Helicopter Approach to Offshore Objects

Pristup helikoptera do offshore objekata

Karel Jeřábek
Institute of Technology and Business in České Budějovice, Department of Transport and Logistics, Czech Republic
e-mail: jerabek@mail.vstecb.cz

Jakub Kraus
Czech Technical University, Department of Air Transport, Faculty of Transportation Sciences, ATM Systems Laboratory, Czech Republic
e-mail: kraus@fd.cvut.cz

DOI 10.17818/NM/2015/2.5
UDK 629.735.3 : 656.61
Review / *Pregledni članak*
Paper accepted / *Rukopis primljen:* 21. 11. 2014.

Summary

This article is focused on the helicopter approach to landing on offshore objects. It describes helicopter approaches and specially designed approaches for the sea. The evaluation of safety in aviation is shown with applications to SOAP approach as well. The helicopter approach to the landing can be considered as part of aviation, which has long been neglected because helicopters are represented only by a minuscule percentage in the overall volume of civil aviation. Because of this, the approach procedures were not designed especially for helicopters, but this type of aircraft with a vertical take-off and landing has irreplaceable role in certain operating situations.

KEY WORDS
helicopter approach
offshore
SOAP
ARA
safety
heliport

Sažetak

Ovaj rad bavi se pristupom helikoptera offshore objektima. Opisani su pristupi helikopterom i posebni postupci pri pristupu na moru. Prikazana je procjena sigurnosti u zrakoplovstvu, koja se također može primijeniti na SOAP pristup. Pristup helikoptera mjestu slijetanja može se smatrati dijelom zrakoplovstva, što je dugo bilo zanemareno jer je udio zastupljenosti helikoptera u ukupnosti civilnog zrakoplovstva minimalan. Zbog toga postupci prilaženja mjestu slijetanja nisu pripremljeni posebno za helikoptere, iako ovaj tip letjelice s vertikalnim uzlijetanjem i slijetanjem ima nezamjenljivu ulogu u određenim operacijama.

KLJUČNE RIJEČI
pristup helikoptera
offshore
SOAP
ARA
sigurnost
heliodrom

INTRODUCTION / *Uvod*

Recently, with the development of RNAV, the helicopter approach to landing subject area is addressed in the Seventh EU Framework Program also from aviation regulators point of view. Thus new instrument procedures specified directly for helicopters such as Point in Space (PinS) or SBAS Offshore Approach Procedure (SOAP) were created. These new approaches allow flying even in poor weather conditions increasing the time availability of various territories.

However, for each new approach there is a need to develop a safety study and continuously identify hazards and manage risks. After the implementation of such an approach to a particular point on Earth, it is necessary to have a system that will perform these processes continuously in order to increase operational safety [1], [2].

HELICOPTER APPROACHES / *Pristupi helikoptera*

A helicopter approach can be classified in the same way as an airplane approach: the instrument and non-instrument approach. The non-instrument approach is the visual approach, which is not addressed here. The instrument approach category includes classic approaches known from the fixed-wing aircraft operations, which are divided into three subcategories: non-precision, with vertical guidance, and precision approach. Furthermore, there is a specific approach for helicopters named PinS, which uses the latest development of GNSS and RNAV.

In terms of the approach to offshore objects, it would be possible to think that there is no difference between this kind of approach and the approach to any other heliport. However, it is important to realize that this idea is not correct because there are some crucial differences. Aside from the possibility that offshore objects move, there may be the following differences compared to mainland, specifically the [2], [3]:

- Non-radar environment
- No, or limited ATS
- Equipment of landing area does not comply with regulations
- High minima
- Long visual final approach segment
- Poor weather conditions

The approach to offshore objects can be divided according

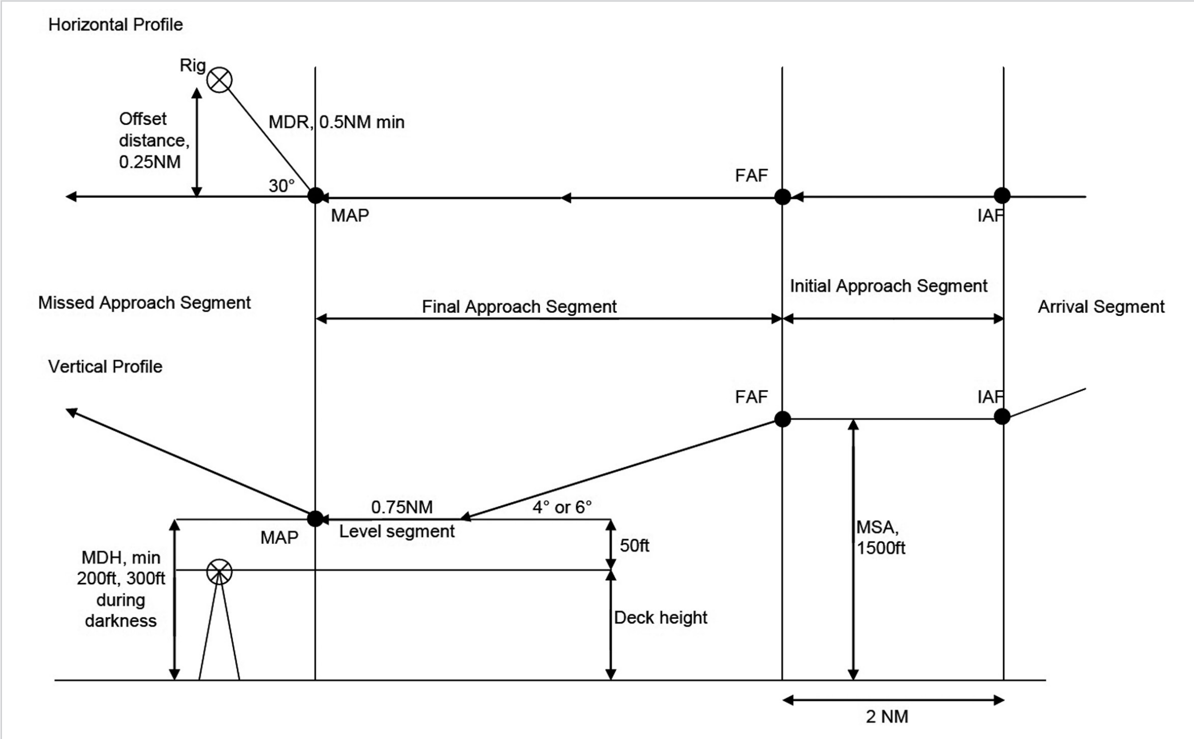

Figure 1 SOAP Approach Plan and Vertical Views

Slika 1. SOAP plan pristupa i vertikalni ogledi

Source: authors, according to [8]

to the aforementioned motion to:

- Static: e.g. oil rig, movement is negligible
- Quasi-static: e.g. anchored objects, move according to sea level
- Moving: e.g. floating vessels

The solutions of helicopter landing sites are specified in the ICAO Annex 14 H, which deals with "heliports". To enable the instrument approach, it is necessary to meet the regulations so that the landing site is either a level heliport, an elevated heliport, a helideck, or a shipboard heliport. Slight differences may occur at a helicopter landing site for HEMS.

In the case of offshore objects they are mostly in international waters, which, although they could be under jurisdiction of a state, they may have different terms and conditions for the operation, since it is a non-standard environment where there is no capability for precise repeatability [1], [3], [4].

ARA (The Airborne Radar Approach)

ARA procedures are used by helicopter pilots flying to oil rigs since the early eighties of the twentieth century. They are based on the use of weather radar, which observes the reflection of oil rigs and the approach track is identified according to that.

- The principle is as follows [3-5]:
- Firstly, the final approach track must be identified, and it must be placed against the wind direction
- The approach is flown with weather radar map mode
- Maximum wind speed and relative wind direction that would be considered safe are not specified in any regulations.
- The approach is flown directly to the oil rig
- Missed approach track is deflected by 10° off approach track
- MAPt is located 0.75NM from the point of landing

SOAP (The SBAS Offshore Approach Procedure)

The SOAP procedure in the project HEDGE was created to reduce operational risks of the ARA procedures [6]. This is the approach procedure which uses the basic GNSS signal refined by the SBAS signal for positioning. This achieved the goal of increasing the use of the RNAV procedures and it also increases the availability of oil rigs. Thanks to the RNAV, it is possible to design a track in any way. Therefore the SOAP procedures are designed as straight-in approaches with an offset so that at critical stage, when using the missed approach procedure, the helicopter can climb into a straight flight. It also uses helicopters avionics, which calculates the approach waypoints before each approach so as to ensure that the approach is always flown against the wind direction. This is done based on the landing point and the wind direction that the pilot enters into the system.

The main advantages of the SOAP compared to the ARA procedures are the [3], [6-8]:

- Reduction of dependence on weather radar
- SBAS reduces the crew workload thanks to vertical guidance
- SBAS improves accuracy and increases repeatability compared with ARA
- SBAS vertical guidance provides altimeter crosscheck
- Provision of direct procedure in the final approach segment and missed approach segment increases safety

A typical SOAP approach is shown in Figure 1 where the most interesting parts of the flight are from the FAF to the MAPt. It consists of two segments: the descending segment and level segment. The length of descending segment depends on the angle of descent and on the MDH (Minimum Descent Height), where the MDH is defined as the height of helideck increased by 50ft and meeting the minimum 200ft during the day and 300ft overnight, according to the radar altimeter. After reaching the

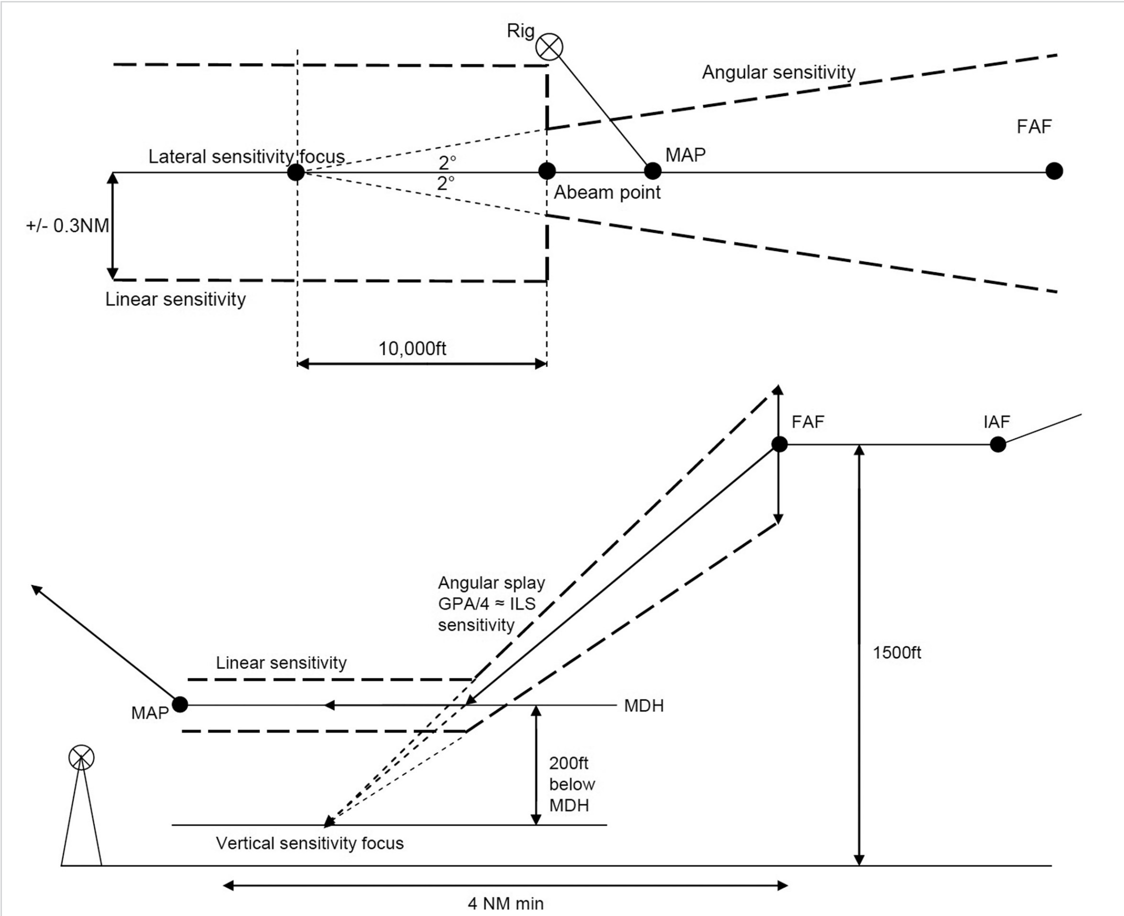

Figure 2 Guidance Provided to the Pilots
Slika 2. Navođenje pilota

Source: authors, according to [8]

MDH, the helicopter goes into horizontal flight and the mission of flight crew is to establish visual contact with the landing site [6-8].

From the above, it is obvious that the MAPt location is crucial for the procedure. The MAPt is defined as the closest point to the landing site from which it is still possible to land safely. The minimum distance is 0.5NM at GS 60kts and maximum angle between the track and the direction towards the landing site is 30°. The length of the level segment is always 0.75NM to ensure sufficient time to get the visual contact [3], [6], [8].

The guidance provided to pilots is shown in Figure 2.

THE APPROACH SAFETY TO OFFSHORE OBJECTS / *Sigurnost pristupa offshore objektima*

THE LEVEL OF SAFETY IN AVIATION / *Razina sigurnosti u avijaciji*

The level of safety in aviation cannot be evaluated with a specific number as in other areas of transport. The safety management manual (SMM) [6] and subsequently regulation L 19 [7] together with the State Safety Program introduce the concept of the Acceptable Level of Safety (ALoS), which is required to be defined by the state in its State Safety Programme (SSP). The state should define the measurable indicators and targets that must be achieved for all aviation. The main purpose of issuing the SSP and the Safety Management System (SMS) is just reaching AloS [2], [5-7].

In determining the value of safety performance indicators and safety performance targets, it is necessary to thoroughly consider the defined area which should be monitored. These areas must comply with the effort to increase the safety of the entire aviation system and not just intervening particular subject. An incorrect definition could lead to a situation that some aviation entities (service providers in civil aviation) will begin to build risk management resistance, because the ALoS will excessively limit their business. In this case, they could use a different approach to risk management than provided in the SMM, SAHARA (figure 3).

THE LEVEL OF APPROACH SAFETY / *Razina sigurnosti pristupa*

The current assessment of the level of safety in aviation is based on the statistics and the analysis of processes. It must include all processes that make up the approach and identify those in which errors are located for the approach. Thanks to this examination, it is then possible to identify the risks, and subsequently determine the overall operational safety of approach.

The main characteristics of approach include airport equipment, used technology, aircraft equipment and approach procedure. From these characteristics it can be seen that the safety evaluation of approach includes very different areas which contribute to the overall safety (form. 1) [11], [12]:

$$f_a = f_{a,t,p,a} \quad (1)$$

where:

f_a = safety level of approach

$f_{a,t,p,a}$ = safety level of aerodrome, technology, procedure, aircraft

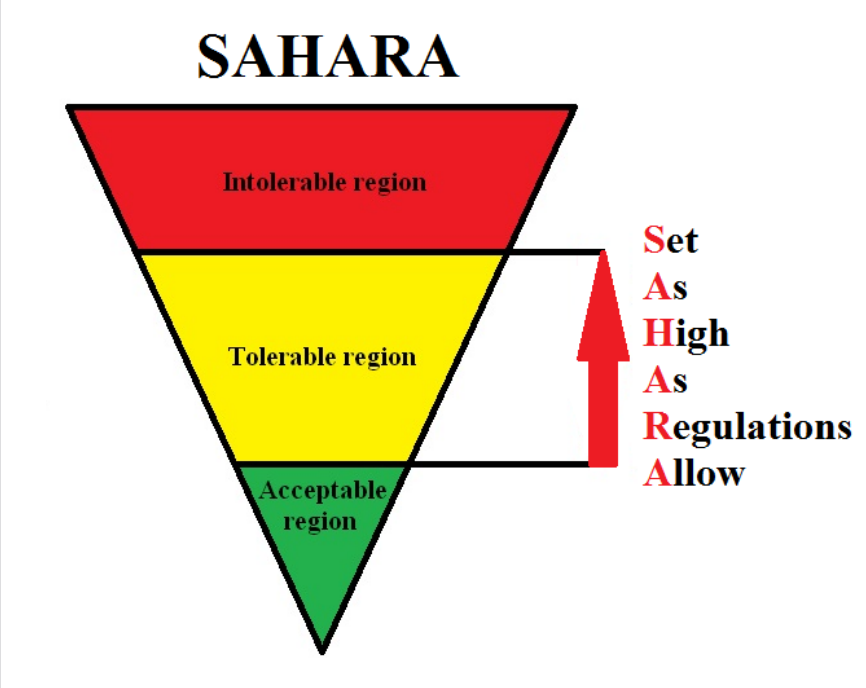

Figure 3 SAHARA
Slika 3. SAHARA

Source: authors

It is important to note this differentiation between the different parts of the safety evaluation of the approach, where the safety assessment of the approach for airlines will only include the functional plane and the correct execution of procedure by the pilot, for example.

When evaluating a new procedure, such as the SOAP, it is necessary to solve the problems of the initial evaluation of safety: creating a safety study for the implementation of this approach. Since there is no initial data, it is appropriate to use the method of Goal Structuring Notation (GSN) [9] to create a Safety Case. Here is the claim that the "SOAP approach is safe" is supported, on the basis of the arguments and evidence, in a way that no counter-argument to contradict this claim can be found.

After assessing the safety and introducing the safety recommendations into operation, it is possible to use the approach and it is necessary to collect information that will be used for continuous monitoring of the level of safety of approach from this point.

It is useful to note that the system of continuous monitoring can be established only in the areas with sufficient traffic, where the approach is used relatively often. In case of a private yacht with a shipboard heliport, the above mentioned system is useless, since mostly there is only one helicopter and one helicopter pilot; so the level of safety of such heliport is in one pilot's hands only [9], [10].

CONCLUSION / *Zaključak*

The approach to landing of a helicopter to offshore objects is considerably more complicated than the approach to the mainland. This complexity is based on the different input conditions that are mentioned above. Creating modern procedures (SOAP) and using the latest technologies are significant steps to increase safety, but its assessment is a very complex task. For the initial simplification, it is possible to use the appropriate methods, but the accuracy of the evaluation is always ensured only by the expert team that compiles this assessment. The subsequent operation and safety evaluation is the responsibility of the helicopter and heliport operators [1], [10].

REFERENCES / *Literatura*

[1] Kazda, A., Caves, R. E. Airport design and operation. 2. edition. Elsevier, The United Kingdom, 522 p. ISBN 978-0-08-045104-6. 2007.

[2] Stopka, O., Šimková, I. Choosing the Suitable Method for Multimodal Logistics Object Location in the Slovak Republic and Setting up the Criteria Matrix. Transport and Communications, Žilina: Žilinská univerzita v Žiline, No. 1, pp. 16-20. ISSN 1336-7676. 2014.

[3] Průša, J. et. al. Světleteckédopravy.1. edition. Galileo – Praha, Czech Republic. 316 p. ISBN 978-80-239-9206-9. 2007.

[4] Voleský, K. et. al. Dopravná a spojovásústava. University of Žilina. 234 p. ISBN 80-7100-441-3. 1997.

[5] Šimková, I., Stopka, O., Kolář, J., Bartuška, L. Ukazovatelevýkonnosti v doprave a logistike. In: Horizontyželezničnejdopravy 2014: sborníkpříspěvků. 1. edition. Žilina: University of Žilina, pp. 277-286, ISBN 978-80-554-0918-4. 2014.

[6] ICAO Doc 9859. Safety Management Manual (SMM). International Civil Aviation Organization. [online] Third Edition, 2013. ISBN 978-92-9249-214-4. [cit. 15.12.2013]. Available form Internet: <http://www.skybrary.aero/bookshelf/books/644.pdf>.

[7] Letecký Předpis L 19. Řízeníbezpečnosti. [online]. [cit. 15.12.2013]. Available from Internet: <http://lis.rlp.cz/predpisy/predpisy/index.htm>.

[8] Project Hedge. Helios. [online]. [cit. 15.8.2014]. Available from Internet: <https://docs.google.com/ewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxoZWRnZWZwN3xneDo3OGEyODY5NTI1MDI2ZTYx>.

[9] GSN Community Standard Version 1. Goal Structuring Notation. [online]. [cit. 2.9.2014]. Available from Internet: <http://www.goalstructuringnotation.info/documents/GSN_Standard.pdf>.

[10] Kampf, R., Gašparík, J., Kudláčková, N. Application of different forms of transport in relation to the process of transport user value creation. PeriodicaPolytechnica Transportation Engineering40 (2) pp. 71 – 75. ISSN: 0303-7800. 2012.

[11] Říha, Z., Němec, V. and Soušek, R., 2014. Transportation and environment-economic research, WMSCI 2014 - 18th World Multi-Conference on Systemics, Cybernetics and Informatics, Proceedings 2014, pp. 212-217.

[12] Koblen, I., Szabo, S. and Krnáčová, K., 2013. Selected information on European union research and development programmes and projects focused on reducing emissions from air transport. Nase More, 60(5-6), pp. 113-122.