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# SIGNAAL MODULAR COMBAT SYSTEM TACTICOS CAPABILITIES DURING HELICOPTER TASKS REALIZATION

## ABSTRACT

The article presents the short of SMCS Tacticos on board Oran class FAC capabilities during sea tasks by multifunctional helicopter using. Some helicopter recovery system functions and procedures including SAR capabilities and in low visibility have been also described. Author tries to give some information about military system which might be used in cooperation with civilian fleet in emergency situations.

Keywords:
Air Control, SAR, Combat Management Systems.

## INTRODUCTION

The common helicopter using during most of combat, SAR and other tasks connected with ships, merchant vessels and oil rigs exploitation nowadays causes that surface systems have to be equipped witch modern Management Systems connected with all ship's vital subsystems like rudder, navigation subsystems, main engine control systems, surface and air zone scanning systems. The most important tasks excluding combat involve SAR and recognition operation at sea. Civilian and Polish Coast Guard vessels can provide main SAR operations with helicopters supporting but only with radio Air Control in good flying object navigation and avionic equipment condition. So far only Naval Ships are equipped witch multifunctional Combat Management Systems with full Air Control options and can be easy used to support helicopter during operation connected with civilian side of human activity at sea, especially in SAR action coordinator assignation. According to previous author will try to show some Orcan class FAC on board SMCS Tacticos Air Control possibilities because that ship and system can be easy used in Polish Responsibility Zone borders. Nowadays there is a five warships in Polish Navy which can provide operations at sea

with helicopters in any weather conditions. Oliver Hazard Perry Frigates can recovery helicopter straight onto the flight deck but Orkan class FAC are able to support other helicopter activities including guiding straight over deck or in close ship's zone in case for instance avionic systems damages. The last task is extremely important when the air zone is exploited by few different helicopters and one of them has problem with radio or radar. Air Control consists of the following capabilities:

— Helicopter recovery;
— Aircraft direction;
— VECTAC[1].

## SOME SMCS CAPABILITIES IN AIR CONTROL

### Helicoter recovery

Helicopter recovery provides the facilities for assistance and guidance of the ship's helicopter during its recovery on board the own ship. The helicopter recovery capability recommends the course to fly and either the speed or the duration for the recovery of the helicopter i.e. the helicopter is directed during the recovery onto/near to the flight deck of the ship. The following helicopter recovery procedures are supported by SMCS Tacticos:

— Ship's Controlled Approach (SCA) in which the helicopter is directed onto the flight deck;
— Emergency Low Visibility Approach[2] (ELVA) in which the helicopter is directed to a position at pre-defined distance straight behind the flight deck[3].

Figure 1. shows a typical pattern for an SCA. The approach course depends on the centre line of light beam emitted by the Glide Path Indicator (GPI)[4] in the horizontal plane. The angle of the GPI centre line and the width of the GPI envelope are inner system parameters. The GPI is also used to guide helicopter in elevation as shown in figure 2. Additional procedural guidance in elevation is given by the helicopter controller. The typical elevation pattern for the lightweight helicopter approach is given in figure 3.

Both described procedures are executed in two phases:

1. Helicopter approach. During this phase of the recovery procedure SMCS Tacticos calculates the helicopter's course and the speed of the duration to

[1] VECTorized Attack.
[2] Also called: Poor Visibility Approach (PVA). According to [1].
[3] This situation is close connected with SAR tasks. By author.
[4] On bard the Orkan class FAC there is not GPI, this system is used with the flight deck only.

reach a gate. This gate indicates the entrance for the final recovery phase and is situated at a pre-defined distance from the future own ship's position. Two helicopter approach calculations can be carried out simultaneously.

2. Helicopter descend. During the descend phase of the recovery procedure SMCS Tacticos calculates the helicopter's course to fly an the duration to reach either the flight deck (SCA) or a position straight behind the flight deck (ELVA).

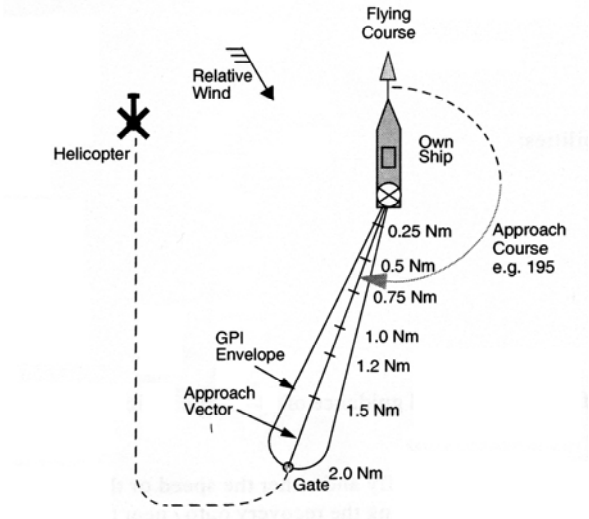


Fig. 1. Typical SCA — Pattern [1]

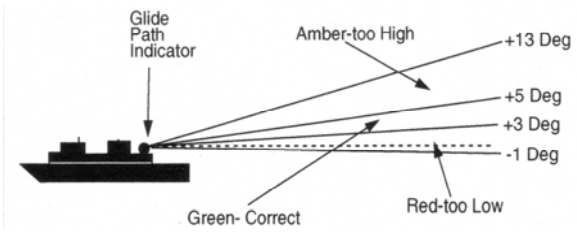


Fig. 2. GPI elevation Pattern [1]

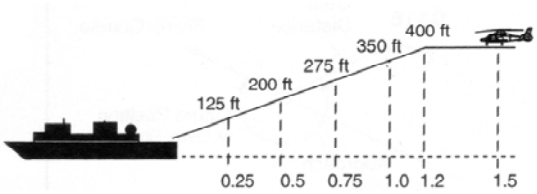


Fig. 3. Typical elevation Approach Pattern [1]

**Helicoter approach**

The helicopter approach is the first phase of the own helicopter's recovery procedure and directs the helicopter to the gate. The gate position depends on two factors as shown in figure 4:

1. The future own ship position when the helicopter reaches the gate. The gate is situated on a circle with predefined radius around this predicted position. The radius of the gate circle i. e. the gate distance is a system parameter.
2. The flying course which the ship sails during the helicopter's landing. The angle of the gate with respect to the flying course is the approach course and can be calculated automatically or entered manually by operator.

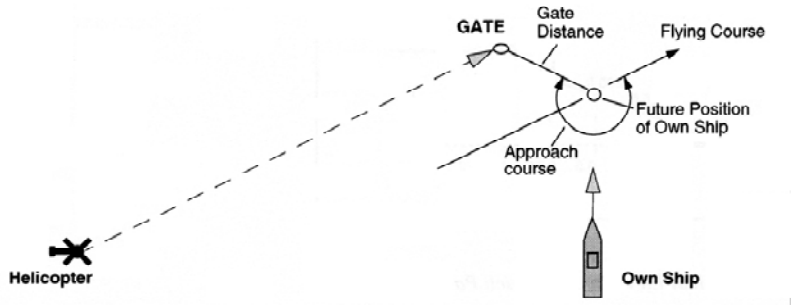


Fig. 4. Helicopter Approach — Direct [1]

The operator can select the one of the following two modes for the calculation to reach the gate:

1. The helicopter's true air speed is considered to be constant[5]. As a result the course to fly and the flight duration are calculated.
2. The duration of the flight is considered to be constant. As a result the course to fly and the required true air speed are calculated. The true air speed is converted into the indicated air speed for the recommendations to the helicopter.

It is possible to reach the gate either directly (fig. 4) or via way points. The course to fly can be based on the magnetic compass bearing or true compass bearing taking into account the direction and speed of the wind. The capability can handle two helicopters at the same time[6]. Indirect helicopter approach is shown in figure 5.

[5] It is preset as system parameter: indicated air speed. According to [1].
[6] This service does not support or offer collision avoidance facilities for the two helicopters.

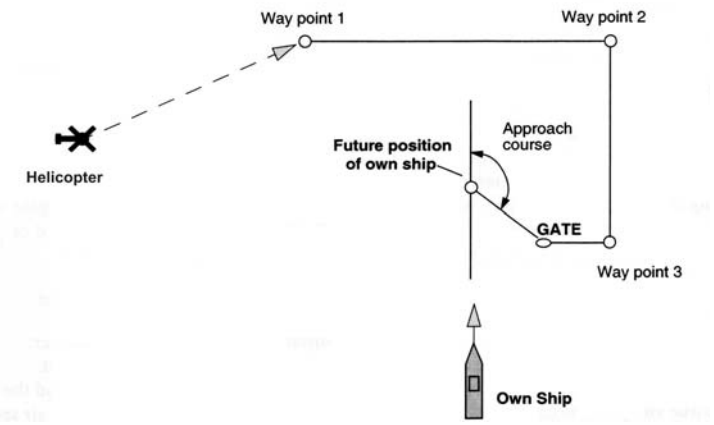


Fig. 5. Helicopter Approach — Indirect [1]

The calculations are repeated until the helicopter has either reached the gate or the calculation is terminated at request. If the gate position has been reached the helicopter descend phase is started automatically. If the descend procedure is busy with another helicopter the helicopter approach will continue in waiting mode until the descend procedure is free to proceed.

### Helicopter descent

Helicopter descent direct a helicopter towards the own ship when the helicopter has reached the gate position. The descend calculation can be started manually or automatically. During this helicopter recovery phase the own ship is supposed to sail or start sailing on the same course as the indicated flying course. In SCA case the helicopter is guided to the ship. In case of ELVA — directed to a predefined position straight behind the helicopter deck (or just the stern deck in case the Orkan class FAC) after which the helicopter starts the landing procedure autonomously (the landing procedure may be guided by flares dropped into the own ship wake). The position to which the helicopter is direct depends on the visibility distance. The default value of the visibility distance is a system parameter (called in System signal dictionary as: ELVA position).

In both modes the helicopter starts descending with a course that is compensated for own ship movements and influences of wind so that the helicopter approaches via a vector that is slaved to the own ship position

As it may be inconvenient or even impossible to sail the ship on the flying course at the beginning of the descend the calculation contains the following facilities:

1. During the first part of the descend (2-1.2 NM) the ship's course is not necessarily the same as the flying course. The helicopter course to fly is calculated for an approach vector that is based on the approach course (related to

a flying course). The GPI envelope is slaved to the own ship based on the approach vector in relation to the actual ship's course. This situation is shown in figure 6a and b for ship's controlled approach (SCA).

2. For the second part of the descend it is assumed that the actual own ship's course has been brought onto the flying course while the helicopter was descending via the first part of the approach vector. This own ship's course change will rotate the GPI envelope onto the approach vector direction. This situation is shown in figure 6b.

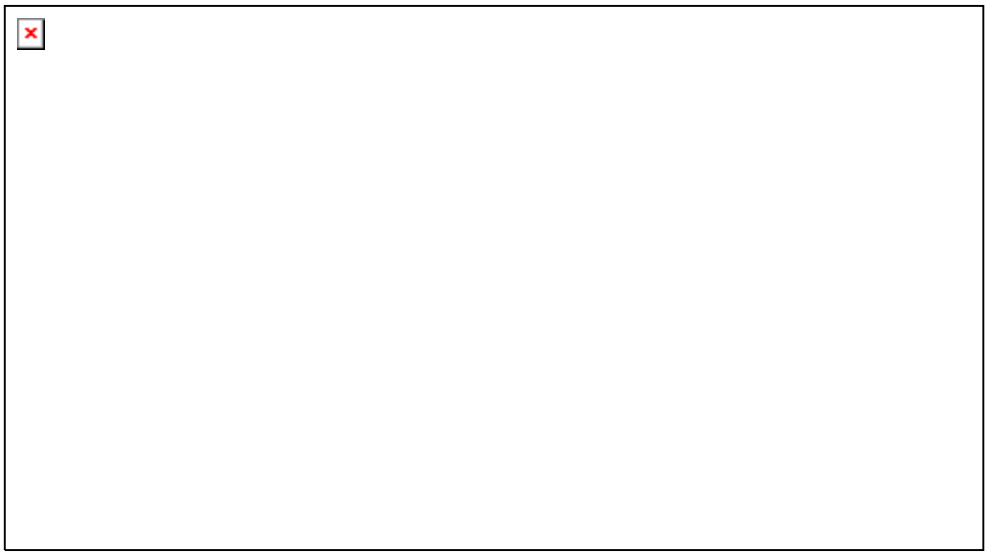

Fig. 6. Helicopter Descend [1]

For an ELVA the approach vector ends at a predetermined position straight behind the flight deck. Figure 6c shows the situation for an ELVA when the own ship sails on flying course. In accordance with the above procedures the capability calculates and uses the measured position and input helicopter speed:

— course to fly (based upon the magnetic compass bearing);
— range to go;
— time to go for the helicopter.

The calculations are repeated to obtain up-to-date results. The capability is terminated automatically if the time to go reaches zero or can be terminated on request by the operator. For SCA distance markers are displayed on the approach vector at the following positions relative to the flight deck: 0.25, 0.5, 0.75, 1.0, 1.2, 1.5 and 2.0 NM. For ELVA the marker displaying procedure is the same. The distance markers can be used by the AIRCO to inform the pilot so he can check his altitude.

## AIRCRAFT DIRECTION

Aircraft direction provides the facilities for assistance and guidance of the helicopter/MPA within the own ship's operating area. This capability directs a helicopter or MPA to a tactical track position or reference position. The system recommends the course to fly and either the speed or the duration for the aircraft direction i.e. the helicopter/MPA is directed to intercept a defined destination. The operator can select one of the following modes for intercept calculation:

1. The helicopter or MPAs true air speed is considered to be constant. The true air speed of the aircraft is calculated from the indicated air speed as entered or reset by the system. The values for the height and the indicated air speed are the system parameters. As a result the course to fly and the flight duration are calculated.
2. The duration of the flight is considered to be constant. As a result the course to fly and the required true air speed is calculated. If the true air speed is more than a maximum value an indication is given that no solution can be found. The true air speed is converted into the indication speed for the recommendations to the aircraft. An intercept calculation based on a fixed duration is shown in figure 7.

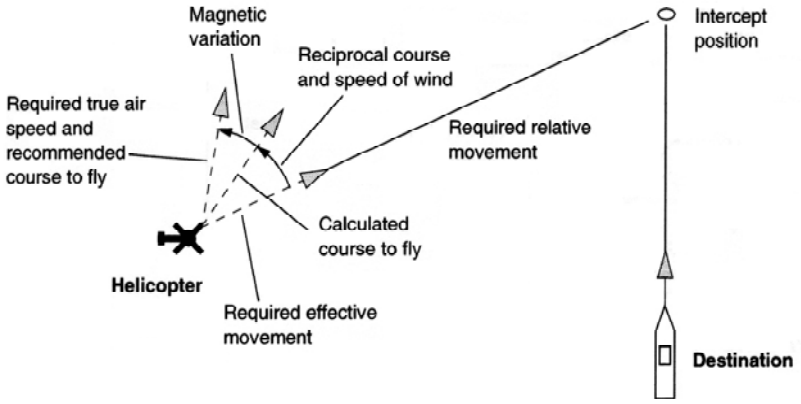


Fig. 7. Aircraft Direction — Direct Intercept Fixed Duration [1]

The intercept calculations can be performed either directly or indirectly via way points. The calculated course to fly is based on the magnetic compass bearing or true compass bearing , taking into account the direction and speed of the wind. In case of a magnetic compass the magnetic variation is used as compensation. The calculations are repeated until either the duration has elapsed, the designated track/reference position is wiped or until the capability is terminated.

## CONCLUSIONS

There is another one procedure called VECTAC in SMCS dictionary, but it is special function and not used during cooperation with civilian vessels and will not be presented. Mentioned procedures are much closer described in SMCS manuals and training support issues, but there is only short briefing about 'Tacticos' possibilities in case a human activity at sea supporting. Especially ELVA procedures are useful because excellent equipped SMCS has two tracking systems[7] which can provide surface and air situation complying in all weather conditions. As we can see Polish Navy ships can support the most important SAR tasks in cooperation with shore, air and surface coordinators.

## REFERENCES

[1] Orkan class handbook for the SMCS Tacticos.

## STRESZCZENIE

Artykuł przedstawia krótki rys możliwości systemu dowodzenia SMCS Tacticos okrętu proj. 660 podczas współpracy ze śmigłowcem dowolnego przeznaczenia. Opisane zostały procedury sprowadzenia śmigłowca na pokład i do momentu zawisu nad rufą okrętu. Załączono szereg konkluzji związanych z wykorzystaniem wymienionych procedur podczas prowadzenia akcji ratowniczej w sytuacji kierowania nią przez okręt wojenny, zwłaszcza w warunkach złej widzialności.

Recenzent prof. dr hab. inż. Andrzej Felski

[7] Sea Giraffe AMB and Sting EO battle systems, both radar multi-beam tracking devices. The Sting EO has also optoelectronic turret with TV-IR camera and laser distance measurement system. By author.