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Transformation of Helicopter PinS Procedures for Airplanes

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Abstract – **This article deals with the possibility to use existing helicopter Point in Space procedures with minor changes for airplanes. The basis is to find parts of PinS procedures that need to be changed, suggest these changes, and then determine whether the revised procedures could be usable and could bring the benefits for airplane operations**

Keywords – Airplane, PinS, Helicopter, visual, GNSS

I. Introduction

Nowadays, a turning point comes in the navigation devices used for IFR flights. This transition from ground navigation infrastructure to the use of satellite systems (GNSS) begins to accelerate with the continuous development of GPS, EGNOS and Galileo.

The most significance has the satellite navigation on approach to landing, procedures named RNP APCH, which can provide sufficient accuracy at ILS level and thus there is no need for ground-based radio navigation infrastructure. This way reduces costs for aerodromes by deploying an instrument approach dependent on GNSS, assuming that the aerodrome is certified as IFR aerodrome. In the event that this aerodrome is "only" VFR, it needs to be transformed from the category VFR to IFR and although the publication costs of instrument approach would be significantly reduced some money will be spend.

To further reduce costs, which is necessary for the development of VFR aerodromes towards IFR, is needed to modify or create a new approach procedure. And it is here that there is the possibility of inspiration from helicopter approach procedures Point in Space (PinS), which was created as a counterweight to RNP APCH procedures and therefore also use only GNSS positioning.

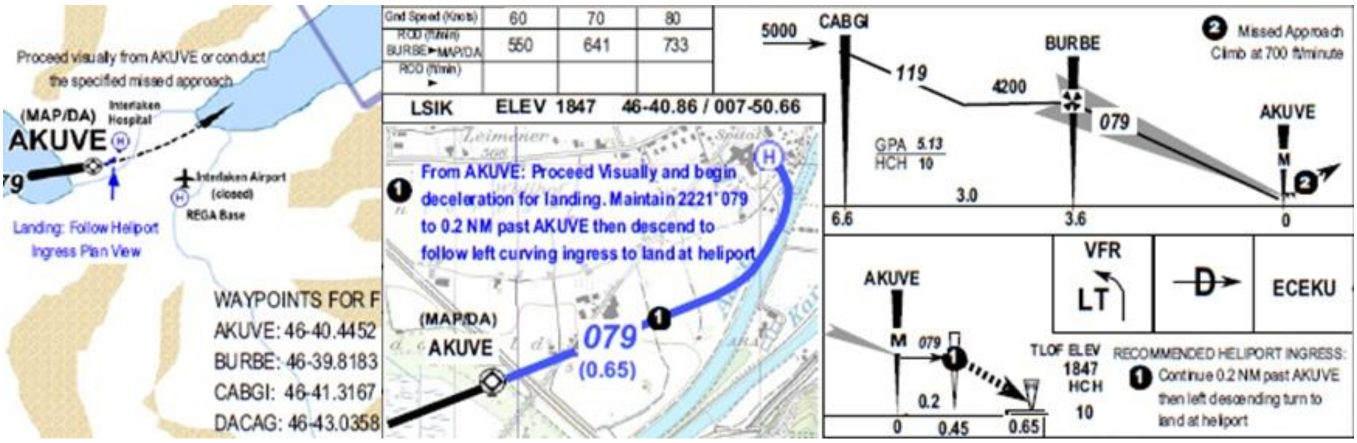
II. Point in Space

PinS is instrument approach procedure intended only for helicopters and are based on GNSS. Currently, PinS procedures are not very widespread, but in Europe they started to be implemented at the HEMS (Helicopter Emergency Medical Service) heliports in Switzerland.

Due to the possibilities of GNSS, there are also projects that try to extend the GNSS navigation for helicopters. One of them is HEDGE, which deals with the use of more accurate GNSS navigation, by using EGNOS, just for helicopters.

PinS procedures are designed to not depend only on one kind of rules of the air - IFR, VFR. At present, point in space procedures could be classified as a non-precision approach; approach without vertical guidance. Due to the use of only basic GNSS, there is necessary to have additional equipment, whether in helicopter or at heliport to use these procedures. Approach is conducted to the reference point, to allow subsequent safe completion of flight. According to that PinS is divided into two categories: Proceed VFR and Proceed Visually.

Figure 1. PinS example from Interlaken [1]



A. *Proceed VFR*

Pins Proceed VFR is designed for landing sites that do not meet the requirements for heliport. As each approach, this will also lead the helicopter to MAPt where the pilot has to decide whether he will continue or carry out a missed approach procedure. As the last part of this approach is under VFR conditions, the pilot may continue the approach to land only if weather conditions are better than VMC minima for the VFR flight. (Table 1)

TABLE 1. VMC VISIBILITY AND DISTANCE FROM CLOUD MINIMA [2]

Airspace Class	C, D, E	G
Visibility	8 km in and above FL 100 5 km below FL 100	5 km *
Distance from cloud Minima	1500m horizontally 300 m (1000 ft) vertically	Clear of cloud and in sight of the surface
* a) lower flight visibilities to 1500 m may be permitted for flights operating: 1) at speed that, in the prevailing visibility, will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or 2) in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels. b) HELICOPTERS may be permitted to operate *in less than 1500 m* (but not less than 800 m) flight visibility, if manoeuvred at a speed that will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision.		

B. *Proceed Visually*

Pins proceed visually is made for landing sites fulfilling the requirements for non-instrument heliport according L 14H. The procedure, as well as the Proceed VFR, lead helicopter to MAPt where the pilot must decide whether to continue visually, or carry out a missed approach procedure. Visual flight segment is still under IFR conditions, but the area of visual segment is not protected from obstacles. Pilot may continue only if it has visual contact with the landing place or another defined point of trajectory.

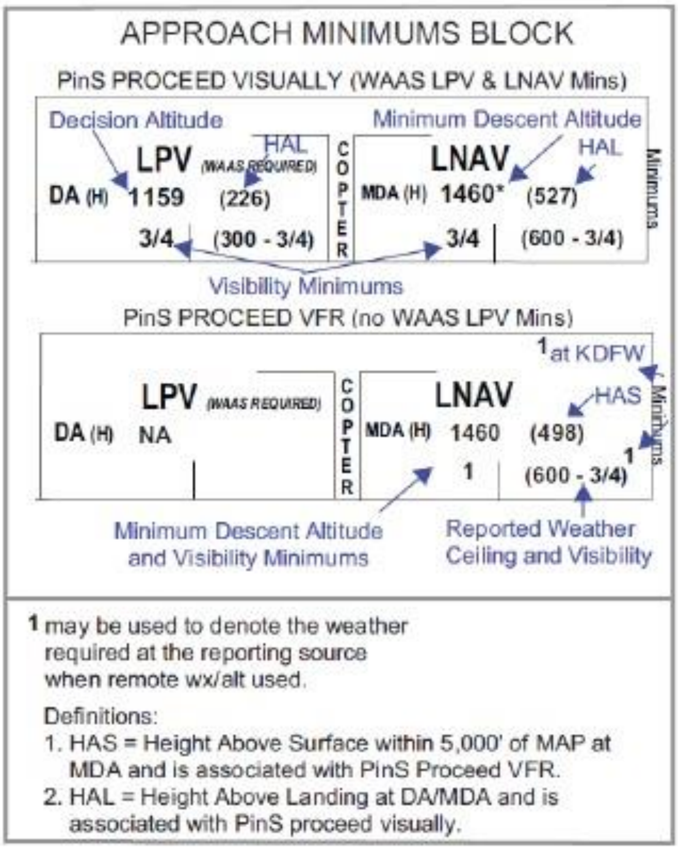


Figure 2. Proceed VFR vs. Proceed Visually [4, adjusted by authors]

III. COMPARISON OF AIRPLANES AND HELICOPTERS

To determine the changes in the PinS procedures is firstly necessary to define an important difference between the flight of airplanes and helicopters, which will affect the use of these procedures. This relates mainly to manoeuvrability of the aircraft and its equipment. The main difference may be the minimum speed of the aircraft, but the PinS procedures counts with relatively high speed flight of helicopter, and therefore speed is only a little change. PinS are also designed flexibly with possible changes of direction in the final approach segment, and while the rotor machine has unquestionably better manoeuvrability than the aircraft with fixed wings, the procedure regulations does not use it completely. However, an interesting place, where the greatest differences between these types of aircraft are, is visual approach segment. The airplane cannot just stop in the air.

IV. PINS MODIFICATIONS

Point in Space procedures, in their current form, though created only for helicopters, have certain elements that should be implemented for airplanes, but before this adaptation can take place it is necessary to create some adjustments.

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TABLE 2. CHANGES IN PINS FOR AIRPLANES

Approach Speed
Possible changes of direction in the final approach segment
Proceed Visually rules
Proceed VFR rules
Airport and runway requirements
The use of SBAS
Controlled airspace and ATC

A. Approach Speed

TABLE 3. VMC VISIBILITY AND DISTANCE FROM CLOUD MINIMA [3]

	Category H	Category A
Initial Approach	70/120 kt	90/150 kt
Final Approach	60/90 kt	70/100 kt
Maximum descend angle	10%	6,5%

Table 3 shows only minimal speed differences between the procedures for designing aircraft category H and A. For this reason would be no problem to add category A into PinS, respectively use for category A "correct" speeds from category H.

B. Possible changes of direction in the final approach segment

PinS procedures allow change of course between the initial approach segment and the middle segment and between the middle segment and final segment up to 120°, respectively 60°. These values ensure the use of PinS procedures also for places where the direct approach could not exist. Due to the manoeuvrability of a smaller aircraft would be appropriate to limit the maximum course change to ensure sufficient time for stabilization of flight between segments and be able to construct the smallest protective areas.

C. Proceed Visually rules

PinS procedures Proceed Visually corresponds to normal IFR approach, where at the MAPt, or the DA must pilot decide whether to continue or perform a missed approach. PinS in this case do not provide a safe distance from obstacles, which is more important when flying airplane than helicopter. Reducing the protection space makes sense in areas with single obstacles, which can be with PinS avoided.

D. Proceed VFR rules

Pins Proceed VFR corresponds to the current situation, when pilots flying VFR use GNSS navigation for approach with custom tracks and fly in even worse weather conditions than required by the rules of the air. Creating Pins Proceed VFR would have legalized these procedures and make it safer.

E. Aerodrome and runway requirements

Heliport equipment for PinS procedures is described in regulations. For visual segment Proceed Visually must heliport meet the criteria for a non-instrument heliport and for Proceed VFR must not. These conditions are the logical outcome of the general rules; you can land VFR on mowed meadow but IFR only at aerodrome. From this perspective, the small aerodrome could gain precision approach, without having to build any equipment at the aerodrome (without thinking of AFIS, see G.), while aerodromes that opt for "better" approach would have to build equipment for IFR runway.

F. The use of SBAS

For better usage of proposed PinS approach for airplanes seems best not to use only basic GNSS, but also SBAS. In this case would be possible to improve design of approach path in view of the requirements for GA thanks to higher accuracy and using not only horizontal but also vertical guidance.

G. Controlled airspace and ATC

The main current shortfall for General Aviation is the need to fly instrument approaches only in controlled airspace and at controlled aerodromes, but this situation should be changed in the coming months.

To enable flying IFR flights at low altitudes and actually down to the ground class F airspace would be implemented in Czech Republic in which IFR flights will be permitted. Since the class F is uncontrolled airspace, it is important to ensure separation between aircraft. In charge of this task is air traffic advisory service, which is not implemented in the Czech Republic. Therefore, the solution could be to let only one flight flying under IFR into the class F airspace.

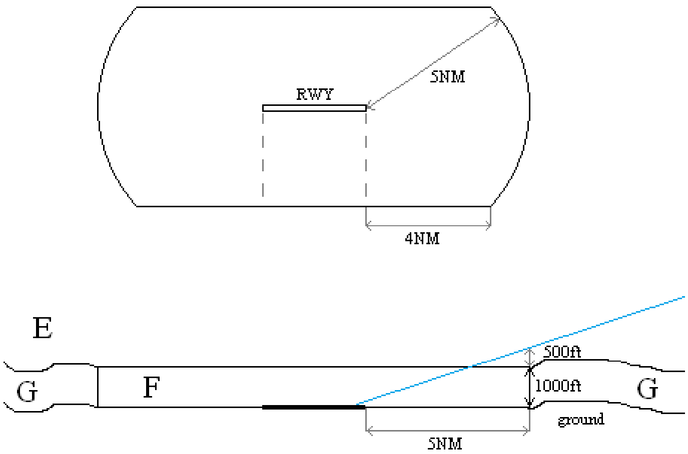

Figure 3. Proceed VFR vs. Proceed Visually

The use of F-class proposed in Figure 3 would be the easiest option, provided that the ATC will be willing to route IFR aircraft through the class E airspace and that they “see and hear” down to handover altitude between ATC and AFIS. (AFIS should satisfy the criteria given to him in ICAO Annex 11 Appendix N.) If there is some reason that ATC has not sufficient surveillance information in handover height, it would be necessary to change class F dimensions, primarily the height limit.

V. CONCLUSION

Important reasons exists for the use of helicopter PinS procedures for airplanes proposed in this paper. The most important one is the need to increase safety by establishing any instrument approach at small aerodromes where pilots creates

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its own procedures and fly by them in weather conditions not complying with VFR, because it is the only way how to get to the aerodrome.

The proposed use of PinS is one way how to get these aircraft safely to the ground with the use of low-cost navigation equipment. An important outcome is that there is no reason why such procedures, although with changes, not use for airplanes. Therefore it would be necessary to determine whether make extension for new aircraft category under PinS name or on the basis of these procedures create a new approach for airplanes. Due to the novelty of the PinS and procedures that are not fully experienced between GA stakeholders, both options are possible.

VI. Acknowledgements

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