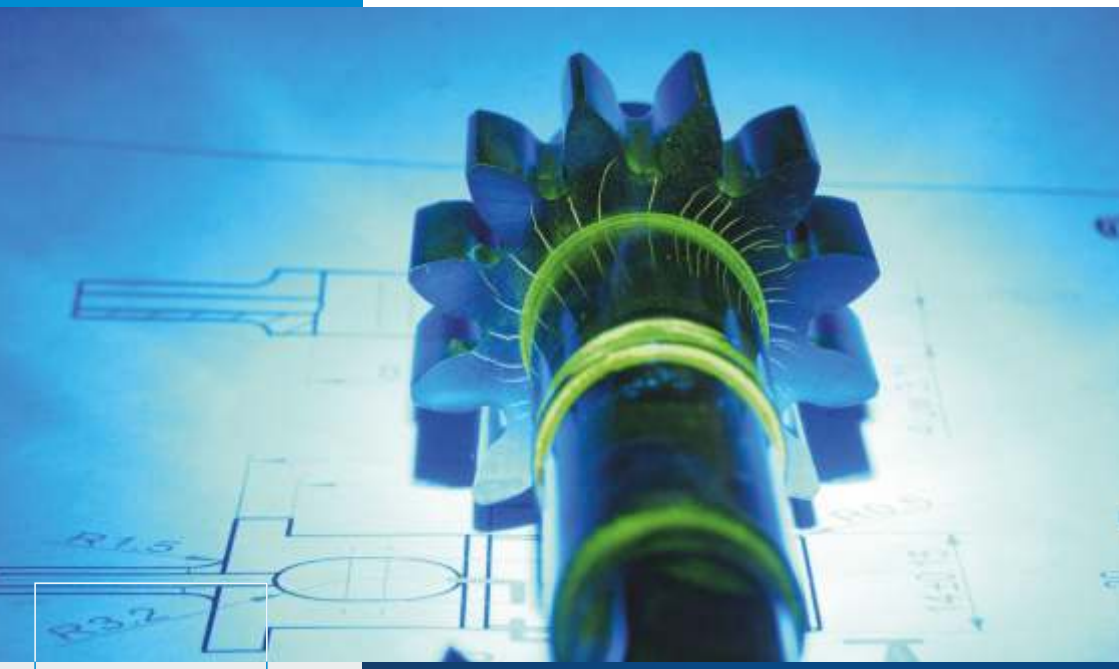


TRUST
IN
THE BEST

WOJSKOWE ZAKŁADY LOTNICZE NO. 2 S. A.

PRODUCTS
AND SERVICES

Manufacture of Harnesses

We manufacture electrical and radio harnesses (power supply, signal, antenna, connection and measurement cables) designed for aviation and automotive industry as well as household appliances, telecommunications and control-measurement equipment. We manufacture electrical and radio harnesses from cables and connectors of all types.

During manufacture, assembly and testing of electrical and radio harnesses, we use solutions applied in the military aviation industry (per NO and MIL standards) and civil aviation using the electrical wiring.

- We use laser marking of harnesses – dedicated for aviation per PN-EN 4650 standard (laser marker MRO-200-A manufactured by Laselec) and other harnesses adapted for laser marking.
- We use computer marking of tags (printers models T208M and TE3124 manufactured by Tyco Electronics and models BP-PR300 Plus and BBP30 manufactured by BRADY).
- For harnesses production we use professional and dedicated tools (a tool for insulation removal manufactured by Schleuniger model UniStrip 2550, soldering stations manufactured by PACE type MBT-350, hand tools manufactured by DNC, KNIPEX, SNAP-ON, STAHLWILLE,
- We engrave flat and round connectors according to markings (mechanical engraving machine manufactured by GRAVOGRAPH model Is400).
- We test manufactured harnesses with the use of professional equipment used in aviation per PN-EN 2283 standard and in other branches of industry (testing system W454 manufactured by WEETECH).
- We also design and manufacture harnesses to customer's order, we are compliant with ISO 9001, ISO 14001, AQAP 2310 i AS/EN 9100 standards.

Manufacture of Rubber Parts

We offer a service of rubber parts manufacture on the hydraulic presses type XLB/DZ-2000 of clamping force 2000kN and maximum dimensions of heating plates 540 mm x 600 mm. Some machines are also equipped with a device generating vacuum, whereas high yield and operation reliability is ensured by the control system PLC Mitsubishi.

The rubber shop equipment enables manufacture of shaped rubber elements and rubber-metal connection.

We have a great experience in manufacture of elements of many rubber compounds such as W-14, W-14-1, IRP-1287, NO-68-1. We also manufacture silicon elements.

Mamufacture and Repair of Composite Elements

We manufacture and repair composite elements with the use of vacuum clamp and heating blankets. During the soaking process, parameters such as temperature, time and vacuum clamp are recorded and they can be saved on a flash disk and printed afterwards.

All production rooms are equipped with hygrometers and digital thermometers enabling continuous monitoring of environmental conditions during the lamination process, including freezers for prepreg storage. In a clean room parameters are controlled with the use of a portable particle counter Lasair III B which meets the requirements of ISO 14644-1: 2015 and ISO 21501-4. It is possible to operate the equipment and download the data remotely. Reports can be generated in a built-in printer.

Main parameters of the process:

- maximum soaking temperature 260°C with the use of heating blankets of different shapes and dimensions;
- heating temperature is recorded with the use of thermocouples type K (10 per channel);
- vacuum clamp is realized with the use of a vacuum pump of capacity 354 [cm3/sec] and 28 inHg (one per channel);
- piece soaking within a range 1÷5 [°C/min], piece cooling 1÷5 [°C/min];
- possibility of operation on two channels simultaneously.

Design and Manufacture of Avionics System Test Equipment

We provide comprehensive solutions for design and manufacture of the avionics system and on-board electronic devices test equipment to customer's order.

An example of test equipment set developed for testing of MiG-29M aircraft new avionics units:

- AVB-29 TESTER - avionics interface tester;
- INSB-29 TESTER - C-050 system interface tester;
- UFCP TESTER - UFCP control panel tester;
- ADC TESTER – air data computer tester;
- MFCD TESTER – multi-function display tester;
- EGI TESTER – EGI platform tester with GPS receiver;
- PS-COM-01 TESTER – R-862 radio station control panel tester;
- BDSA TESTER – audio signal matching block tester;
- MDP TESTER – mission computer tester.

The test equipment enables comprehensive testing and fault location of devices to the level of a specific module.

Voice Massages & Alerts Unit (VMAU)

The VMAU is a digital voice message unit. The device is provided with 52 discreet inputs and the ARINC 429 interface. It enables generation of 64 audio messages activated via the ARINC 429 interface or up to 52 messages activated via the discreet inputs. Moreover, the discreet inputs status is sent through the ARINC 429 interface to the mission computer and other devices.

The VMAU unit may be applied as a replacement for the existing voice messaging systems of Russian make, installed on the MiG-29 aircraft, such as:

- P-591_B with unit P.-591-24;
- P-591_B with unit P.-591-48;
- AŁMAZ-UP;
- RI 65.

Tactical number setting module

VMAU ver. 02A replacing unit P.-591-48 with input-output ARINC 429.

VMAU Tester

The VMAU Tester serves the purpose of complex checking, periodical maintenance services, and VMAU failure finding. Moreover, the tester enables preparation of voice commands and their implementation in the VMAU unit. The device is placed inside the Explorer Express transport suitcase, providing for its high mobility.

VMAU Tester provides for checking the following parameters:

- ARINC 429 input/output;
- voice messages calling discreet inputs;
- configuration inputs;
- audio outputs.

The tester is designed for MROs as well as for aviation units operating aircraft equipped with VMAU, including MiG-29.

The VMAU Tester consists of the following:

- the VMAU Tester device;
- operating manual;
- grit power feeding unit;
- connecting bundles to the VMAU.

2E-ME Unit of the Integrated On-Board Control and Pilot Warning System “EKRAN”

The 2E-ME Unit serves the purpose of presentation of messages fed from the 1E unit on the LED display and recording them in the internal memory.

2E-ME Unit has three indicator lights (FAIL, TURN, MEMORY), two pushbuttons for using the unit menu, and DATA connection enabling reading of data from the internal memory.

Advantages of using the 2E-ME Unit:

- fully compatible with the 2E-01 Unit;
- possibility to record up to 500 messages in the 2E-ME internal memory (twice the number of messages recordable on the 2E-01 Unit LM-35P tape);
- possibility to review the recorded messages on 2E-ME Unit display;
- ergonomic and easy to operate;
- safe data archiving and documenting in the computer or printing out hard copies;
- swift reproducing and analysis of check results in the computer or on hard copy;
- elimination of the necessity to use the costly LM-35P tape;
- absence of necessity to perform periodical maintenance (e.g. cleaning the printing head needles, cleaning the tape pressing roller, adjustment of the feeding roller coupling etc. in the 2E-01 Unit).

The 2E-ME unit comprises of the following:

- unit 2E-ME;
- operating instruction.

The 2E-ME unit additional equipment comprises of the following:

- 2E-MP external memory (1 item per 4 aircraft);
- 2E-MC memory reader with connecting cable;
- software.

Control Panel PS-COM-01

Control Panel PS-COM-01 serves the purpose of controlling radio R-862.

The device enables storing of up to 100 frequency channels together with the names attributed to these, operation with two frequencies (awaiting-edited frequency plus operational frequency), direct frequency selection monitoring of the frequency selected through superior (Master) panel (Slave mode), cooperation between the radio and the mission computer MDP (ARINC 429).

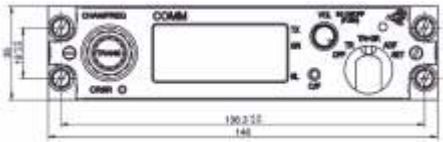
PS-COM-01 may also be utilized for control of other-type radio equipped with the ARINC 429 interface.

Technical Data

- DC power supply: nominal + 27V;
- absorbed power: 10W maximum;
- display: alphanumeric LED, 2-row, 8 characters in each row;
- number of characters displayed simultaneously: 16;
- range of frequencies operated: 100.000 to 149.975MHz with leap 25kHz; 220 to 399.975MHz with leap 25kHz;
- transmission type: 2D3A, ARINC-429, RS-485;
- time for device readiness to operate: not exceeding 2 s;
- weight: not exceeding 1 kg.

Control Panel PS-COM-01

External dimensions of front panel PS-COM-01



Control panel PS-COM-01 complies with the environmental conditions according to NO-06-A103, NO-06-A105, NO-06-A107.

IFF System Control Panel Type PS-CIT-01

Panel PS-CIT-01 serves the purpose of controlling IFF system type AN/APX 125 on the MiG-29M aircraft and type DPX 7 on the MiG-29UBM aircraft. It may be also utilized on another aircraft equipped with the IFF system transponder, interrogator.

The panel enables control and selection of data for IFF system modes: M1, M2, M3, M4, M5 Level 2, MC and MS EHS, and for display of settings for the interrogator operation mode for unit AN/APX125.

Panel PS-CIT-01 utilizes the ARINC429 interface or Rs485 for external communication.

Information is displayed on 3ATI display of the 480x480 resolution.

The panel is adjusted for operation in the NVIS mode.

Control panel PS-CIT-01 complies with the environmental conditions according to NO-06-A103, NO-06-A105, NO-06-A107.

Panel PS-CIT-01 installed on the Polish Air Force MiG-29 aircraft

Pulpit PS-CIT-01

Technical Parameters:

- DC power supply: nominal +27V;
- absorbed power: 27W maximum;
- transmission type: ARINC 429 2xOUT/1xIN Rs485;
- time for device readiness to operate: ≤ 2s;
- weight: ≤1kg.

Tester T-PS-CIT-01

TESTER T-PS-CIT-01 serves the purpose of panel PS-CIT-01 complex testing, periodical maintenance and failure finding. The device was placed inside the Explorer Cases transport suitcase, providing for its high mobility.

TESTER T-PS-CIT-01 provides for testing the following:

- RS485 communication between panel PS-CIT-01 and its peripheries;
- ARINC 429 communication between panel PS-CIT-01 and its peripheries;
- discreet input and output signals of the PS-CIT-01 panel;
- keyboard and the remaining manipulation elements of the PS-CIT-01 panel;
- PS-CIT-01 panel display lighting adjustment systems;
- PS-CIT-01 panel power supply systems.

The tester is dedicated for both MROs and aviation units operating the PS-CIT-01 panel.

The TESTER PS-CIT-01 set comprises of the following:

- the TESTER PS-CIT-01 device;
- operating manual;
- wireless keyboard;
- connecting bundless.

Plasma Spraying

We have Sulzer Metco Multicoat APS system which can be easily adjusted to various thermal spray processes. The production floor is equipped with an ultrasonic bath, grit blasting machine and CMM which are necessary to prepare material before and after the processing. Thermal spray process is performed with high-powdered jet of ionized argon and hydrogen to melt metallic powders.

Types of processing:

- plasma spraying of abradable coatings;
- plasma spraying of anti-wear coatings;
- plasma spraying of thermal barrier coatings (TBC);
- plasma spraying of ceramic coatings.

For the purpose of restoring engine parts during overhaul, metallic and ceramic materials are applied in order to enhance abrasive wear resistance. Our offer is directed not only to the aviation industry but also to metallurgical, energy, engineering, automotive and military sector.

We have a certified laboratory for coating evaluation, which is equipped with modern control equipment dedicated to perform hardness test, adhesion pull-off test and microstructure test.

We have the following certificates:

- two certificates of personnel from the training GE Metcut CCL and Avio Aero;
- laboratory procedures approved by GE Metcut CCL (implementation of specification GE S-459 and Exhibit 5 certificate)*;
- AS 9100 Quality System*;
- NADCAP Certificate (coatings)*.

* during recertification process

Special Process for Part Machining SHOT PEENING

We offer a service of shot peening on RÖSLER machine, type SP 1200R G1, which works in the automatic mode and is programmed and controlled from the computer level. The device is equipped with a shot peening chamber with a rotary table which has a diameter of 1200 mm and ABB robot, IRB 4600-60 kg-2,05 m. Emission of working medium – steel shot CW-28 G3 of a nominal size 0.028 inch and finish G3, is performed by two 10 mm nozzles, a vertical internal lance or rotary nozzle with manual replacement. The process runs according to a procedure programmed individually for each component.

A shot peening chamber enables processing of components with a maximum size:

- ø 1300 mm x 1400 mm or,
- 650 mm x 200 mm x 1400 mm.

Shot peening converts residual tensile stress into residual compressive stress, leading to significant extension of operation life and increase of its load-carrying ability. Shot peening is a specially designed process of increasing fatigue strength of elements which are subject to strong stresses. Procedures of surface treatment such as grinding, milling, bending or heat treatment cause residual tensile stress.

Materials that are subject to shot peening:

- carbon steel;
- stainless steel;
- titanium;
- aluminum alloys.

The process runs according to SAE Aerospace AMS2432 rev. T and Agusta-Westland STA100-84-09 rev. D specifications. The operating staff is a qualified personnel with a level of training confirmed by certificates approved by the Federal Aviation Administration (FAA) – Level 2 for operators and the highest, Level 3 for programmers-process engineers.

WATERJET Cutting

We offer a service of waterjet cutting on the WATERJET NCP-4020 D BEV which is numerically controlled and enables precise cutting of any materials having thickness 0,1 mm – 170 mm.

Main parameters of the WATERJET NCP-4020 D BEV:

- bench: 4000 mm x 2000 mm with division for 3D head 3000 mm x 2000 mm and microhead 1000 mm x 2000 mm;
- positioning accuracy: +/- 0.05 mm / 1 m;
- repeatability: +/- 0.025 mm;
- control: CNC FANUC 32i duplex;
- software: IGEMS 5Xmoduł CAM and IGEMS Professional;
- laser zero indicator: 2D/Beveljet;
- head: Beveljet – 5 axes, movement of axis A=+/- 90°, movement of axis C=+/- 400°, movement of axis Z=170mm, nozzle cutting 0.8 mm;
- microhead: nozzle cutting 0.3-0.4 mm.

Heat and Thermochemical Treatment

We have a professional machinery park enabling heat and thermochemical treatment:

Heat treatment in vacuum or inert gas:

- furnace chamber dimensions 450 x 450 x 600 mm;
- feed weight up to 150 kg;
- maximum temperature 1200°C;
- materials: ferrous alloys;
- equipment meets the requirements of AMS 2750.

Performed processes: quenching, tempering, annealing, solutioning, ageing, vacuum carburizing by Piro-Carb method.

Heat treatment in air atmosphere:

- furnace chamber dimensions 250 x 250 x 600 mm;
- feed weight up to 10 kg;
- maximum temperature 1100°C;
- materials: ferrous alloys, copper-base alloys.

Performed processes: hardening, tempering, annealing, box carburizing.

Heat treatment in air atmosphere:

- furnace chamber dimensions 500 x 1000 x 2000 mm;
- feed weight up to 50 kg;
- maximum temperature 650°C;
- materials: aluminium alloys, ferrous alloys;
- equipment meets the requirements of AMS 2750.

Performed processes: solutioning, ageing, annealing.

Mechanical Services - Turning, Milling, Grinding and Bonding

We have a professional machinery park enabling turning, milling, grinding and bonding.

Turning:

- turning on clamps;
- conventional turning;
- turning on automatic lathe;
- turning on CNC automatic lathe with a bar feeder;
- CNC turning;
- CNC turning with capture.

Milling:

- conventional milling;
- CNC milling;
- plotter milling of light materials;
- coordinate boring and drilling;
- engraving.

Grinding:

- roller grinding;
- hole grinding;
- surface grinding;
- CNC grinding;
- tool sharpening;
- honing;
- lapping.

Bonding:

- welding;
- hard soldering;
- pressure welding.

Electroplating

We offer a service of electroplating with the ability to apply standard and unique galvanic coatings both on steel and aluminium. The quality of the electroplating processes is confirmed by external audits that confer the rights to issue certificates in respect of national, European, civil and military standards.

Main galvanic processes:

- conventional anodizing with colouring;
- hard anodizing;
- aluminium chromatizing;
- technical chromium plating;
- zinc plating;
- tin plating;
- zinc barium oxidizing-phosphatizing;
- zinc phosphatizing;
- indium plating;
- cadmium plating;
- copper plating;
- chemical high-phosphorous nickel plating;
- electrochemical nickel plating;
- steel oxidizing;
- lead plating;
- steel passivation;
- silver plating;
- selective application of electrolytic coatings.

The coatings meet series of standards such as:

- MIL-A-8625F;
- MIL-DTL-5541F;
- MIL-STD-1501E;
- MIL-C-26074;
- MIL-DTL-13924D;
- AMS 2700.

The quality of galvanic coatings is assured by series of tests:

- visual check;
- thickness test by eddy-current method;
- corrosion resistance test in the neutral salt mist;
- microhardness test;
- adhesion test with the use of tape;
- abrasion test for hard anode coating;
- check of sealing degree with the use of coloured drop test.

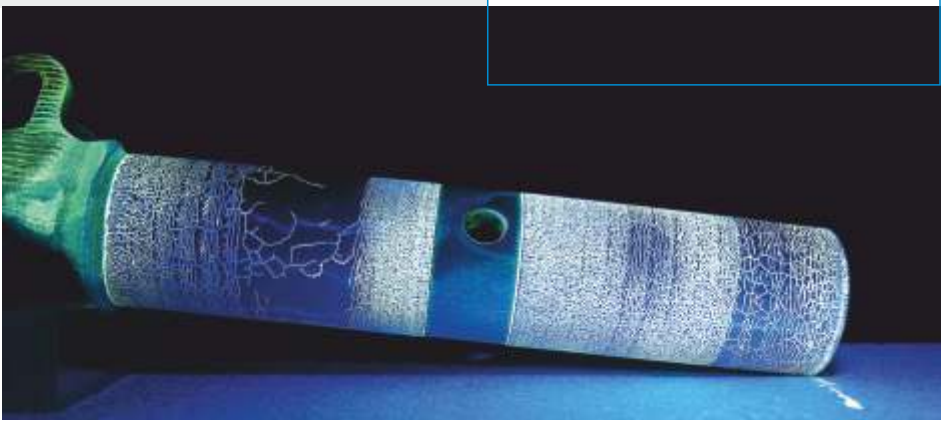
Non-Destructive Testing - NDT

We offer non-destructive testing with the use of five different methods:

- **PT (Penetrant Testing)** – testing with liquid penetrant used for detection of surface discontinuities in structures and components made of ferromagnetic and non-ferromagnetic materials as well as non-ferrous metals;
- **MT (Magnetic Testing)** – testing with magnetic field used for structures and components made of ferromagnetic materials: ferritic steels, cast iron and cast steel;
- **ET (Eddy Current Testing)** – testing with high and low frequency eddy currents with the use of flat and rotary heads used for testing of structures and components made of ferromagnetic and non-ferromagnetic materials as well as non-ferrous metals (the method enables testing of discontinuities without removing the coating);
- **UT (Ultrasonic Testing)** – testing with ultrasonic waves with the use of contact technique (sending-receiving method);
- **RT (Radiology Testing)** – X-ray testing with a film method.

The NDT personnel is certified in accordance with EN 4179/NAS410 (Level 2 and 3 in PT, MT, ET, UT and RT methods).

We have PART-145 certificate for non-destructive testing of civil aircraft.



Painting Services

We offer painting services within the following scope:

- painting of civil and military aircraft;
- painting of ground support equipment;
- painting of large-size vehicles;
- painting of equipment and elements.

We provide wet painting by air spray and airless spray method with the use of the following painting products:

- epoxy;
- polyurethane;
- alkylic;
- acrylic;
- polyvinyl.

We provide services of paint coating removal with the use of the following methods:

- chemical;
- selective removal of paint coating:
  - Plastic Media Blasting (PMB);
- mechanical: tarnishing, grinding.

The process of paint application and drying is monitored with the use of hythergraphs recording conditions of painting and drying round-the-clock in the form of records of temperature and relative humidity.
Apart from painting, we provide change of aircraft graphics by application of self-adhesive foil of any size.

Servicing and Overhaul of Aviation and Industrial Hydraulic and Pneumatic Devices

We provide servicing and overhaul of aviation and industrial hydraulic and pneumatic devices.

hydraulic:

- servomotors;
- amplifiers;
- distributors;
- valves (non-return valves, cut-off valves, control valves, safety valves which are controlled mechanically, electromagnetically, hydraulically and pneumatically);
- impeller and jet fuel pumps;
- gear pumps and hydraulic motors;
- filters;
- hydraulic accumulators;
- dampers.

pneumatic:

- servomotors;
- distributors;
- valves (non-return valves, cut-off valves, control valves, safety valves which are controlled mechanically, electromagnetically, hydraulically and pneumatically);
- pressure regulators.

Possible working media:

- oxygen;
- nitrogen;
- air.

Possible working liquids:

- hydraulic oil compliant with MIL-H-5606 and MIL-H-83282;
- aviation fuel JET A-1;
- cooling agents;
- spirit-water mixtures.

Servicing and Overhaul of Flight Instruments

We perform checks, servicing and overhaul (repairs) of flight instruments installed on MiG-29, Su-22, C-130, F-16 aircraft as well as Mi-8 and SH-2G helicopters. Works on these instruments are performed in accordance with the source documentation and with the use of dedicated equipment.

The scope of flight instruments:

- altimeters (barometric and electrical);
- airspeed indicators (aerodynamic, Mach number, electric);
- rate-of-climb indicator (variometers);
- HSI and AI instruments;
- aviation clocks;
- temperature indicators;
- engine-speed indicators;
- voltmeters, ammeters;
- manometers;
- gyroscope instruments;
- fuel indicators;
- pressure indicators;
- information plates;
- magnetic compasses;
- oxygen devices:
  - controllers;
  - reducers, valves;
  - control panels;
  - transmitters;
  - ventilation devices;
  - oxygen manometers.

We develop and perform modifications/ modernizations of flight instruments to customer's order. We perform works on flight instruments for domestic and foreign customers.

We have a well-developed base of control and measurement equipment. We have a workshop, equipment, tools and personnel trained for work with the oxygen system equipment.

Servicing and Overhaul of Electrical Devices

We perform checks, servicing and overhaul (repairs) of electrical devices installed on MiG-29, Su-22, C-130, F-16 aircraft as well as Mi-8 and SH-2G helicopters. Works on these devices are performed in accordance with the source documentation and with the use of dedicated equipment.

The scope of electrical devices:

- electric motors;
- electromechanisms;
- DC and AC generators;
- electromechanical and static converters;
- generator control blocks (boxes);
- commutation equipment (switches, buttons, relays, contactors, commutation boxes, control panels);
- engine operation control devices;
- electrical grid control devices (voltage regulators, electrical grid safety devices, frequency control block, differential relays);
- transmitters, signalling devices (fuel amount, oil and fuel level, position, temperature, pressure, ionization, direction, g-load);
- microswitches – limit signalling devices;
- transformers, electric filters, lighting devices;
- fuel indicators and flowmeters;
- autopilot and air data computer devices;
- regulators, controllers, automatic switches.

We perform works on electrical devices for domestic and foreign customers.

We develop and perform modifications/ modernizations of electrical devices to customer's order.

Servicing of Aviation Electronic Devices and Navigation Systems

On the basis of long experience and with the use of modern testing equipment, we provide servicing of aviation electronics and radioelectronic systems on the maintenance and overhaul level for MiG-29, Su-22, F-16 and C-130 aircraft.

Servicing and repair of aviation radioelectronic devices:

- IFF transponders and interrogators;
- analog radio stations;
- SDR radio stations;
- TACAN, VOR, ILS, GPS navigation systems;
- radio altimeters;
- radar stations;
- laser stations with MiG-29 thermal direction finder;
- gyroscopic platforms;
- mission computers;
- radar warning receiver (RWR) systems;
- armament control devices;
- digital video recorders – DVR;
- audio recorders;
- multi-function colour displays – MFCD;
- digital/analog navigation indicators;
- electronic interfaces.

RELIABILITY

RESPONSIBILITY

SAFETY

AWARENESS

WOJSKOWE ZAKŁADY LOTNICZE NO. 2 S. A.

Bydgoszcz
107 Szubińska St.
85-915 Bydgoszcz, Poland
phone: + 48 52 36 28 601
fax: + 48 52 36 28 602
e-mail: sekretariat@wzl2.mil.pl

Warszawa
1/3 Księcia Bolesława St.
01-452 Warszawa, Poland
phone: +48 22 532 43 01
fax: +48 22 532 43 04
e-mail: sekretariat@wzl2.mil.pl

www.wzl2.mil.pl