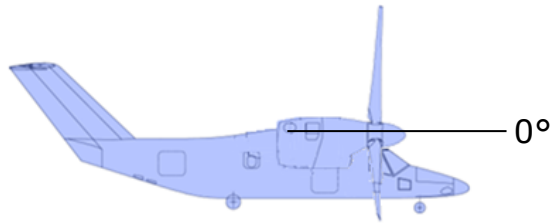1. Departure
2. In flight
3. Arrival
4. General

[1] First commercial civil tiltrotor activity is expected in 2019.

Definitions

Airplane Mode: A configuration with the proprotors on the down-stop and set to cruise RPM.


VTOL/Conversion Mode: means all approved configurations (gated proprotor positions) and flight modes where the design operating proprotor speed is that used for hover operations.

Note: the term "Helicopter Mode" is not used. This is to avoid confusion as helicopter mode implies a configuration where the proprotors are fixed at 90°. This configuration is used for stable and very low speed hover only. Angles greater than 90° may be used for hovering backwards at low speed.
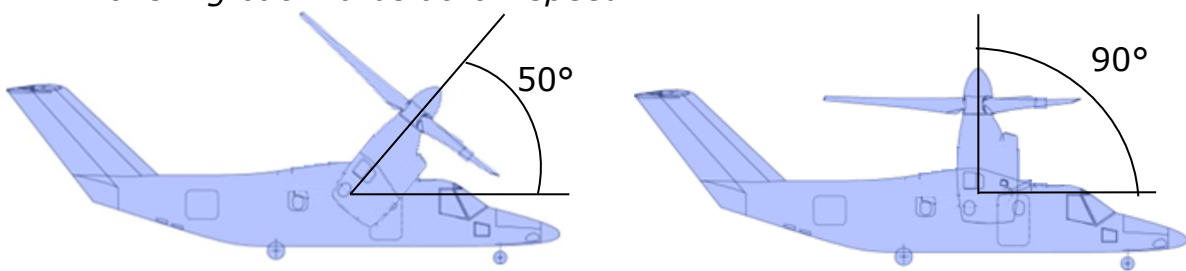
Maximum Dimension: The largest overall dimension of the tiltrotor (rotors turning), equivalent to "D Value" for a conventional helicopter.

Maximum Dimension
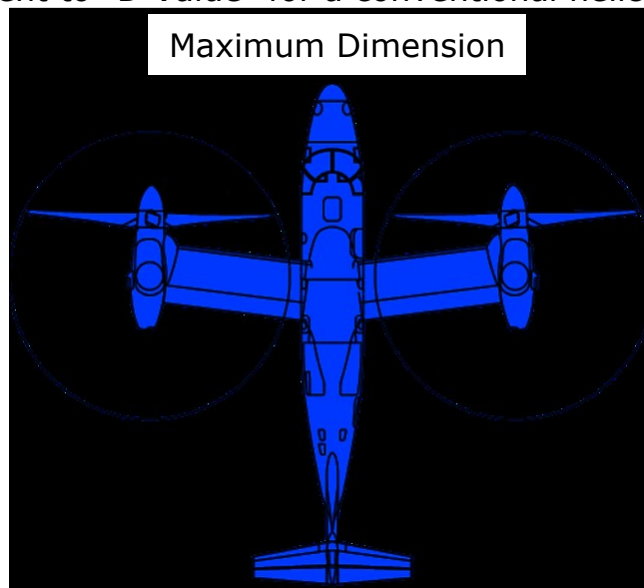
Further Guidance

In addition to this sheet, ICAO is developing guidance material for tiltrotor aircraft. It is anticipated this guidance will be issued in mid 2018.

Disclaimer

This document is intended as guidance material only. The material within has the sole purpose of providing information on the differences between tiltrotor and conventional aircraft from an Air Traffic Management perspective for awareness only. The data given is based on experience from the AW609 tiltrotor, when other tiltrotors begin operating this material will require review. Whilst this material may be used to give suggestions on the way to manage tiltrotors or to provide guidance and best practice, in no way does it supersede existing national or international regulation on the affected environment and matters.

Q&A Table of Contents

Q&A

1. Departure

1.1. Start-up

➢ Q: Is there any difference in start-up time between helicopters or airplanes start-up and tiltrotors?

A: No. Start-up times are comparable to those of modern helicopters and aeroplanes.

➢ Q: Can tiltrotors use the same helipads as helicopters?

A: In general, yes. In accordance with the ICAO guidance material, tiltrotors may use helicopter helipads based on the tiltrotor's maximum dimension which is equivalent to a helicopter's "d" value.

1.2. Taxi

➢ Q: Should ATM expect tiltrotors to taxi on the ground or hover like a helicopter?

A: Ground taxi will be the preferred way to taxi. Hover taxi will be possible as well, but not recommended due to localised down-wash.

➢ Q: In case of ground taxing what speed will the tiltrotor normally use?

A: 10 kts

➢ Q: As in some airports, runway crossing is required to be as fast as possible with additional requirements such as keeping all engines running, will it be possible to ask tiltrotors to speed up? If so, up to what speed?

A: 20-30 kts

➢ Q: With regard to airport design, can a tiltrotor's maximum dimension be used in the same way as an airplane's wingspan or is there the need to add some rotating tip effects?

A: There is no need to add a factor to make a tiltrotor's maximum dimension when compared with medium and large aircraft.

➤ Q: A tiltrotor's propellers can be set on different positions during taxiing. Could this produce undesired or higher than actual known vortexes (higher than those already known for helicopters of equivalent size)?

A: No.

➤ Q: Is there any other different behaviour during taxiing from other aeroplanes or helicopters?

A: No.

1.3.   Roll and Take-off

➤ Q: Does rolling on runway for take-off require the same length as aeroplanes? What is a typical runway occupancy of the AW609 in time/distance?

A. Less than 15 sec./Less distance (200-300 m)

➤ Q: Can a tiltrotor roll for take-off be considered as Short Take-Off and Landing (STOL) operation?

A: Yes.

➤ Q: Can take-off be performed vertically from a Helipad (VTOL) and horizontally (STOL) from a runway?

A: Yes but limits are placed on VTOL take-off weight. If a high weight is present a STOL may be the only possible procedure.

➤ Q: During a take-off roll, is the vortex generated by tiltrotor consistent with its wake turbulence category (equivalent sized helicopter) or is there any additional vortex area to be considered?

A: The vortex generated is consistent with its wake turbulence category.

➤ Q: What is the minimum height at which tiltrotors may convert from VTOL/Conversion mode to Aeroplane mode? How long does the conversion take?

A: It depends on the take-off procedure used (Performance Class 1 or 2). In general there is no need to rush to complete the conversion to aeroplane mode since the airspeed and climb rate achieved in airplane and VTOL/conversion mode overlap for some time during a standard departure profile.

Minimum height to begin conversion will be 15 ft during take-off in Performance Class 1.

2. In Flight

2.1. Climb

➤ Q: What is the average vertical and horizontal speed of a tiltrotor during climb?

A: In Airplane mode 160 KIAS and 1,000-1,500 ft/m during initial climb.

In VTOL/Conversion mode 80 KIAS up to 2500 ft/m.

➤ Q: Can ATC request an increase in the rate of climb of a tiltrotor? If so, up to what value?

A: Yes. It depends: 2,500 ft/m

2.2. Cruise

➤ Q: Is the vortex generated by tiltrotor consistent with its wake turbulence category (that of an equivalent sized helicopter)?

A: Yes.

➤ Q: What is the usual and maximum cruising altitude of tiltrotors?

A: Around 20,000 ft up to a maximum of 25,000 ft.

➤ Q: What is the usual and maximum speed of tiltrotors?

A: It depends on altitude and the specific tiltrotor model, but generally speaking Vcruise will be approximately 250 KTAS and maximum speed will be around 275 KTAS.

➤ Q: To what speed can tiltrotors be requested to slow down to?

A: For low level cruise (up to 8,000ft) a slow down to hover can be achieved. Above this altitude the tiltrotor is an airplane mode and therefore can be slowed down to the standard minimum airspeed (130 KIAS (C-12 type)).

➢ Q: In case of such a request from ATC, how long does it take for a tiltrotor to slow down from cruising speed to hovering (or to the minimum speed)?

A: It will be consistent with a helicopter.

➢ Q: What is the maximum altitude that a tiltrotor can reach in VTOL/Conversion mode when moving and hovering?

A: Around 8,000 ft according to gross weight.

2.3.   Descent

➢ Q: Is the Top Of Descent (TOD) and subsequent vertical speed consistent with other airplanes?

A: Yes.

3. Arrival

3.1.   Approach

➢ Q: When Instrument Final Approach has been initiated, how far from the touchdown zone of the runway should ATC expect a tiltrotor to start slowing down and converting to it's desired landing configuration?

A: Before IAF an initial conversion will be made to 50° conversion angle and 140 KIAS (no later than FAF); after MAP conversion will be made to 75° conversion angle and the speed reduced to less than 90 KIAS.

➢ Q: During an instrument approach, which is the most suitable altitude/height to brake the approach and go towards a Helipad?

A: The final portion of an instrument approach will be flown in VTOL/conversion mode (conversion angle >50° with a maximum speed of 140 KIAS). Therefore, the approach can be flow down to standard

minima and after MAP perform a final speed reduction (if not performed before) to proceed to the helipad.

➢ Q: Is the vortex generated by tiltrotor consistent with its wake turbulence category or there's the need for additional spacing from following traffic during the approach phase?

A: It is consistent.

3.2. Landing

➢ Q: What is the final approach speed of a tiltrotor?

A: It depends on the nacelle configuration used but it will be similar to modern helicopter speeds during final approach.

➢ Q: What is the landing speed of a tiltrotor?

A: For a rolling landing, around 40 Kts.

➢ Q: Can a tiltrotor land both vertically on the helipad and horizontally on the runway?

A: Yes.

➢ Q: What is the runway minimum occupancy time after landing?

A: No additional time required companies with other aircraft.

4. General

➢ Q: According to its profile, tiltrotor might be flown similarly to a helicopter. Would it be feasible to allow a tiltrotor to comply with less-restrictive helicopter requirements (e.g. visibility minima)?

A: Yes.

➢ Q: In general, will a tiltrotor be managed over and around airports more in a helicopter configuration or more in airplane mode?

A: Managed as a helicopter.

➢ Q: In the intent of providing Air Traffic Service Providers and Officers with tiltrotor traffic management guidance material, please add any other suggestion, data or information that could be of use:

A: In all critical phases of flight a tiltrotor can be managed as though it is a helicopter.

More specifically:
- During take-off, up to 1,500 ft AGL approximately, can be considered to be a helicopter.

- From 1,500 ft AGL on departure to 1,500 ft AGL before landing or Holding pattern included, can be considered as an aeroplane.

- On final approach as a helicopter.

- For fuel planning and weather minima as a helicopter.

- Emergency procedures will be handled as a helicopter in VTOL/conversion mode.