

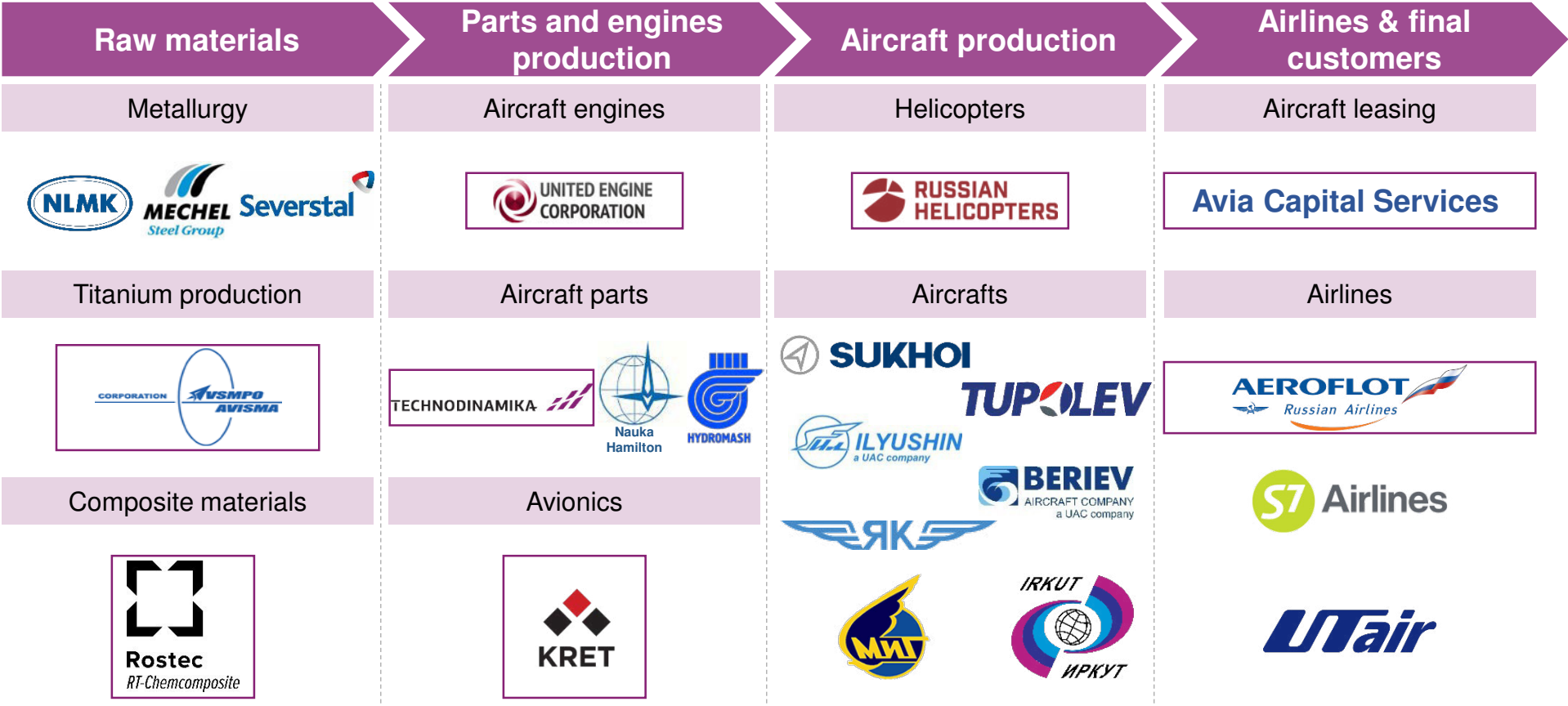
JSC “Technodinamika” presentation

Standard of vanguard

TECHNODINAMIKA 



Today Russia has strong competencies **across the whole value chain** of the aviation industry

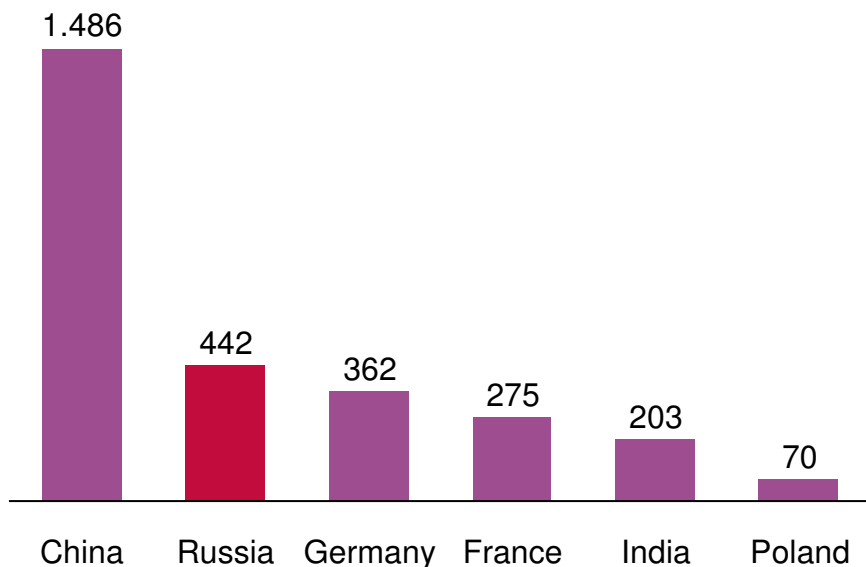


 Subsidiaries of Rostec

Russia is maintaining and developing its **profound R&D** and **manufacturing expertise** in aviation

Russia has one of the largest R&D community in the world...

Number of researchers, thousand people



...and significant capabilities in aircraft development and production

- Over **420 000 employees** in Russia's aviation industry
- **10** specialized universities preparing more than 5k graduates every year
- Significant number of manufacturers with long history of success



Technodinamika is the **Russian leading Tier 1 supplier** of aviation systems and equipment

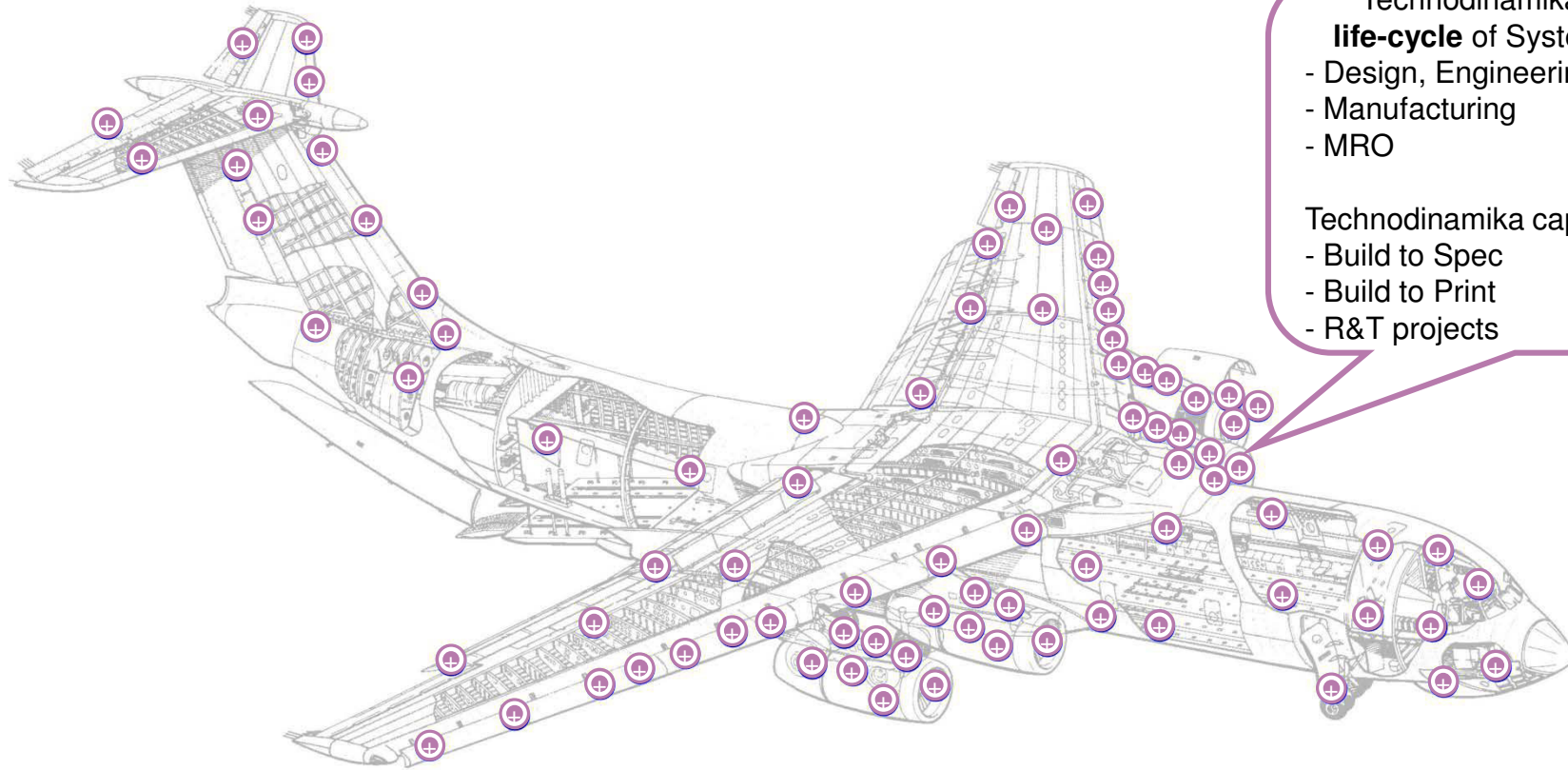


33
Production
facilities

9
Engineering
centers

30 000
employees

Technodinamika S&E represents up to **18%** of aircraft cost



Technodinamika cover the **full life-cycle** of System & equipment:

- Design, Engineering
- Manufacturing
- MRO

Technodinamika capabilities:

- Build to Spec
- Build to Print
- R&T projects

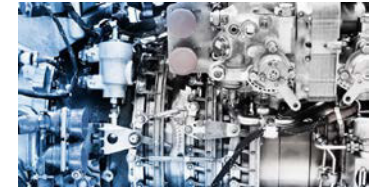
Landing gears	Environmental Control System	Inert gas system	Engine starting system
Electrical system	Aircraft fuel system	Ground service equipment	Parachutes
Hydraulic system	Engine fuel system	Oxygen system	Evacuation system
Flight control	Auxiliary power unit	Emergency equipment	Fire protection system

We invest **about 1 B EUR** by 2020 in the foundation of Competence Centers, centralized Design Center and quality management system

Key initiatives launched

Competence Centers

- Consolidation of competences (casting, forging, and machining) of our entities at Competency Centers to optimize capacity utilization 24/7, reduce costs and enhance quality



Industrial consolidation

- Relocation of small production facilities from Moscow to the regional plants to enjoy economy of scale and reduced costs



International Quality System

- Introduction of international AS/EN 9100 QMS standards and certification to strengthen competitive position and expand into global markets



We have positive experience in several projects with **international partners**

Localization of aircraft landing gear parts

Development of fire protection system

Partner



Project goal

- Localization of aircraft landing gear units for SSJ-100 in cooperation with Safran Landing System
- Implementation of best practices in production in accordance with international requirements to suppliers of aviation products

- Development of fire protection system for SSJ-100 & MC-21 in cooperation with Curtiss Wright
- Development of competencies of integrator in the production of fire production system

Description and status

- Authorization of Safran Landing System is received
- Audit procedures of manufacturing processes has been conducted
- Prototype is produced, quality level is confirmed

- 20% lighter, improved performance and reliability
- Longer service life (30 years) and lower operating costs compared to the others international solutions
- Phase of design engineering and prototype production is completed



Actuation systems

Technodinamika's expertise in Actuation systems

Tu-204



Tu-334



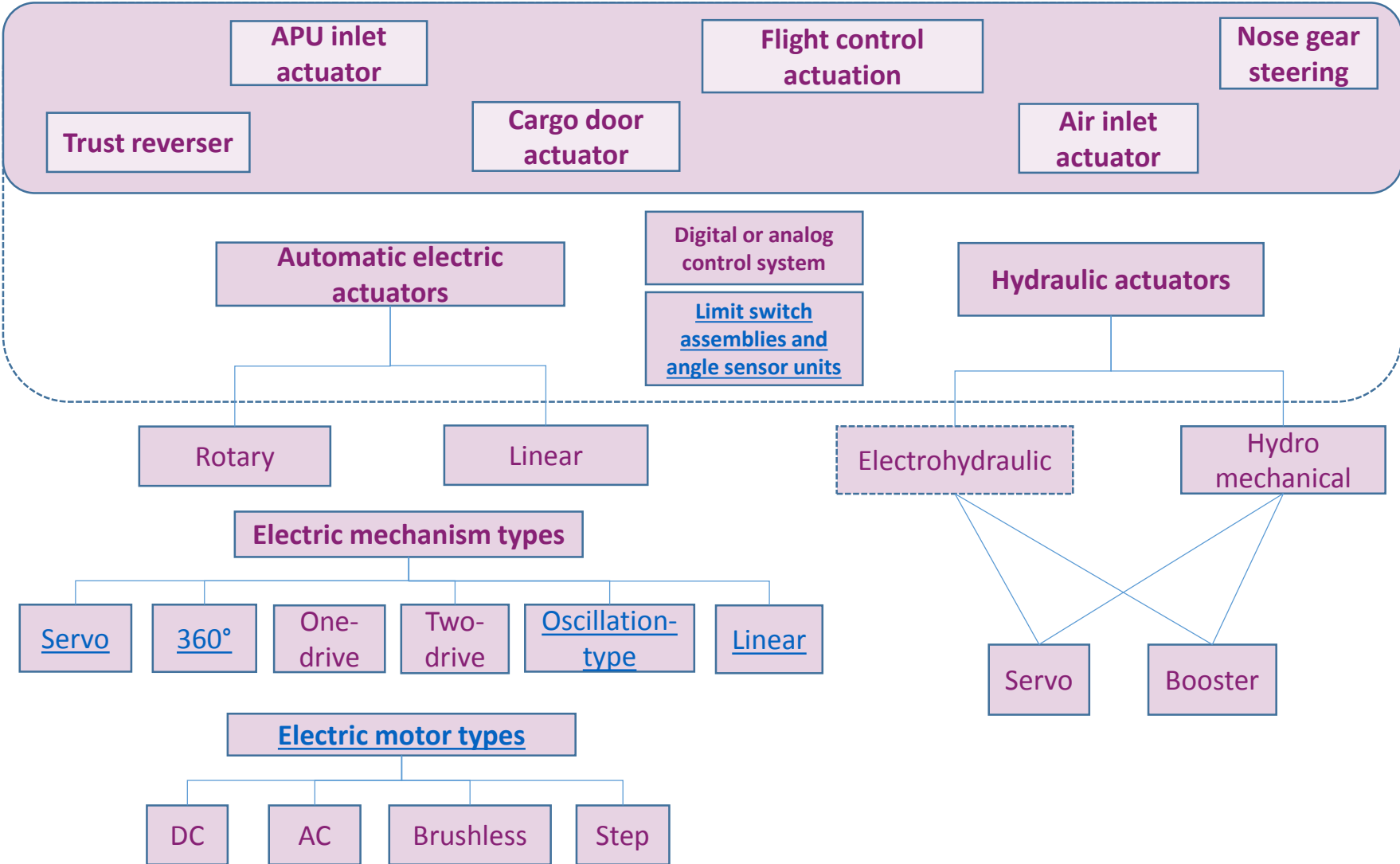
MC-21



IL-96M



Be200



Technodinamika's latest development in Actuation systems

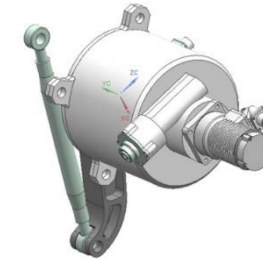


PD14 thrust reverse actuator



Our latest development is the thrust reverser actuation system (TRAS) for the new PD-14 engine intended to power the Russian Irkut MC-21 commercial aircraft.

MC-21 Electric actuator for air starter valve of PD-14 engine



MC-21 cargo door electric actuators



BUS20-02 unit designed to provide power and signal for **controlling nose landing gear turning**. Device dimensions are 390x60x195 mm, the weight is 1.8 kg. The unit does not require forced heating or cooling, its configuration factors may be changed if required.



6Ts.270 control unit for stabilizing fin

The unit controls 4 electromechanical brakes and 6 hydraulic valves in a differential mode and also processes signals from 14 potentiometric pickups. The device is equipped with a built-in checkout console with a graphic LED indicator used for ground servicing of the unit itself and the system in general.



The conceptually new two-channel electrohydraulic rotary actuating unit is the first development of its kind in Russia. It was created in order to increase power capacity of low-power hydraulic rotary actuating units. While retaining power of the new actuating unit, weight is decreased by 17% as compared to conventional wing-flap system actuating units of similar power.

Actuation systems facilities



ELECTROPRIVOD (Kirov)

Foundation in 1955 and part of Technodinamika since 2015. Designed over 200 aeronautic actuation products that are introduced in serial production.

- Scientific and technical complex with unique experimental base and highly-qualified specialists and designers, who use advanced computer technologies.
- Industrial complex, which provides manufacturing of experimental specimens and serial production.

AS/EN 9100 certified

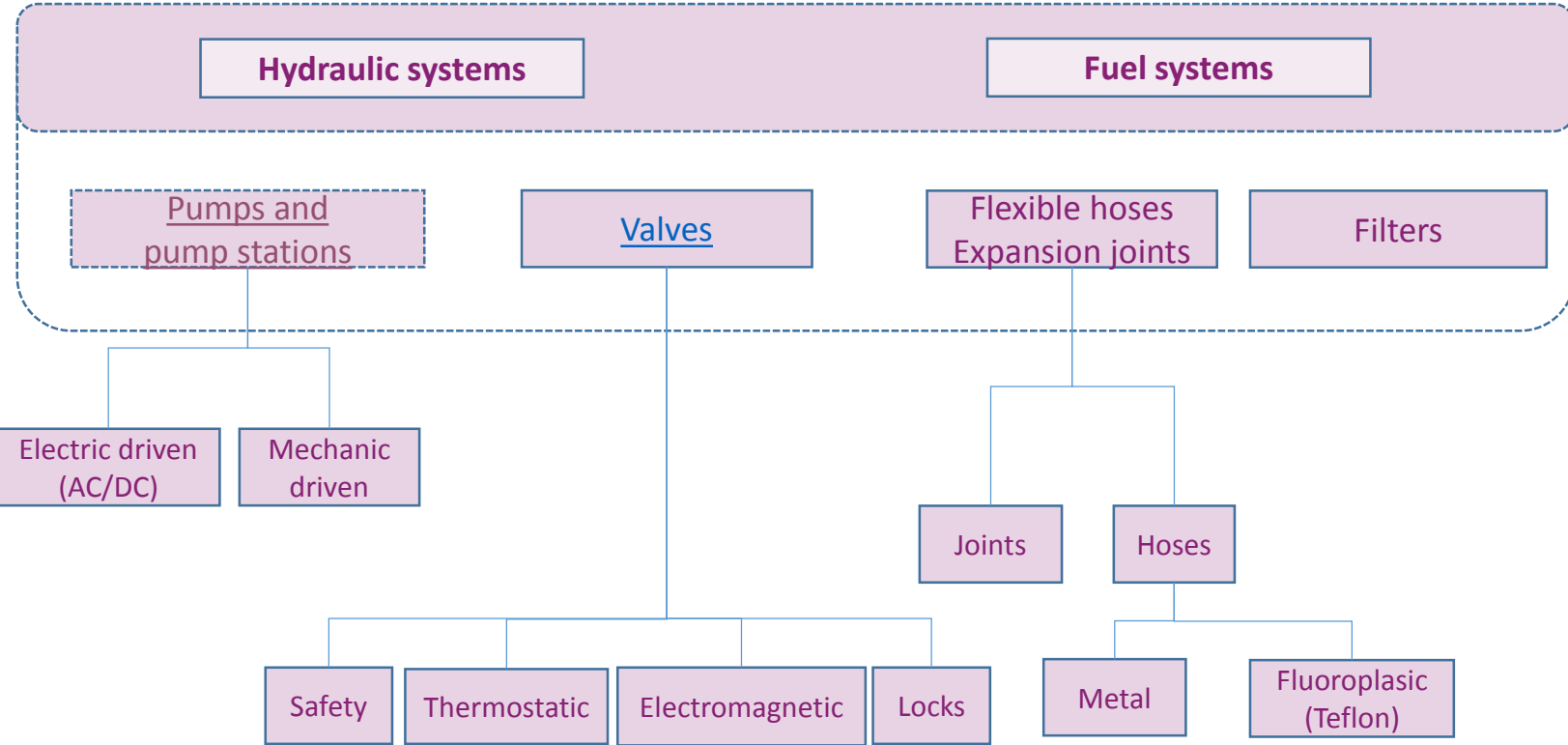


Hydraulic and Fuel systems

Technodinamika's expertise on Hydraulic and Fuel systems

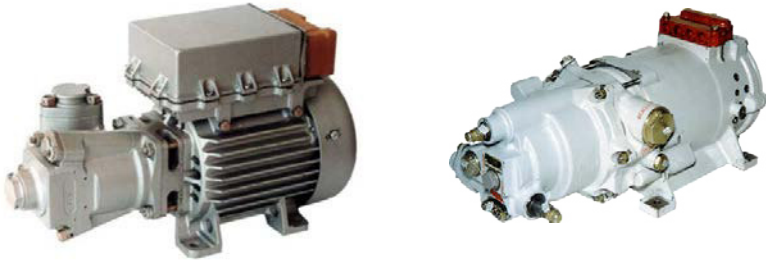


Technodinamika has expertise in designing and producing hydraulic pumps.

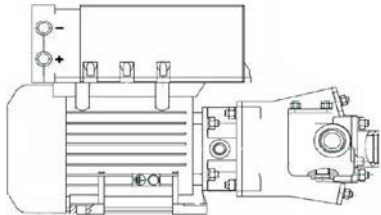


Technodinamika's latest development in Hydraulic & Fuel systems

- During the period 2014-2016, Technodinamika's subsidiary **Gidravlika** has successfully conducted import replacement campaign of a number of **hydraulic stations** and **pumps** used in various aircrafts and helicopters programs such as AN-124, IL-96, Mi-26. The Design has been fully developed within Technodinamika.



- **New pump station for Mi38 Helicopters.**



- axial-plunger pump with feed regulator, feed regulator filter, overflow filter valve
- direct current electric motor or alternating current motor.

Hydraulic and fuel systems facilities



GIDRAVLIKA (Ufa)

AS/EN 9100 certified

Foundation in 1939. Since 1944 holds competences in filter production. Since 1945 holds competences in flexible hoses production. Since 1965 becomes specialized in APU production. Since 2011 is Gidravlika is part of Technodinamika.

Tier 1 supplier of hydraulic, oil, fuel and air systems for aircraft and helicopter platforms. Tier 1 supplier of washable filters equipped with visual or electrical clogging indicators for Russian Helicopters.



MMP Znamya (Moscow)

AS/EN 9100 certified

Foundation in 1942 with a specialization in fuel pumps since then. Since 1950 hold competences in production of hydraulic pumps. Since 1955 production of axial piston pumps and centrifugal pumps.

Since 1975 holds competence in engine control aggregates. Since 2008, the company is implementing a project of technical re-equipment and reconstruction with the aim of creating advanced modern production, corresponding to the equipment, quality and volume of products manufactured by the world's leading manufacturers.



MPO Rumyantsevo (Moscow)

AS/EN 9100 certified

Foundation in 1922 with a specialization in fuel systems. Today, this factory design and produce sophisticated fuel regulating equipment for automatic control systems for turbojet and turboprop engines for military and civil aviation, as well as fuel metering unit (FMU) to regulate the supply of gaseous or liquid fuels to surface gas turbine power drives.



Development of helicopter crashworthy fuel systems

Customers benefits – Crashworthy fuel system

Technodinamika designs and produces crashworthy fuel system to supply helicopter manufacturers.

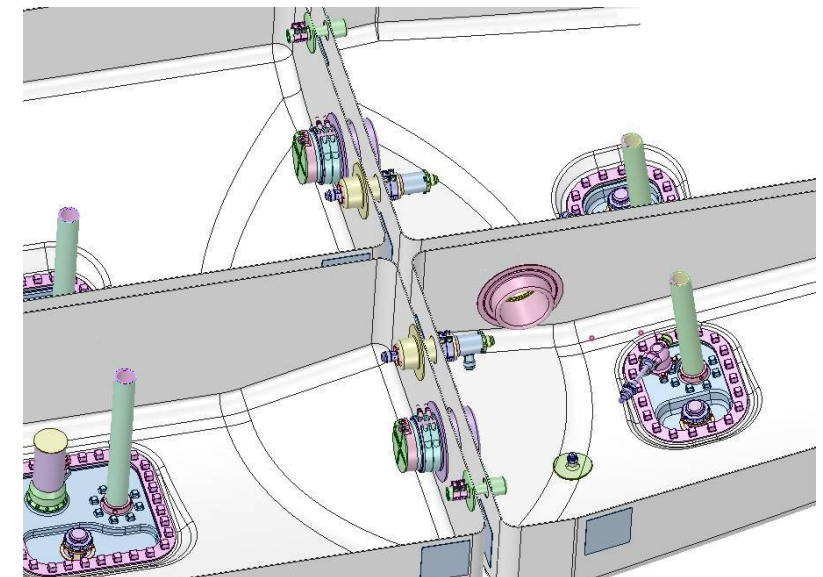
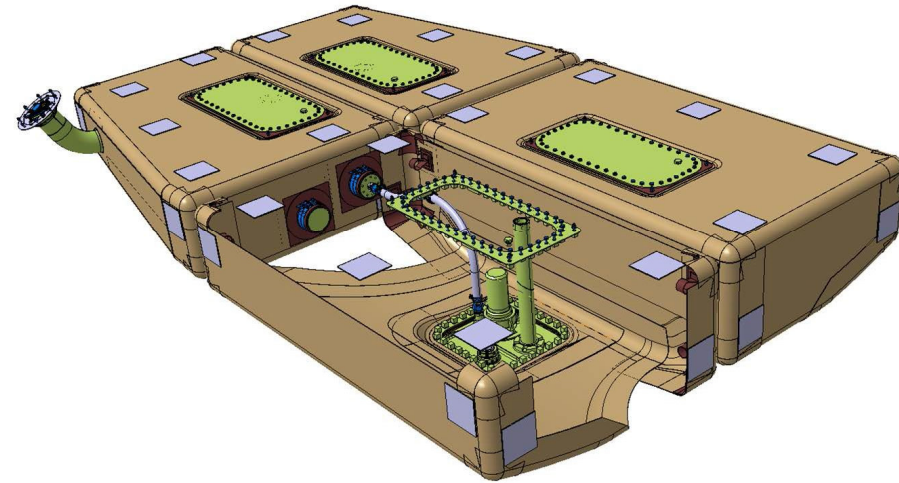
Modern helicopters fuel system must not allow fuel leakage if dropped from a height of $H = 15.24\text{m}$ without initial acceleration on rigid surface.

The new-generation crashworthy fuel system developed by Technodinamika, is a new step forward in the improvement of aviation safety, designed with technical optimization and the implementation of advanced technologies to produce highly reliable and safety fuel system.

Key advantages:

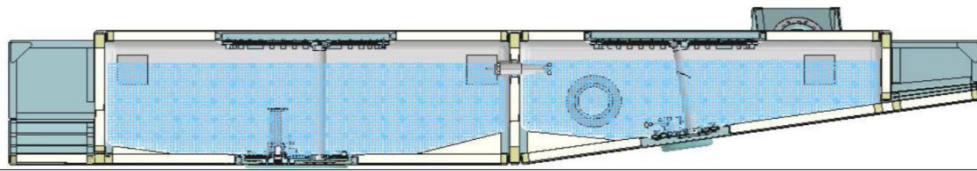
Unique cost to excellency

- Reliability
- Reduced costs
- Reduced operation costs
- Reduced system weight

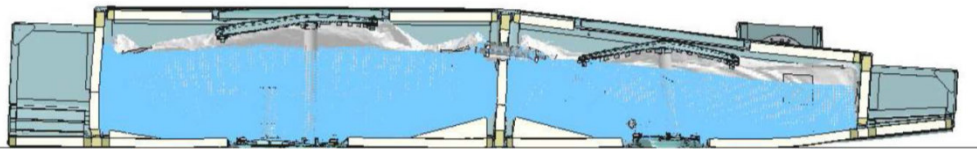


Flexible fuel tanks

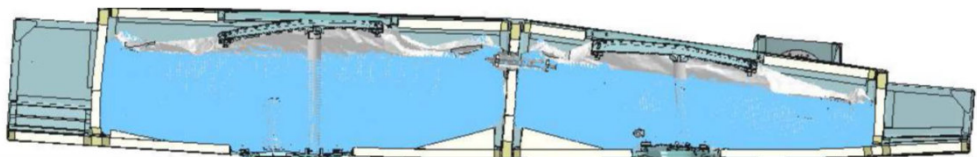
- In order to make fuel system crashworthy there are 2 critical components that has to be designed: flexible fuel tanks and crashworthy units(aggregates). Manufacturing technology of flexible fuel tanks has been selected of rubberized fabric. Five samples of heavy textile fabric was made, tested, and the best one was selected with optimal characteristics.
- Disposable cardboard casing was designed, manufactured, tested and approved as optimal, chip and most convenient.
- Calculation of dynamic deformation of the compartment frame with soft fuel tanks at the drop of a rigid barrier with a height of $H = 15.24$ m 'The results of this study are shown below.



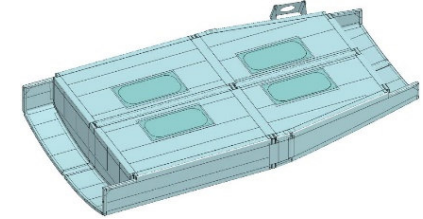
$t=0$ ms



$t=10$ ms



$t=16$ ms



Experimental prototype of the bottom of the helicopter with flexible fuel tanks



Disposable cardboard casing of the fuel tank without a shell.



Disposable cardboard casing of the fuel tank with a shell.

Crashworthy units(aggregates)

In order to design crashworthy units(aggregates) 2 approaches has been chosen - the classical scheme of RnD and additive manufacturing.

Additive Manufacturing is the technology that build 3D objects by adding layer-upon-layer of material plastic, metal or something else. After manufacture of aggregates, it can be tested, properly of design solutions can be evaluated.

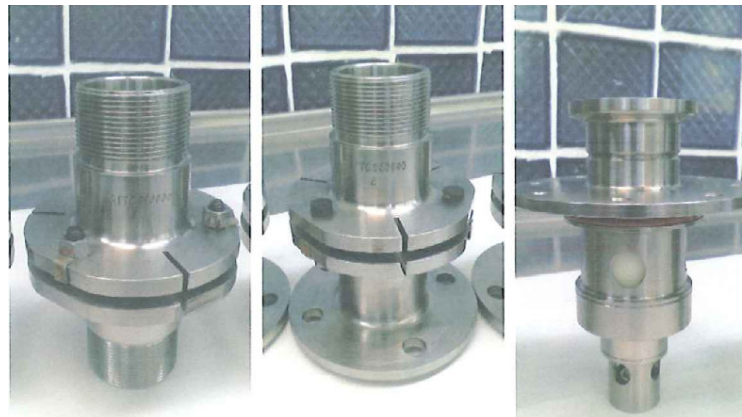
A program of tests for compliance with the requirements of crash resistance AP-29, p.952 was made. Testing prototypes of crashworthy units(aggregates) held successfully.



Crashworthy aggregates made with the help of additive technology(3d print)



Crashworthy units(aggregates)



valve after durability test under the action of axial load



Electric power systems

Technodinamika's expertise on Electric power systems

Tu-204



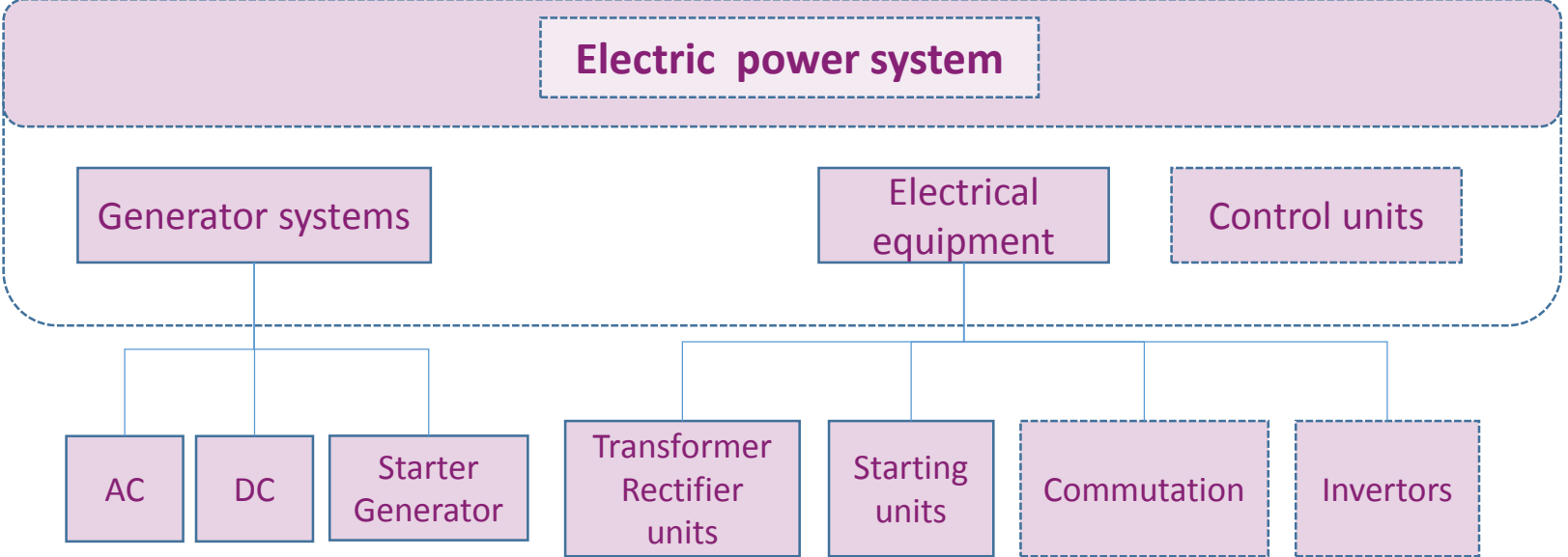
IL-96



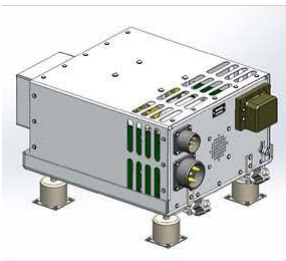
Ka 62



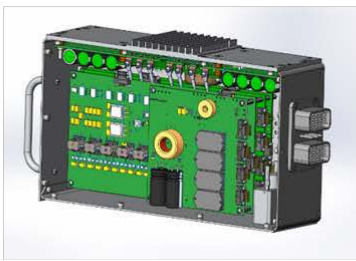
Ansats



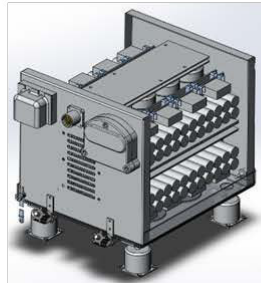
Transformer Rectifier Units



Starter-generator control and protection unit



Generator Electrical Starting unit



Commutation



Invertor



Tier 1 supplier for helicopter programs

Technodinamika is Tier1 supplier for several electric power systems for Russian & Export markets

KA-62



- ✓ DC Starter generator
- ✓ DC Brushless Generator STG9V
- ✓ Generator control & protection unit

MI-171 A2



- ✓ TRU
- ✓ Static inverter

KA-226



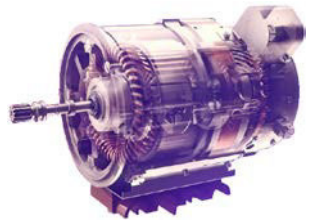
- ✓ DC Starter generator
- ✓ Generator control & protection unit
- ✓ Static inverter

ANSAT



- ✓ DC Starter generator
- ✓ Generator control & protection unit

Technodinamika's latest projects on Electric power systems



STG-9V

Technodinamika developed a new generation brushless DC starter-generator able to supply 27V DC 2000 horsepower aircraft.

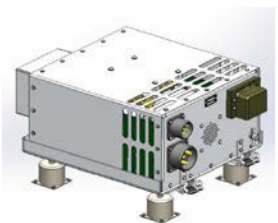


GSR-40 series are 3-stage synchronous 40 kVA AC-generators using air-cooled technology able to operate in variable frequency mode.

The GSR-40 series is designed to provide the main electrical power source of the new-generation aircraft and helicopter platforms.



TRU-9 series are AC to DC convertors designed to provide a 27V output voltage when supplied by a 115/200 input voltage. Our modern design and electronic base increases the reliability and life-time of our system to reduce customers maintenance costs.



Inverter POS-1000M

Design unified for the requirements of modern civil platforms (SSJ100, MS21).

Electric power systems facilities



JSC UAPO (Ufa)

AS/EN 9100 certified

- Manufacturing of electrical machines, electronic and automatic control devices for power supply systems for aircraft and ground systems.
- Ceramic and castings center.



Electroprivod (Kirov)

AS/EN 9100 certified

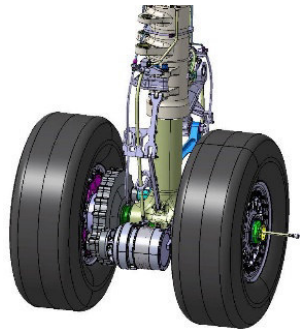
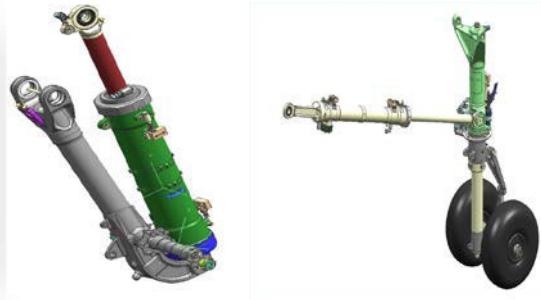
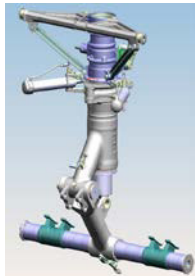
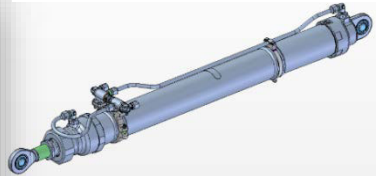
Foundation in 1955. Since 1989 acts as independent enterprise. Since 2015 a subsidiary under control of Technodinamika. Designed over 200 products that are introduced in serial production.

- Scientific and technical complex with unique experimental base and highly-qualified specialists and designers, who use advanced computer technologies.
- Industrial complex, which provides manufacturing of experimental specimens and serial production.



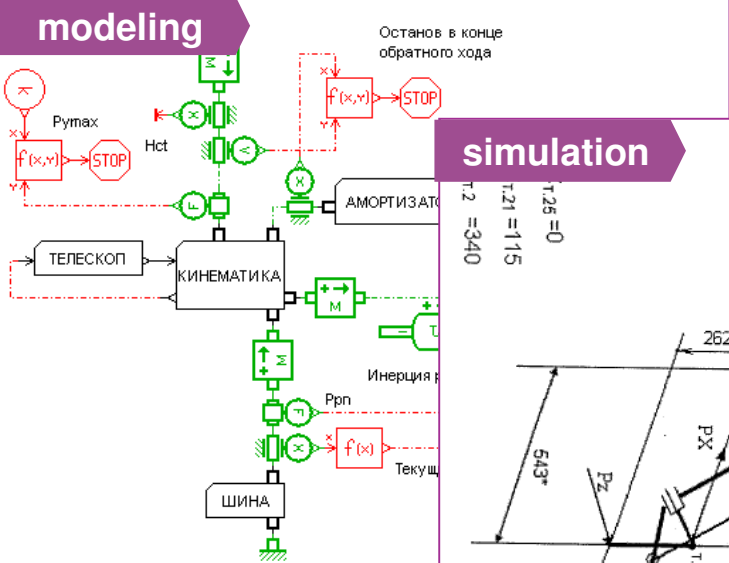
Landing Gear systems

Technodinamika's expertise in Landing Gear systems



Aviaagregat design & engineering capabilities

modeling



Останов в конце обратного хода

$f(x,y)$ STOP

Р_{уmax}

Нсг

АМОРТИЗАТОР

ТЕЛЕСКОП

КИНЕМАТИКА

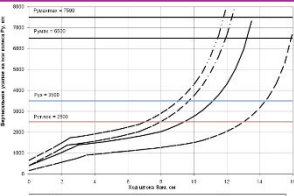
Инерция

Р_{рп}

Текущ

ШИНА

simulation



τ₂₆ = 0

τ₂₁ = 115

τ₂ = 340

268°

262°

543°

P_x

P_z

τ₂

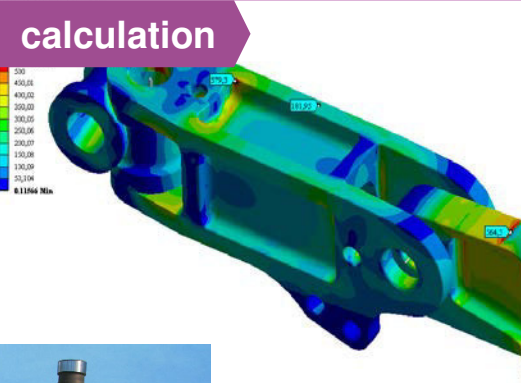
L_x

0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000

0 2 4 6 8 10 12 14 16

Рисунки: Max = 1000
Fmax = 1000
Fmax = 1000
Fmax = 1000

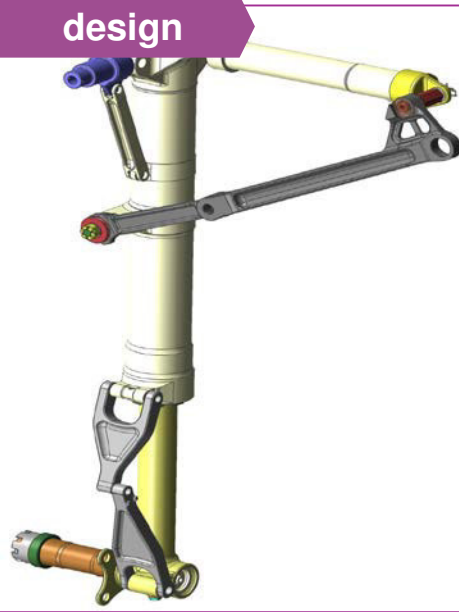
calculation




0 500 1000 1500 2000 2500 3000 3500 4000 4500 5000

0.11566 MPa


design



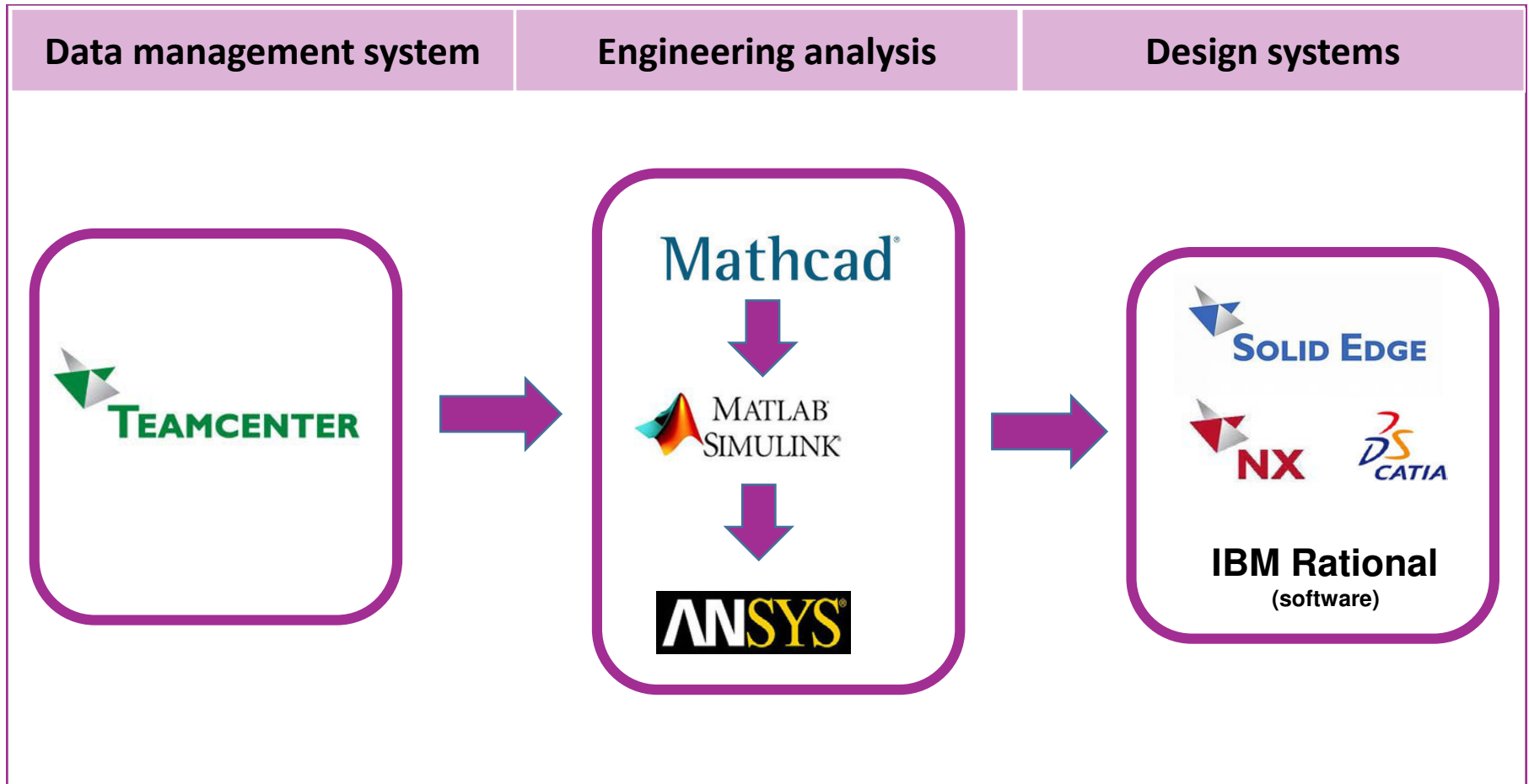
testing



development



Aviaagregat Software package



Aviaagregat – Machining workshop

List of machining equipment:

5AX MACHINING CENTER, SUCH AS - HERMLE C40, C20

TABLE DIAMETER: from 280 to 700 mm,
DRIVE POWER: 15 kW

**UNIVERSAL MACHINING CENTER, SUCH AS – SHW
UNISPEED6**

TABLE DIAMETER: 1600mm
DRIVE POWER: up to 36 kW

**CNC TURNING LATHE, SUCH AS – MONFORTS RNC700,
ROMI E320, GILDEMESTER CTX420, SCHUTLE 305**

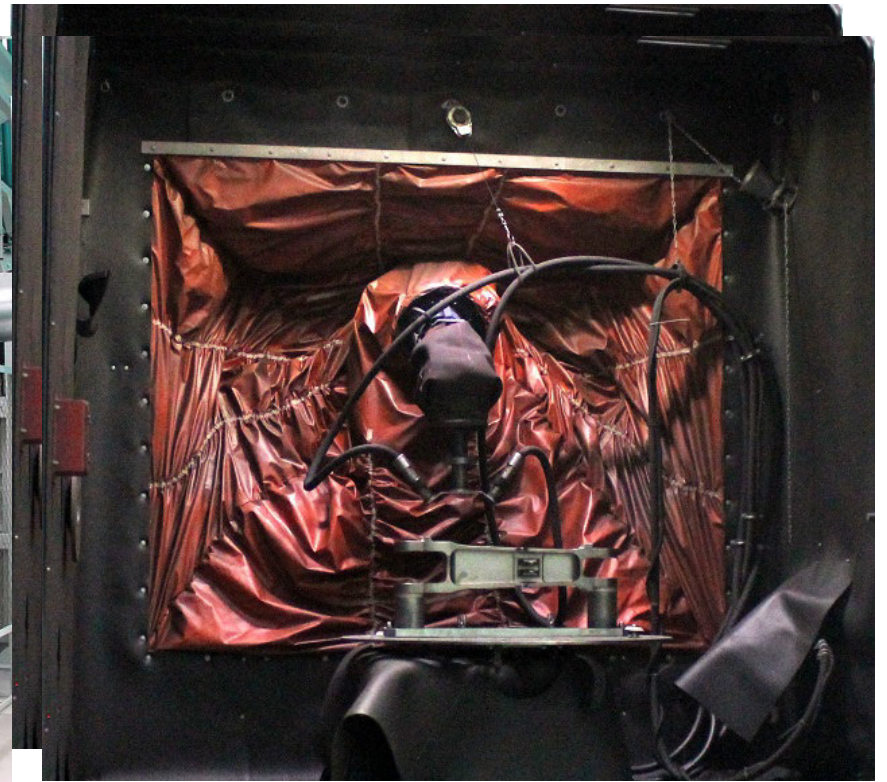
MAXIMUM CUTTING DIAMETER: 305 to 700 mm



Aviaagregat – Fluorescent penetrant inspection shop area



Aviaagregat – Shot Peening shop area



Aviaagregat – New Etching workshop



Aviaagregat – Manufacturing & Quality

- ✓ Material traceability from workpiece to final parts during manufacturing
- ✓ Enterprise Resource Planning (ERP) is in progress
- ✓ Failure mode and effects analysis (FMEA)
- ✓ Key performance characteristics determination and control (per EN/AS9100)
- ✓ Product control plan – determination of all product and process inspection points required to deliver a defect-free outcome

Aviaagregat Certification - AS/EN 9100

- ✓ EN 9100 certification issued by Bureau Veritas
- ✓ Development of Project management office and implementation of project management system.
- ✓ Development and implementation of EN9102 First Article Inspection (FAI)
- ✓ New instruments for process improvement:
 - ✓ Implementation of 5 Why technique, Pareto chart analysis and Ishikawa diagrams.
 - ✓ Implementation of 8D culture.
 - ✓ Statistical analysis, Process-behavior Shewhart charts.



BUREAU VERITAS
Certification

Certificate of Approval

This is to certify that the Quality Management System of:

JSC "AVIAAGREGAT"
65, ZAVODSKOE SHOSSE, SAMARA, 443009 RUSSIA

has been audited in accordance with the requirements of
EN 9104-001:2013 by Bureau Veritas Certification and conforms to the following
Quality Management Systems Standards detailed below

Standards

BS EN ISO 9001:2008
EN 9100:2009
(Technically equivalent to AS9100C)

Scope of certification

**MANUFACTURING AND TECHNICAL SUPPORT OF COMPONENT PARTS FOR
AEROSPACE INDUSTRY.**

Certification Structure: **Single Site**

This certificate forms part of the approval identified by certificate number: **RU1282-1**

Original ISO Approval: 26 DECEMBER 2012
Original ASCS Approval: 26 DECEMBER 2012
Certificate Issue Date: 25 DECEMBER 2015
Certification Expiry Date: 14 SEPTEMBER 2018


Andrew Kirkby
Authorised Signatory

  aerospace sector certification scheme

 **UKAS**
MANAGEMENT SYSTEMS
008

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organization.

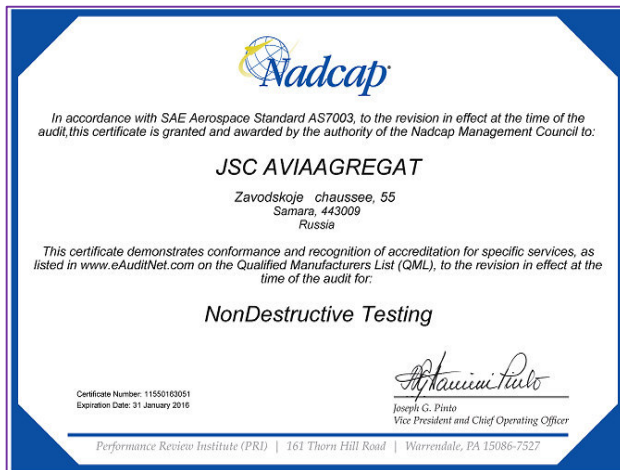
Certification Body: Bureau Veritas Certification Holding SAS-UK Branch
5th Floor, 66 Prescot Street, London, E1 8HG, United Kingdom.



Page 1 of 1

Aviaagregat Certification - NADCAP

1. Obtained NADCAP accreditation for **Fluorescent Penetrant Inspection**.
2. Obtained NADCAP accreditation for **Automatic Shot Peening**
3. Under-accreditation for NADCAP certification for **Etching**



All relationships, audits and communications with certification representatives are performed by English-speaking personnel. No outsource agencies are involved.



Development of electric actuator for landing gear wheels

The electric actuator of main landing gear legs provides:

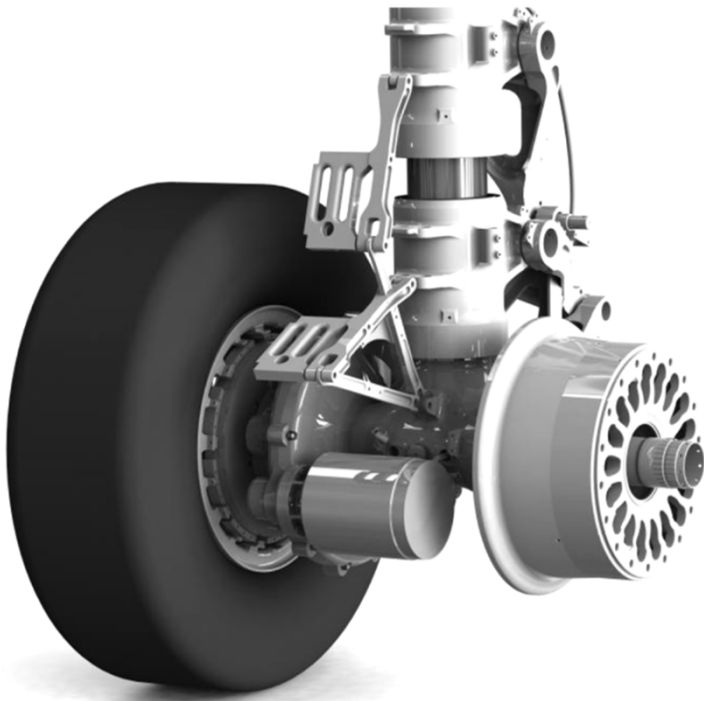
- 1 The taxiing of an airplane without the usage of main engines and pushback tug
- 2 The movement of an airplane while backtracking
- 3 On-the-spot turn while taxiing



The current experimental sample was exposed at the exhibitions MAKS-2015 and the ARMIA-2016

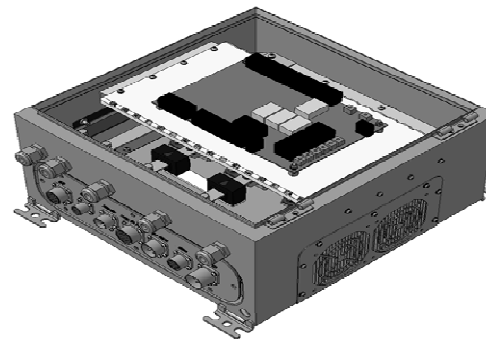
Composition and characteristics

Traction wheel module



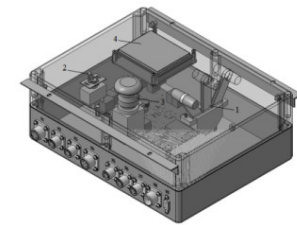
It is installed on main landing gears,
rotates external wheels
2 items on 1 aircraft
Nominal power 2x50 кВт
Rotation frequency up to 240/min (40
km/h)
Torque, moment is 2x4,5 кНм
Mass 2x150 кг

power converter



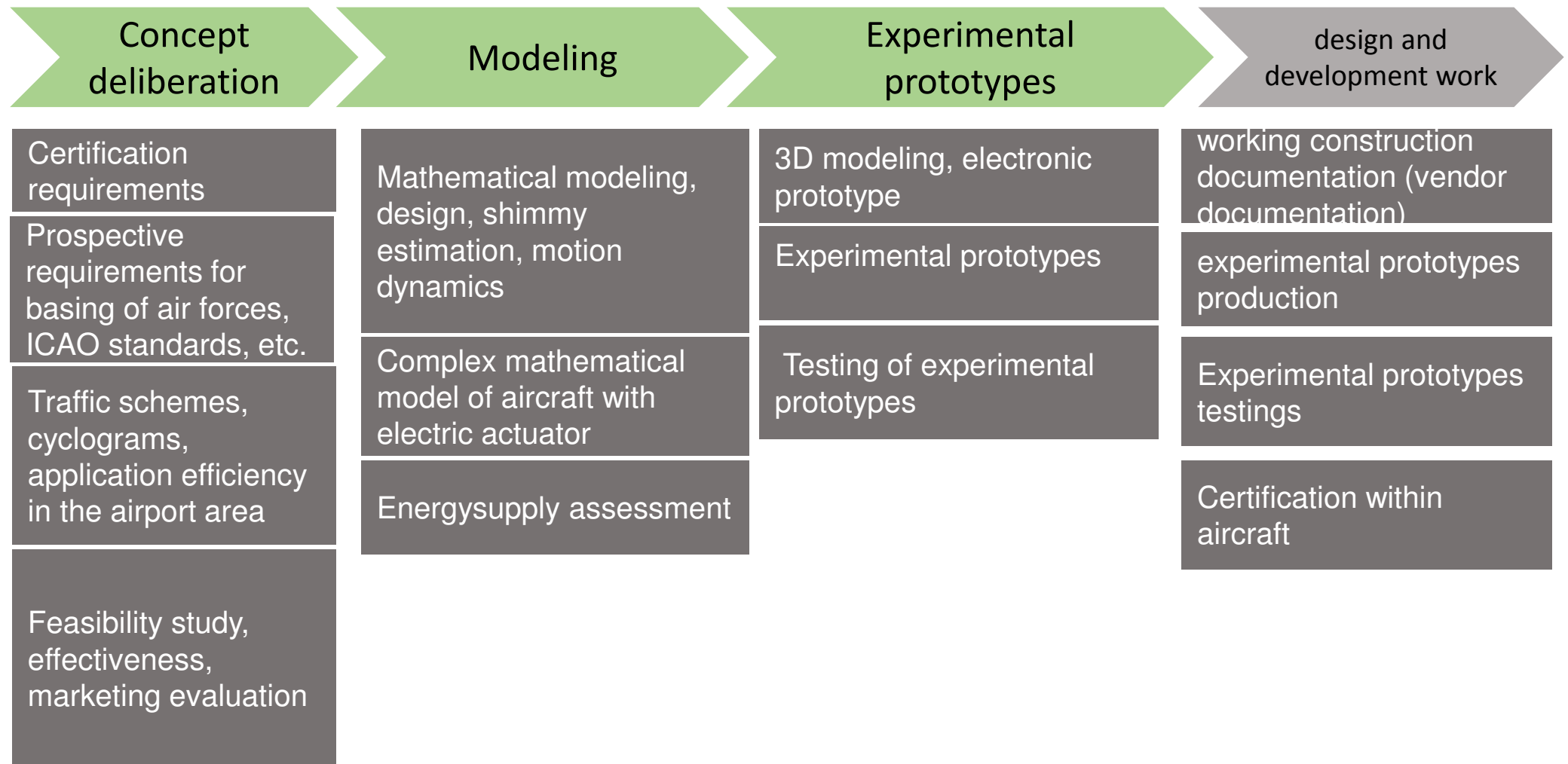
**Provides power and control
of main electromotor**
2 items on 1 aircraft
Power Supply 200/115 В 400
Гц
Mass 2x25 кг

control box in a crew
cabin



**Control of speed and
mode: moving forward,
backward, turning on the
spot**
Power Supply 27 В
Digital interface with
ARINC429 airplane
systems

Joint research works on Electric actuator were carried out in 2013-2016





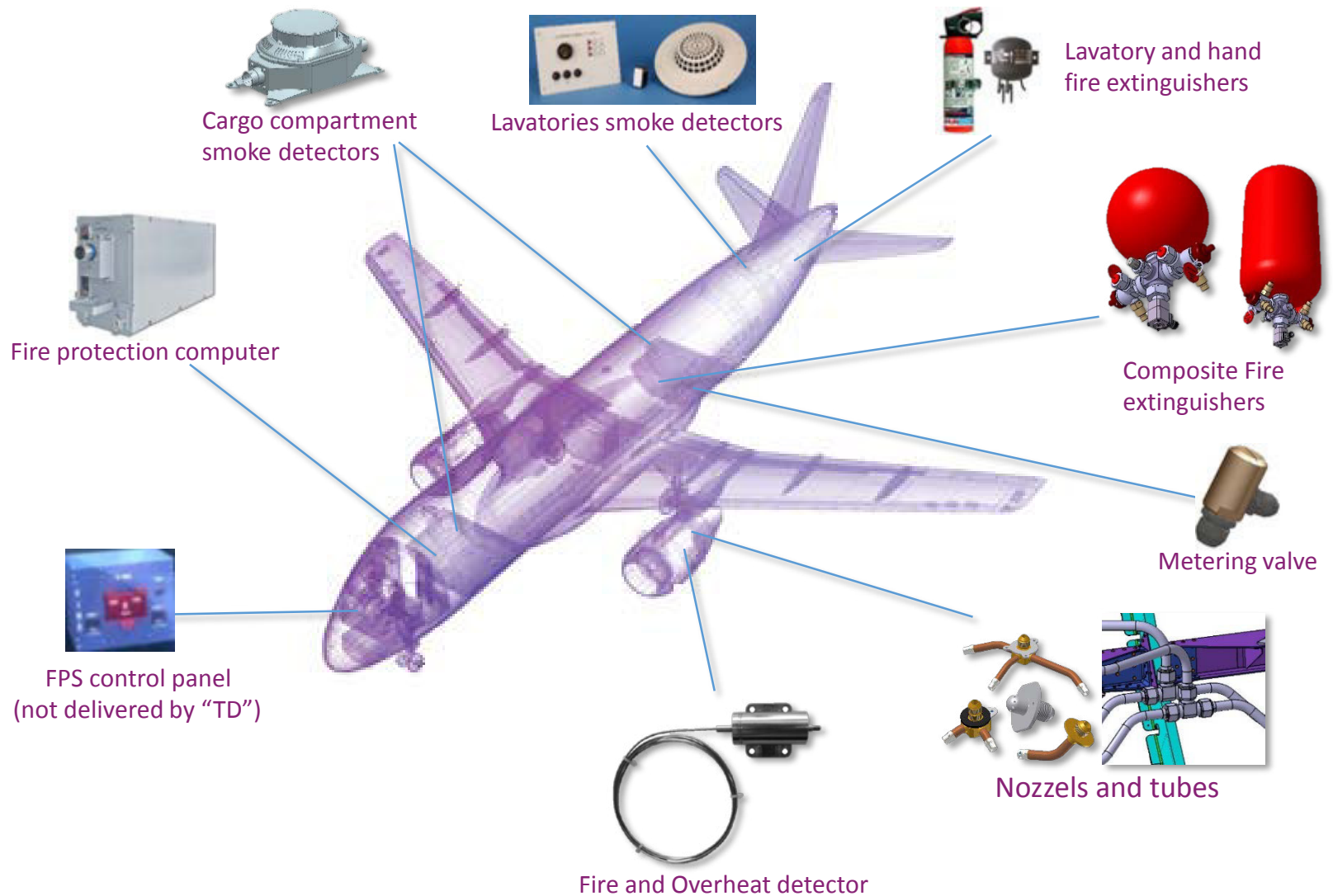
Fire Protection/Detection Systems

Technodinamika's expertise on Fire Protection / Detection Systems

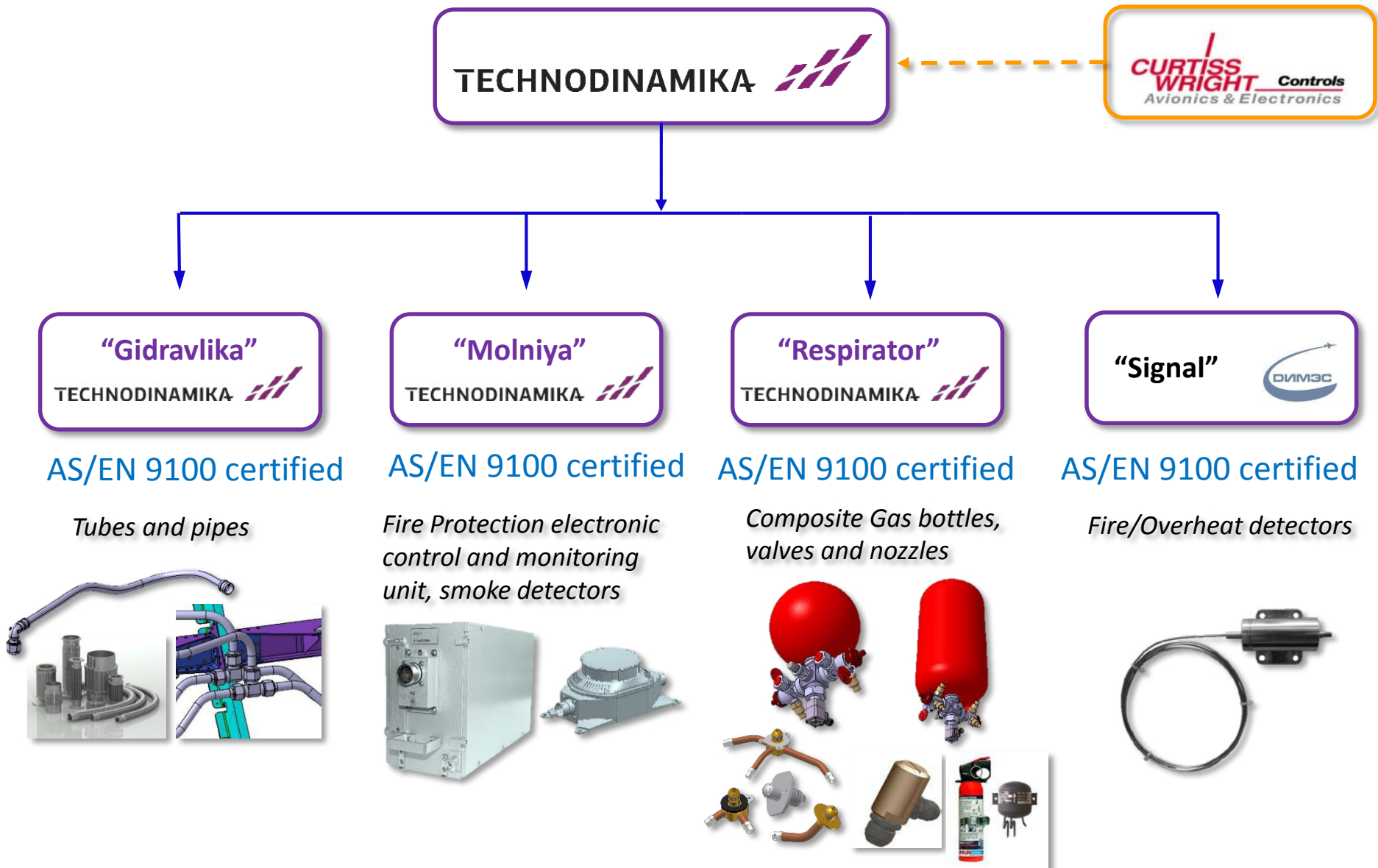
Most Russian defense programs (firex)



New civil application



Technodinamika acts as System Integrator



Technodinamika acts as System integrator & Tier 1 supplier



System integrator

Prime developer, prime contractor and 1st tier supplier;
After-sales service provider.

Developer and producer for:

- Fire Protection Computer
- Fire extinguishers, incl. APU, engines, cargo compartment
- Handheld fire extinguishers
- Metering valves
- Nozzles
- Manifolds and tubing
- Fire extinguisher for waste containers

Adviser and Tier2

Advise and support for the development, integration,
certification of the FPS and its components; sales support.

Developer and 2nd tier supplier for:

- Smoke detectors
- Remote indicators
- Control Panels

Newly-developed fire computer unit

FPC-1
(Molniya)

TECHNODINAMIKA



FC-310
(Curtiss-Wright Controls)



Parameters (for each channel)	FPC-1	FC-310
Fire/overheat detector inputs	11	4
ARINC 429 interface		
- transmitters	2	2
- receivers	4	1
ARINC 825 (CAN) interface	5	3
ARINC 664 (Ethernet) interface	1	-
Weight	4,2 – 4,5	4,55

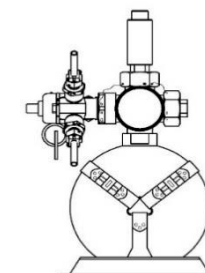
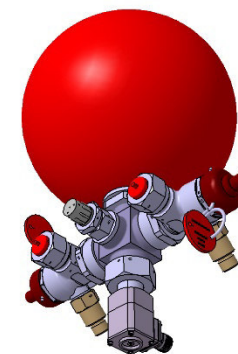
Fire Protection System components weight & reliability features

FPS Component		Weight, kg	MTBF, fh	Comment
Fire Protection Computer		4,2 – 4,5	25 000	Mass depends on configuration
Fire/Overheat detector		0,2 – 0,4	500 000	Mass depends on sensing tube length (from 2 to 12 meters)
Smoke/overheat detector for Cargo compartment		0,43 / 0,45	320 000	Existing 1-channel model / model with 2 independent channels and connectors (in progress)
Smoke/overheat detector for lavatory		0,425 / 0,36	320 000	Existing model / new design (in progress)
Fire Extinguishers for Engines, Cargo and APU		-	500 000	See next slide
Fire extinguishers for lavatory waste containers		0,44 (0,05)	730 000	(in brackets – for micro-capsulation solution)
Hand held fire extinguishers (1,3 liters volume, burst pressure 41,4 bar)		0,36	132 000	Empty weight is shown. (1,95 kg when charged with 1,59 kg of Halon 1211)
Slow discharge (metering) valve for Cargo compartment		0,39	1 200 000	Pressure: 150 kg/sm ² -> 7kg/sm ² Flow rate: 35-40 l/min
Nozzle for Cargo compartment		0,05	6 000 000	
Nozzle for Engine Gas-generator compartment		0,32	6 000 000	
Nozzle for Engine Fan compartment		0,34	6 000 000	
Nozzle for APU compartment		0,35	6 000 000	

Fire extinguisher's weight & reliability



- ✓ Maximum operating pressure – 150 kg/sm²
- ✓ Operation and Storage temperatures – from -60oC to +80oC
- ✓ Recharge interval – 10 years
- ✓ Delivered with or without attachment brackets



Extinguisher type	Bottle Shape	Bottle Volume, liters	Quantity of discharge heads	Empty weight with attachment brackets, kg	Empty weight without attachment brackets, kg	Dimensions, mm height x diam x width
1-2-1	Sphere	2	1	1,79	1,59	280 x 170 x 225
1-3-2	Sphere	3	2	3,01	2,73	305 x 190 x 280
1-4-2	Sphere	4	2	3,3	3,02	330 x 212 x 280
1-6-2	Sphere	6	2	3,88	3,6	360 x 241 x 280
2-8-2	Cylinder	8	2	4,28	4	505 x 195 x 280
2-8-3	Cylinder	8	3	4,71	4,43	575 x 195 x 280
1-10-2	Sphere	10	2	4,86	4,58	400 x 278 x 280
1-12-2	Sphere	12	2	5,35	5,07	420 x 294 x 280
2-16-2	Cylinder	16	2	6,41	6,13	585 x 247 x 280
2-20-2	Cylinder	20	2	6,9	6,62	620 x 270 x 280

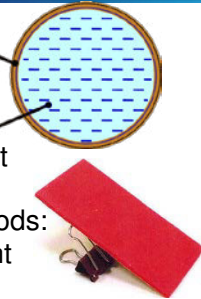
New developments and R&D projects

Smart autonomous Fire Extinguishers materials

Polymeric enclosure
Diameter 60 - 300 mkm

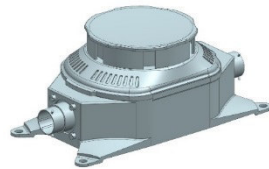
Halons, Novec 1230
or Russian equivalent

Various application methods:
sticker, sheet, paste, paint



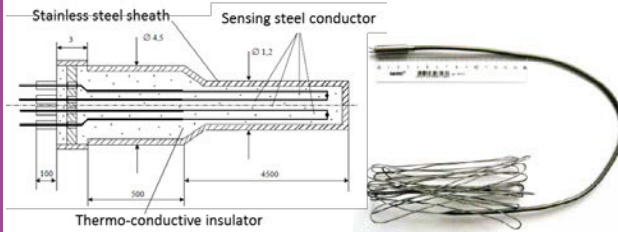
- Fully autonomous
- Opening temperature is adjustable in the range 100 - 220°C and above
- Microcapsules may contain conventional halons, Novec1230, etc.
- Estimated lifecycle ~10years
- Environment temperature: -40°C to +50 °C
- Extremely light solutions
- Adaptable to helicopter & aircraft avionic, electrical, cabin,APU compartments

New design of smoke/overheat detector



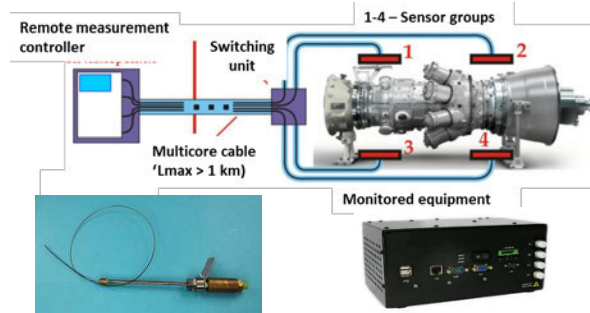
- FAA TSO-C1d compliant design
- Two LED technology-based wave to minimize probability of false alarm
- Two independent channels with two connectors
- Quantity of needed detectors onboard can be 2 times lower
- Weight reduction
- Prototype: mid 2017

Thermo resistive fire/overheat detectors



- Two sensing loops inside one sensor cable provide redundancy for higher reliability
- Measured temperature - up to 1100OC
- Max sensor length - > 12 m
- Response time - 3 sec
- Sensing element weight - 10,5 g/m
- Control unit weight (optional) - 0,150 kg

Optical fiber fire/overheat detectors



- Temperature and exact location can be detected
- Measured temperature: up to 1000°C
- Temperature measurement accuracy: 1°C
- Overheating location accuracy: 0,1 m
- Max sensor length: 1 km
- Immediate response time
- 1 controller can integrate ~100 sensors from various a/c compartments



Oxygen System

Technodinamika's expertise on Oxygen System

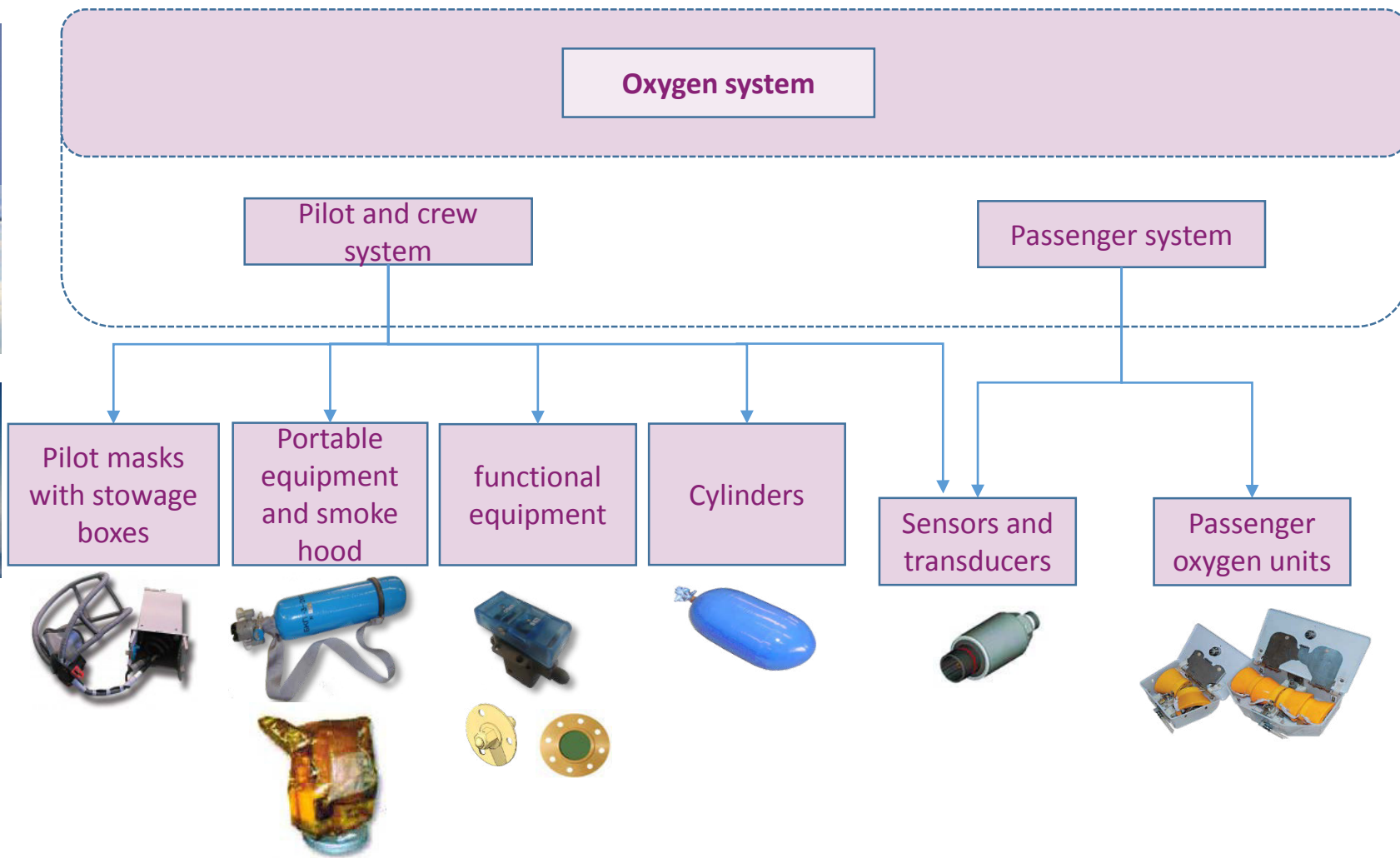
Most Russian defense



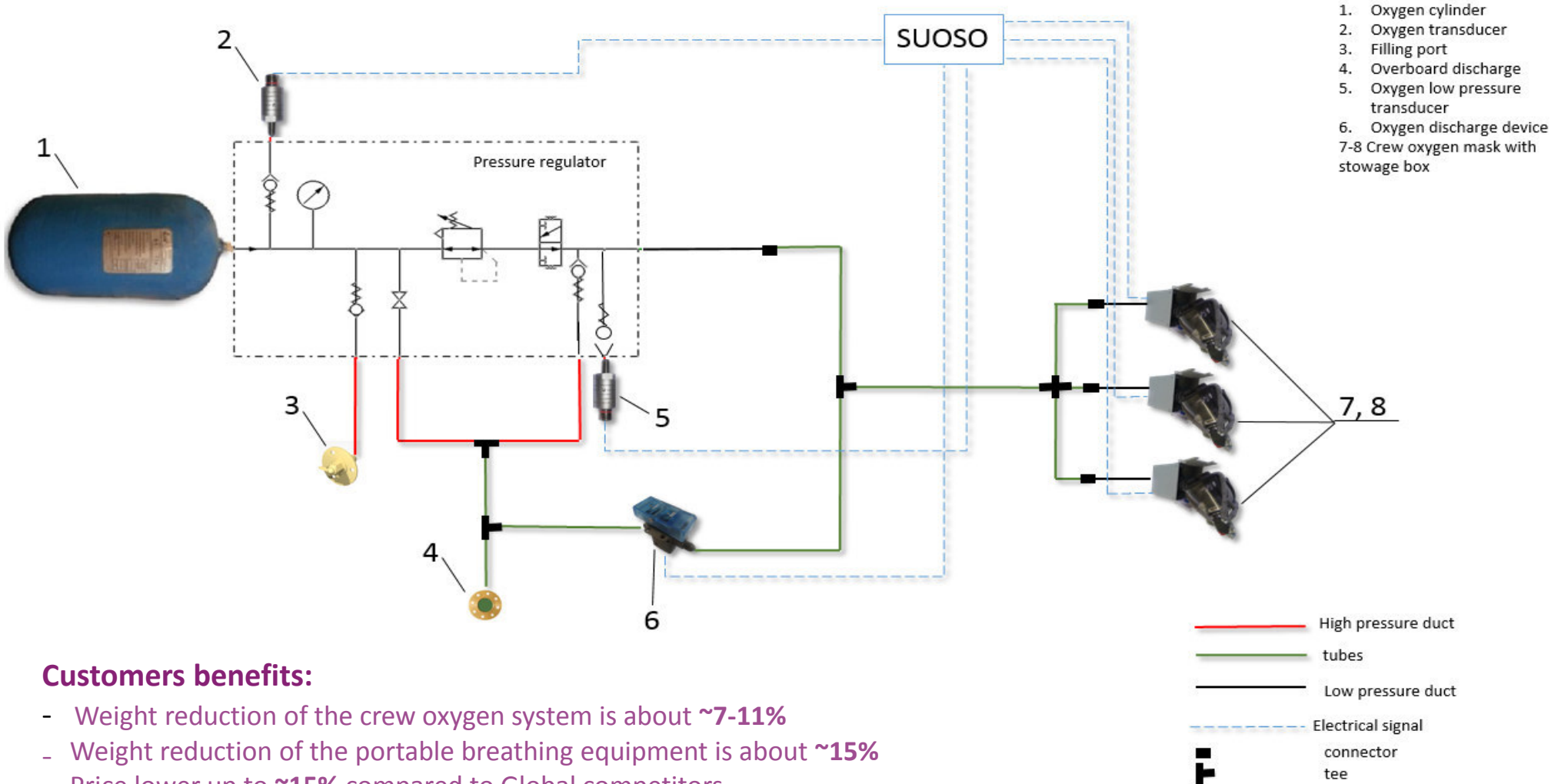
Tu-204



New civil application



New civil application



Customers benefits:

- Weight reduction of the crew oxygen system is about **~7-11%**
- Weight reduction of the portable breathing equipment is about **~15%**
- Price lower up to **~15%** compared to Global competitors
- Adaptable to all advanced commercial and cargo aircrafts.

Oxygen equipment technical characteristics



Oxygen cylinder (16 and 25 liters):
 Pressure charge: 12,7 MPa
 Unused oxygen: 6% of the full volume
 Outlet flow: 200 L/min in NTPD
 Temperature of emergency fire condition: 130 C
 Mass of the charge oxygen cylinder:
 16 L (oxygen - 2080 L) – 8.7 kg
 25 L (oxygen - 3250 L) – 12.5 kg
 Service life: 26,5 years
 MTBF: 30 000 hours



Crew oxygen mask with storage box.
 Crew mask:
 Work pressure: 0,42 - 0,7 MPa
 Maximum consumption through the mask: 120 L/min
 Conditions: mixture, “100%” , emergency condition
 Leakage: 0,006 L/min
 Mass – 0,7 kg
 MTBF – 85 000 hours

Storage box:
 Leakage: 0,004 L/min
 Mass – 0,84 kg
 Service life: 30 years
 MTBF – 108 000 hours



Portable oxygen cylinder
 2,4 L (oxygen – 311,5 L)
 3,5 L (oxygen - 467 L)
 Unused oxygen: 7% of the full volume
 Pressure charge: 12,7 MPa
 Mass of the charge portable oxygen cylinder:
 2,4 L (oxygen – 311,5 L) – 1,87 kg
 3,5 L (oxygen - 467 L) – 2,7 kg
 MTBF – 240 000 hours
 Service life: 26,5 years



Passenger oxygen unit:
 Service life: 30 years
 MTBF: 60 000 hours
 Chemical oxygen generator service life: 15 years
 Mass: according of the geometry and size



Overboard discharge indicator:
Work pressure: 4,22 MPa
Mass: 0,02 kg
Service life: 30 years
MTBF: 60 000 hours



Filling port:
Mass: 0,07 kg
Service life: 30 years
MTBF: 450 000 hours
 Service life of



Transducers:
Mass: 0,15 kg
Voltage: 27 V
Watt: 0,4 W



Oxygen discharge device
Working pressure: 0,7 MPa
Mass: 0,5 kg
Voltage: 27 V

Oxygen systems facility



Respirator (Moscow region)

AS/EN 9100 certified

Respirator was founded in 1932 and is one of the oldest company specialized in oxygen systems for aviation, diving and medical applications in Russia. In 2009, Respirator joined Technoldimanika Group and became our specialized design ,engineering and production company for all oxygen systems.





Filtration systems

Technodinamika's filtering solutions

FILTER ELEMENTS



Technodinamika's filter elements use surface filter materials from 5 microns, as well as composite filter materials from 1 micron. These filter materials are capable of fluids purification to Cleanliness Class 3 with a fluid filtration flow rate from 5 to 400 l/min.

In addition, Technodinamika produces regenerable surface filter elements which can be cleaned by an ultrasonic technology developed by Technodinamika. This cleanable and re-usable solution has significant advantages while operating in harsh environment and MRO constrains.

FILTERS



Serial production of a wide range of hydraulic, fuel, and air filters.

- filtration rating 5 to 200 microns
- flow capacity 0,6 to 400 l/min
- operating pressure 0,5MPa to 35MPa

Latest development of 9 fine filters (rated at 1, 5 and 10 microns) for advanced aviation OEMS.

Tier1 supplier for the latest civil and military helicopters and aircrafts and for engine filters for spacecraft and space launch vehicles.

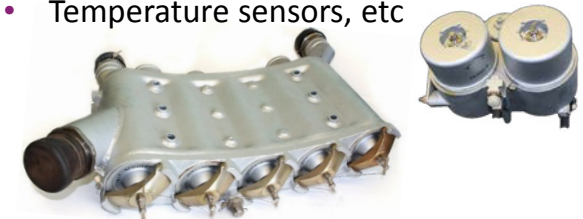
FILTER UNITS



Technodinamika is currently developing new filter units and multi-component filter modules for HP and LP hydraulic systems.

These future units will provide fine filtration and will be equipped with:

- Filter element clogging detectors
- System pressure sensors
- Pressure switches
- Temperature sensors, etc



Technodinamika's experience in filtration systems



MC-21



Be-200



Sukhoi SuperJet 100



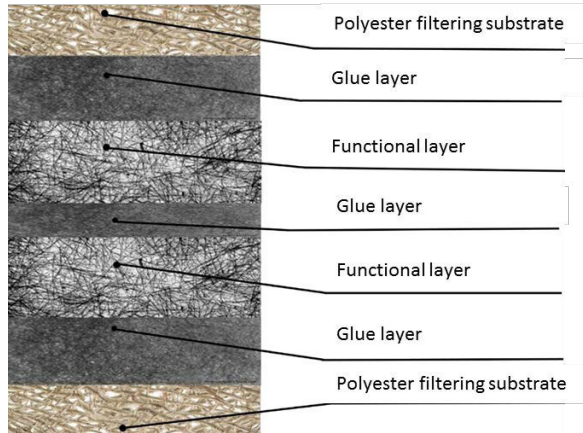
**High-pressure
filter module**

**Hydraulic filter high and
low pressure**



Air filter element

Technodinamika's latest projects on Filtration systems



Development of **composite filter material** with nominal filtration rating of **5 microns** and of **10 microns**



Development of 9 fine filters (**rated at 1, 5 and 10 microns**) for advanced aviation programs.

Development of **new filter units and multi-component filter modules for HP and LP hydraulic systems.**

These future units will provide fine filtration and will be equipped with:

- Filter element clogging detectors
- System pressure sensors
- Pressure switches
- Temperature sensors, etc



Filtration systems facilities

AS/EN 9100 certified

GIDRAVLIKA (Ufa)

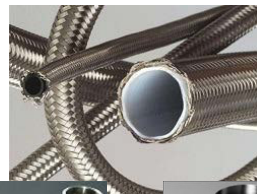
Foundation in 1939. Since 1944 holds competences in filter production. Since 1945 holds competences in flexible hoses production. Since 1965 becomes specialized in APU production. Since 2011 is Gidravlika is part of Technodinamika.

Tier 1 supplier of hydraulic, oil, fuel and air systems for aircraft and helicopter platforms.

Tier 1 supplier of washable filters equipped with visual or electrical clogging indicators for Russian Helicopters.

The facility is highly mechanized and automated and equipped with modern manufacturing solutions: CNC machines, robotic complexes and computer equipment. For the serial production of products at the plant, the latest scientific and technological achievements are introduced:

- plasma welding methods;
- technology of processing metals using the effect of superplasticity;
- electrochemistry;
- vacuum-plasma spraying, etc.

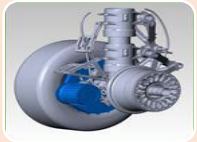


Technodinamika's development for More Electrical Aircraft



Electric power system

- Generator of unstable frequency 120 kVA (2017 - tests of the experimental sample)
- Aircraft engine start systems (Electric starters for surface gas turbine engines - in series production)



Electric Green Taxiing System

- Electric Green Taxiing System (2015: test campaign achieved for Superjet 100 program)
- Electromechanical landing gear extension & retraction drives (2014 – prototypes for the Tu-204 aircraft)



Environment control system

- Electric drive for ECS compressor (2011 - experimental model, tested for 50 thousand rpm)
- Mathematical models of aggregates and SCR for LRWBA (2016)



Flight control and actuation system

- Electromechanical control system for slats and flaps (onboard of Tu-204SM)
(1st experience: An-70 aircraft, supplier for Tu-204SM program, under-development for IL-112V)
- Electromechanical control system of adjustable stabilizer (a prototype for the Tu-334 was manufactured)



Sub systems and components for engines

- Electromechanical engine thrust reverse control system (Will equip the PD-14 engine of MC-21 aircraft)
- The electric drive pump-regulator (2015 - prototypes)



Anti Ice systems

- Newest heating elements and ice detectors (2016 - experimental samples)
- Mathematical model of electrothermal PIC for LRWBA (2016)

THANK YOU FOR YOUR ATTENTION !