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# POSSIBILITIES OF NEW TECHNOLOGIES IMPLEMENTATION IN HELMET-MOUNTED CUEING AND DISPLAY SYSTEMS FOR POLISH MILITARY HELICOPTERS

**Andrzej Szelmanowski, Paweł Janik, Mirosław Sobielarski**

*Air Force Institute of Technology*
*Ksiecia Boleslawa Street 6, 01-494 Warsaw, Poland*
*tel.:+48 261 851 603, +48 261 851 444, +48 261 851 123*
*fax: +48 261 851 646, +48 261 851 612*
*e-mail: andrzej.szelmanowski@itwl.pl*
*pawel.janik@itwl.pl, miroslaw.sobielarski@itwl.pl*

***Abstract***

*The article presents selected results of work in the Air Force Institute of Technology in the study of modern, digital helmet-mounted display systems and helmet-mounted cueing systems, manufactured for polish military helicopters. There are presented possibilities of new informatics and optoelectronics technologies, implemented in the SWPL-1 CYKLOP helmet-mounted display system (built in the AFIT's Department for Avionics and dedicated for Mi-8 and Mi-17 helicopters) and the helmet-mounted cueing system NSC-1 ORION (built in the AFIT's Department for Avionics for polish military helicopters W-3PL and Mi-24 helicopters).*

*The main attention was devoted to the presentation of the Demonstration Station (built in the AFIT Department for Avionics), designated to test new technologies and functions of the helmet-mounted display systems for future application on board the Polish military helicopters (e.g. TV/FLIR visualisation and quaternion calculate of pilot's helmet space orientation).*

***Keywords:*** *helmet-mounted display systems, helmet-mounted cueing systems, research and simulation station*

## 1. Introduction

Helmet-mounted data presentation systems are one of the new technology components of modern, technically advanced aircrafts, equipped with the integrated avionics systems. Currently, they use digital helmet-mounted flight manoeuvre, navigation and aiming data imaging systems and warning systems informing about hazardous situations or malfunctions of supervised on-board equipment and installations to assist the pilot's work [2, 8, 12]. That is the reason why, helmet-mounted imaging and indicating systems become the basic equipment of modern multifunctional combat airplane and helicopters. They are also an important bargaining instrument in the new modification programs of technologically less advanced aircraft. The main purpose of their use is the visible increase of so-called pilot's situational awareness and flight safety as well as efficiency and effectiveness when it comes to use of on-board weapons and survivability of crews [6, 8].

In classic version, helmet-mounted data presentation systems use day vision ocular displays and night vision goggles (Fig. 1.), which are standard equipment of e.g. AH-1 Cobra and AH-64 Apache military helicopters or F-16, RAFALE, and MIRAGE-2000 military aircraft [8]. They allow not only the direct (i.e. displayed in front of the pilot's eyes) informing about the flight manoeuvre and navigation parameters (which is very crucial during the manoeuvre flight), but also give directive commands (commanding activities necessary to complete the task) or warnings about emergencies or malfunctions (obtained from health check systems of on-board equipment).

*Fig. 1. The ANVIS Helmet-Mounted Display System for AH-1 military helicopters [8]*

Among numerous methods used to present flight parameters, there are used indirect methods using head-up displays motionless in relation to the cabin (e.g. HUD-type) and direct methods, in which helmet-mounted displays (ocular or video) are permanently connected with the pilot or operator's helmet [8]. In addition, on the helmet's ocular or viewfinder there are displayed vital information about, among others, flight velocity, altitude, and rate of climb as well as cueing data for all weapons. The display also shows information needed in an emergency.

The flight manoeuvre and navigation data presentation systems have evolved significantly, starting from instruments mounted in the cockpit requiring the full pilot's attention, used in all fighter aircraft flying, to the HUD system currently used in F-16 and other modern military aircraft and helicopters. Currently, the helmet-mounted data presentation systems are also used in movable weapons of a moving aircraft's control (e.g. in terms of the helmet-mounted target indicator for a cannon or a guided missile) and in search and rescue systems (to control the angular position of an observation and cueing head or a suspended reflector).

For example, the F-16's pilots have a digital image displayed on the helmet's viewfinder with the JHMCS (Joint Helmet-Mounted Cueing System) cueing-imaging system at their disposal. This system presents only cueing data and the pilots read flight information from the HUD display or liquid multifunctional displays [8, 12].

## 2. The SWPL-1 CYKLOP Helmet-Mounted Display System for Mi-17-1V helicopters

The SWPL-1 CYKLOP is the first polish helmet-mounted display system developed in the AFIT's Department for Avionics for Mi-17-1V helicopters. This system enables day and night (using night vision goggles) pilotage. The SWPL-1 system collects and processes information from on board systems and installations and transfers it to helmet mounted displays in the format of graphic symbols or digital information essential for providing combat mission.

The SWPL-1 helmet mounted flight parameters display system (Fig. 2.) successively installed on the Mi-17-1V helicopters allows piloting the helicopter both in day and at night conditions (using the night vision goggles) without the need for continuous tracking the indications on the dashboard [1, 7]. The system is designed for the crew commander (the first pilot) and the second pilot. It enables imaging the selected flight manoeuvre and navigation parameters as well as control of a drive unit operation.

Daylight flight parameters imaging is performed using the helmet-mounted head-up display DWN-1. At night, flight parameters imaging is performed using the night vision goggles and the NWN-1 helmet-mounted night display. The system also allows generation of warning (WARN) signals about dangerous situation on board the helicopter and generation of FAIL signals informing the pilot about the failure of the on-board systems and installations [1, 11].

The SWPL-1 system in the version for the Mi-17-1V helicopter performs imaging of 16 flight parameters in three variants of sets (chosen by each of the pilot independently) and includes 28 emergency states in the warning (WARN) and error signalling (FAIL) system. Prior to each flight, the system performs automatic diagnosis of the technical condition of the system's basic modules, with the ability to add corrective and navigation data [1].

*Fig. 2. The SWPL-1 Helmet-Mounted Display System for Mi-17-1V military helicopters [11]*

The SWPL-1 system enables the crew to observe the area and to control the basic flight parameters and monitor the technical condition of the selected helicopter on-board systems at the same time. This system receives and processes information from the helicopter on-board systems and passes it to the helmet-mounted displays in the form of graphic symbols or in a digital form. The system enables imaging of selected flight manoeuvre and navigation parameters and the drive unit operation's parameters.

The main element of the SWPL-1 system is the above mentioned KG-1 graphical computer, which is a computing module processing signals about flight manoeuvre and navigation parameters received from the on-board transmitters (after their initial standardisation in the UDS-1 signal matching system) into the form of graphic symbols or in the digital forms required to imagine on the helmet-mounted displays.

The source information from the on-board systems of the helicopter is passed to the UDS-1 signal matching system. This system is responsible for transformation and standardisation of analogue and binary signals as well as implementation of logical functions related to the generation of the WARN and FAIL signals.

Processed signals are then transmitted to the KG-1 graphic computers. The graphic computer is the main element of the system executing data selection and transformation algorithms and generating information imaging signals to the helmet-mounted head-up display. It also cooperates with the on-board GPS satellite navigation receiver and the on-board ADU aerodynamic data unit using the bus compliant with the ARINC-429 standard.

To ensure the reliability of the information presented system uses the method of matching their indications for instrument board. The procedure for matching of indications covers the most important pilotage-navigational parameters, depicted in the SWPL-1 system.

For example, the matching algorithm uses a vertical speed following relationship:

$$\Delta W_Z(t_k) = \frac{1}{T_{MATCH}} \cdot \left[ K_{MATCH} \cdot V_Z(t_k) - W_Z(t_{k-1}) \right], \tag{1}$$

where:

$W_Z(t_k)$ – values of the matching vertical speed after matching procedure,

$V_Z(t_k)$ – value of the vertical speed before matching procedure,

$K_{MATCH}$ – coefficient of gain in the matching track, dependent on altitude of flight,
$T_{MATCH}$ – time constant of delay in the matching track, dependent on altitude of flight.

On the board of the Mi-17-1V helicopter, there is a function of flight parameters visualisation for the first pilot (the crew commander) and the second pilot (the pilot/operator) in terms of information necessary for the combat mission accomplishment. There is capability for the pilots independently to select an operating mode and the appropriate imaging related to it depending on a current need and executed task circumstances. The system operation is controlled using dashboards and commutation elements installed on the steering device.

Additionally, the SWPL-1 system executes the functions of signalling of exceeding the dangerous flight altitude, warning about the dangerous situation on the helicopter's board and malfunctions (errors) of the on-board systems [1].

### 3. The NSC-1 ORION Helmet-Mounted Cueing System for W-3PL helicopters

The NSC-1 ORION is the first polish helmet-mounted cueing system (Fig. 3.) developed in the AFIT's Department for Avionics and dedicated especially for W-3PL GŁUSZEC and Mi-24 helicopters (for the version equipped with the Integrated Avionics System). The NSC-1 system designed for W-3PL is capable of providing helmet controlled target cueing of the turret gun 12,7 mm WKB-M and other helicopter’s guided weapon systems, displaying pilotage-navigational and aiming information during day and night flights (using NVG) at the same time. The NSC-1 system can realize the above-mentioned functions independently or in cooperation with an optoelectronic surveillance system (e.g. TOPLITE system).

*Fig. 3. The NSC-1 Helmet-Mounted Cueing System for W-3PL military helicopters [11]*

The NSC-1 helmet-mounted cueing system was built into helmet-mounted control of the movable shooting position with the 12.7 mm WKM-B rifle and cooperation with the Toplite observation and cueing head (built in the W-3PL Głuszec helicopter's board). This system is electronically coupled with the integrated avionics system of the W-3PL Głuszec helicopter. Thanks to this system, it is ready to operate in the so-called network centric system enabling implementation of an advanced flight training of a flight crew and meeting the conditions to use it in accomplishment of combat missions on the modern battlefield in all daily (day-night) conditions. In the development version, the system can control the angular position of the observation and cueing head (with the ability of helmet-mounted displaying the information received from it) and can be used in helmet-mounted target indication for guided projectiles.

The main component of the NSC-1 system, specifically, the KG-1HC graphical computer, is designed to determine instant three-dimensional pilot's helmet orientation (that data is transferred to the integrated weapons control system). To determine this helmet's spatial orientation, the NSC-1 system utilizes modern optoelectronic measuring system and computer based analytical module with the artificial neural network technology [10].

To ensure the correct determination of space orientation of the pilot's helmet system NSC-1 uses electro-optical method with 3-LED sensors. The procedure for determining the angular position of the pilot's helmet is implemented in the graphical computer KG-1HC.

For example, the neural network algorithm uses the coordinates of the light spots of 3-LED sensors following relationship:

$$\left[E(t_k), A(t_k)\right] = \left\lfloor W_{ij} \right\rfloor x \left[X_i(t_k), Y_i(t_k)\right] + \left\lfloor B_{ij} \right\rfloor \ , \tag{2}$$

where:

$[E(t_k), A(t_k)]$ – matrix of parameters of the angular position of the pilot's helmet,
$[X_i(t_k), Y_i(t_k)]$ – matrix of coordinates of the light spots of 3-LED sensors,
$[W_{ij}]$ – matrix of coefficients of the neural network weights stated in the learning network,
$[B_{ij}]$ – matrix of coefficients of the neural network biases stated in the learning network.

The modernness of the NSC-1 system lies in the fact that it is built in an open architecture, designed for mounting on helicopters of an adequate process ability level, i.e. W-3PL Głuszec. To perform the function of the helmet-mounted control over the helicopter's weapons control, this system specifies, in the same coordinate systems, the position of the helmet, the head, and the movable position. The necessary data for the helmet mounting NSC-1 cueing system are downloaded from the navigation part of an integrated avionics system built on the W-3PL Głuszec helicopter. To ensure ergonomics and shortening of the process of preparing on-board weapons to use, the flight manoeuvre and navigation parameters as well as data for cueing process are illustrated on the WND-1 integrated day-night display mounted on the pilot's helmet. The system cooperates with the latest (developed in the PCO company), miniaturised PNL-3M night vision goggles reducing load on the pilot's cervical spine.

Using the built NSC-1 helmet-mounted cueing system, the angular location of the movable position with the 12.7 WKM-B rifle (in the version built within a technology demonstrator) and other elements of the on-board weapon system, among others the movable Toplite observation and cueing head and guided missile's coordinators (in the development version) can be controlled. In order to ensure its operation, this system is coupled with the KM-1 mission computer (built on the W-3PL Głuszec helicopter) and it requires a helmet-mounted angular position determination of the helmet and a helmet-mounted cueing process data imaging system (including a so-called reticule enabling the emergence of the cueing axis aim for the pilot's eye).

The element integrating the NSC-1 helmet-mounted system is the KG-1HC graphical computer cooperating with the KM-1 mission computer consisting the main element managing the operation of the integrated avionics system of the W-3PL Głuszec helicopter. In particular, this system cooperates with a laser scope of the Toplite observation and cueing head and the on-board power grid's power system. Cooperation of the NSC-1 system with the avionics system and other measurement systems on the helicopter is performed using interfaces: MIL-1553B, ARINC-429, RS-485, ETHERNET 10/100, and USB.

The NSC-1 helmet-mounted cueing system's functions in the helmet-mounted weapons control system of the W-3PL Głuszec helicopter are: visualisation of the cueing symbols on the helmet-mounted head-up display (taking into account currently used weapons and their ballistic data); cueing the selected movable weapons system on the helicopter to the external target (by a system operator); measuring the azimuth and the pilot helmet's elevation angles in relation to the helicopter's cabin and sending them in the digital form to the application preparing ballistic and cueing data in the mission computer. In the field of control over the weapons system, the built technology demonstrator of the W-3PL Głuszec helicopter's helmet-mounted weapons control system includes adapted moveable shooting position (with the 12.7 mm WKM-B rifle) and the position for simulation of the selected functional parameters of the Toplite observation and cueing head (the SGT-1 simulator built in the AFIT).

In terms of process solutions, the presented NSC-1 system is based on innovative solutions unprecedented in the world [10].The applied construction and process solutions in the built, integrated, helmet-mounted weapons control system of the W-3PL Głuszec helicopter are at the highest process level. A ground-breaking solution in the performed project is the use of artificial neural networks technology in determining the angular position of the pilot's helmet (developed in the AFIT) and the WDN-1 integrated day-night display (developed in the PCO company), used for the purposes of the helmet-mounted flight manoeuvre, navigation and cueing information imaging with the PNL-3M miniatured night vision goggles (built in the PCO company).

The operation of the NSC-1 system includes the helicopter's weapons control, in which the pilot's head movement in terms of azimuth and elevation causes an appropriate movement of a target axis of the movable shooting position with the 12.7 mm WKM-B rifle. This enables firing without taking hands off the control element and the helmet-mounted target indication and enables fast system's switching on the observation and cueing head's signals used for precision shooting.

Preliminary testing accuracy of determining the spacial position's angles of the pilot's helmet for the NSC-1 helmet-mounted cueing system were performed on the test station, built in the AFIT for teaching the neural network used in the electro-optical and hybrid methods [10]. This station for the tested application with the neural network provides: automated presenting and measurement of the azimuth and elevation angles of the cueing axis; automated measurement of the spatial position of the helmet with the determination of the azimuth and elevation angles of a helmet zeroing axis via a measurement system; sending these angles in the digital form to a measurement application for archiving and further analysis; determining the accuracy of the angular position.

On the basis of the results of tests conducted in the AFIT, it was found that out the most convenient method for application in the NSC-1 helmet-mounted cueing system is the hybrid method. It is one of the ways to increase the accuracy of determining the angular position of the helmet combining several component methods (electro-optical and inertial). This system can be optimised in terms of the number and types of signals and ways of their processing (e.g. using the Kalman filter). A considerable advantage of the NSC-1 system is its construction based on the integrated avionics system of the W-3PL Głuszec helicopter, using MIL-1553B (in terms of management of the helmet-mounted system operation) and MIL-1760 digital buses (in terms of controlling the weapons system). It allows building it on other, new or upgraded, combat helicopters with the integrated avionics system [5, 9, 10].

The built NSC-1 helmet-mounted cueing system as a technology demonstrator supports the testing process of new methods (and devices for their technical performance), and can provide a basis for their further development within the domestic industry.

## 4. The Demonstration Station to test new functions of Helmet-Mounted Cueing Systems

The Research&Demonstration Station, developed in the AFIT Department for Avionics, is designed to test new functions of the helmet-mounted display systems for polish military helicopters [5, 9, 11]. The station enables, among others, testing of translucent data presentation from different systems, for example: the Surveillance Imaging System (Toplite or others systems), multi radionavigation systems (VOR/ILS/TACAN), Air Traffic Control systems and Collision Avoidance Systems (TCAS/EGPWS).

The highlight and the especially promising aspect of the Demonstration Station (Fig. 4.) is the research of possibilities to enhance the operational capabilities of the HMD system through adding the verbal communication assistance feature. It enables the pilot verbally to select the scope of data to be displayed on the HMD. One of the essential strengths in a modern battlefield is, i.e. having the option to recover personnel or equipment from an area of danger. Special military units were formed in the Polish Armed Forces for the execution of SAR and CSAR search-rescue tasks. A helicopter, which could support the execution of these tasks if the W-3PL Głuszec helicopter with a mounted, integrated avionics system. Fitted with a moving fire position (with the option of helmet-mounted control) and an observation-cueing system with a TOPLITE head, which enables the detection and identification of a survivor at large distances with the use of an integrated com-system and a RSC-125G on-board radio direction finder.

*Fig. 4. Demonstration Station for new functions testing of Helmet-Mounted Display Systems [11]*

Introducing to operation of the SWPL-1 helmet-mounted system and development of the NSC-1 helmet-mounted cueing system, as well as a base of gained experience allowed for the construction of a demonstration device for the presentation and verification of the possibilities of a helmet-mounted visualization system for the images obtained from the observation-cueing heads.

The presented technology allows expanding the possibilities and functions of the W-3PL Głuszec helicopter regarding the execution of main SAR and CSAR tasks, with its main function being saving human lives. One of the solutions supporting the execution of search-rescue actions is the introduction of the QuickDraw 2 device on board of the Mi-8/17 helicopters [3, 4]. Connected with the on-board VHF/UHF radiostation of the integrated communication system, the QuickDraw 2 can act as a CSAR search radio. Such a set cooperates with the AN/PRC-112 survivor’s radio, which can operate in the following frequency ranges: 121,500 MHz VHF/AM; 243,000 MHz and 282.8 MHz UHF/AM; two programmable frequencies (A or B) from the 225-300 MHz UHF/AM range. QuickDraw2 device powered with four AA batteries, which allows ca. 24-h operation. In order to cooperate with the on-board radio, the QuickDraw 2 needs to be connected to the headphone circuit of the crew commander or the pilot-operator of Mi-8/17 helicopters with an integrated communication system.

A demonstration device for the technologies in the scope of a helmet-mounted imaging system for information from observation-cueing heads was constructed in order to present and verify the possibilities of the helmet-mounted visualization system for images obtained during the execution of aviation search-rescue missions. The device uses daylight TV cameras, NVG residual light cameras and FLIR thermal light cameras [11]. In this system, the images from the camera, which is guided by the helmet onto a selected survivor search area are directly transferred to the on-board command position, enabling their further analysis, i.e., with the aim to identify the survivor, define the options and manner of his evacuation. The demonstration device enables testing different variants of imaging presented on the helmet display, which allows the pilot-operator to select the optimal presentation method for the piloting-navigational data and the images from observation-cueing heads in real time.

A flight simulator station is used for training pilots in executing CSAR missions. It enables performing helicopter flights, navigating and observing land in the search area, as well as approaching a survivor and supervising his evacuation by a rescue squad in all weather conditions, both day and night.

The constructed demonstration device uses the elements of the SWPL-1 helmet-mounted flight parameter imaging system. The functions of imaging information from TV daylight and FLIR infrared cameras were implemented with a matrix generating an image with high resolution and adjustable light intensity. The generated image is sent by an optic system to a semi-transparent mirror in the DWN-1 display, which displays it onto the pilot's eye, together with the image of the surroundings reaching the pilot.

For the helmet-mounted control of the daylight and infrared camera zeroing line position control, the constructed demonstration device uses a micro-electronic movement parameter sensor, enabling the determination of spatial orientation angles of the pilot's helmet through measuring its angular velocities and linear accelerations. In this application, angular position of the pilot's helmet is calculated with the use of algorithms basing on the quaternion technology.

To ensure the correct determination of space orientation of the pilot's helmet system NSC-1 uses micro-electronic inertial sensors. The procedure for determining the angular position of the pilot's helmet is implemented in the graphical computer KG-1HC.

For example, the quaternion algorithm uses the components of the measured linear acceleration following relationship:

$$\{G_{PO}(t_k)\}\circ\{Q_{SP}^{PO}(t_k)\}=\{Q_{SP}^{PO}(t_k)\}\circ\{G_{SP}(t_k)\}\ , \tag{3}$$

where:

$\{Q_{SP}(t_k)\}$ – quaternion describing the angular position of the pilot's helmet to the helicopter,
$\{G_{PO}(t_k)\}$ – components of the measured linear acceleration of the pilot's helmet,
$\{G_{SP}(t_k)\}$ – components of the measured linear acceleration of the helicopter.

A combat search-rescue mission can be supported by an on-ground operator (Fig. 5.). The on-ground operator position enables guidance of the pilot via verbal communication (aware passing of information, communicating attitudes and emotions) and indicating new navigation points and new simulated hazards in search-rescue missions.

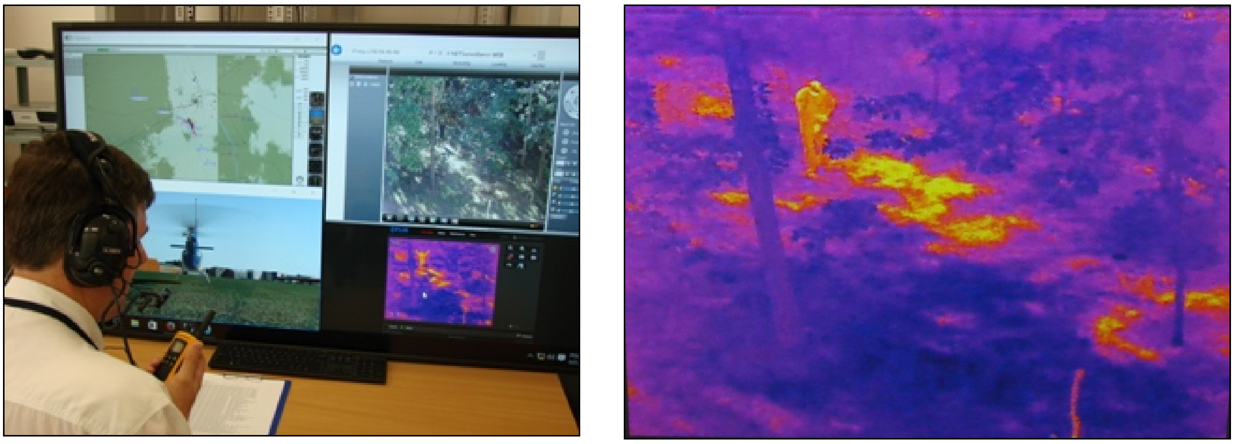

*Fig. 5. On-ground Operator Station for visualisation testing of Aircraft Surveillance Systems [11]*

The position of an on-board operator is designed for the analysis of images received on a current basis from the helicopter conducting a search-rescue mission. Its aim is to support the search for the whereabouts of a survivor and determination of approach conditions and the possibility for immediate evacuation.

The constructed system allows the pilot to carry out flights according to the previously loaded waypoints (with the use of the NAVIGATION screen) or on a current basis, according to the guidelines received via the radio from the on-ground operator [9, 11].

The large-screen computer set with software dedicated for the analysis of photos received from the FLIR thermal camera acts as the operator position in the constructed demonstration device.

One of the numerous functions of that software is to enter a temperature range, which allows automatic searching for objects with the same temperature as that of the body of the missing person/s [11]. The use of a thermal camera enables to, i.e., define the condition of the survivor within a range of his body temperature (degree of hypothermia), which allows to determine the conditions through the application of specific procedures and tactics for the forces dedicated for his recovery. In the scope of equipment for search tasks, the constructed demonstration device includes, i.e., TV cameras and thermal FLIR cameras with software enabling automatic detection of bodies with a set limit temperature (e.g. 36°C) or within a set temperature range (e.g. 36-42°C). It allows for quick identification of object with a temperature similar to the human body temperature (a potential survivor or other personnel).

The demonstration devices constructed in AFIT allows testing different versions of the used equipment within the ranges of their parameters (i.e., imaging latency time) and control algorithms, which can be used in search-rescue missions.

## 5. Summary

In the article, there are presented modern, digital helmet mounted display systems and target cueing systems, manufactured in the Air Force Institute of Technology for polish military helicopters. There are designed to support pilot's operations and situational awareness in the scope of helmet mounted pilotage-navigational and target aiming information and warnings about dangerous situations or malfunctions in the aircraft's installations.

The modern military avionics systems, navigation and cueing systems in particular, use the helmet-mounted data presentation systems more and more often. Use of the helmet-mounted data presentation systems in modern aircraft significantly improves the piloting's safety. This is particularly important during accomplishing difficult missions at night or in poor visibility conditions. In such cases, the observation of the environment without taking eyes for observation of the instruments in the cabin greatly simplifies the piloting process and increases the chance to execute difficult tasks. It is expected that more and more pilots of modern military aircraft will learn to fly with a helmet equipped with the HMDS functions. Research on prototypes of the HMD system have been in progress for over twenty years and show that both the air force academies' graduates and the pilots should have no problems with getting used to the new helmet-mounted data presentation system.

One of the most important elements in ensuring an adequate level of the pilot operating the helmet-mounted data presentation system's safety is an individually fitted helmet. It is extremely important both in terms of safety and data displayed in the helmet, because the functionality of the HMDS is based on the precise placement of optical instruments. The SWPL-1 system produced in AFIT with digital manoeuvre and navigation data processing is designed mostly for Mi-17 helicopters, but it can be implemented on other types of aircraft (e.g. Mi-24 helicopter, PZL-130 Orlik trainer aircraft).

The experience and technical skills gathered during designing and development of SWPL-1 system proved, that it is possible to build such a system for a brand new aircraft (with modern avionics), and adjusting the solution to the existing equipment (currently in service, with analogue avionics). As a result, the system collects and processes information from on board systems and installations and transfers it to helmet mounted displays in the format of graphic symbols or digital information essential for providing combat mission.

The NSC-1 system is capable of providing helmet controlled target cueing of the turret gun 12,7 WKB-M and other W-3PL's guided weapon systems, simultaneously displaying pilotage-navigational and aiming information during day and night flights (using NVG). Above-mentioned functions can be realized by the NSC-1 system independently or in cooperation with an optoelectronic surveillance system (e.g. TOPLITE system). The modernity of NSC-1 is based on the fact, that the system is prepared in open architecture philosophy and is designed for aircraft with adequate technological level, e.g. W-3PL Głuszec.

The systems proposed by the AFIT: the SWPL-1 Cyklop helmet-mounted flight parameters display system and the NSC-1 Orion helmet-mounted weapons control system support the testing process of new devices and may be a basis for their further development within the domestic industry, including equipping the modernised military helicopters with such a system.

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