

WARSAW - POLAND

AIR FORCE INSTITUTE OF TECHNOLOGY



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**WE IMPROVE
EVERY
TECHNOLOGY**



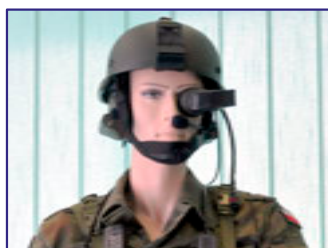
Air Force Institute of Technology (AFIT) is a research organization supervised by the Minister of National Defence. Its mission is support and research into problems of operating of products of aeronautical engineering.

Owing to the studies in the field of reliability and broadly understood flight safety, the Institute has significantly contributed to the development of Polish aviation. The Institute's output comprises hundreds of elaborations - effects of research and experimental works, design efforts, and technical/servicing activities - applied in the Air Force of the Polish Armed Forces.



RESEARCH AREAS:

- On-ground and in-flight tests
- Diagnostic systems dedicated for aviation technology
- Support for the aviation technology management
- Simulation and modelling
- Avionic systems
- Air armament
- Reconnaissance, command and training systems
- C4ISR systems integration
- Unmanned Aerial Vehicles
- Diagnostics of airfields pavement
- Testing of petroleum and working fluids
- Products testing and certification



WE'VE GOT:

- The State concession No. B-404/2003 granted by the Ministry of the Interior & Administration
- The NATO Commercial and Government Entity (NCAGE) Code 0481H
- The Internal Audits System (No. W-45/10/2017) in the field of scientific and research support of operation/maintenance of military aeronautical systems
- Research laboratories awarded Certificates of Accreditation by the Polish Centre for Accreditation
- The Quality Management System consistent with the NATO AQAP-2110 and the PN-ISO
- The authority to confer the post-doctoral degree

AFIT – THE CENTER OF INNOVATIVE AVIATION TECHNOLOGIES





ITWL'S INTEGRATED AVIONICS SYSTEM



THE MANNER FOR HELICOPTERS' ADAPTATION TO MODERN BATTLEFIELD

A HELICOPTER ON THE MODERN BATTLEFIELD

A HELICOPTER FULFILLS TWO FUNCTIONALITIES ON THE DIGITAL BATTLEFIELD:

AS A SENSOR – INFO SOURCE
(data on itself, on objects, etc.)

AS AN EXECUTIVE ELEMENT - EFFECTOR
(attack, transportation, etc.)

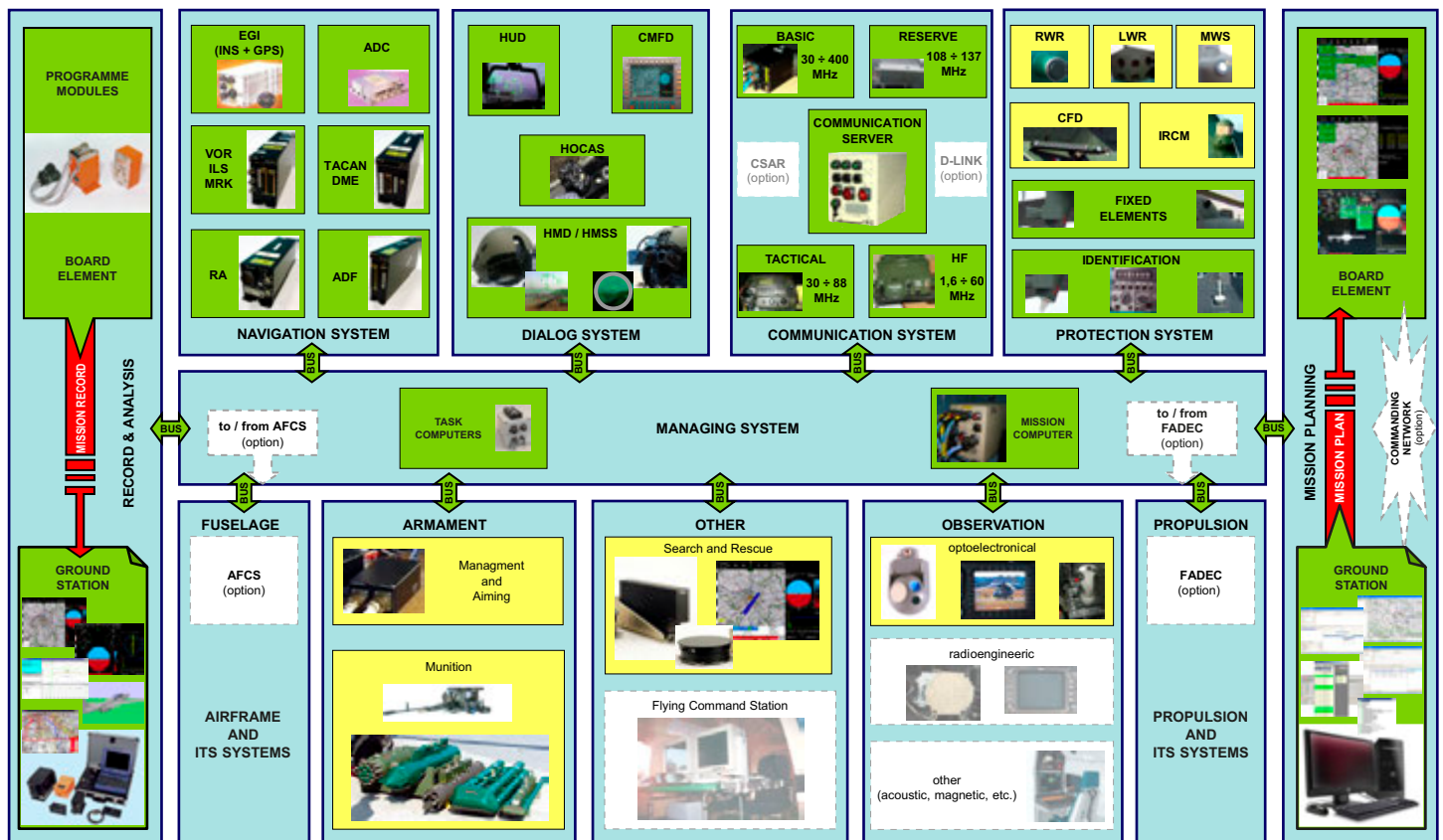
ABOVE FUNCTIONALITIES DEMAND:

- abilities for day and night activities;
- high situation awareness for crew;
- reduction of repeated crew activities load;
- high survivability on battlefield;
- high precision attack and firepower;
- broadband and secure communications;
- selected helicopter elements diagnostic automation;
- mission planning automation;
- spare parts and logistic system standardization.

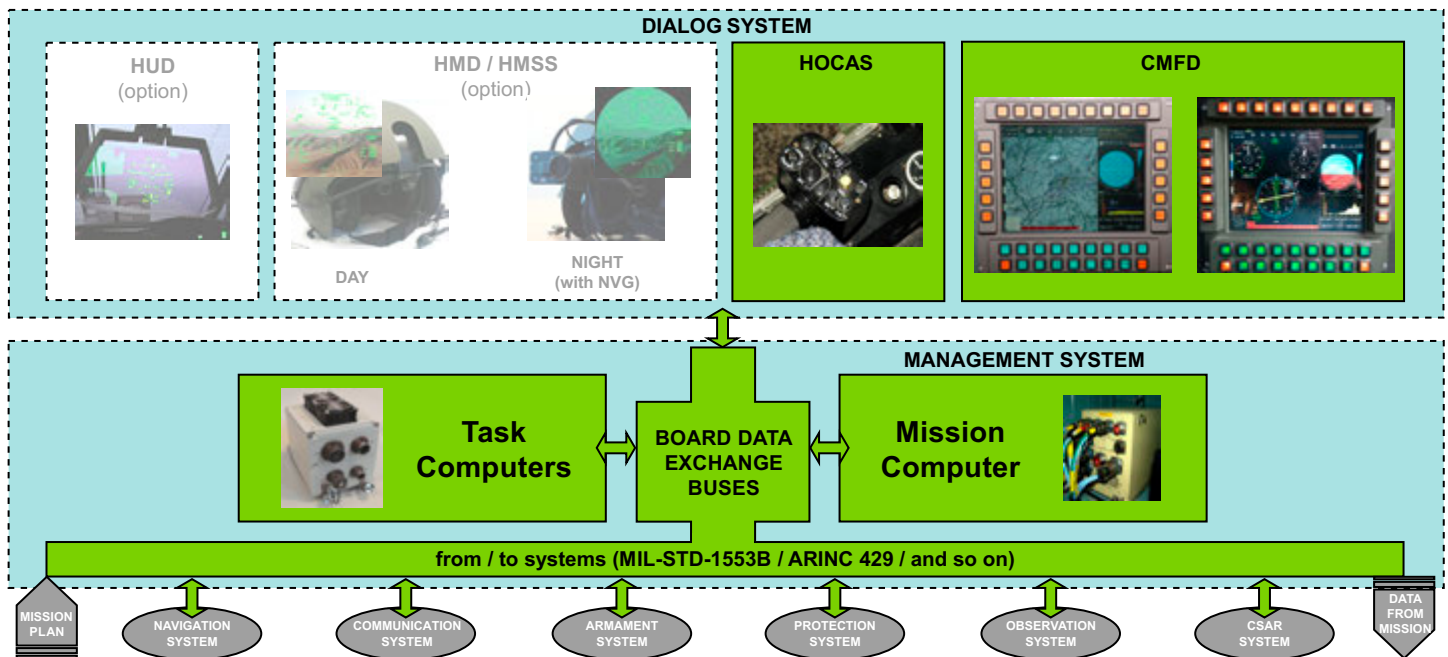
THERE IS AVAILABLE A FULL HELICOPTER PARTICIPATION IN THE FRAME OF NETWORK CENTRIC BATTLEFIELD BUT ONLY WHEN THE HELICOPTER EXISTS AS THE COMPUTER NETWORK, IT MEANS WHEN IT POSSES ON THE BOARD **THE INTEGRATED AVIONICS SYSTEM**

(ZSA)

THE INTEGRATED AVIONICS SYSTEM DEVELOPED BY ITWL

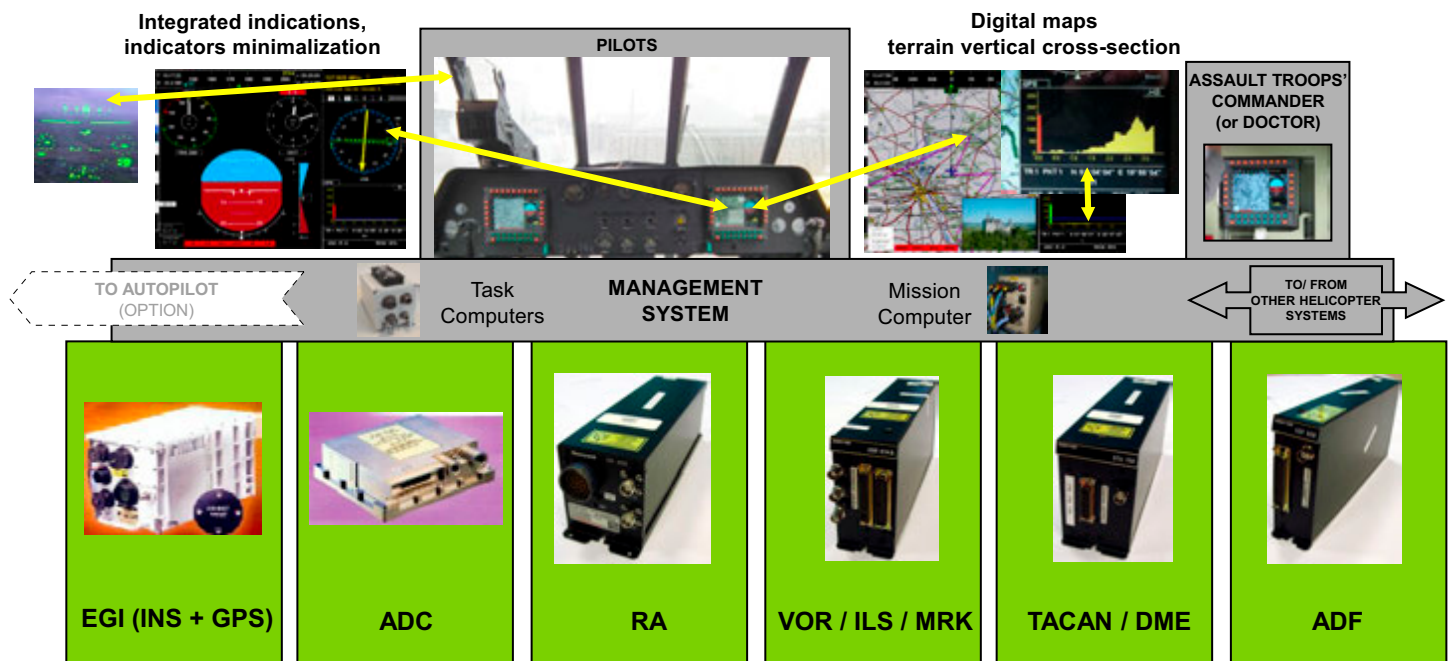


ZSA - AS AN UNITED DISPLAY AND MANAGEMENT



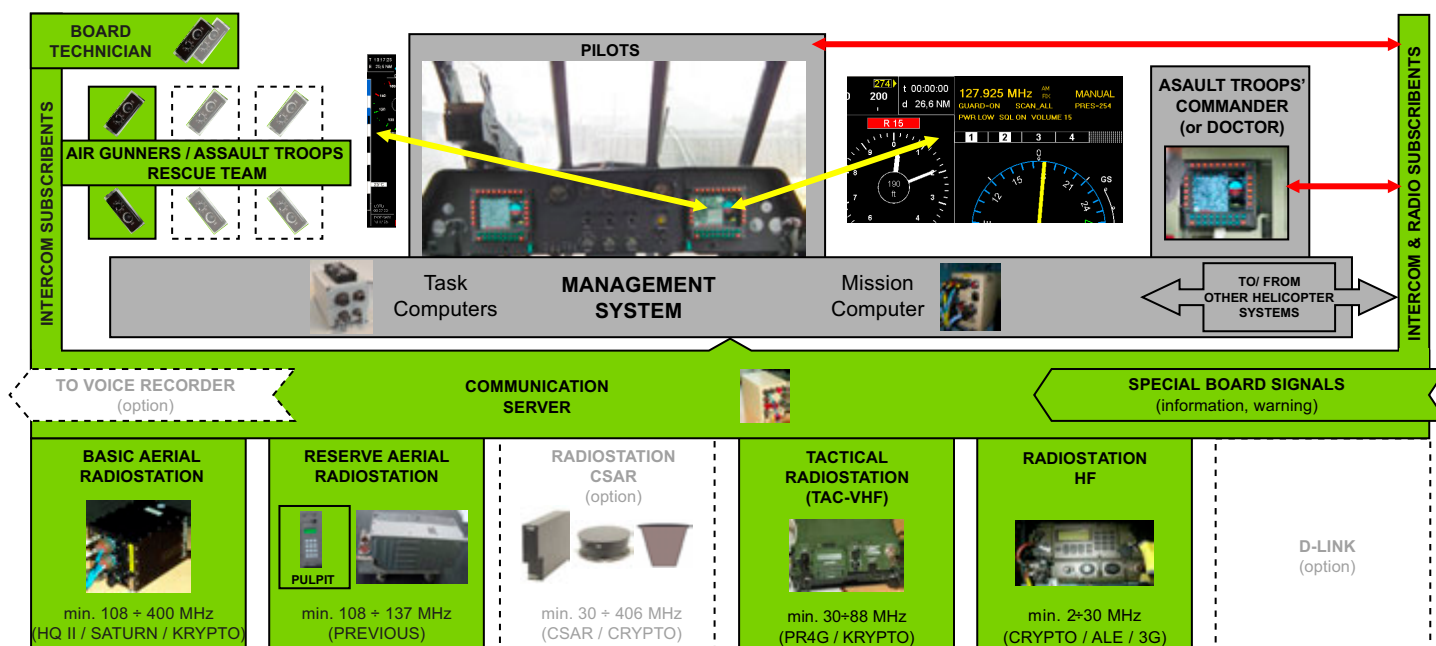
- IMAGERY ON THE TRANSPARENT DISPLAYS (HUD, HELMET MOUNTED DISPLAY), WITH VISION OF SURROUNDINGS;
- INDICATIONS IMAGERY SYNTHESISED FROM MANY DATA SOURCES;
- SYSTEMS CONTROL WITHOUT LIFTING-OFF HANDS FROM THE FLIGHT CONTROLS (HOTAS / HOCAS);
- EASY DEVELOPMENT AND MODERNIZATION THANKS TO so-called „THE OPEN ARCHITECTURE”.

ZSA - THIS IS THE PRECISE NAVIGATION



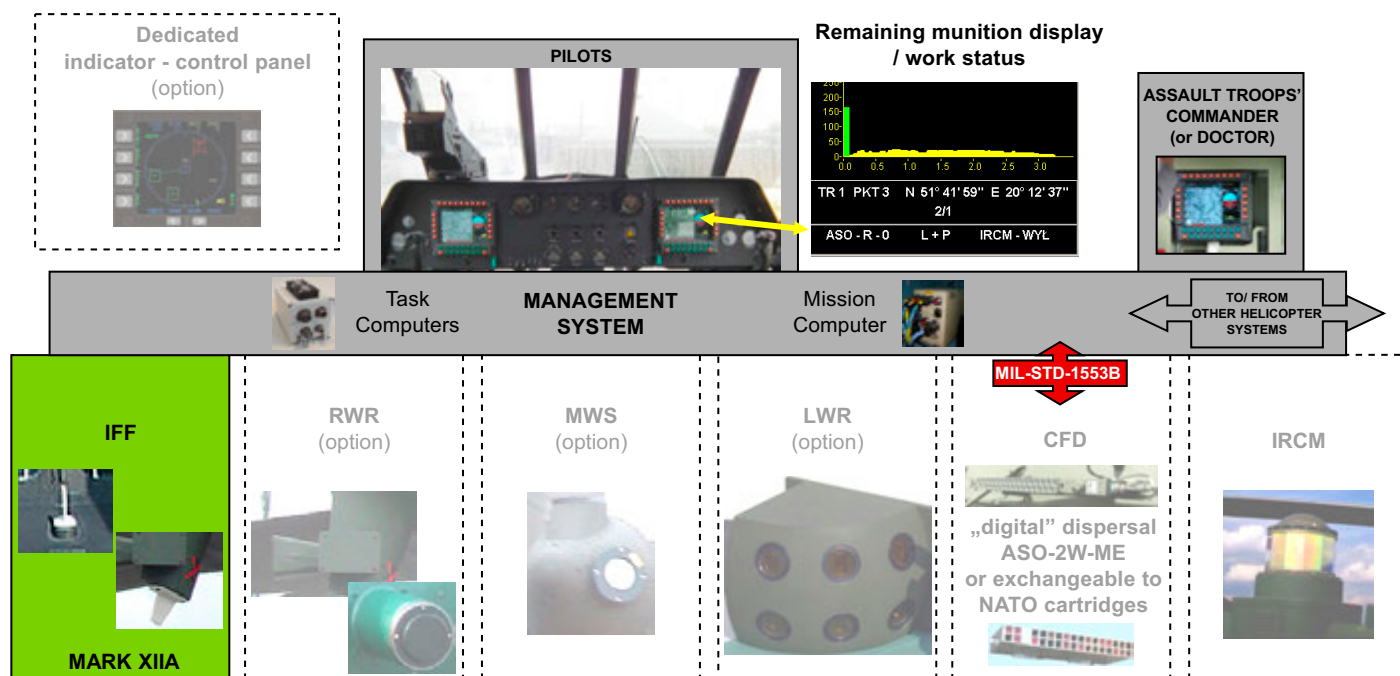
- HIGH PRECISION FLIGHT PARAMETERS AND LOCALISATION INCLUDING THAT AT HOVERING IN MOUNTAINS AND OVER WATER;
- ABILITIES TO FLY IN THE INTERNATIONAL SPACE (ICAO / UE / NATO);
- ROUTE AND FLIGHT PLANNING DISPLAY ON THE MULTIFUNCTIONAL DISPLAYS (CMFD);
- DIGITAL MAP (ROTATIONAL AND MOVING, SEVERAL SCALES) WITH VERTICAL TERRAIN CROSS-SECTION;
- AUTOMATED FLIGHT ON ROUTE (option).

ZSA - THIS IS THE SECURE, MULTIBAND COMMUNICATION



- **SECURE AERIAL AND TACTICAL COMMUNICATION: HF-VHF-UHF BAND RADIOSTATION;**
- **ACCESS TO ANY RADIOSTATION FOR CREW AND AN ASSAULT COMMANDER;**
- **INTEGRATED INTERNAL COMMUNICATION ON THE BOARD OF THE AIRCRAFT;**
- **ABILITY FOR INDEPENDENT OR MUTUAL COMMUNICATION BETWEEN CREW AND ASSAULT TROOPS;**
- **EMAGERY / DISPLAY AND MAINTENANCE ON CMFD.**

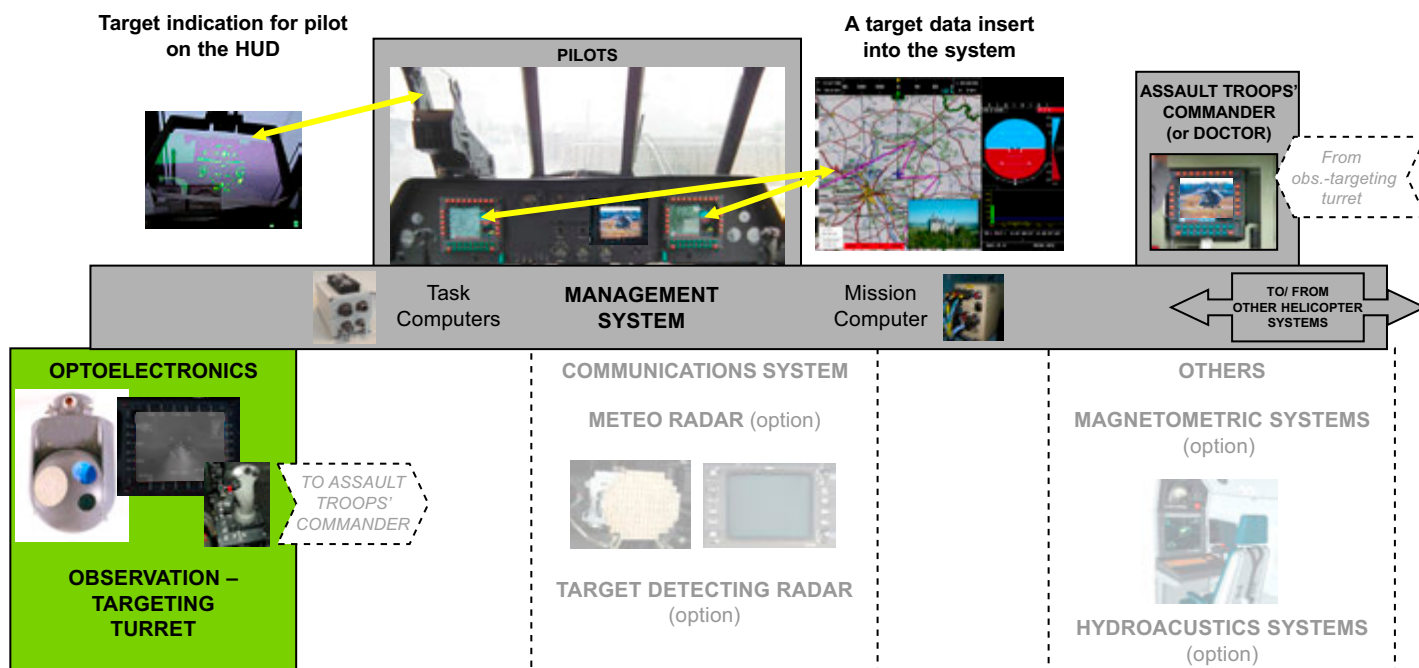
ZSA - THIS IS THE MODULAR SELFDEFENCE



- **READINESS FOR QUICK ADAPTATION FOR ANY AIRCRAFT;**
- **AUTOMATION OF SELECTED FUNCTIONALITIES;**
- **USAGE OF EXISTED SELFDEFENCE ELEMENTS (FOR EXAMPLE: MODERNIZED ASO-2);**
- **DATA ARCHIVE.**

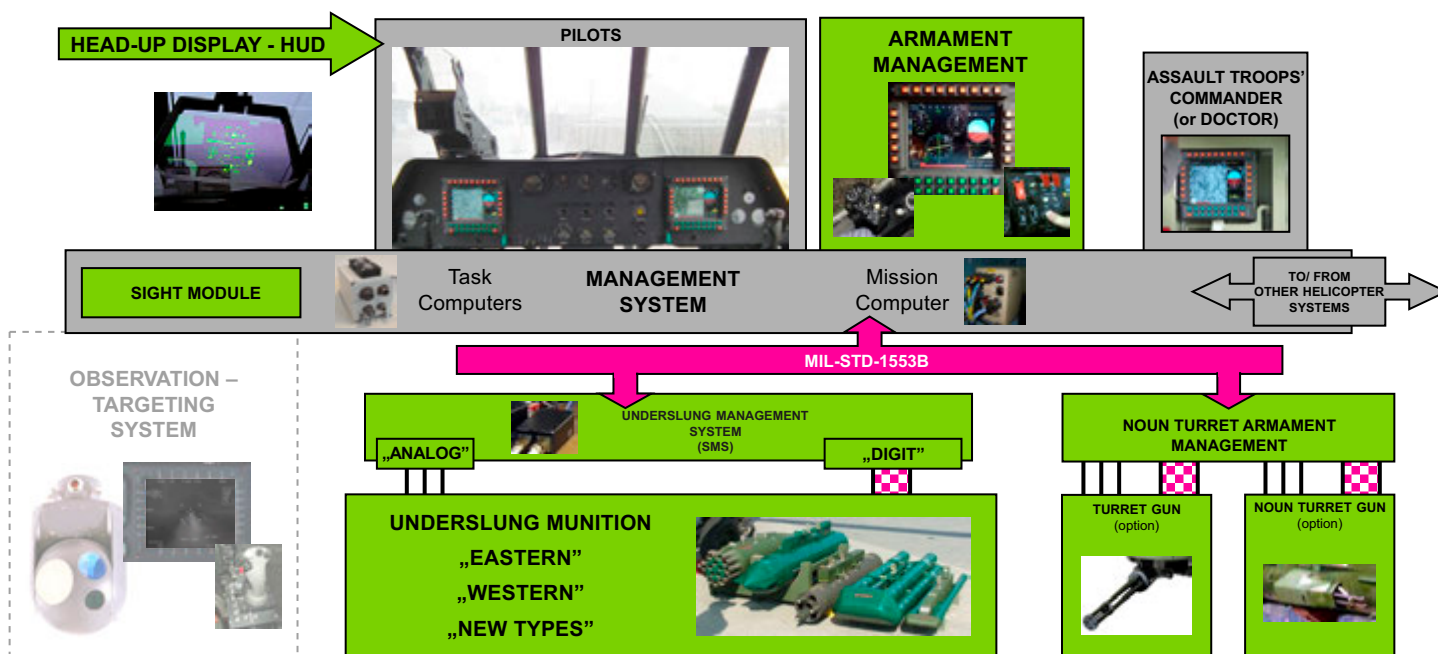


ZSA - THIS IS THE ADVANCED OBSERVATION AND TARGETING



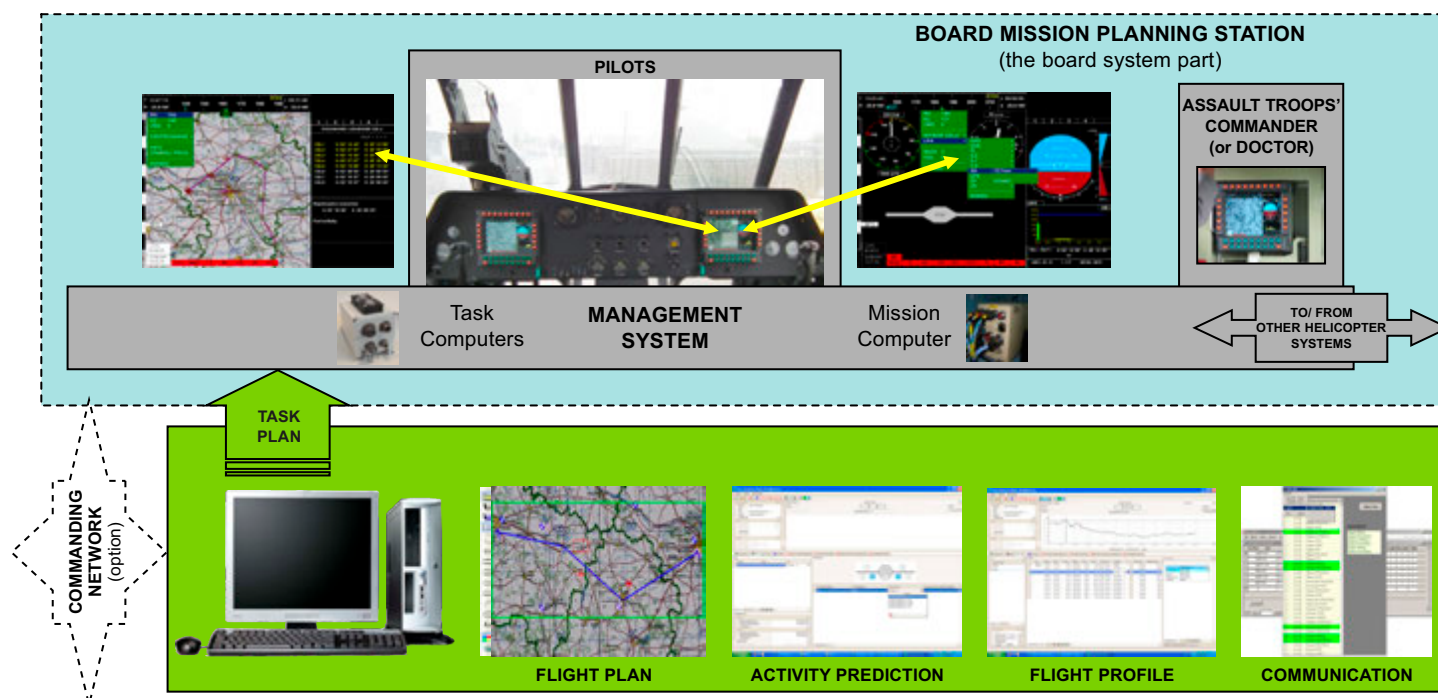
- THE ELECTROOPTICAL PAYLOAD (EOP) SYSTEM INTEGRATION WITH WHOLE ZSA – DATA IN THE SYSTEM (IN RADAR - option);
- ABILITY OF THE DIGITAL IMAGERY RECORDING IN THE ZSA SYSTEM (TRANSMISSION - option);
- ACCESS TO IMAGERY FROM EOP FOR TASK TEAM COMMANDER (option);
- ABILITY TO INTEGRATE OTHER ZSA WITH TARGET DETECTING SYSTEMS (option).

ZSA - THIS IS THE "DIGITAL" ARMAMENT SYSTEM



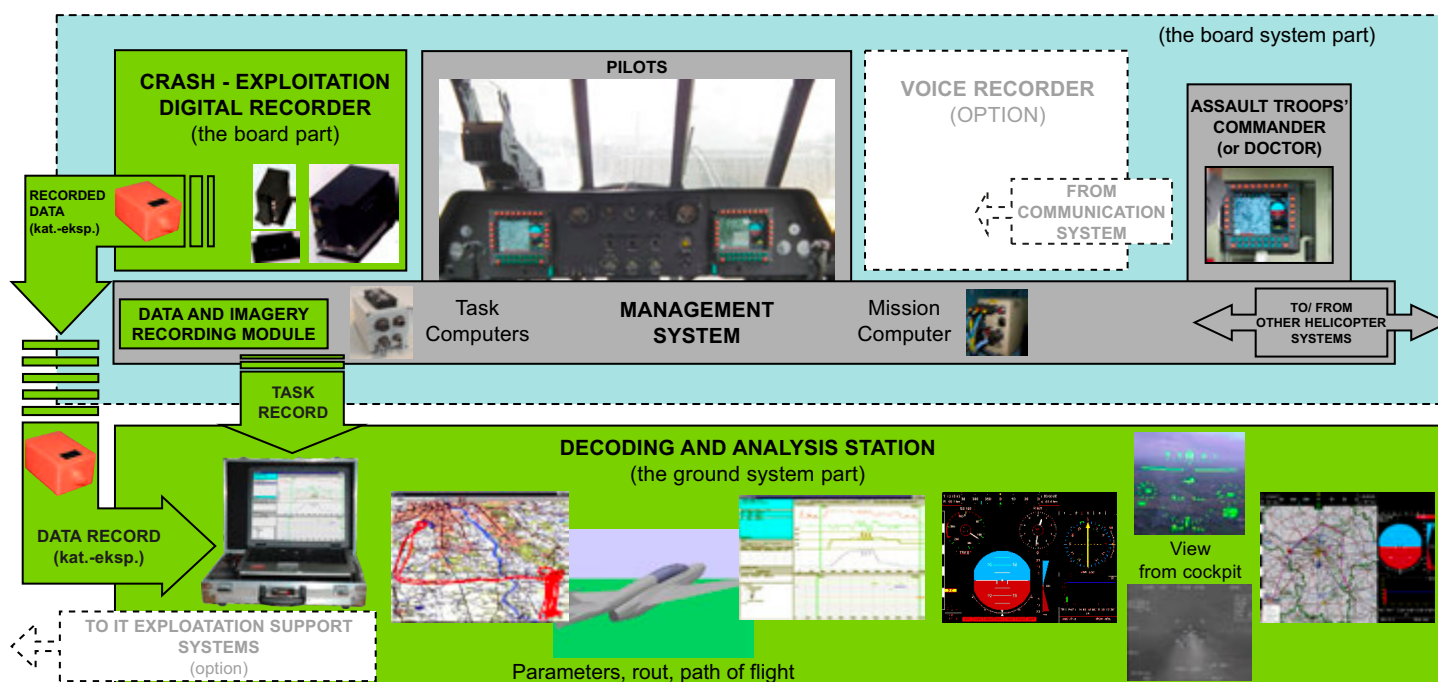
- ABILITY FOR USE ANY „EASTERN“ AND „WESTERN“ WEAPONS;
- PRECISION AIMING SYSTEM – NEW MODES: MOUNTAIN / URBAN TERRAIN;
- „OPEN ARCHITECTURE “;
- EASY TO DEVELOP FOR NEW MUNITION

ZSA - THIS IS THE AUTOMATION OF MISSION PLANNING



- **PLANNING OF THE FLIGHT ROUTE, TARGETS, COMMUNICATION, MUNITION USAGE, ect.;**
- **ABILITY FOR MISSION PLANNING ON ANY HELICOPTER LANDING AREA (BOARD STATION);**
- **AIRCRAFT DATA BASE: NAVIGATION AIMS, ect.;**
- **ABILITY TO COOPERATE WITH COMMAND AND CONTROL NETWORK (option).**

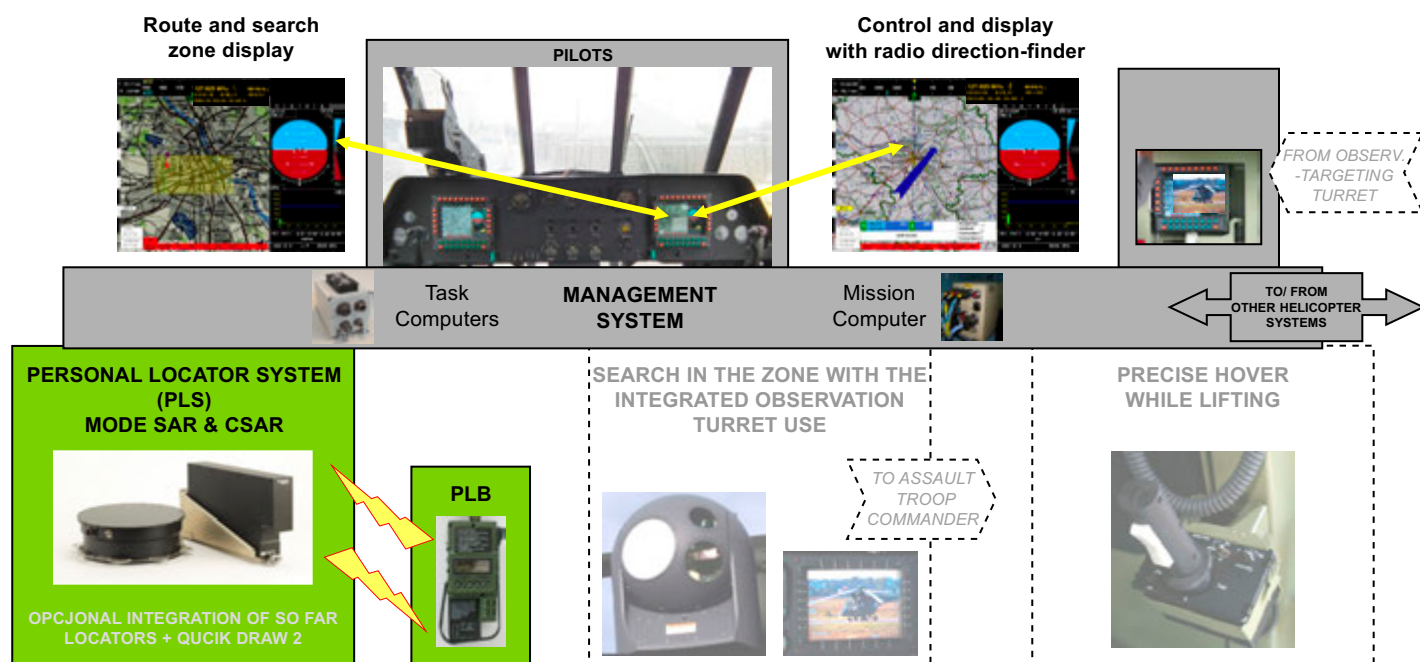
ZSA - THIS IS THE QUICK TASK DEBRIEFING



- **QUICK ACCESS TO DATA AT FLIGHT AND AT TASK REALIZATION;**
- **FULL ANALYSIS OF CREW ACTIVITIES AND TASK REALIZATION;**
- **DATA USAGE FOR EXPLOITATION AND AVIATION ACCIDENTS ANALYSIS;**
- **DATA ARCHIVE.**

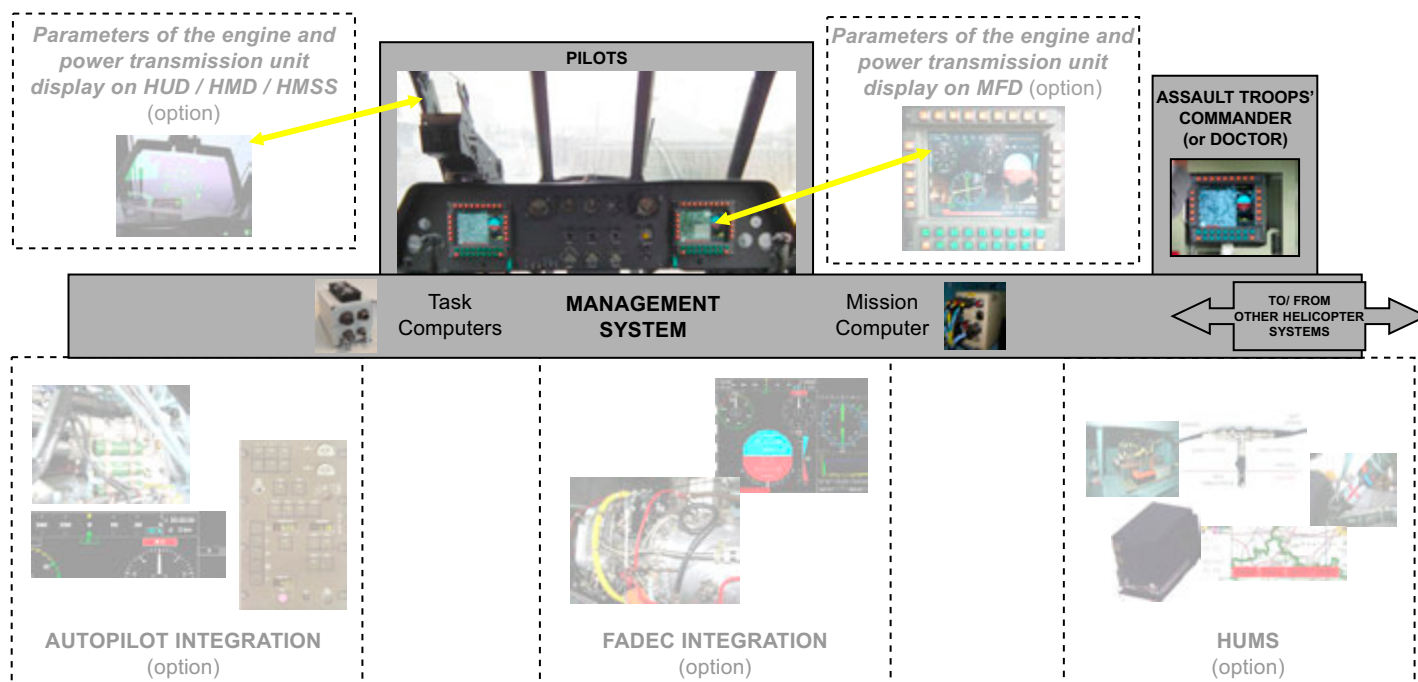


ZSA - THIS IS EASY RECOVER ISOLATED PERSONEL



- LOCATION SYSTEM INTEGRATION WITH WHOLE ZSA („CASTAWAY” DATA IN THE SYSTEM);
- DISPLAY AND SYSTEM CONTROL FROM MFD;
- SECURE COMMUNICATION SYSTEM WITH „CASTAWAY” (ENCRYPTION, SHORT MESSAGES);
- SEARCH ROUTE DISPLAY AND MARKING SEARCHED ZONE.

ZSA AND PLATFORM SYSTEM



- AUTOPILOT INTEGRATION WITH ZSA – AUTOMATIC FLIGHT CONTROL SYSTEM (option);
- FADEC INTEGRATION WITH ZSA – DATA AND DISPLAY BY ZSA (option);
- HEALTH AND USAGE MONITORING SYSTEM – so called HUMS (option);
- DATA TRANSMISSION ON AN AIRCRAFT STATUS FROM ITS BOARD TO THE GROUND STATION (option).

ZSA - THE NEW AICRAFT POSSIBILITIES



- Day, night and IMC activities
- Precision navigation based on so-called EGI (INS+GPS)
- Aircraft placement on the digital map
- Display of terrain shape in front of the aircraft
- Accurate flight parameters at low flight speed and at the hovering
- Flight parameters display in front of the pilot's eye (HMD – option)
- Integrated, multiband, secure communication system
- Integrated self-defence system with „digital” type dispersal ASO-2W (option)
- Automated munition and targeting management system
- „Eastern” and „Western” armament utilization
- SAR / CSAR tasks abilities
- Efficiency diagnostics for selected board systems
- Automated process for mission planning



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PROGRAMY REALIZOWANE WE WSPÓŁPRACY Z WZL-1 S.A. I PCO S.A.

HELMET MOUNTED DISPLAY SYSTEM



SWPL-1
„CYKLOP”



APPLICATION:

- ♦ The System is intended to display helicopter's flight parameters in front of the pilot's eye what make easier to control the helicopter and simultaneously reading the flight parameters and observing the surroundings at the same time. Information are displayed as graphic symbols and in the digital form.
- ♦ The System can be used at day and night (in collaboration with NVG)

CYKLOP System Displays mounted on the THL-5 Helmet



Daylight DWN-1



Night NWN-1 for NVG type PNL-3

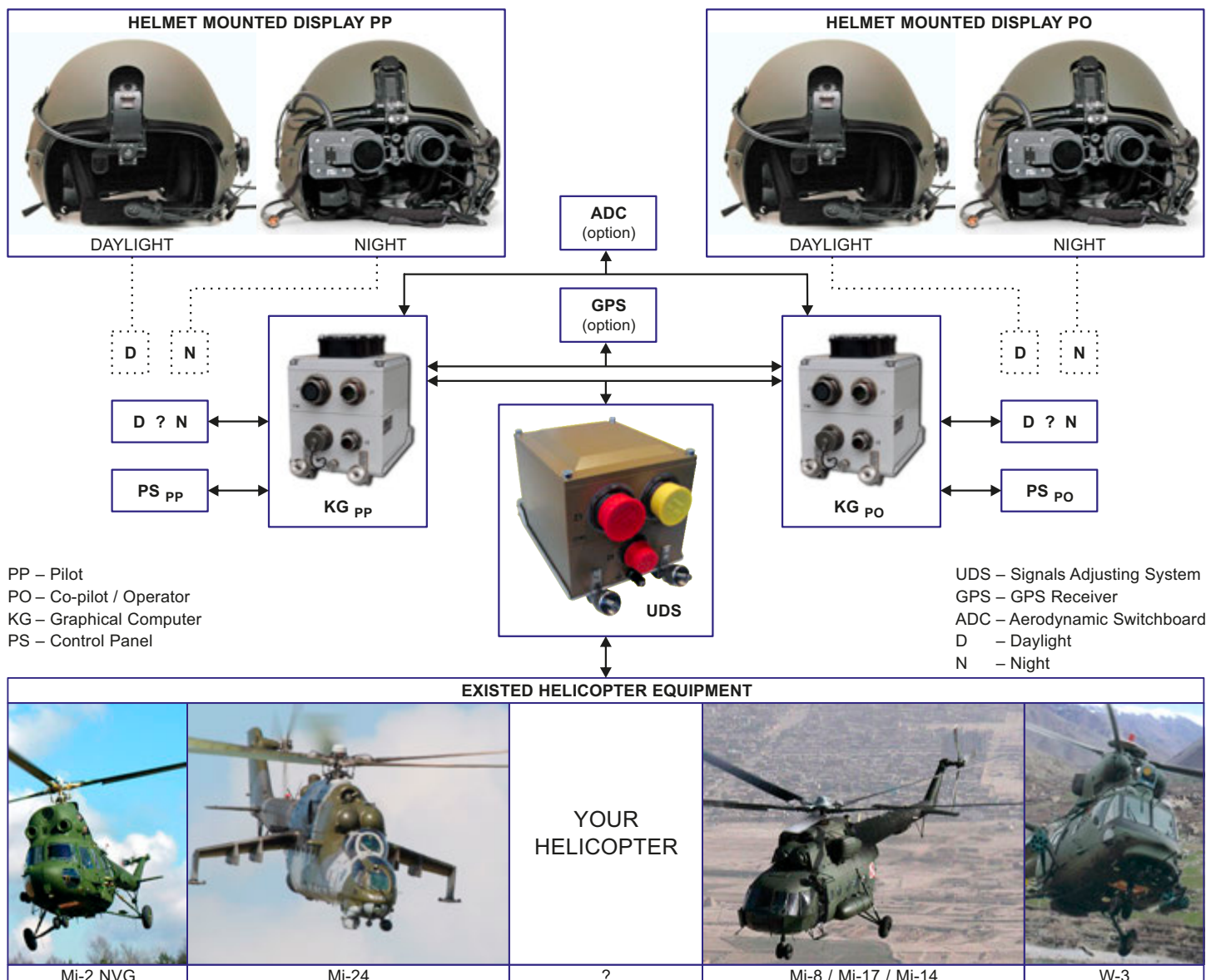


SYSTEM'S ADVANTAGES:

- ♦ Improvement of situational awareness in combat missions realization,
- ♦ Improvement of safety during helicopter flight,
- ♦ Improvement of perception of information necessary to mission realization, allowing a view of the cockpit at the same time.



GENERAL FLOW CHART OF THE SYSTEM:



SYSTEM'S CAPABILITIES:

- ♦ Displaying of piloting and navigational information as well as engine indicators,
- ♦ Warning about emergency on the helicopter's board - WARN,
- ♦ Signaling on board helicopter systems failures - FAIL,
- ♦ Symbols compatibility with STANAG MILSTD-1787B,
- ♦ Information receiving from existed board systems (analog option MIL-STD-1553B),
- ♦ Autonomous display control by a pilot and co-pilot,
- ♦ Cooperation with on-board navigational satellite system GPS,
- ♦ System readiness for use monitoring.



TECHNICAL DATA:

GENERAL DATA:

- ♦ Board electrical power supply (28 V),
- ♦ 16 flight parameters in four variants of displaying, chosen autonomously by each pilot,
- ♦ It identifies 27 signals are taken into account in the warning and failure signaling system,
- ♦ Automatic diagnostics before a flight with a possibility of loading initial data to the system,
- ♦ Extended external diagnostic equipment (on the laptop basis),
- ♦ Work temperature range $-30^{\circ}\text{C} \div +50^{\circ}\text{C}$,
- ♦ Max power intensity $\leq 1.5\text{A}$.

DAYLIGHT HELMET DISPLAY DWN-1:

- ♦ Angle dimension of displayed picture $\geq 20^{\circ}$
- ♦ Magnification $1\times$
- ♦ Display's weight $\sim 0.44\text{ kg}$



NIGHT HELMET DISPLAY NWN-1:

- ♦ PNL-3 goggle's field of vision with NWN-1 $\geq 36.5^{\circ}$
- ♦ Angle dimension of displayed picture $\geq 24^{\circ}$
- ♦ Magnification $1\times$
- ♦ Display's weight $\sim 0.2\text{ kg}$



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HELMET MOUNTED SIGHT SYSTEM „ORION”



PURPOSE:

- ♦ The ORION Helmet Mounted Sight System is to control the homing of turret gun as well as other armament systems. In front of the pilot's eye ORION displays aiming and pilotage parameters during the day and night flights.
- ♦ The functionalities can be performed independently or in cooperation with an optoelectronic head.

BASIC DATA:

- ♦ displays:
 - flight parameters and aiming data,
 - warning status,
 - errors,
- ♦ performs automatic diagnosis before the flight;
- ♦ possibility to load the initial data to the system;
- ♦ supplied from the board current power network (28 V);
- ♦ maximal weight of set: helmet, measurement system, display, NVG – 2.85 kg.

The ORION Helmet Mounted Sight System realizes its functionalities in the frame and cooperation with the Integrated Avionic System as a subsystem of the IAS.



The complete set of day-night ORION Helmet Mounted Sight equipment mounted on the pilot's helmet

THE DAY-NIGHT HELMET DISPLAY

NSC-1:

- ♦ field of vision $\geq 40^\circ$
- ♦ angle dimension of projected vision $\geq 20^\circ$
- ♦ an image enlargement $1\times$
- ♦ display weight $\sim 40\text{ g}$



NIGHT VISION GOGGLES FOR NSC-1:

- ♦ field of vision $\geq 40^\circ$
- ♦ a image enlargement $1\times$
- ♦ weight $\sim 500\text{ g}$



HARD AVIONIC HELMET THL-6NSC/P:

- ♦ composite material
- ♦ adopted to NVG
- ♦ adopted to oxygen mask
- ♦ integrated wires fastening
- ♦ dimension (adjusting) $56 \div 63$
- ♦ dynamic microphopne – impedance $50\ \Omega$
- ♦ headphone inserts – impedance $300\ \Omega$
- ♦ headphone circuit resistance $130 \div 1100\ \Omega$



GRAPHIC COMPUTER KG-1HC:

- ♦ length 256 mm
- ♦ width 140 mm
- ♦ height 99 mm
- ♦ weight 3.7 kg
- ♦ communication MIL-STD-1553B



APPLICATION

The standard version of the system is meant for cooperation with IAS and mobile stand on the W-3PL helicopter board.

Standard version includes:

- ♦ controlling according to HOCAS (Hand on Collective and Stick) System;
- ♦ possibility to indicate the target for the mobile stand by helmet system;
- ♦ display from the optoelectronic head;
- ♦ possibility of the initial indication of the point for the optoelectronic head by the Helmet Mounted System;
- ♦ target pointing for guided missiles – under development.



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Project co-realized with funds from The National Centre for Research and Development (No O R00 0063 09)



Project developed by the consortium of:
ITWL (leader); Bumar Żołnierz S.A. (PCO); ZM TARNÓW S.A.;
FAS Mariusz Ficoń; WSK PZL Świdnik S.A.

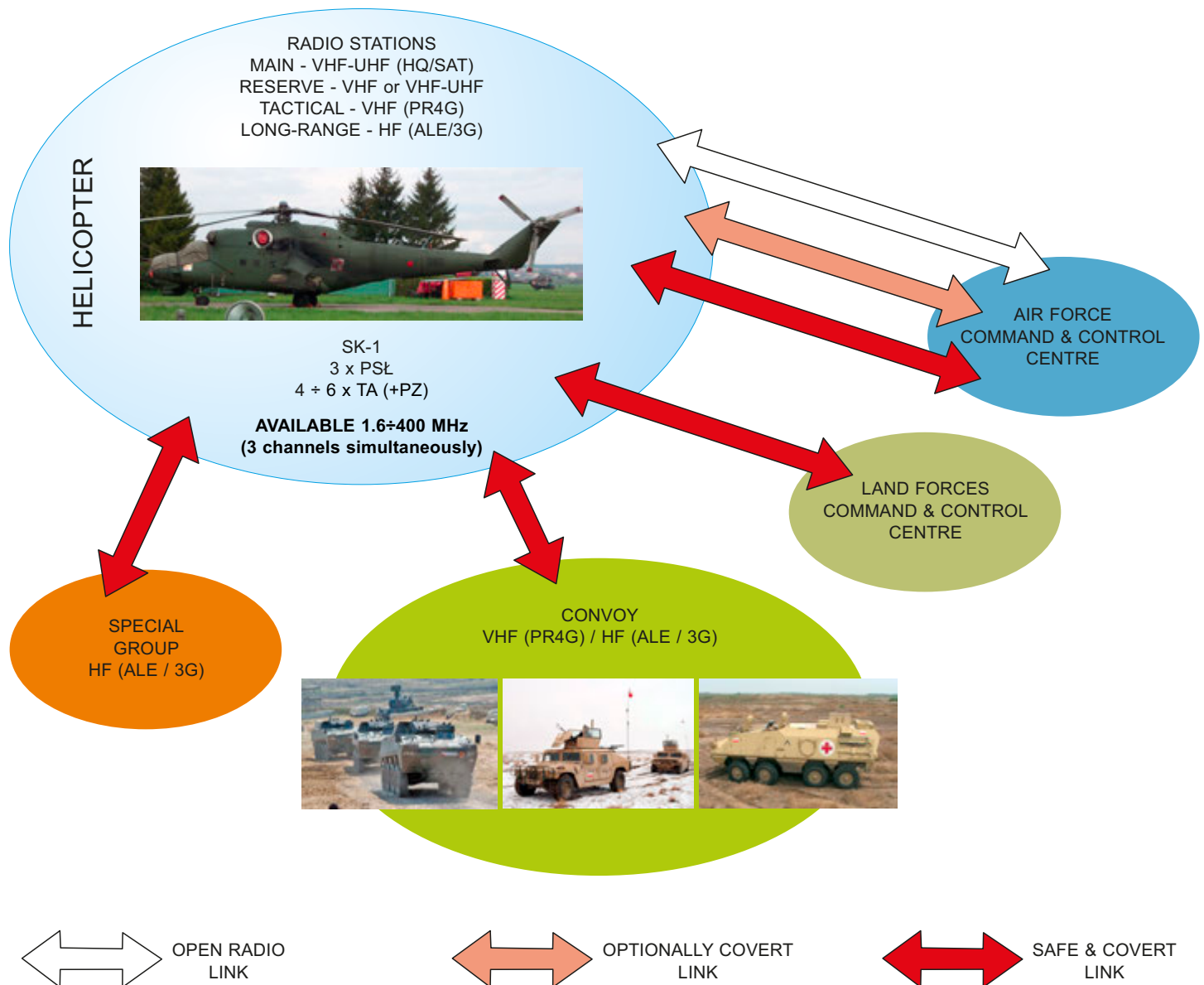
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INTEGRATED COMMUNICATION SYSTEM FOR HELICOPTERS



GUIDELINES FOR SYSTEM APPLICATIONS

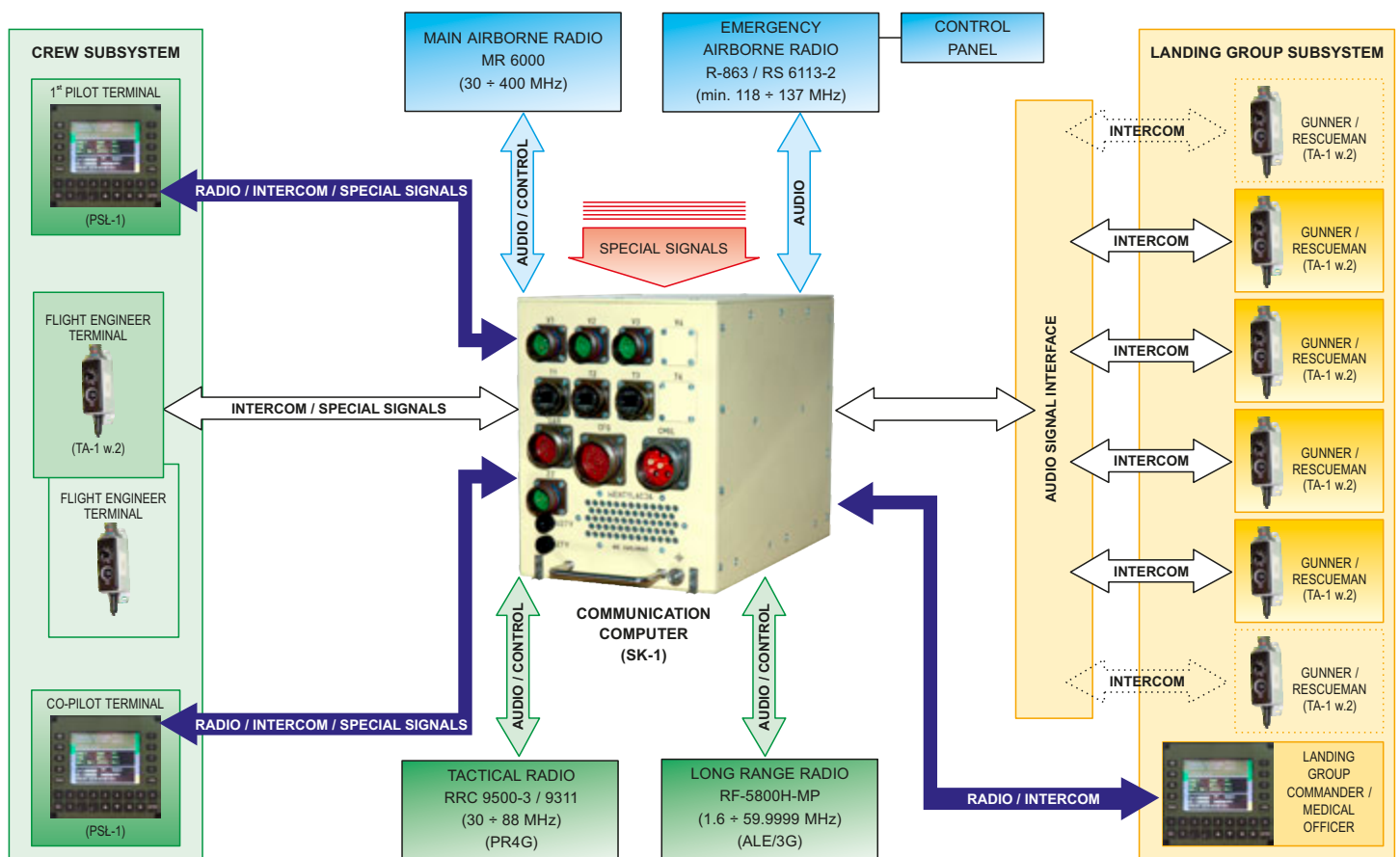


INTEGRATED COMMUNICATION SYSTEM PROVIDES:

- ♦ communication with: other aircraft, ground-based systems and monitoring systems in the HF/VHF/UHF frequency ranges,
- ♦ using open and encrypted communication (COMSEC/TRANSEC) and Automatic Link Establishment (ALE/3G),
- ♦ Internal Communication System on the helicopter's board: first pilot, co-pilot, flight engineer, commander of landing troops, up to 6 gunners (in medical version: medical orderly and rescue man),
- ♦ monitoring of special audio signals (navigational and warning),
- ♦ internal and external communication control,
- ♦ pilots' and landing-troops commander's access to any radio station (independent communication channels)
- ♦ cooperation with communication planning system,
- ♦ communication with air crash survivor (CSAR version),
- ♦ emergency air communication in case of communication server damage,

The System can also be developed in order to transmit data.

ICS STRUCTURE



BASIC DATA:

- ♦ power supply + 27 V DC (UPS recommended)
- ♦ weight
 - SK-1 total, regardless of configuration ~ 11 kg
 - PSL-1 communication control panel ~ 1.7 kg
 - Control unit ~ 0.3 kg
 - ISA-1 audio signal interface ~ 2.0 kg
- ♦ dimensions:
 - SK-1 ARINC ¾ short
 - PSL-1 communication computer 160×150×115 mm
 - ISA-1 audio signal interface 165×130×130 mm
- ♦ climatic and mechanical requirements MIL-STD 810E,
- ♦ external interfaces MIL-STD 1553B, RS-485, RS-232, USB ethernet, audio signals
- ♦ cooperating signals
 - up to 5 radio stations
 - up to 12 special AUDIO signals

It is possible to integrate other set of radio station, according to customer's requirements.

In case of upgrade of existing helicopters with the use of Integrated Communication System, if the customer requests it the radio station used previously on the board can be applied as a reserve radio station.

Integrated Communications System can be a component of an integrated avionics system.

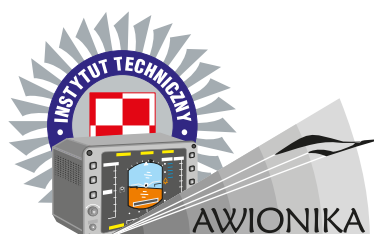
Moreover, a diagnostic system for Integrated Communication System has been developed and implemented on a mobile industrial computer.

This System is to evaluate maintenance of system components (including radio station) as well as to prepare a communications plan.

ITWL provides personnel training on how to use of the Integrated Communication System, and ensures further maintenance of the System.



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ATRAX

VERTICAL TAKE-OFF/LANDING UNMANNED AERIAL VEHICLE



The vertical take-off/landing (VTOL) unmanned aerial vehicle ATRAX is a quadcopter of advanced structure made of glass and carbon fibre composites. It offers the ability to follow a pre-set route in a fully autonomous mode of operation. Its 360-degree surveillance pod provided with three-axis stabilization system of 0.10° accuracy is furnished with thermal imaging and daylight camera(s). An innovative power plant consisting of eight independent motors significantly improves the flight safety – ATRAX is capable of flying with two motors out of order. ATRAX has been provided with secure-coding data transmission system that offers the highest possible level of data transmission security.

The technology and the manufacture, both of the composites and the electronic components, are provided by ITWL (Air Force Institute of Technology).

At ITWL there is a certified Training Centre for UAV Operators.

THE SYSTEM CONSISTS OF:

- ♦ ATRAX UAV
- ♦ Command and control station
- ♦ Antenna array
- ♦ Shipping container (road case)



APPLICATIONS

- ◆ Urban areas monitoring
- ◆ Support for SAR operations
- ◆ Assessment of effects of disasters, including contamination/pollution
- ◆ Monitoring of high-voltage transmission/distribution lines
- ◆ Monitoring of railway system infrastructure – railway tracks, power distribution lines, etc.
- ◆ Pipelines monitoring
- ◆ Personal and asset protection
- ◆ Monitoring of forest areas, including investigation into flora and fauna



SPECIFICATION:

- | | |
|---|----------------------------|
| ◆ Blade tip to tip span | 190 cm |
| ◆ Height | 65 cm |
| ◆ Take-off weight
(depending on payload configuration) | 7 ÷ 22 kg |
| ◆ Payload capacity | 15 kg |
| ◆ Radius of action | 5 km |
| ◆ Straight flight | up to 35 km |
| ◆ Endurance
(depending on payload configuration) | 45 ÷ 60 min |
| ◆ Service ceiling | ~ 1000 m |
| ◆ Capable of getting armed with smoke
and/or stun grenades | – in military applications |

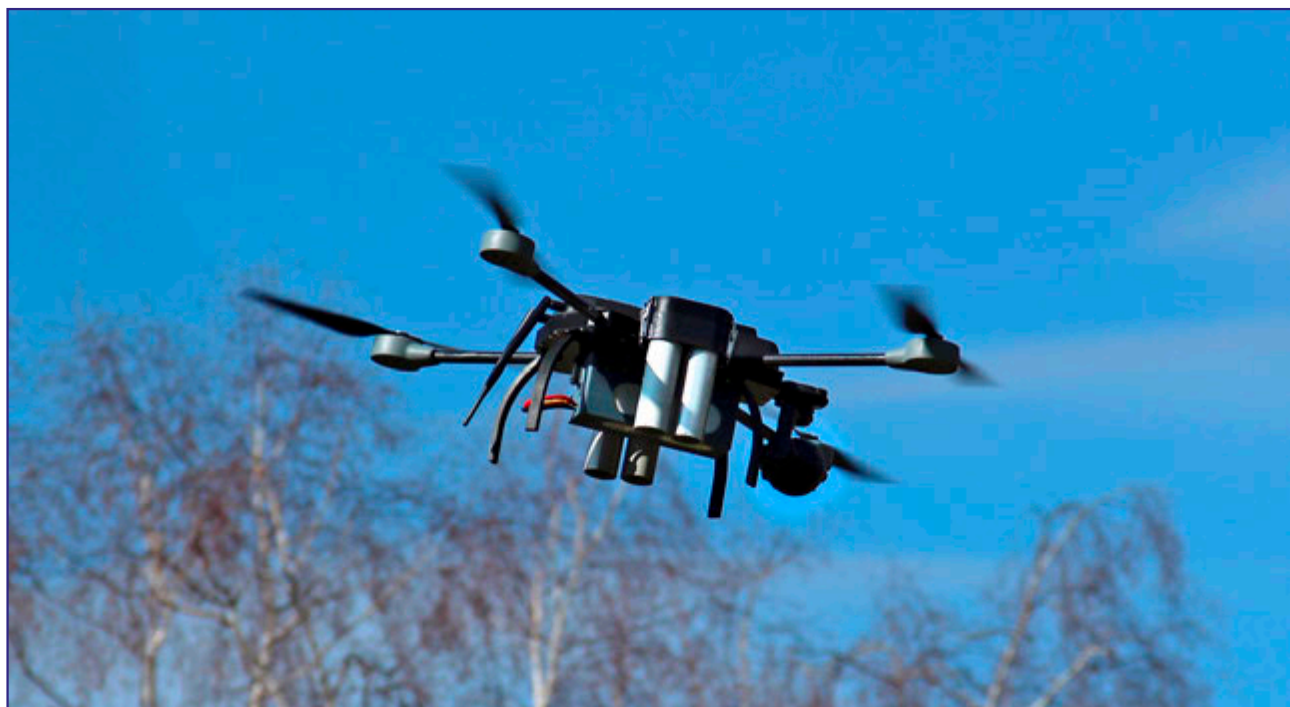


Product awarded
with "Defender"
at the 22nd International
Defence Industry Exhibition
(MSPO) in Kielce, 2014

AtraxM

SHORT RANGE VERTICAL TAKE-OFF AND LANDING DRONE

The AtraxM unmanned aircraft is an entirely Polish structure, which can be used to observe the terrain, support the artillery shelling, mark a crowd of people or destroy ground facilities.



KEY CHARACTERISTICS:

- ♦ Quiet electric drive
- ♦ Modular design of carbon fibre
- ♦ It does not need a runway
- ♦ Designed to be operated from the boards of the Navy
- ♦ Interchangeable observation and function modules
- ♦ 4- or 8-motor version
- ♦ Resistant to weather conditions
(rain, snow, fog, dust and dirt)



AVIONICS

- ♦ Auto-pilot with the possibility of: planning the mission before the flight, changing parameters in real time, as well as updating the database position in real time
- ♦ Protection against the communication failure or the failure of one of the systems as well as the loss of GPS/ GLONASS
- ♦ Different variants of optoelectronic heads and specialised equipment (according to the customer's needs)
- ♦ Coded digital data and image transmission system which provides bi-directional communication
- ♦ Ability to transmit the full HD image
- ♦ Completely modular, and easily modifiable system architecture

You can arm the drone with a grenade container (4 pieces).

TECHNICAL SPECIFICATIONS:

♦ Take-off weight of the unmanned aircraft	4.9 ÷ 6.7 kg
♦ Span between propeller ends of the unmanned aircraft	1.2 m
♦ Maximum speed of the unmanned aircraft	80 km/h
♦ Cruising speed of the unmanned aircraft	20 km/h
♦ Maximum climb speed of the unmanned aircraft	16 m/s
♦ Maximum ceiling	2000 m
♦ Optimal height of the aircraft	5 ÷ 350 m
♦ Flight length	40 (*60) min
♦ Permissible wind	< 8 m/s
♦ The unmanned aircraft operational radius in the urban area	2 km
♦ The unmanned aircraft operational radius in the open area	10 km
♦ NSK control panel weight	4.5 kg

Operational capacities at the company / troop level

- ♦ providing the explosives and grenades – after applying the container
- ♦ detection, marking and transmission of data on the enemy position
- ♦ autonomous observation of a specific terrain zone, including routes of the march of own troops
- ♦ supporting rescue and search missions
- ♦ detection of pollution

Operational capabilities in the civil market

- ♦ supporting SAR actions
- ♦ evaluating effects of natural disaster, including pollution examination
- ♦ controlling railway infrastructure – tracks, railway infrastructure, etc.
- ♦ monitoring pipelines
- ♦ protection of persons and property
- ♦ monitoring of forest areas, including study of fauna and flora



AtraxC

VERTICAL TAKE-OFF AND LANDING DRONE

The main task of **Atrax C (Combat)** is to carry a large quantity of payloads, i.e. smoke, stun-flash and anti-tank grenades. The advantage of **Atrax C Drone** is the possibility of multiple use, and within the armed conflict, it can frequently support infantry and mechanised troops.

Atrax C Drone is a carbon fibre structure. It can be used for observation, artillery fire support and destroying ground facilities. It provides the possibility of collecting high-quality recognition data in real time.

The drone is foldable and entirely fits in a backpack.



Operational capabilities in the civil market:

- ♦ supporting SAR actions
- ♦ evaluating effects of natural disasters
- ♦ railway infrastructure control
- ♦ monitoring pipelines
- ♦ protection of persons and property
- ♦ monitoring of forest areas, including a study of fauna and flora



TECHNICAL SPECIFICATIONS:

♦ Take-off weight	11 ÷ 17 kg
♦ Span between propeller ends	1.70 m
♦ Maximum speed	70 km/h
♦ Optimum cruising speed	20 km/h
♦ Maximum climb speed	10 m/s
♦ Maximum ceiling	2000 m
♦ Optimal height of the air platform operation	5 ÷ 350 m
♦ Flight endurance	40 min
♦ Permissible wind	< 8 m/s
♦ Operational radius in the urban area	2 km
♦ Operational radius in the open area	10 km
♦ NSK control panel weight	4.5 kg
♦ It is possible to arm the drone with a grenade container	12 pieces



JC-3Duo head made of a glass composite and aluminium is electro-mechanically stabilised in two axes. It is equipped with a daylight camera with a resolution of 1920×1080 and a function of 30× optical zoom, and also an infrared camera with a resolution of 640×480.

PROPERTIES:

- ♦ auto-pilot with the possibility of planning the mission before the flight and changing parameters in real time
- ♦ automatic take-off and landing
- ♦ protection against the communication loss or the failure to one of the systems
- ♦ coded, digital data and image transmission system which provides bi-directional communication
- ♦ 4- or 8-motor version
- ♦ resistance to weather conditions (rain, snow, fog, dust and dirt)
- ♦ GMTA (*Ground Moving Target Autopilot*) expanded system – an automated system for targeting and opening fire at a ground target
- ♦ different variants of optoelectronic heads and specialised equipment
- ♦ capability to transmit the full HD quality image
- ♦ detection, marking and transmission of data on the enemy position
- ♦ detection of pollution

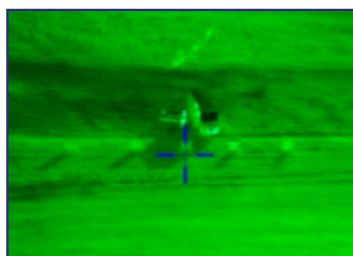
Non-stop surveillance system AtraxH Horus

The AtraxH Horus provides effective, economical means of protection and monitoring, by using an observation system in the form of an autonomously controlled Unmanned Aircraft Vehicle placed in the Virtual Mast.

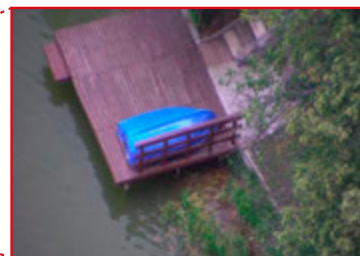
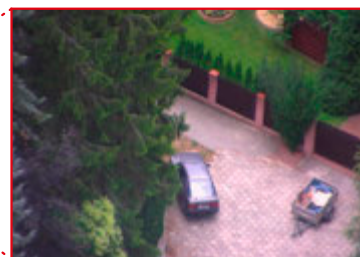
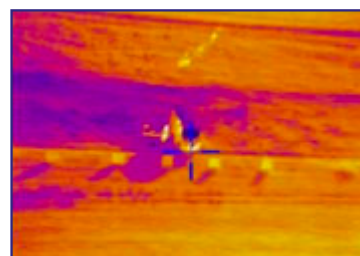
AtraxH Horus is equipped with a modern observation head TV/IR/L. Thanks to the use of wired power from the mobile generator, an uninterrupted and stable hover of the Air Platform is possible for a minimum of 8 hours in a wide range of weather conditions



OBSERVATION **NON-STOP**



ONE BUTTON START-STOP



The AtraxH Horus system is dedicated to services and formations performing tasks in the field of critical infrastructure, rescue and search activities (on land and sea), security of mass events, protection of facilities and property, limiting and counteracting the effects of natural disasters, such as the Border Guards, Fire Brigade, Police, Municipal Guards, Forest Service and others.



JC-1 Head made of polymeric materials is electro-mechanically stabilized in three axes. It is equipped with a daylight camera with a resolution of 720×576 and thermal camera with a resolution of 640×480. The thermal camera has a 4× digital zoom function and allows you to work in five color palettes. The daylight camera is only for preview.



JC-3 Head made of a glass composite and aluminium is electro-mechanically stabilized in two axes. It is equipped with a daylight camera with a resolution of 1920×1080 and a function of 30× optical zoom.

JC-3 Duo Head made of a glass composite and aluminium is electro-mechanically stabilized in two axes. It is equipped with a daylight camera with a resolution of 1920×1080 and a function of 30× optical zoom, and also an thermal camera with a resolution of 640×480.



JC-2 Head made of polymeric materials is electro-mechanically stabilized in three axes. . It is equipped with a daylight camera with a resolution of 1920×1080 and a function of 30× optical zoom.



UNMANNED AERIAL VEHICLE NeoX



This is an aircraft for comprehensive purpose of both civil and military nature. It has a long flight time and multi sensor equipment. Depending on the task type, it may observe the area, identify and indicate the target and, in the combat version, neutralise ground objects as well.

NeoX's EQUIPMENT:

- ♦ dual sensor head – daylight sensor (1920×1080) and a thermal imaging sensor (640×480)
- ♦ parachute and airbag for landing
- ♦ optional equipment:
 - contamination sensor;
 - digital camera for taking high definition orthophotos/reconnaissance photographs



NeoX SYSTEM'S CHARACTERISTICS

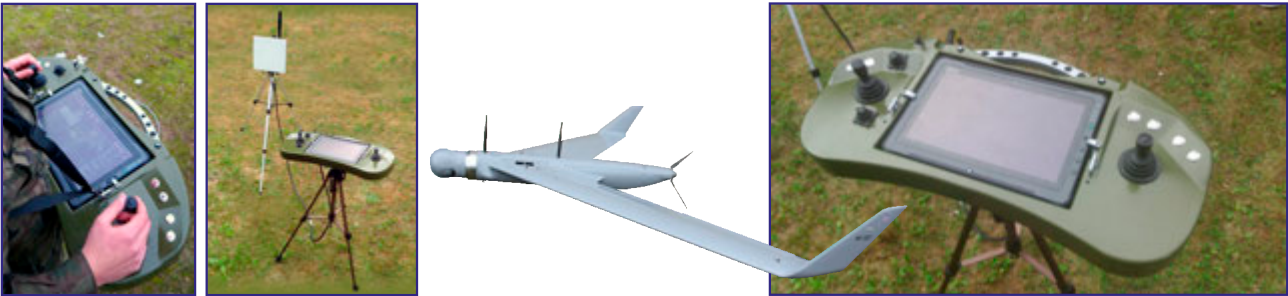
- ♦ automatic take-off system
- ♦ parachute landing system
- ♦ advanced systems improving flight safety
- ♦ the system is operated by two operators
- ♦ ergonomic ground control station (GCS)
- ♦ entire portable system in two backpacks
- ♦ communication system working in the S/C band
- ♦ secure data encryption system AES-256 with the ability to introduce coded keys from the frequency level

FLIGHT MODES

- ♦ following in the direction shown by the observation head
- ♦ flight along the fixed route
- ♦ circulation around the indicated object
- ♦ flight to the point with the specified coordinates

APPLICATIONS

- ♦ cooperation with artillery systems as a means of reconnaissance-by-fire
- ♦ determining the coordinates of a target for the artillery
- ♦ monitoring of state borders
- ♦ observation of the battlefield
- ♦ checking the forest areas (for fires, missing persons)
- ♦ securing mass events
- ♦ control of natural disasters and their effects



TECHNICAL DATA

♦ Wingspan	2.59 m
♦ Length	1.48 m
♦ Take-off mass (max)	9 ÷ 11 kg
♦ Payload mass	2.5 kg
♦ Construction material of flying platform and observation heads	composites
♦ Drive type	electric motor
♦ Minimum flight speed	50 km/h
♦ Maximum horizontal flight speed	170 km/h
♦ Operating height	100 ÷ 1000 m
♦ Flight ceiling	4000 m above sea level
♦ Flight time/operation range	90 ÷ 120 min/10(30) LOS
♦ Radius of action	15 km (up to 30 km*)
♦ Flight preparation time	up to 10 min
♦ Permissible wind speed	up to 12 m/s
♦ Digital data link	AES-256
♦ Platform lighting	navigation – possible to turn off by the operator

* according to type of the antenna system

AERIAL TARGET JET 2



APPLICATION

Unmanned jet powered aerial target system designed to practice anti-aircraft troops in firing „KUB” and „OSA” missile systems.

SPECIFICATION

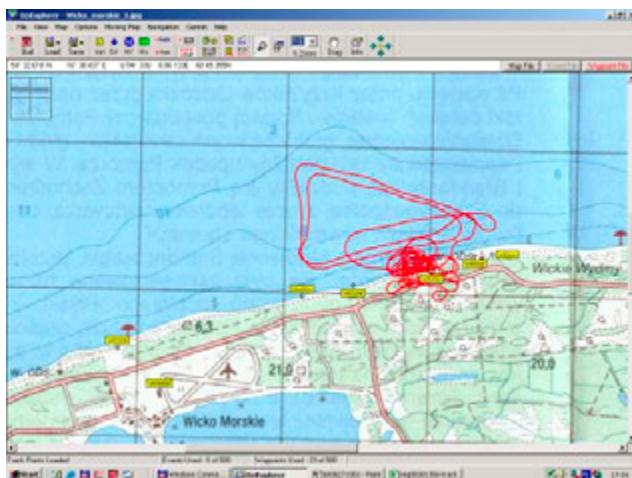
- | | |
|---|--|
| ♦ Power unit | 2 jet engines 2×160 N |
| ♦ Max take-off weight | 85 kg |
| ♦ Wing span | 2.85 m |
| ♦ Length | 3.55 m |
| ♦ Operating speed | 65 ÷ 150 m/s |
| ♦ Climb speed | 6 m/s |
| ♦ Service ceiling | 1000 ÷ 5000 m |
| ♦ Operating range | 35 km |
| ♦ Endurance | 60 min |
| ♦ Radar reflector active area | 1.5 m ² |
| ♦ Start | pneumatic launcher |
| ♦ Landing | parachute system |
| ♦ Automated start and landing, programmed flight path, controlled from ground station | |
| ♦ Optional payload: | - night flight lights
- two pieces of IR source |



AERIAL TARGET 'SZERSZEŃ-M1' MODERNISED VERSION

APPLICATION ...

... to provide troops with field practice in firing portable anti-aircraft missiles from launchers of the STRZAŁA-2M and GROM types; also, in firing anti-aircraft gunnery.



THE SMCP-WU 'SZERSZEŃ'

- | | |
|---|---------------|
| ♦ Wing span | 3.2 m |
| ♦ Max take-off weight | 35 kg |
| ♦ Flying/level speeds | 70 ÷ 180 km/h |
| ♦ Operating range | 20 km |
| ♦ Service ceiling | 1000 m |
| ♦ Endurance | 120 min |
| ♦ Programmiert air route | |
| ♦ Payload: | |
| - sleeve-target system with miss distance indicator | |
| - parachute-landing system | |
| - radar reflector (optional) | |

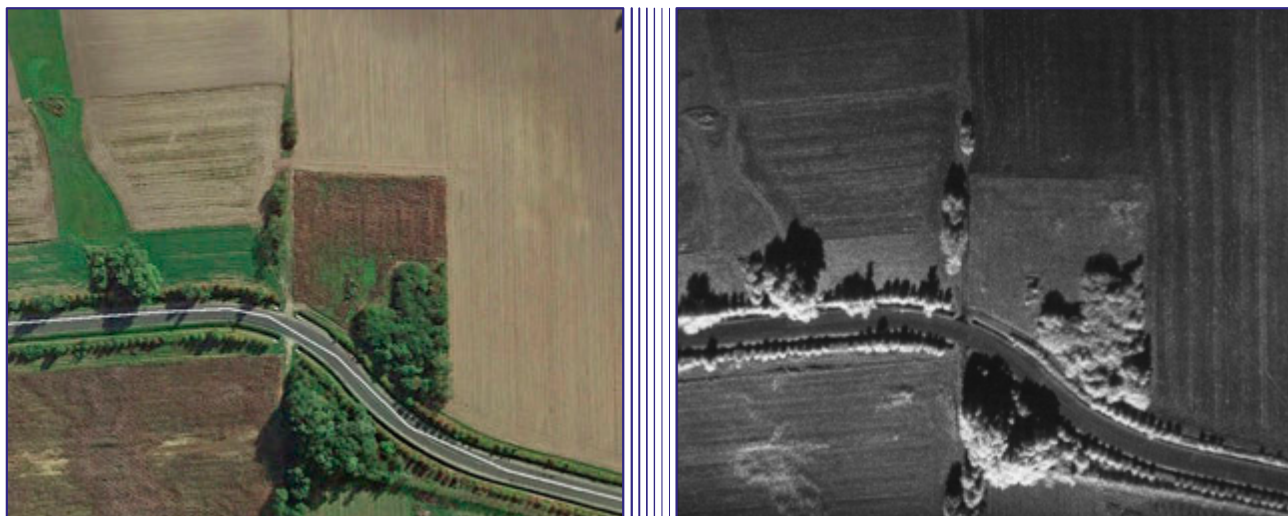
microSAR (SYNTHETIC APERTURE RADAR)

A microSAR (Synthetic Aperture Radar) is an all-weather day/night system capable of collecting, by means of electromagnetic radiation, high-resolution imagery of ground surface from both the UAV and the manned aircraft.

The microSAR is capable of collecting ground-surface imagery with resolution up to 15 cm.

The microSAR radar may be used to civil as well as military application, especially to:

- patrolling,
- reconnaissance/surveillance,
- cartographic and geodetic (earth-surface surveying) services.



An instance of SAR imagery

TECHNICAL SPECIFICATIONS

- | | |
|--------------------------------|-------------|
| • Modulation | FMCW |
| • Number of receiving channels | 2 |
| • Frequency | “Ka” band |
| • Resolution | up to 15 cm |
| • Radar modes | SAR/GMTI |
| • Weight | about 9 kg |

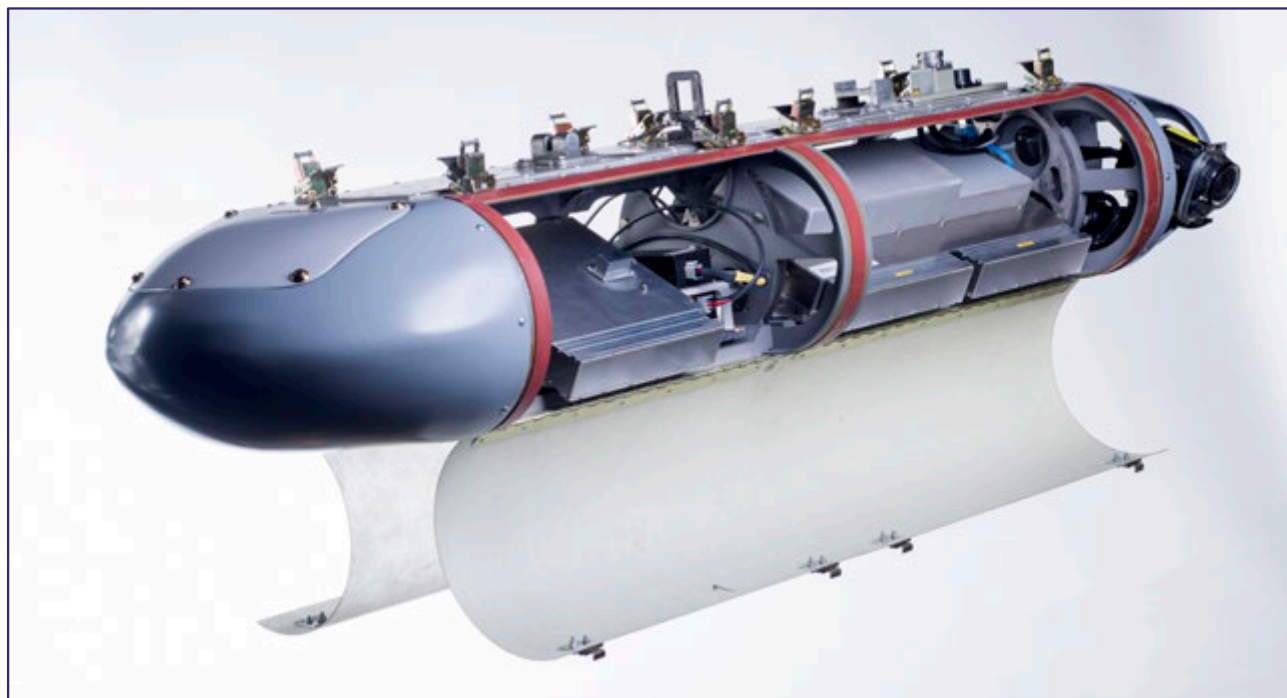
Project financed by the National Centre for Research and Development under the 1st Applied Research Programme

RESEARCH POD 'ZYGMENT-M'

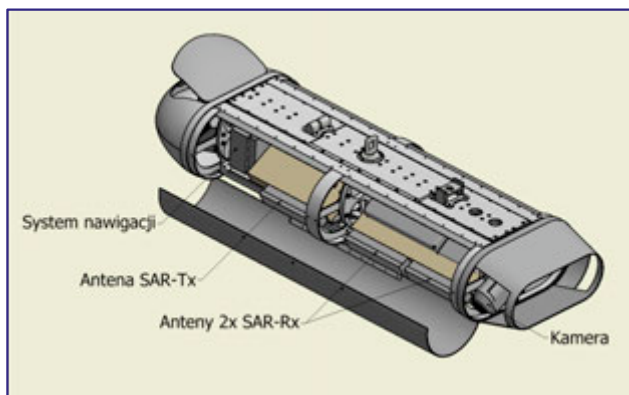
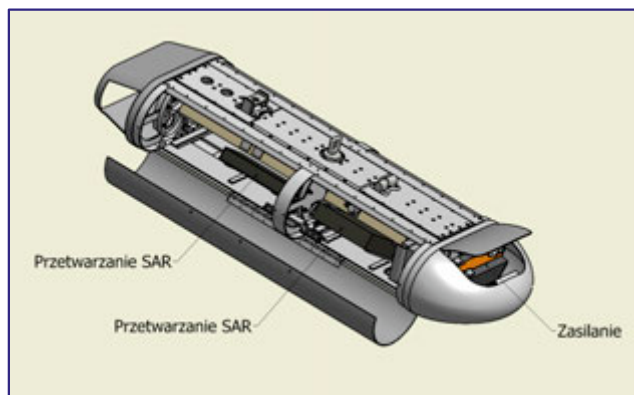
The Research Pod 'Zygmunt-M' has been designed for flight tests of prototype airborne devices/systems, in particular, radars and communication systems. The primary application of the pod is flight tests of the mikroSAR (SyntheticAperture Radar).

The pod may be equipped with a number of extra sensors independent of airborne systems, e.g. navigation and communication systems, a video camera, an autonomous power supply system.

The applied type of hardpoints allows the AFIT's Flying Laboratory to be used as a carrier.



mikroSAR radar in the research pod



TECHNICAL SPECIFICATIONS

- Dimensions 116 × 35 × 18 cm (L×W×H)
- Bare weight 11 kg
- Optional payload:
 - SAR radar
 - navigation system
 - communication system
 - video camera
 - autonomous supply system

AFIT AUTOPILOT AP2

APPLICATION:

- ♦ air target imitators,
- ♦ unmanned monitoring aircraft,
- ♦ vertical take-off and landing aircraft,
- ♦ independent flight parameter recorder for the unmanned and manned aircraft.



The aircraft autopilot consists of the following devices:

- ♦ the AHRS spatial orientation system,
- ♦ areometric unit with static and dynamic pressure sensors,
- ♦ the receiver of the GPS, GLONASS, BeiDou satellite navigation systems,
- ♦ the central navigation centre with a flight parameter recorder and a recorder of data to non-volatile memory,
- ♦ the microprocessor system of processing and coordination of signals from on-board and external sensors,
- ♦ external communication ports (radio modem, PPM receiver, RS232 communication, executing systems),
- ♦ the conditioning and power distribution module.



UAV Szerszeń



UAV Jet-2



UAV Nietoperz

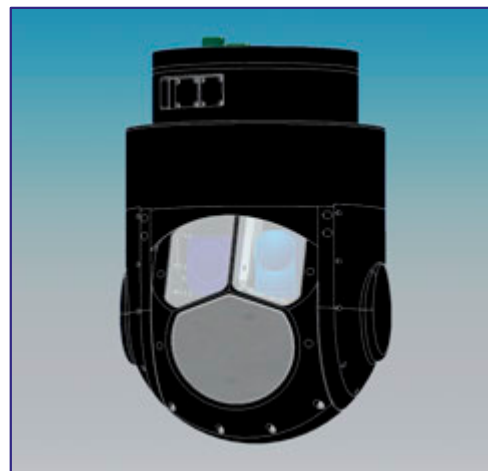
OPTOELECTRONIC OBSERVATION HEAD WH-2

Application:

- Observation of static and dynamic objects in the visible light and infrared ranges.
- The software enables switching the device into an automatic tracking mode.
- Measuring the distance to a selected target.
- Can be used on:
 - medium and large unmanned aerial vehicles,
 - small and medium manned aerial vehicles,
 - land vehicles (inverted position),
 - observation masts / building roofs.
- The selection of sensor and function configuration depends on the expectations of the buyer.

Visible light camera:

- Technology: CMOS
- Resolution: 1920 × 1080
- Focal length: 4.7 ÷ 94 mm
- Optical / digital zoom: 20× / 12×



Laser rangefinder:

- Wave length: 1.55 μm
- Laser class: 1 (eye-safe)
- Repetition time: 1 Hz
- Measurement range: 10 ÷ 5000 m

Other:

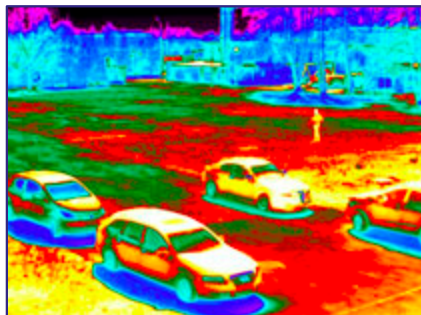
- Diameter: Ø290 mm
- Height: 439 mm
- Weight: 16 kg
- Casing material: anodized aluminium
- Power supply: 24V DC
- Planar rotation ranger
 - horizontal ±175°
 - vertical +15°; -90°

Thermal imaging camera:

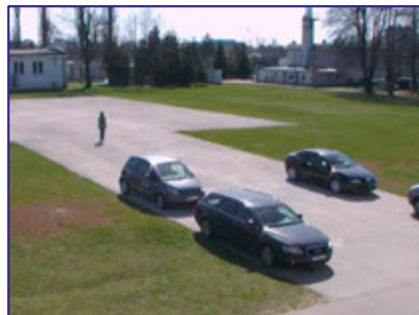
- Technology: FPA
- Resolution: 640 × 480
- Spectral range: 8 ÷ 14 μm

Examples of source (without additional information) images obtained from WH-2 sensors:

Thermal imaging camera:



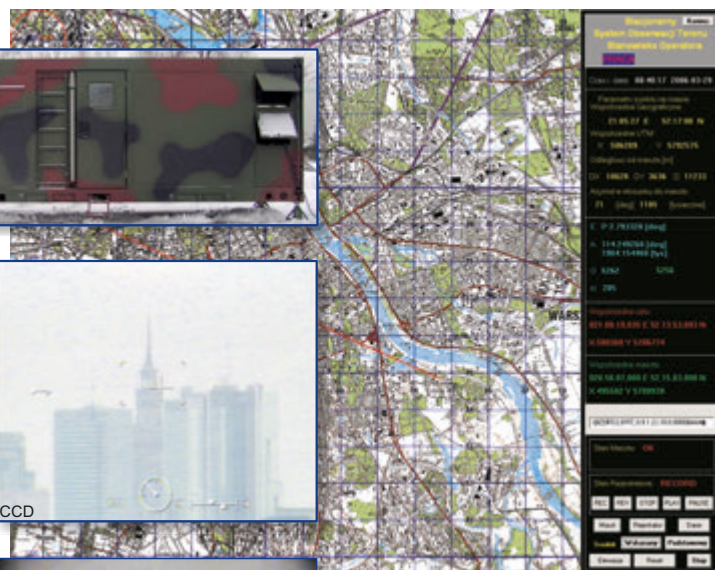
Visible light camera:



THE STATIONARY TERRAIN-SURVEILLANCE SYSTEM

APPLICATION

The **Stationary Terrain-Surveillance System** can be used to observe and keep close watch on selected areas and/or objects. Cameras included in the system can perform in different ranges of electromagnetic spectra (visible light and infra-red radiation), at different times of day/night, and under various weather conditions.



TURRET-DELIVERED IMAGERY
AS DISPLAYED ON THE OPERATOR'S STATION

STRUCTURE

The **Stationary Terrain-Surveillance System** consists of:

- ♦ Mobile mast MM36
- ♦ Electro-optical surveillance turret
- ♦ Imagery-transmission system
- ♦ Operator's station
- ♦ Logistic-support providing equipment
- ♦ Container to house the operator's station



OPERATOR'S INTERFACE

PILOT's SURVIVAL/IMMERSION SUIT Type MUP-1



APPLICATION

The suit has been designed for aircrew members flying over sea areas. It provides hypothermia protection in case of ditching/other emergencies. The "dry" type suit has been made of hi-tech waterproof "breathable" materials that permit of air and water vapour/sweat transmission.

Main features:

- ♦ excellent thermal protection,
- ♦ flame-resistant,
- ♦ waterproof (hi-tec "breathable" materials, attached socks),
- ♦ latex neck and wrist seals,
- ♦ thermal comfort at high environment (air) temperature levels,
- ♦ fitted for co-operation with an anti-g suit (trousers),
- ♦ weight - 2 kg.

SAMANTA IT SYSTEM

SAMANTA IT System online version is a set of modules supporting operation of Aircraft used by the Polish Armed Forces. SAMANTA IT System enables current and periodic analysis of operational processes of armed forces in the scope of reliability and safety of flights, operational states and management of their work resources. The System gathers, processes and transmits operational data concerning each AF, its units, devices, airfield equipment, appeared lacks of parts and training of Aviation Engineering Services staff.



IT System **SAMANTA** Operation management support

The System gathers, processes and transmits operational data concerning each Aircraft, its units, airfield devices and equipment.

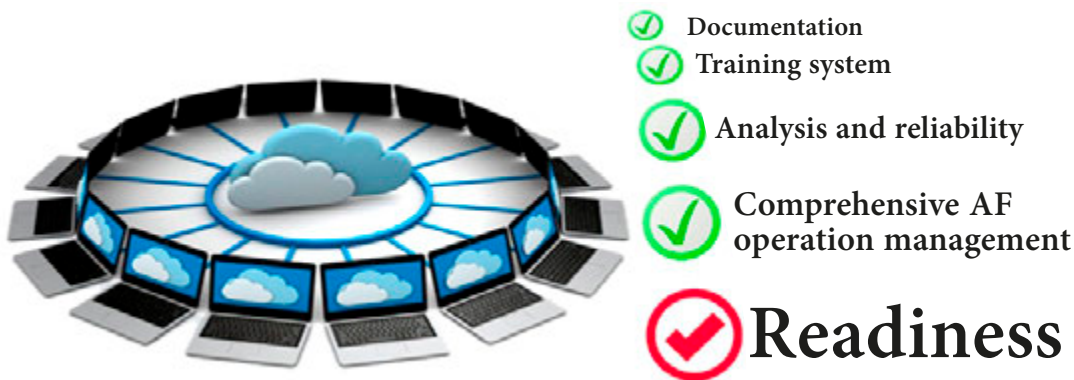
SAMANTA IT System gathers and processes, among others, the following data:

- work and service life of aircraft and their units
- daily operational states
- causes and results of failures
- performance of flights, services, overhauls and bulletins
- operation planning
- AF migration and their units between military units (companies)



- Samanta enables conducting of many analyses of AF operational process, and in particular:
- comprehensive assessment and forecasts of AF reliability and safety (for any time period)
 - assessment of operational state and operational resources of particular AF elements
 - assessment of the completion stage and effects of AF modernization
 - assessment of influence of particular AF elements on its reliability and safety

Main functions of the system



The new version of the system enables its further development and compatibility with other IT systems.

Additional modules have been developed and implemented:

- measurement and control instruments, aircraft ground handling, mobile service and repair workshops, instruments (metrology)
- Tools Central Record
- Specialist Training Record
- Report about the state, turn and needs of tapes
- Unmanned Aerial Vehicle module (UAV)
- Tribology





ITWL



COMPREHENSIVE SYSTEM FOR ANALYSIS AND ASSESSMENT OF FLIGHT SAFETY IN THE POLISH AIR FORCE TURAWA



- Index number: JIM 7030PL0221398
- Organizer of the system: Inspectorate for Flight Safety of the Polish Ministry of National Defense
- System administrator: Instytut Techniczny Wojsk Lotniczych
- Implemented in the Polish Air Force: Order of the Head of the Inspectorate for Armed Forces Support No. 88 from 25 August 2011
- Built in the three-tier architecture.
- It operates in the MIL-WAN military network.

APPLICATION:

- IT support of the system flight safety management;
- Analysis and assessment of the flight safety condition on the basis of comprehensive information concerning aviation incidents that have taken place;
- Identification and statistical codification of possible threats connected with air missions;
- Human Factors Analysis and Classification System (HFACS);
- Management, monitoring and assessment of efficiency of implemented preventive measures on all air force echelons;
- Management of the process of planning and performing air missions;
- Monitoring of the effectiveness of flight training that supports flight safety management;
- Detailed analysis of the history of flight training process of each member of flying personnel;
- IT support of risk management in the process of military aircraft operation.



USERS:

- Inspectorate for Flight Safety of the Polish Ministry of National Defense
- Armed Forces Branches General Command
- Operations Command
- General Staff of the Polish Armed Forces
- Inspectorate for Armed Forces Support
- Air Force Inspectorate
- Troops and tactical units of the Polish Armed Forces
- Aviation units directly using aircraft



THE LBĆw-10 BOMBING TRAINING SYSTEM



The LBĆw-10 bombing training system is intended to practical training of basic aircrew in bombing. It is used on aircraft operated by the Polish Air Force.

The system consists of the following components:

- the LBĆw-10 aerial training bomb,
- adapters, which enable to undersling the training bomb under the external pylons (single and multi-breech) in the Su-22, MiG-29 and TS-11 Iskra aircraft.

The LBĆw-10 aerial training bomb incorporates three basic elements: ballistic cap, body assembly, and stabilizer. The signalling cartridge, located in a stabilizer assembly, traces bomb flight path after its separation from the carrier.

Bomb includes integrated fuse system.

BASIC TECHNICAL DATA

♦ LBĆw-10 bomb length	645 mm
♦ LBĆw-10 bomb diameter	110 mm
♦ Bomb weight	13 kg
♦ Signalling cartridge burning time	40 s
♦ Signalling cartridge ignition time	1 s
♦ Operation temperature	-55 ÷ +60 °C
♦ Transportation box total weight (with bombs)	40 kg
♦ Number of bombs in the box	2

The product developed and made by ITWL and by DEZAMET Metal Works, Nowa Dęba.

AERIAL TARGET SIMULATORS SET ZICP



APPLICATION

The aerial target simulators set (ZICP) is intended for training of anti-aircraft defence subunits on shooting ranges. It is used to combat aerial attack means with barrel weapons and with the following types of rockets: air-to-air, ground-to-air, and water-to-air.

The ZICP aerial target simulator system incorporates:

- the ICP-1 aerial target simulator;
- the ICP-R aerial target simulator;
- missile launcher with the firing control installation.

TECHNICAL DATA

The ICP-1 aerial target simulator

- ♦ diameter 57 mm;
- ♦ length 1100 mm;
- ♦ max speed ~ 425 m/s;
- ♦ active flight time ~ 0.8 s;
- ♦ total weight 5.2 kg;
- ♦ tracer burning time ~ 40 s.



The ICP-R aerial target simulator

- ♦ diameter 57 mm;
- ♦ length 1180 mm;
- ♦ max speed ~ 425 m/s;
- ♦ active flight time ~ 0.8 s;
- ♦ total weight 5.3 kg;
- ♦ tracer burning time ~ 65 s;
- ♦ parachute falling velocity with tracer ~ 5 m/s.

On-ground launcher of aerial target simulator

- ♦ launcher length ~ 1.70 m;
- ♦ launcher barrel length ~ 1.50 m;
- ♦ barrel diameter 57 mm;
- ♦ number of barrels in the launcher 5
- ♦ angle of launcher elevation $20 \div 80^\circ$.

WW-15 LAUNCHER

71,5 MM NON-GUIDED MISSILES



The WW-15 and WW-15/N Launchers are designed to fire non guided cal. 70 mm rockets from combat helicopter platforms.

LAUNCHER COMPOSITION

- ♦ 15 barrels with interlock contact mechanism
- ♦ load-bearing with carrying handles
- ♦ wiring
- ♦ front shield

TECHNICAL DATA

- | | |
|----------------------------------|----------|
| ♦ barrel diameter | 71.5 mm |
| ♦ number of barrels | 15 |
| ♦ length | 1700 mm |
| ♦ width | ~ 430 mm |
| ♦ launcher empty weight | ~ 45 kg |
| ♦ carrying handles gauge WW-15 | 250 mm |
| ♦ carrying handles gauge WW-15/N | 355 mm |

The product developed and made by ITWL and by MESKO S.A. Skarżysko Kamienna

DEVELOPMENT OF A TECHNOLOGY OF FLARES AND LAUNCHERS COMPLYING WITH STANAG-4687 FOR PASSIVE PROTECTION OF MANNED AIRCRAFT

The project was carried out by a consortium consisting of three companies: the Air Force Institute of Technology - project leader, the Institute of Industrial Organic Chemistry and BORYSZEW S.A. NYLONBOR branch.

As a result of the project the following items have been constructed:

- ♦ prototype batch of the K-811H launchers subjected to qualification tests, including in-flight testing on the W-3 helicopter;
- ♦ prototype batch of the TNZ-811H subjected to qualification tests, including in-flight testing on the W-3 helicopter;
- ♦ technical documentation for manufacturing of a sample batch of the flares and launchers;
- ♦ stand for assessment of the passive protection system's effectiveness.

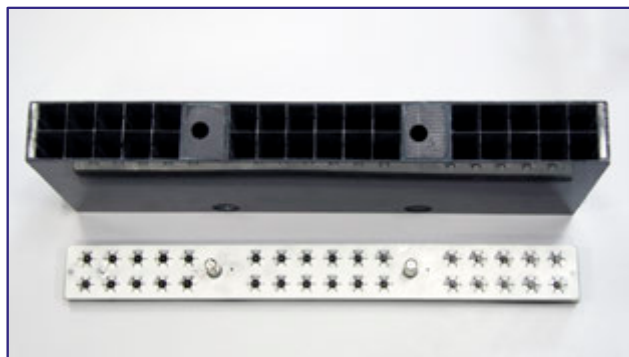
THE TNZ-811H FLARE

It is an element of the aircraft passive protection system and its aim is to disturb homing missiles.



THE K-811H LAUNCHER

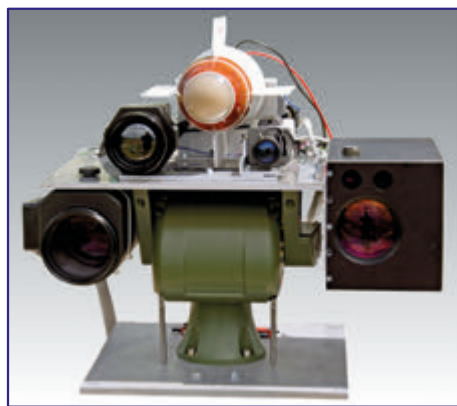
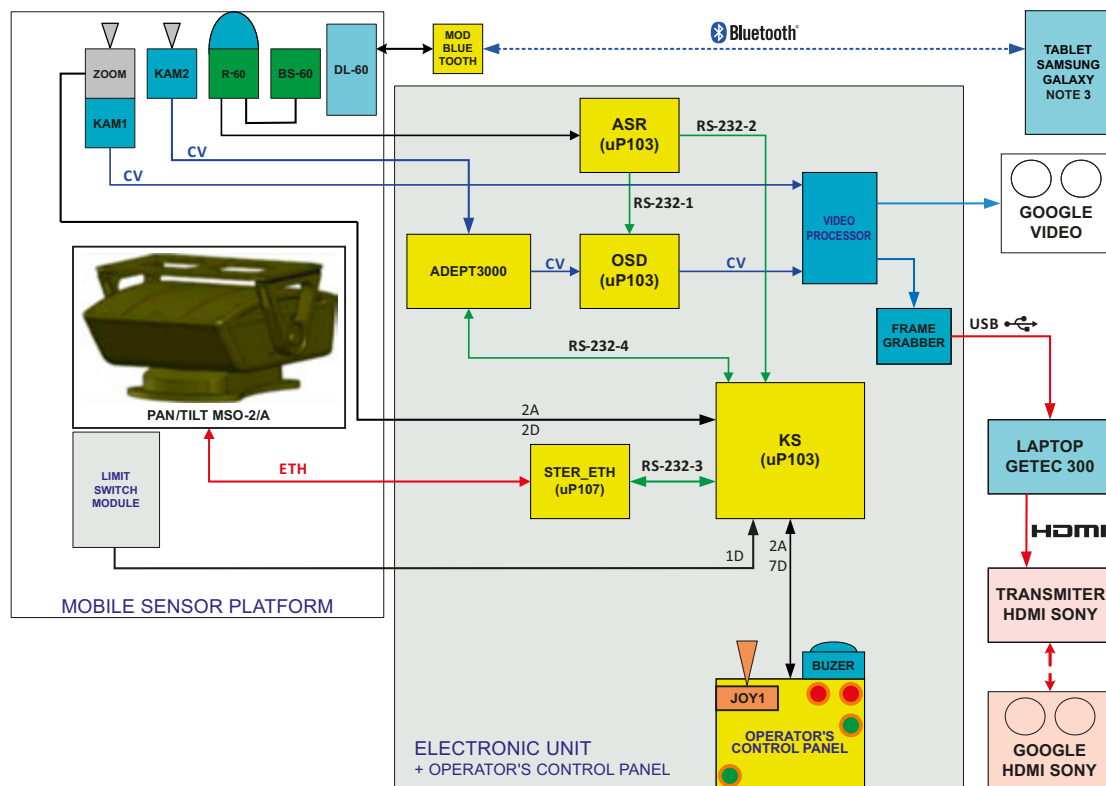
The function of the K-811H launcher is to launch NATO standard 1×1×8 inch flares from a helicopter using the ASO-2W passive protection system.



THE STAND FOR ASSESSMENT OF THE PASSIVE PROTECTION SYSTEM'S EFFECTIVENESS

The test stand enables conducting of an analysis of registered data for the purpose of determining:

- ♦ the effective sequence of flares' launching with the aim of disturbing homing head of a missile
- ♦ the most effective manoeuvre of anti-missile aircraft while launching flares at the same time



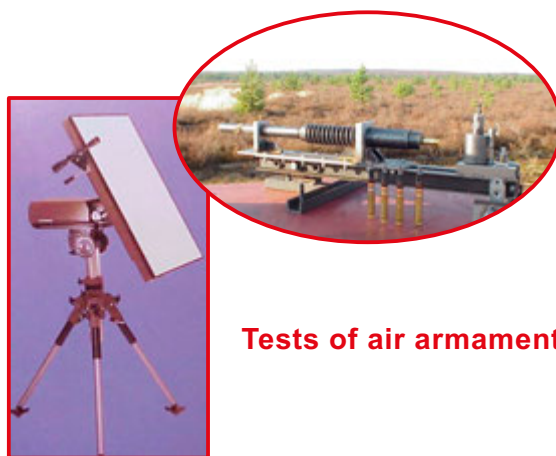
Conclusions resulting from tests of the stand for the flares' effectiveness enabled to determine:

- ♦ the optimal sequence of flares' launching with the aim of disturbing the work of a missile coordinator;
- ♦ parameters of helicopter's manoeuvre preventing the return of a missile coordinator to the helicopter tracking mode;
- ♦ quality of tested flares (TNZ-811H, PW-118, PPI-26) from the perspective of the effectiveness of disturbing.

TESTS OF AERONAUTICAL HARDWARE AND AIR ARMAMENT



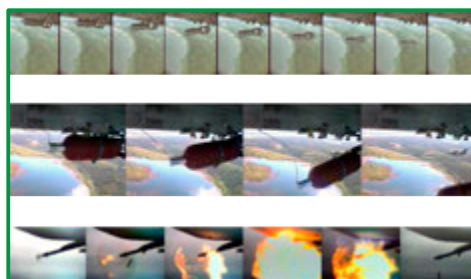
Flight testes of air
warfare agents



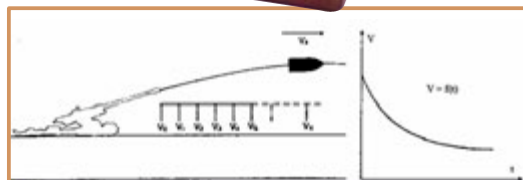
Tests of air armament

Cameras/sensors housing pod LZR-1
(recorders)

Determination of ballistic
characteristics of warfare
agents



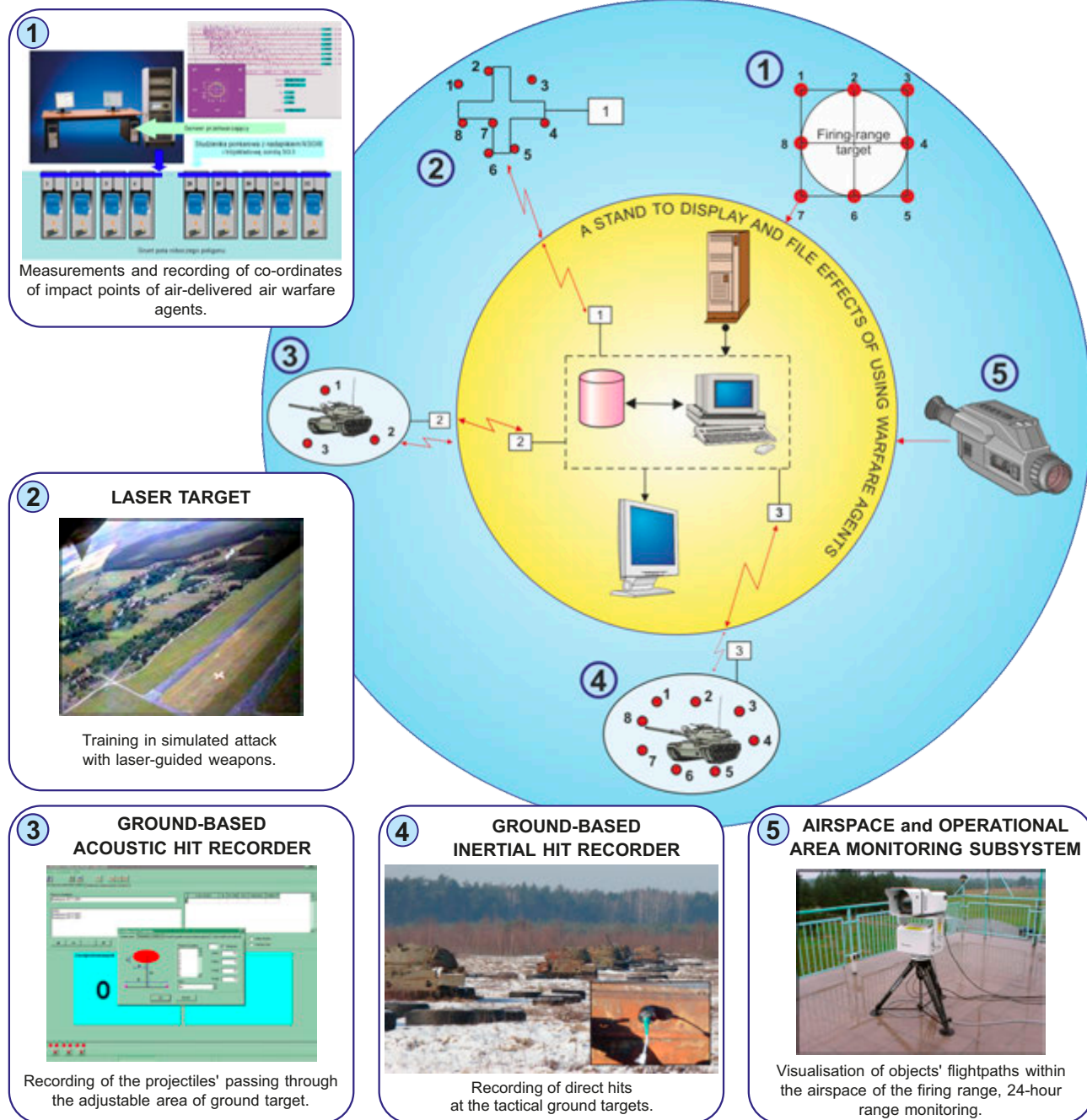
Investigation into internal ballistics
of solid-fuel rocket engines



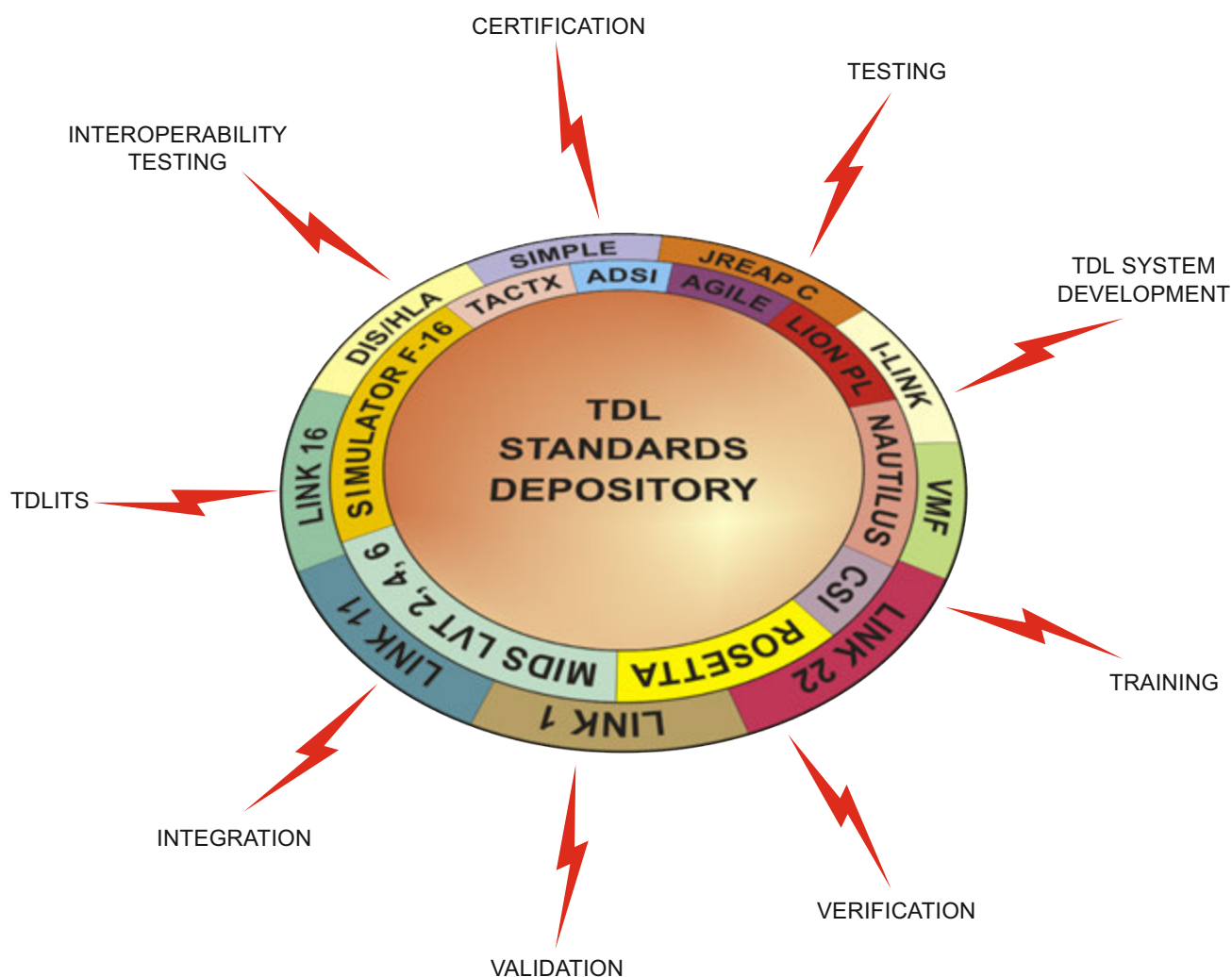
SYSTEM TO EVALUATE EFFECTS OF USING AIR WARFARE AGENTS AT THE AIR FORCE'S SHOOTING RANGE

The assessment of the accuracy of using warfare agents in the course of aircrew training

THE SYSTEM IS COMPOSED OF:



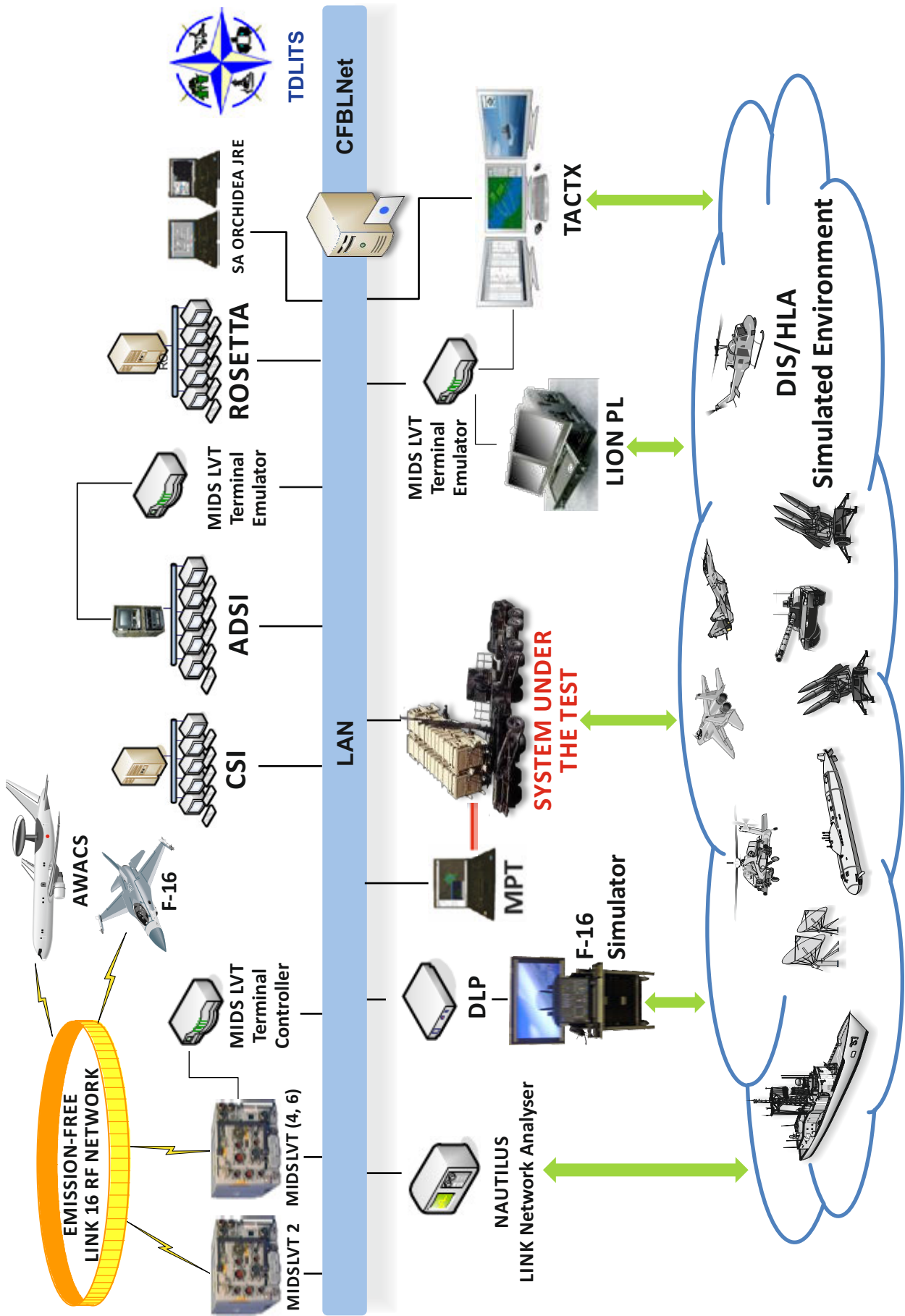
TACTICAL DATA LINK STANDARDS DEPOSITORY



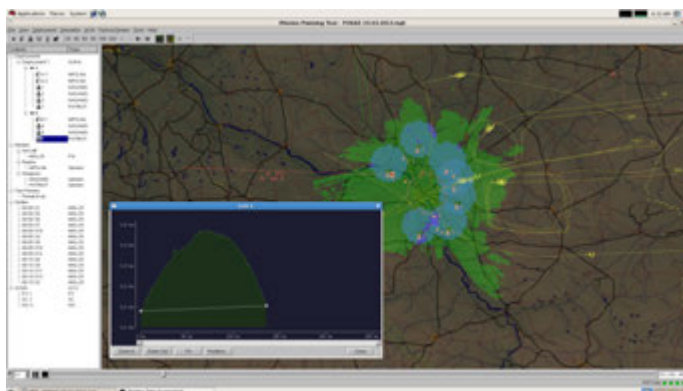
Tactical Data Link Standards Depository was developed in the Air Force Institute of Technology under the project „Development of TDL systems transfer technology for command and communications”. This technical solution provides verification of functionality of command and control (C²) and weapon control systems in the field of TDL standards implementations, processing, algorithms as well as procedures.

Research & Development project and was financed by Ministry of Science and Higher Education in the period of 2009-2011.

THE FUNCTIONALITY SCHEME OF TDL STANDARDS DEPOSITORY



MISSION PLANNING TOOL (MPT)



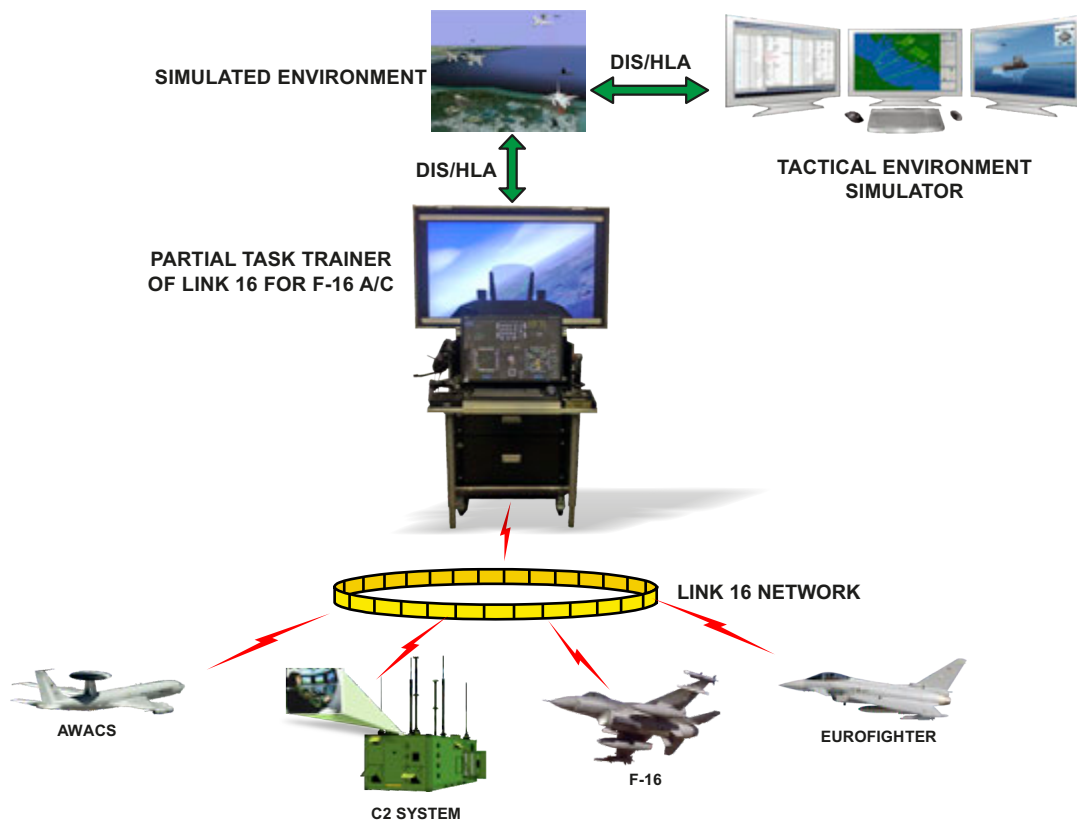
The Mission Planning Tool (MPT) has functionality for Ground Based Air Defence (GBAD) air defence deployment design and optimization in relation to the designed sorties.

MPT allows for a particular deployment of air defence equipment: tactical control units, missile launchers, radars and other sensors (already defined in a local database). The MPT's main purpose is to determine air defence equipment Line of Sight (LOS), process Airspace Control Means

(ACMs) and Airspace Control Orders (ACOs), design sorties scenario and perform in-depth analysis of deployment effectiveness.

MPT could be implemented in GBAD units and higher echelons involved in operational missile defence planning.

Simulation and Emulation system of Link 16 functionality on board of the Polish aircraft F-16 „Partial Task Trainer of Link 16 for F-16 A/C”



The Partial Task Trainer of Link 16 for F-16 (PTT) is a complete training system, which allows pilots to work with aircraft avionic, operational and tactical procedures in an efficient training environment. The simulator is operating in a standalone or networked environment, allowing several pilots to practice and execute team tactics. The systems allows to connect directly to Link 16 ground support systems. The trainers have a build-in scenario generator, which controls constructive forces. Easily selectable scenarios allow the instructor or the pilots themselves to immediate access and train dynamic setups. The scenarios are dynamic and not scripted, so they will evolve differently depending on how the pilots apply their tactics.

PTT is compliant with NATO and other military standards such as STANAG 5602, STANAG 5516, DIS, HLA.

Main features:

- Presentation of Link 16 image in a horizontal (Horizontal Situational Display - HSD),
- Presentation of the radar image - guidance (Fire Control Radar - FCR),
- Presentation of Link 16 image - the main target by the all data presentation elements used for the F-16 platform, including mounted display (HUD - Helmet Mounted Display),
- RAP distribution and Fighter Control via Link 16 SIMPLE.

AIR DEFENSE SYSTEM INTEGRATOR



INTENDED TO

Multi-interface gateway and translator (routing & forwarding, Track management, Common picture for aircrafts, IFF information, Detailed track/unit status, Radar sensors bearing, full operational capability of Link 16 command and control, and many more.

KEY FEATURES:

- ♦ Full C² system, supports AEW Systems, Radars, Link 1, Link 11 Link 16, ATDL and more:
 - **MLIU** Multi Link Interface Unit;
 - **MDB** Data Base for MLIU, contains information about tracks, mission, weapons, etc.
 - **TSD** Tactical Situation Display - module for recognised air picture creation and presentation;
 - **TacView/C²** Module responsible for conjoined recognised air picture with tactical data, now fully C² capable.

SPECIFICATIONS

- ♦ Link 16 MIDS LVT (1553B interface)
- ♦ Link16 SATCOM RS-422
- ♦ Link 16 (TCP/IP; UDP- Multicast/Unicast; Serial)
- ♦ Link 11 NTDS / Parallel Interface
- ♦ Link 11B
- ♦ NATO Link-1
- ♦ ATDL-1
- ♦ JREAP A/B/C

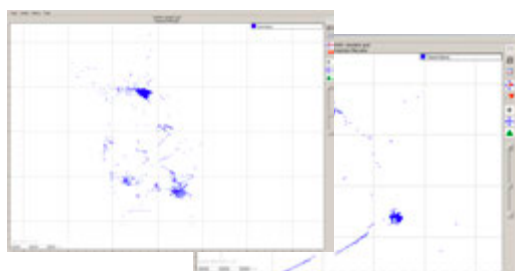
CO-OPERATION:

- ♦ 16 serial interfaces
- ♦ 4 modem channels
- ♦ 2 1553B
- ♦ 16 Ethernet ports
- ♦ 4 fiber channel ports

NAVWAR (NAVIGATION WARFARE)

- **GNSS Satellite System Jamming**

Developed technology enables various configuration change for jamming elements, according to user predefined rules and requirements (spoofing by type: directional, Omni-directional and area).

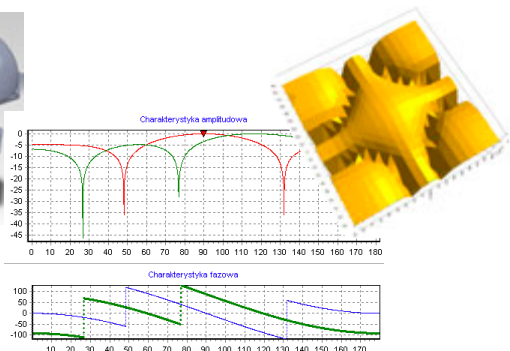
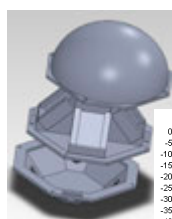


- **GNSS Satellite System Spoofing**

Technology developed by ITWL enables target-based input of invalid positional and navigational data for GNSS receivers.

- **GNSS Satellite System Interference Detection**

Developed technology enables detection and degradation of interference influence on proper GPS work. This solution is based on advanced digital processing and analysis of received signals using GPS receiver in real-time.



- **GNSS Satellite System Interference Countermeasure**

Developed technology enables time-space elimination of interference signals from useable mix-signal received by GPS. This solution is based on adaptive creation of receiving directivity characteristics of antenna's structure.

Research & Development project and is financed by Ministry of Science and Higher Education in the period of 2009-2011.

GROUND BASED SYSTEM FOR DETECTING AND TRACKING OBJECTS IN LOW EARTH ORBIT

ABSTRACT OF THE RESULTS

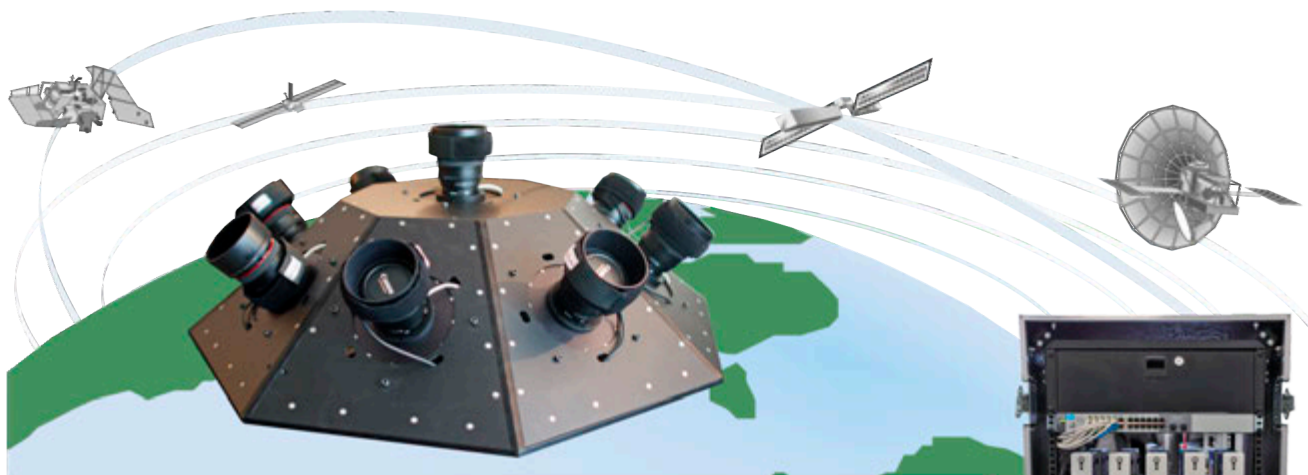
System is designed to detect, recognize and record satellites and other objects in Low Earth Orbit and compare their parameters with NORAD TLE database. As an output user can build his own Low Earth Orbit Objects (LEO) database.

Ground Based System for Detecting and Tracking Objects in Low Earth Orbit consists of:

- 9 CCD cameras - FLI Proline PL16803 with Canon EF 50mm f/1.2 lens,
- 9 computers - EPC-945-D16 with camera control software,
- EPC-945-D16 server with KTStationPilot and KTVView software,
- Mechanical camera alignment system.

In the Project framework special software was developed. This software consist of following programs:

- Surveillance station control program - KTStationPilot,
- Image analysis and recognition program - KTRecon,
- Image browser program FITS-KTVView,
- Database updating program TLE KTLEDownload.



System of 9 CCD FLI cameras with camera control and power circuits.

Ground Based System for Detecting and Tracking Objects in Low Earth Orbit reliably detects northern hemisphere satellites. System recognizes satellites by comparing their orbital parameters with ephemerides published by NORAD.

System effectiveness was proved both under good weather (stars up to 6 mag. visible) and under high altitude clouds obscurance (stars +1 mag. visible).

Project was carried out in consortium with KenBIT sp.j. Company.



VIRTUALISATION-TECHNOLOGY BASED AIRCRAFT-DEDICATED DIAGNOSTIC SIMULATOR



PURPOSE

Engineering staff training in performing maintenance procedures, in detecting and removing any malfunctions.

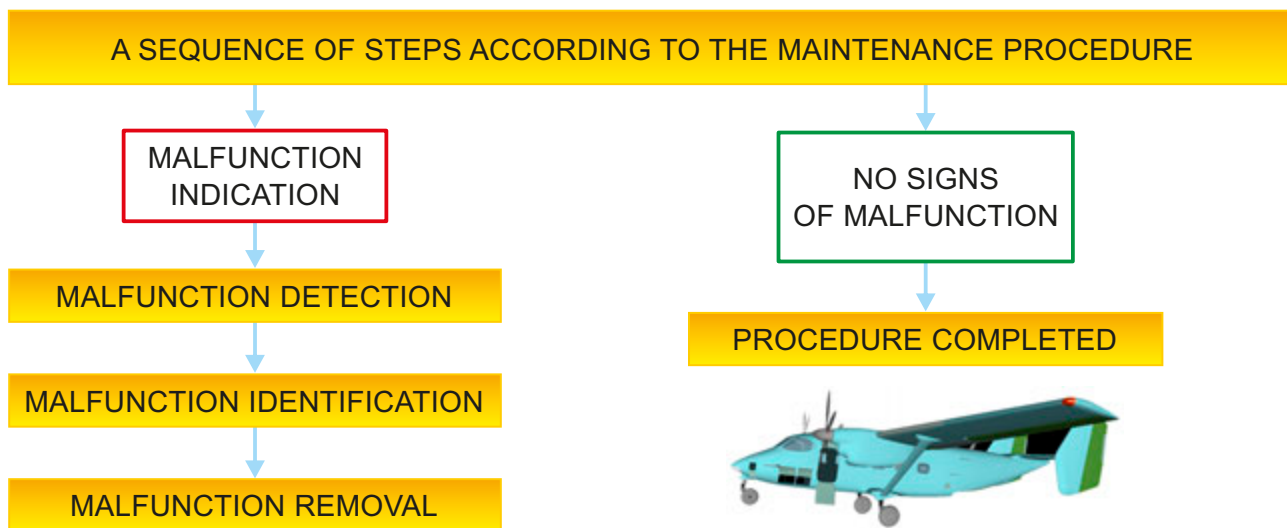
COMPONENTS

- A trainee's station – a virtual cockpit
- A trainee's station – a virtual fuselage
- An instructor's workstation
- The M-28 aircraft dedicated training package



BASIC FUNCTIONS

- Preparation of exercise scenarios
- Performance of a scenario-based exercise:
 - Presentation of automatically generated correct maintenance procedures, with comments
 - Instruction/training in maintenance procedures with system-generated prompts
 - Instruction/training in maintenance procedures with no prompts
 - Examination
- Recording of the exercise
- Reproduction of the recorded exercise (DEBRIEFING)
- Evaluation of the exercise performance



ADVANTAGES

- Visualisations based on virtual environments, with touchscreens applied
- Software inherent capability to change the simulated aircraft
- Capability to introduce another aircraft types

The simulator has been developed under the Project “Development and tests of a diagnostic simulator of an aircraft with virtualisation technology applied”, Project No. UDA-POIG.01.03.01-00-201/09-00, financially supported by the Operational Programme “Innovative Economy”.

The Project is carried out by the scientific consortium composed of:

- Instytut Techniczny Wojsk Lotniczych (Air Force Institute of Technology), Warszawa, Poland
- Wyższa Szkoła Oficerska Sił Powietrznych (Polish Air Force Academy), Dęblin, Poland



INNOVATIVE ECONOMY
NATIONAL COHESION STRATEGY



EUROPEAN UNION
EUROPEAN REGIONAL
DEVELOPMENT FUND



PROCEDURAL-DIAGNOSTIC SIMULATOR OF A VIRTUAL REALITY ANTI-AIRCRAFT MISSILE SYSTEM WITH ELEMENTS OF AUGMENTED REALITY

PURPOSE:

Training of technical personnel in the scope of: implementation of technical services, detection and removing of malfunctions, and carrying out combat operation through service in the conditions of simulated air situation.



COMPONENTS

- ♦ Instruments of the command and homing cabin
- ♦ Autonomous unit for the creation of multimedia presentations with elements of augmented reality
- ♦ Large-format graphic presentation system
- ♦ Instructor's position

BASIC FUNCTIONS

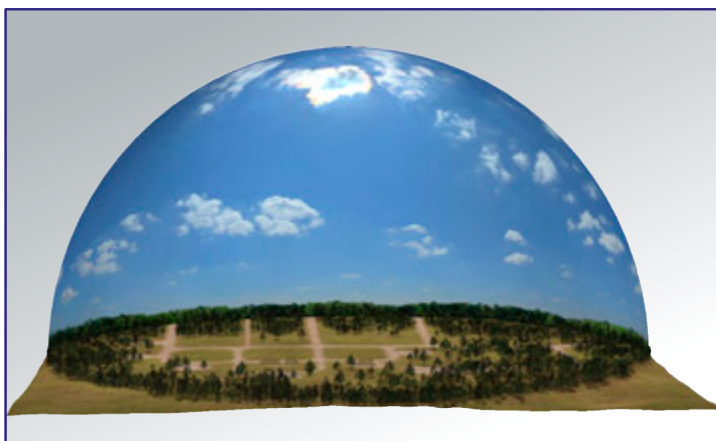
The procedural-diagnostic simulator will enable to carry out service activities (including function check) and allow to carry out an exercise of combat operation of anti-aircraft missile system (PZR). The virtual cabin enables:

- ♦ carrying out standard checks,
- ♦ software introduction of failures during performance of operation activities,
- ♦ simulating typical failure states,
- ♦ virtual start-up of external equipment (e.g. antenna column, launcher, etc.),
- ♦ setting and tuning the instruments,
- ♦ execution of PZR combat operation,
- ♦ archiving service activities on the simulator,
- ♦ evaluation of correctness of performed actions.



ADVANTAGES

- ♦ Decrease of training costs.
- ♦ Limiting training with the use of battle equipment.
- ♦ Training with the use of virtual reality (VR) and augmented reality (AR) technologies.
- ♦ Visualisation based on virtual environment and touch panels.
- ♦ The possibility to implement software changes and reconfigure working desktops in the case of modernization of the PZR.
- ♦ The possibility to expand didactic database including scenarios of detecting and removing new malfunctions.
- ♦ Using augmented reality technology as a tool supporting technical personnel during carrying out operation activities on a real-life object.



The simulator is part of a project titled: *Development and implementation of a procedural-diagnostic simulator of a virtual reality anti-aircraft missile system with elements of augmented reality* no. O ROB 0050 03 001, financed by the National Centre for Research and Development, within the framework of competition no. 3/2012 on national defence and security.

TRAINING SYSTEM IN THE FIELD OF AVIATION TECHNOLOGY WITH THE USE OF VIRTUAL REALITY (VR)

Developed on the basis of the latest technologies. It includes three basic modules:
e-learning training, procedural training and virtual training.



E-learning training module is based on KSD SOWA training system developed by Air Force Institute of Technology. It allows for technical personnel training in terms of operation of aircraft used in the Polish Armed Forces, with the use of multimedia technologies. The built-in learning management system (LMS) allows to prepare an individual training path for each student and to verify progress by built-in tests.

Procedural training module is a universal cockpit of the aircraft, in which touch screen monitors and fixed control elements were mounted. All the analogue instruments, breakers and switches were projected in 3D graphics. Owing to interactivity, it is possible to operate all the control elements in the same way as in a real cockpit, and the use of surroundings visualisation allows to carry out a simulated flight. A very significant innovation of this solution is a functional and system combination of real multifunction panels with virtual on-board instruments. The simulator allows crews to master modern solutions of “glass cockpit” type without the necessity to use a real helicopter, i.e.:

- ♦ task preparation process (mission planning station),
- ♦ mission performance in accordance with a developed plan,
- ♦ plan modification or development of a completely new mission during flight and its implementation,
- ♦ selection of an appropriate operation mode and a method of imaging,
- ♦ the use of a central system for controlling systems with the use of MFD and control elements on the collective shaft (the so-called HOCAS),
- ♦ processes related to the start-up and shutdown of the integrated avionic system,
- ♦ implementation of transport, airborne, search and firing tasks.



Virtual training module allows to conduct advanced training in the field of construction and operation of aircraft and other complex structures in a virtual environment, without the necessity to access the actual construction of the aircraft. The use of goggles and “virtual hands” allows to operate all the control elements, and a trainee can move around and inside the aircraft. This module allows for training in the following field:

- ♦ arrangement of elements and units on board,
- ♦ operation of individual on-board systems,
- ♦ performance of services and repairs,
- ♦ performance of emergency procedures.



MULTI-MEDIA SYSTEM TO ASSIST AERONAUTICAL TRAINING



APPLICATION

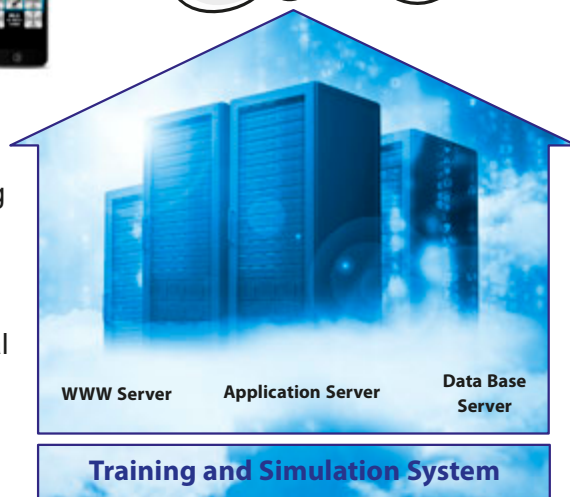
- ♦ System has been designed for:
 - interactive pilot's training and ground staff training
 - training in procedures to be followed in in-flight emergencies
 - training oriented at implementation of new procedures specified in e.g. aeronautical technical or maintenance bulletins/reports.

FUNCTIONAL FEATURES

- ♦ high applicability (in practice, no limitations regarding the location and number of interactive educational work stations)
- ♦ training to any number of participants
- ♦ low operating expenditures
- ♦ monitoring of the technical staff proficiency
- ♦ capability to quickly include subsequent lessons into software structure

SPECIFICATIONS

- ♦ The computer-assisted teaching systems comprise two major components:
 - Learning Management System (LMS)
 - knowledge included in sequences of lessons and exercises.
- ♦ To satisfy the needs of design and implementation of interactive distant-teaching systems, the object-oriented lesson format labelled SCORM has been applied.
- ♦ Lessons and/or exercises generated according to this standard can be presented by means of Learning Management Systems made by different manufacturers.



FLIGHT DATA RECORDING SYSTEM S2-3a



A - Acquisition Unit S3-1a-2; B - Protected Unit (of the FDR type) S2-3a-K; C - Pilot's Index-Feeding Unit S2-3a-P;
D - Recorded Data Reader S3-1c-O; E - Computer Tester WTS4; F - Tester WTS4/AP702C

The **S2-3a** Recording System has been designed for automatically recording information on aircraft operation, surviving air accidents/crashes, and reproducing the collected data in the Flight Data Processing Laboratory in order to:

- ♦ evaluate aircraft control quality/pilot's flying skill,
- ♦ evaluate health/maintenance status of airborne systems,
- ♦ investigate prerequisites for air accidents, and air accidents themselves.

The **S2-3a** system has been intended for recording flight parameters of the W-3, SW-4, Mi-8, Mi-14, Mi-17, Mi-24 helicopters, and for aircraft: TS-11 Iskra, M-28 Bryza, C-295 Casa and Orlik TC-II.

Data is stored in cassettes: the maintenance one (to evaluate aircraft control quality/pilot's flying skill, and health/maintenance status of airborne systems), and the protected one (to analyse causes of air accidents).

FLIGHT DATA RECORDING SYSTEM S2-3a

The S2-3a system comprises two basic groups of items: the airborne and the ground-based ones:

Airborne items include:

- ◆ Acquisition Unit S3-1a-2 with the Maintenance Cartridge S3-1a-2K
- ◆ Protected Unit S2-3a-K
- ◆ Pilot's Index-Feeding Unit S2-3a-P

Ground-based items include:

- ◆ Recorded Data Reader S3-1c-O
- ◆ Computer Tester WTS4/AP702C
- ◆ PC.

The Acquisition Unit **S3-1a-2** is the heart of the system, linked to many and various inputs.

The Maintenance Cartridge **S3-1a-2K** has been designed for recording data used in the post-flight evaluation of mission performance, and for diagnostic purposes.

The Protected Unit **S2-3a-K** has been intended to survive aircraft failure or air accident/crash and to maintain measurements taken. It satisfies specific standards and withstands:

- ◆ impacts that result in overloads up to 3400 g, for 6.5 ms;
- ◆ penetration with a metal [piercing] mandrel;
- ◆ compression with static force 22.25 kN;
- ◆ temperature of 1100°C for 30 min;
- ◆ deep salt-water pressure of 60 MPa, for 30 days and nights;
- ◆ influences of corrosive fluids.

The Pilot's Index Feeding Item **S2-3a-P** located in the cockpit enables feeding of the pilot's index number.

The Recorded Data Reader is connected to a computer furnished with an interface card to read data recorded either in the Maintenance Cartridge.

The Tester **WTS4/AP702C** is connected to the Acquisition Unit to check individual measuring channels and calibrate them.

TECHNICAL DATA:

• Max time of continuous recording	> 12
• Number of on/off inputs	48
• Number of analogue inputs	14
• Number of frequency inputs	4
• Number of inputs from selsyn/resolver sensors (from an artificial horizon or a compass, and a throttle lever)	5
• Date/time recording	
• Pilot's index number recording (up to 6 digits)	
• Diagnosing of the recording system	

FLIGHT DATA DECODING SYSTEM OAZ (OBJECTIVE RECORD ANALYSIS)



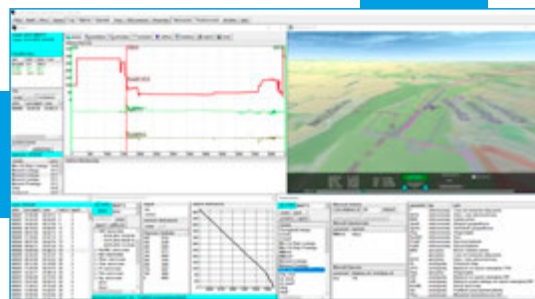
The basic function of OAZ system is decoding of data from the Maintenance Cartridge and Protected Unit, flight analysis based on recorded parameters and archiving of records.

Main features of the Flight Data Decoding System:

- ♦ operation in the Windows environment;
- ♦ own database with tools to search through it;
- ♦ data record and analysis;
- ♦ aircraft diagnostics module;
- ♦ extended module of graphic presentations;
- ♦ usage simplicity.

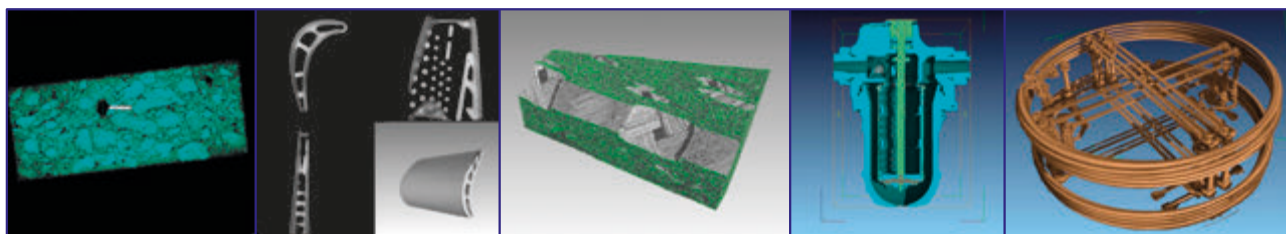
The system provides:

- ♦ aircraft motion animation;
- ♦ display of flight route against a digital map;
- ♦ marking of characteristic points of the plots with markers;
- ♦ flight data recording in text files;
- ♦ printouts of flight records (selected parameters with failure and maintenance exceedances reported).



THE COMPUTED TOMOGRAPHY (CT) BASED NON-DESTRUCTIVE TESTING (NDT) SYSTEM

Instytut Techniczny Wojsk Lotniczych (Air Force Institute of Technology) offers their services in the field of the CT-based metrology and analysis. The testing work is carried out with the GE's v/tome/x m 300 CT system applied. The system uses the high power (max. 300 kV / 500 W) X-ray tube. The 180 kV / 15 W X-ray tube for the nano-CT scanning is also a component of the system.

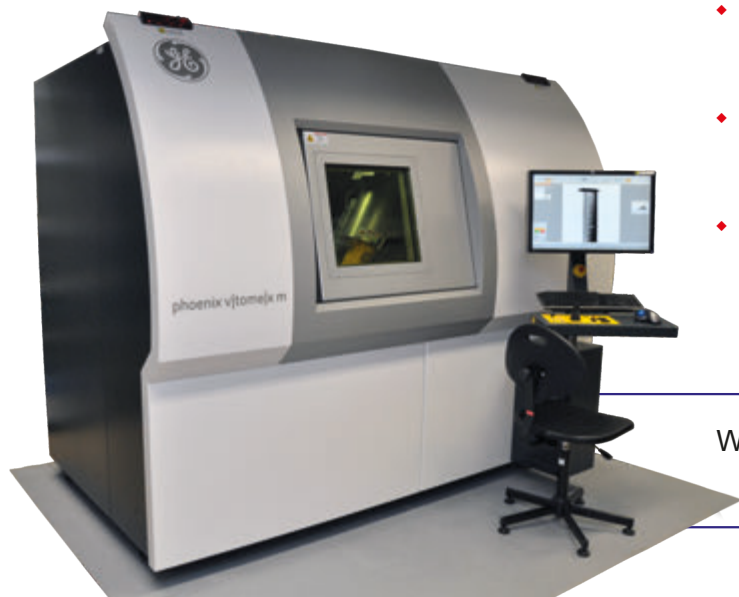


Scientific research and analyses cover the following materials:

- ♦ Titanium alloys
- ♦ Steel
- ♦ Composites
- ♦ Concrete
- ♦ Rubber
- ♦ Others

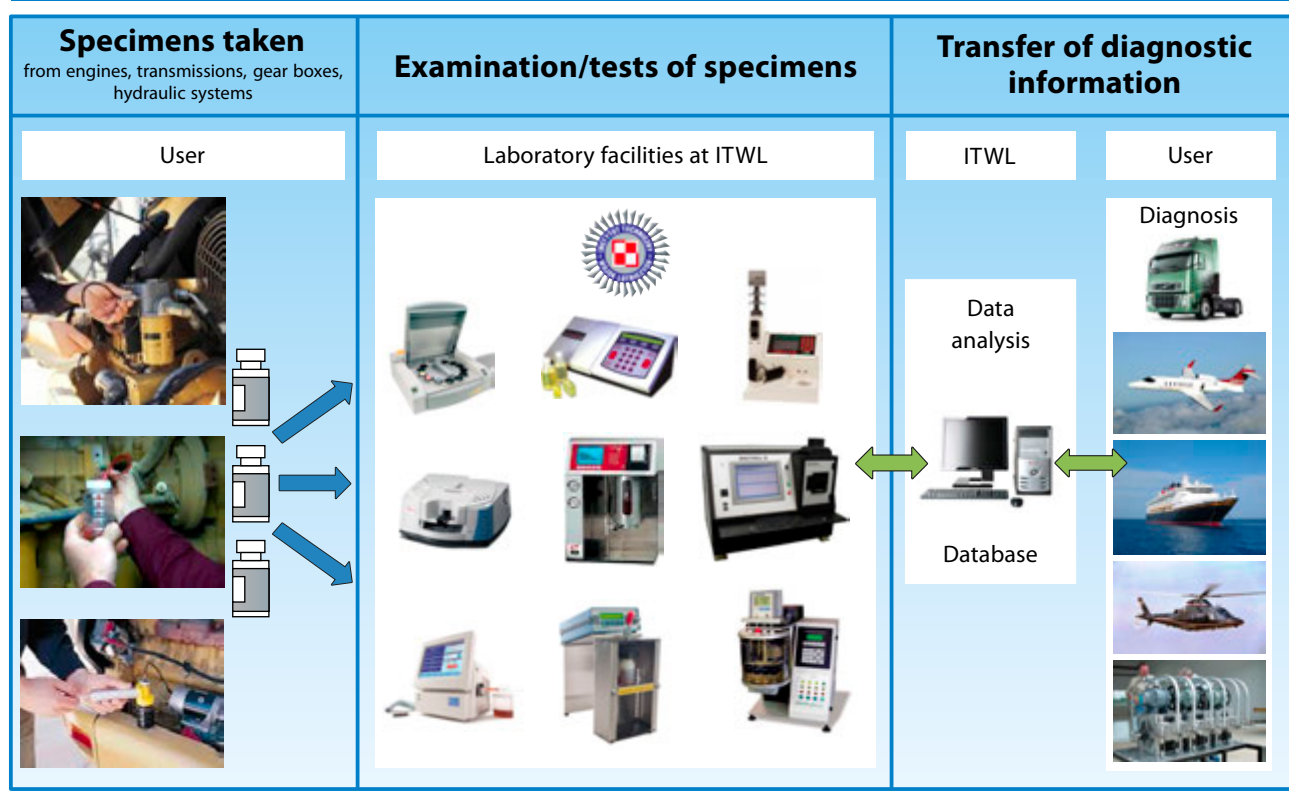
The system offers:

- ♦ Detectability of failures of > 0.5 mm with the 180 kV X-ray tube
- ♦ Testing/evaluation of high-density materials (e.g. aircraft engine turbine blades) with the 300 kV X-ray tube
- ♦ Analyses of electronic circuits (integrated circuits (IC) included)
- ♦ Diagnosing of explosives/pyrotechnic compositions
- ♦ Complex diagnosing of aeronautical (sub-)systems



Weight of objects under examination: 50 kg
Approximate dimensions: 50×50×60 cm

A SYSTEM FOR TRIBOLOGICAL ANALYSIS (DIAGNOSIS)



PURPOSE

Designed for the support of operation and maintenance of engineered systems, the System for Tribological Analysis (STA, Polish abbrev. SDT) enables examination of oil specimens and hence, evaluation of health/maintenance status of oil systems in engineered objects such as transmissions, turbine bearing systems, motor vehicles, aeroplanes, helicopters, vessels, machinery, and other ones.

DESCRIPTION OF THE SYSTEM; THE SYSTEM'S COMPOSITION

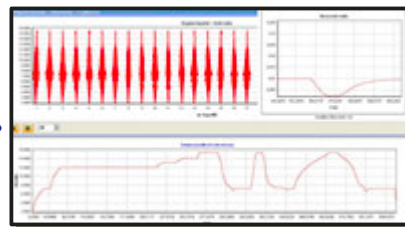
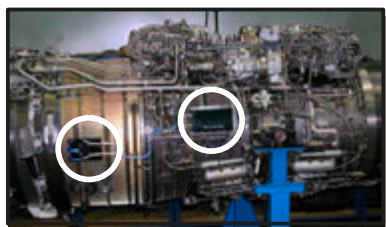
The System for Tribological Analysis may include the following facilities:

- ♦ **Laboratory** equipment, following the PN-EN ISO/IEC 17025 standard:
 - To control and verify tests conducted with the Field Subsystem engaged,
 - To issue expert opinions and find causes of excessive wear of tribological pairs.Laboratory equipment includes:
 - Optical emission spectrometer
 - X-ray spectrometer
 - Immediate read-out ferrograph
 - Analytical ferrograph
 - Automatic particle counter
 - Viscometer
 - Chromometer/Colorimeter
 - Density meter
 - FT IR spectrometer
 - Measuring device to determine the content of fuel in the oil
- ♦ **Computer terminals** – computer network capable of exchanging data with various reliability analysing systems to provide management for data processing and filing, and diagnostic inference.
- ♦ **Field (optionally) terminals** – terminals located directly at Users' premises, furnished according to particular needs (option worth considering while there is a large fleet of vehicles/vessels/machines or systems that require immediate operational/maintenance decisions).

ADVANTAGES

- ♦ EVALUATION OF AND FORECAST ON THE SYSTEM'S HEALTH/MAINTENANCE STATUS IN THE COURSE OF CURRENT OPERATION/ROUTINE MAINTENANCE
- ♦ EARLY DELIVERED WARNINGS ON EXCESSIVE WEAR OF THE SYSTEM'S COMPONENTS
- ♦ DETECTION OF PRE-FAILURE CONDITIONS
- ♦ IDENTIFICATION OF SOURCES OF WEAR-AND-TEAR AND OF IMPURITIES IN THE OIL
- ♦ ON-CONDITION MAINTENANCE
- ♦ SCHEDULING NECESSARY MAINTENANCE PROCEDURES, REPAIRS, OVERHAULS
- ♦ REMOVAL OF METALLIC PARTICLES TO EXTEND THE SYSTEM'S LIFE

ENGINE HEALTH MONITORING



Real-time airfoil deflection monitoring using blade arrival times, measured by magnetic sensors and precise 200MHz-clocked counters.

BENEFITS:

- ♦ Early Detection of Fatigue Cracks.
- ♦ Component usage monitoring & prognosis / life extension (airfoils, blisks, disks).
- ♦ Foreign Object Damage protection.
- ♦ Non-synchronous vibration monitoring (stall, flutter, surge).

BLADE VIBRATION SENSORS

Passive eddy-current sensors for blade tip-timing: High durability probes for long-term operation in adverse environment.



CI-1B – sensor for titanium blades of military turbofan engine (RD-33)

TF-2 – ceramic sensor for military engine fan. Sensor design optimized for titanium airfoils. Build-in amplifier, two analog outputs (XY) to measure twist angle



CCM-2b – sensor for pressure HP turbine blades of military turbofan engine operating in temperatures greater than 1000°C. Passively cooled by bypass air.



CCM-1a, sensor for turbine blades of military turbojet engine operating in temperatures greater than 800°C. Passively cooled by ambient air.



High Power Tip Timing sensor for commercial engine fan blades (titanium). Optimized for high clearance (up to 0.5"), high radius operation. Build-in amplifier, dual output: analog and digital tip-timing.

Embedded Computer

Real-time blade vibration monitoring, data recording and basic analysis
FPGA based architecture, SD flash data storage

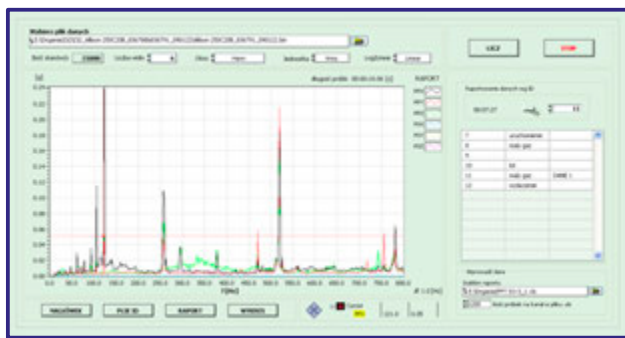


HEALTH MONITORING OF TURBOMACHINERY BASED ON VIBRATION MEASUREMENT

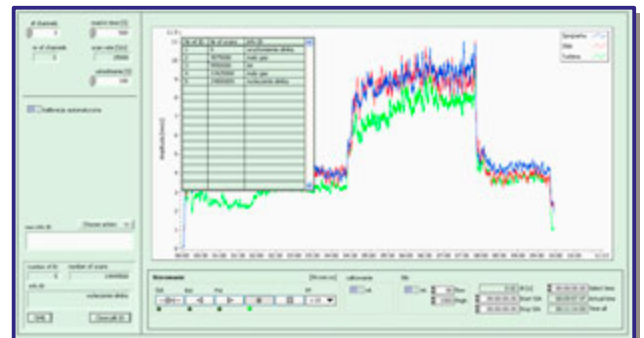
Advanced engine vibration monitoring capabilities. Excellency in analysis rotating components response.

DIAGNOSED MACHINES:

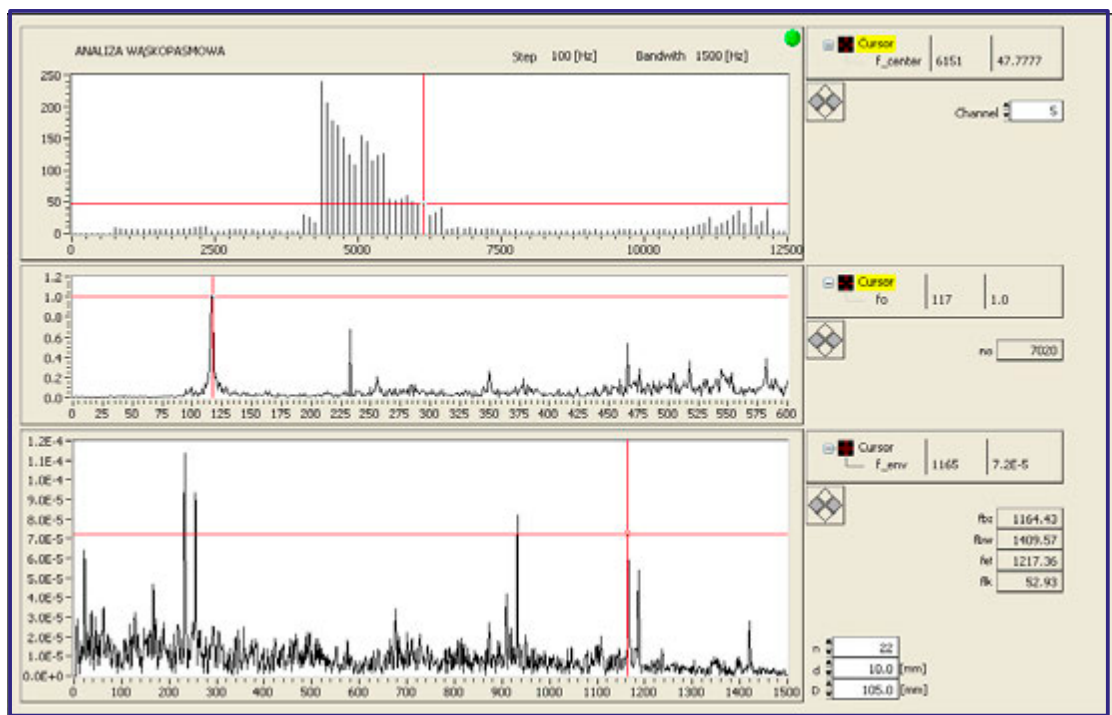
- aircraft engines,
- power generators,
- stationary compressors, turbines,
- bearing systems,
- gear boxes.



Baseband/subset/zoom FFT



Limit testing: acceleration / vibration velocity / power / peakhold in selected band



Frequency Response Function

AIRWORTHINESS DIVISION OFFERS:

IN THE FIELD OF TRACKING AND ASSESSING THE HEALTH/MAINTENANCE STATUS OF AIRCRAFT DESIGNS TO EXTEND SERVICE LIVES THEREOF:

- Analyses of strength and durability of aircraft structures based on flight-tests delivered measurements, and full-scale fatigue strength testing
- Analyses of aircraft lives and predictions on fatigue wear based on aircraft operation-and-maintenance data
- Development of aircraft operation-and-maintenance profiles based on recorded flight data
- Current control and diagnosis of aircraft health based on geometrical measurements
- Detection of failures to aircraft structural components – hidden corrosion and fatigue cracks
- Detection of defects in composite materials – delaminations, disbonds, porosity, foreign-matter inclusions
- Examination of complex-structure components
- Detection of water inclusions in sandwich structures with honeycomb core
- Generation of computer-based models for FEM computations; analyses of these models for linear and non-linear ranges



IN THE FIELD OF AERONAUTICAL COMPOSITE STRUCTURES:

- Design and development of manufacturing processes, repairs of all-metal and composite structures
- Design and development of practices to manufacture aircraft composite structures
- Investigation into physical properties of bonds, composite materials and hybrid (composite/metal) materials (DMA – dynamic mechanical analysis)
- Numerical strength computations for composite structures

TESTING METHODS IN USE:

- Eddy-current, ultrasonic, D-Sight testing, shearography, infrared mapping, penetrant and magnetic testing
- High- and Low-Cycle Fatigue (HCF, LCF), crack resistance and propagation, tensile static testing

TRAININGS IN:

- Design and manufacture of composite materials
- NDT methods

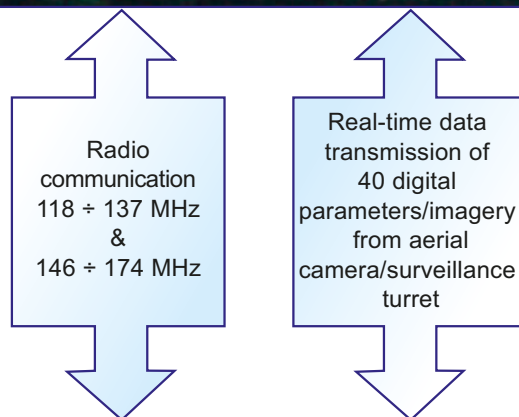


FLYING LABORATORY



THE SYSTEM COMPRISES

- An airplane carrying equipment to measure any parameters of flight-tested devices /systems, incl. system for real-time transmission of data/imagery from aerial-camera/surveillance turret;
- Ground communication station for receiving, decoding, and filing information /examined parameters transmitted from the airplane.



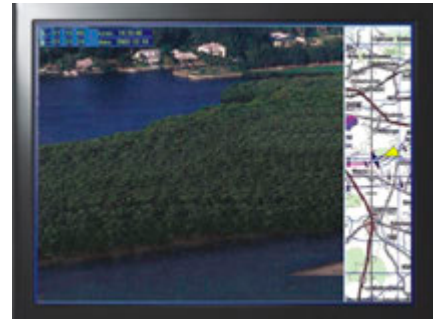
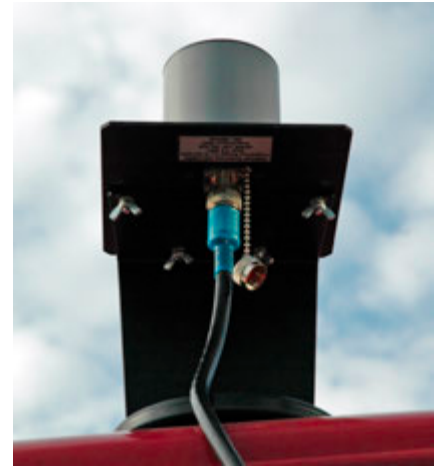
APPLICATIONS

- Tests of prototype airborne devices/ systems, avionics included, under environmental conditions typical of a flight;
- Tests of aeronautical equipment to be put in production;
- Tests of Unmanned Aerial Vehicles (UAVs) autonomous control systems;
- Surveillance & monitoring of disaster (flood, fire, earthquake, etc.) endangered areas;
- Examination/measurements of air pollution up to 5 000 m (16 000 ft), including particulate matter and greenhouse gases (carbon dioxide, /CO₂/, chlorofluorocarbons /CFCs/)



CAPABILITIES

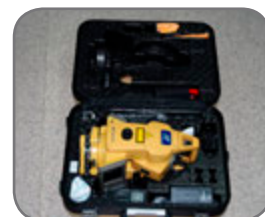
- Radio communication in aerial band 118 ÷ 137 MHz (AM);
- Radio communication in band 146 ÷ 174 MHz (FM);
- Data/imagery transmission via satellite (pre-planned);
- Measuring capability 40 digital parameters;
- Surveillance turret control: directly on board, or remotely from ground station;
- Weight of aircraft carried equipment – up to 200 kg (75 kg on board, up to 120 kg as external stores);
- Ground station crew: 3
- Aircrew members: 1÷2
- Aircraft fix displayed on a digital map in ground station;
- Recording and real-time analysis of parameters/imagery.



PROJEKT CELOWY DOFINANSOWANY ZE ŚRODKÓW MNiSW
(UMOWA NR 148501/C-T00/2007)



MOBILE LABORATORY FOR AIR EVENTS INVESTIGATION AND FLIGHT DATA ANALYSIS



APPLICATION

The Laboratory is intended to support the Air Accident Investigation Board's activities on the site of air events and under stationary conditions. The Laboratory with its instrumentation provide preservation of traces indicating causes of the air event, as well as prompt accomplishment of investigation and testing work, and issuing expert opinions.

EQUIPMENT

- ♦ laboratory vehicle
- ♦ towed trailer
- ♦ special investigation equipment
- ♦ auxiliary equipment
- ♦ communications and computer systems

The Laboratory is the property of the Flight Safety Inspectorate (Ministry of National Defence).



ITWL



LABORATORY FOR ENGINE FUELS AND LUBRICANTS



The ITWL (Air Force Institute of Technology) laboratory for engine fuels and lubricants is an independent accredited laboratory executing orders from domestic and foreign entities. To its customers it offers the execution of professional tests in accordance with legal requirements as well as both Polish and European standards. The technical competence is accredited by the Polish Centre for Accreditation (AB 098) and the Minister of National Defence (11/MON/2014). The laboratory has implemented a quality management system compliant with the PN-EN ISO/IEC 17025 standard as well as an integrated management system, which complies with the PN-EN ISO 9001, PN-EN ISO 140001 and AQAP 2110 standards.

AREAS OF LABORATORY ACTIVITY:

Tests of fuels and pressure fluids used in the civil, aircraft, marine and heating technology for the purposes of:

- quality control of the fuels and lubricants inventories in the Armed Forces,
- fuels and lubricants quality control for civil entities and individual customers,
- conformity assessment of products intended for the national defence (OiB),
- military acceptance,
- certification,
- arbitration,
- operational monitoring of equipment and industrial installations,
- operating fluids state assessment within the framework of the equipment and vehicles maintenance,
- other works in the field of fuels and operating fluids, including opinions, expertise, etc.

Direct contact:
DIVISION OF FUELS AND LUBRICANTS
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tel.: +48 261 851 055; 261 851 084; fax: +48 261 851 125
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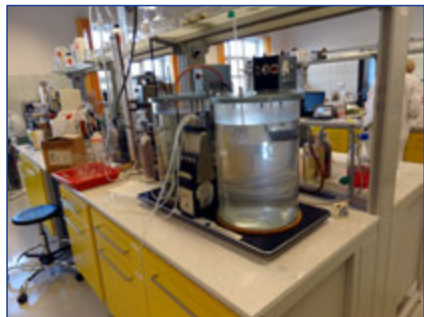
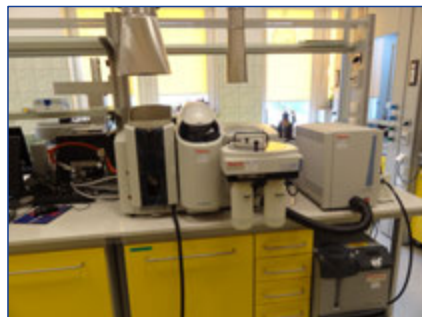
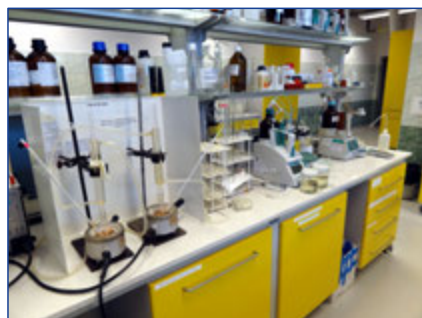
AIR FORCE INSTITUTE OF TECHNOLOGY
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TESTED PRODUCTS:

- aircraft turbine engine fuels
- aviation and automotive petrol
- oils for aviation and marine technology
- diesel oils
- marine fuels
- heating fuels
- petrol and diesel oil bio-components
- biofuels
- automotive engine and gear oils
- industrial oils including: turbine, hydraulic and gear oils
- oils and preservatives
- cutting oils
- plastic lubricants
- fluids for hydraulic brake systems, cooling systems, vehicle windscreen wash systems

THE LABORATORY PROVIDES:

- independence and professionalism
- qualified scientific, engineering and technical personnel
- the use of modern test equipment
- experience in the field of quality control of liquid fuels, lubricating oils, aviation oils, brake fluids, hydraulic fluids and other pressure fluids, bio-components and lubricants
- reliability of the results within the areas related to the quality of fuels, petroleum products as well as bio-components and security
- high quality of the provided services



DIVISION for AIRFIELD SYSTEMS

The primary task of the division is building, maintenance and diagnosing of airfield pavements.



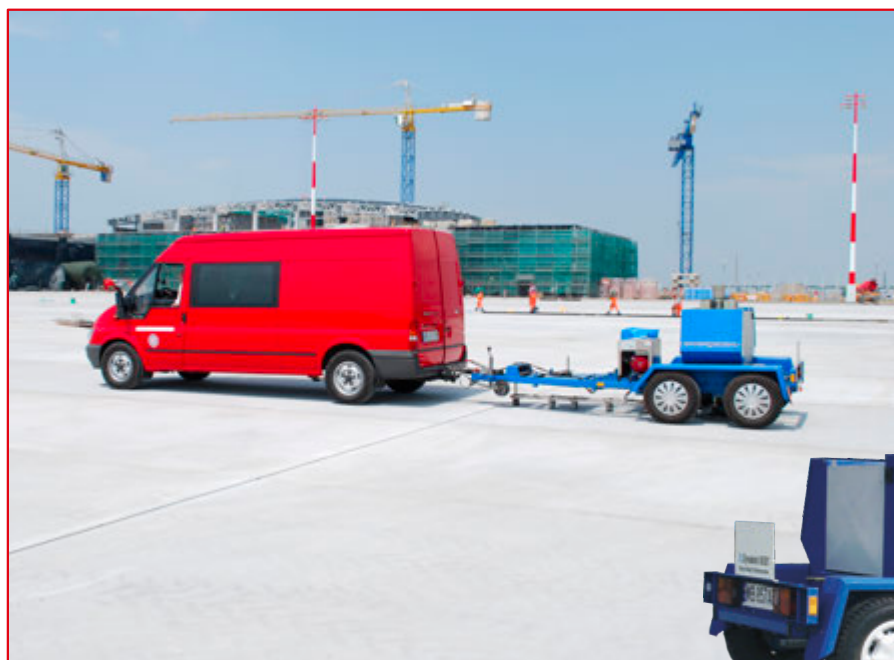
Essential research and design lines:

- ♦ New engineering processes of repairs and maintenance of artificial airfield pavements
- ♦ Adaptation of military airfields to the needs of NATO
- ♦ New engineering processes of rebuilding airfield pavements after wartime destruction
- ♦ Pavement constructions for operational airfields used by fighters and transport aircraft
- ♦ Physical and mechanical testing of airfield/road pavements intended materials
- ♦ Highways as used in Air Force missions
- ♦ Airfield-pavement diagnosing system
- ♦ Development of new methods of airfield pavements testing
- ♦ Investigation into effects of modern aeronautical systems upon airfield pavements
- ♦ Consultations and engineering supervision in the course of repairs and maintenance-dedicated testing work
- ♦ Professional advice and expert opinions



HEAVY WEIGHT DEFLECTOMETER HWD

The HWD has been designed for non-destructive measuring of airfield/road pavements strength. Owing to short duration of measurements and mobility of the device the testing of the airfield pavement strength does not usually produce any air traffic disturbances. The results of the pavement strength measurements are presented in form of PCNs (Pavement Classification Number) according to ICAO (International Civil Aviation Organization) requirements.



SPECIFICATIONS

♦ Max. impact loading applied to the pavement	240 kN
♦ Impact loading duration	25 - 30 ms
♦ Range of distances between test points and loading center	to 2.5 m
♦ Number of test points	9
♦ Weight	1 930 kg
♦ Length	4.45 m
♦ Width	1.75 m
♦ Height	1.40 m



SURFACE ROUGHNESS MEASUREMENT OF AIRFIELD PAVEMENTS



The ASFT - Airport Surface Friction Tester on the T-10 trailer is used for the purpose of measuring the airfield pavement surface roughness. Similar devices are a standard at Polish and foreign aerodromes by weather reporting using NOWTAM and SNOWTAM, and thanks to high mobility, they are a valuable device for measuring friction in times between aircraft take-offs and landings. Roughness test results are given in the form of coefficient of friction in accordance with the following requirements:

- Annex 14 to the Convention on International Civil Aviation, Aerodromes, Volume I, Aerodrome Design and Operation, Fifth Edition, ICAO.
- Advisory Circular No: 150/5320-12C, U.S. Department of Transportation, Federal Aviation Administration.

The ASTF on the T-10 trailer is included in the lists of the above mentioned documents.

TECHNICAL SPECIFICATION OF THE ASTF DEVICE:

- | | |
|------------------------------------|------------|
| • Measurement speed | 65/95 km/h |
| • Thickness of the water layer | 1.0 mm |
| • Tank capacity | 1,000 ltr |
| • Storage of results | digital |
| • Pressure in the measurement tire | 7 bar |
| • Water pressure | 0.20 bar |



EXPERT OPINIONS AND CONSULTANCY

Tests of materials for building of airfield/road pavements



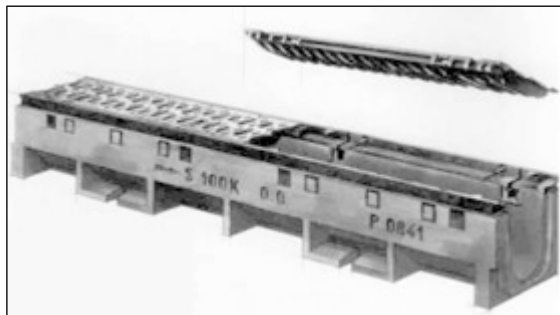
The Airfield Division of AFIT offers:

- ♦ professional advice in the course of building airfield/road pavements,
- ♦ check tests in the course of construction work,
- ♦ acceptance expert reports on the construction work accomplished,
- ♦ expert reports on building materials in use,
- ♦ diagnosing of constructions,
- ♦ consultations to solve current problems in the field of construction work,
- ♦ partial/full-range consultation while building pavements,
- ♦ surveying of damages to airfield/road pavements.

Testing work, expert opinions, consultancy – all activities conducted in compliance with Polish, European Standards in force and ITWL-developed procedures.



TESTS OF MATERIALS FOR BUILDING OF AIRFIELD/ROAD PAVEMENTS



The Airfield Division of Air Force Institute of Technology tests and evaluates of suitability new materials and products for use on airfield pavements.

The Airfield Division offers testing of:

- ♦ drainage channels,
- ♦ clay, concrete and plastics pipes for drains and sewers,
- ♦ products and systems for the protection and repair of concrete structures,
- ♦ joint fillers and sealants,
- ♦ airfield pavement marking materials,
- ♦ geosynthetics for use in airfield pavements,
- ♦ deicing/anti-icing chemicals (e.g. acetate and formate based deicers),
- ♦ building materials (e.g. cements, aggregates),
- ♦ others materials and new products for use on airfield infrastructure.

