

AUTONOMOUS

FLIGHT TECHNOLOGIES



www.aft.ro

Autonomous Flight Technologies - AFT

(over 10 years of activity), is a dominant player on the Romanian Unmanned Aerial Systems (UAS) industry, specialized in the design, development and production of autonomous systems, cost-effectively and reliably perform all kinds of missions, in severe weather and with minimal terrain limitations.

Today, AFT is the no.1 Romanian UAV company and one of the top from the Eastern Europe. We deliver complex solutions for military and civilian applications (our first autopilot was developed in 2006) and for military operations (our first target drone was produced in 2005). In 2017, we achieved NATO recognition for the best STANAG 4609 implementation. Our mission is to be one of the top technology provider in this industry.

AFT developed UAS Hirrus family (Hirrus L, Hirrus XL), UAS Signus family (Signus150, Signus 35V) and target UAS Quarrus family (Quarrus 1, Quarrus 2, Quarrus 3, Quarrus 4).

Of these, the Hirrus system has been tested and homologated with Romanian MoND and demonstrated maturity by participating successfully in NATO Unified Vision 2014 and Unified Vision 2016 interoperability exercises, organized in Norway.

All, Hirrus and Signus family use the same command control application, ground control terminal, autopilot, etc. which provide 100% interoperability between these systems also with other NATO countries that require intel standardized data, provided by UAS.

AFT Vision

Our vision is to minimize the importance of pilot skills of the human factor by providing complex UAV solutions based on highest technologies in a user friendly and intuitive manner.

AFT Goals

- To provide innovative solutions and services to the defense, police and security forces as well as to the civilian customers
- To create multi-operational, multi-purpose systems based on advanced unmanned technologies
- To provide products leading in performance, reliability and cost-effectiveness
- To provide the customer with the best solution and support
- To provide excellent and dedicated UAS crews by training and technical support
- To promote and cultivate long-term relationships with customers
- In cooperation with our partners and dedicated service stations, to provide efficient and reliable services to every customer worldwide
- To develop good relations and partnerships with companies, worldwide, in common projects

AFT Aims during UAS developing process

- Using proved experience on UASs developed and tested for Over 10 Years
- Simplicity in use – Easy to assembly, operate and autonomous capability from launch to recovery
- Transportable – Easy to carry and transport
- Launch & recovery in any terrain – No need for prepared area, accurate recovery by VTOL/parachute
- Simple maintenance

AFT UAS portfolio

Hirrus L

Hirrus L is an advanced and affordable mini UAS.

Hirrus L comprises usually 3 aircrafts in a system, handled as stand-alone or installed on one vehicle.

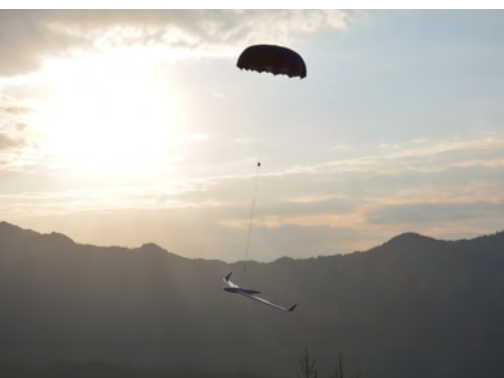
Can be operated by a team of 3 persons with fixed or portable terminals

Main Features and Capabilities:

- Day/Night sensor stabilized EO payload
- Highly modular, simple assembly, rapid turnaround
- Fully automated with autonomous flight capability
- Low profile and noise signature, covert operation
- Retractable payload
- Highly transportable stand-alone or vehicle/shelter mounted system
- Catapult Launch & Parachute Recovery
- Automatic takeoff and recovery

Advanced features

- Over-the-flight take over control (remote GDT)
- Real time stabilized day/night imagery data for urban operation over-the-hill intelligence
- Preprogramed fly restrictions
- Terrain digital elevation model on board
- Target acquisition capability
- Able to operate 2 or more aircrafts in the same time, including swarm capability
- Operational below cloud base, in harsh weather conditions
- Mission autonomy, accurate navigation, with or without GPS or datalink
- Remote Video Terminal (RVT)
- STANAG 4586 compatibility
- STANAG 4609 compatibility



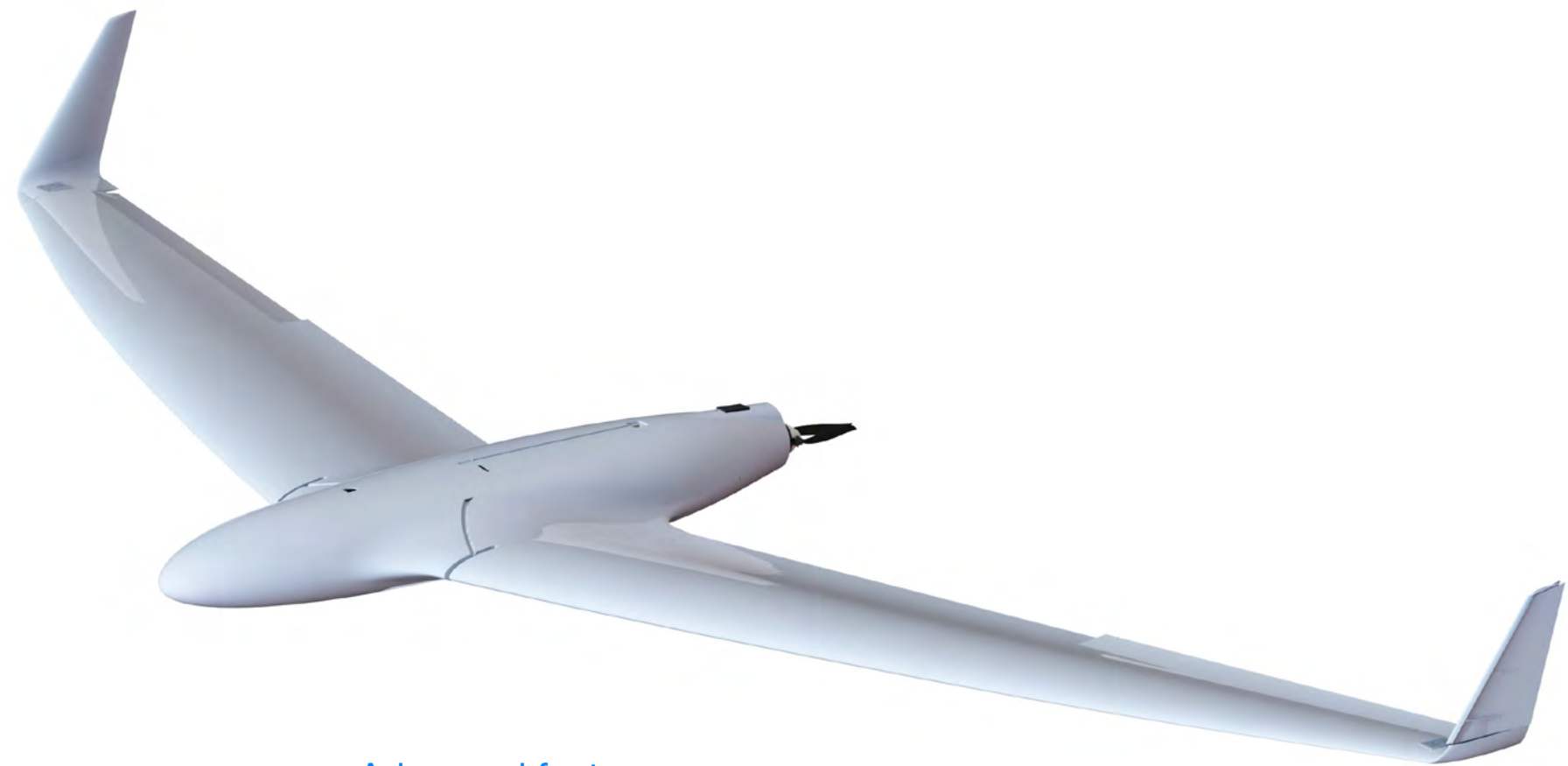
Hirrus XL

Hirrus XL is an advanced and affordable mini UAS.

Hirrus XL comprises on usually 3 aircrafts in a system, handled as stand-alone or installed on one vehicle. Can be operated by a team of 3 persons with fixed or portable terminals.

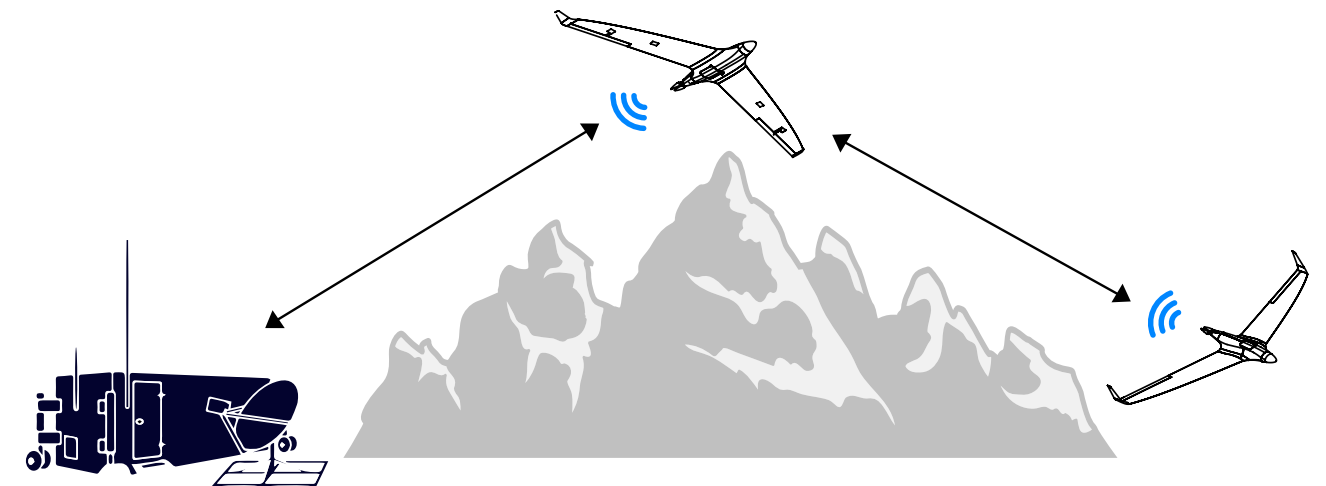
Main Features and Capabilities

- Day/Night sensor stabilized EO payload
- Highly modular, simple assembly, rapid turnaround
- Fully automated with autonomous flight capability
- Low profile and noise signature, covert operation
- Retractable payload
- Highly transportable stand-alone or vehicle/shelter mounted system
- Catapult Launch & Parachute Landing
- Automatic takeoff and recovery



Advanced features

- Over-the-flight take over control (remote GDT)
- Real time stabilized day/night imagery data for urban operation over-the-hill intelligence
- Preprogramed fly restrictions
- Terrain digital elevation model on board
- Target acquisition capability
- Able to operate 2 or more aircrafts in the same time, including swarm capability
- Airborne Data Relay (ADR), over-the-hill missions
- Operational below cloud base, in harsh weather conditions
- Mission autonomy, accurate navigation, with or without GPS or datalink
- Remote Video Terminal (RVT)
- STANAG 4586 compatibility
- STANAG 4609 compatibility



Signus 35V New

Signus 35V is an advanced, affordable, long endurance Small Tactical UAS (STUAS). Signus 35V comprises 3 - 5 aircrafts in a system, installed on one ground vehicle/shelter. Can be operated by a team of 3 persons with fixed or portable terminals.

Main Features and Capabilities

- Tri-sensor stabilized EO payload (Day/Night – cooled/uncooled) with laser pointer
- Highly modular, simple assembly, rapid turnaround
- Automatic takeoff and recovery
- Fully automated with autonomous flight capability
- Low profile and noise signature, covert operation
- Long endurance, extended operational range
- Retractable payload
- Multiple payload capabilities
- Highly transportable vehicle/shelter mounted system



Advanced features

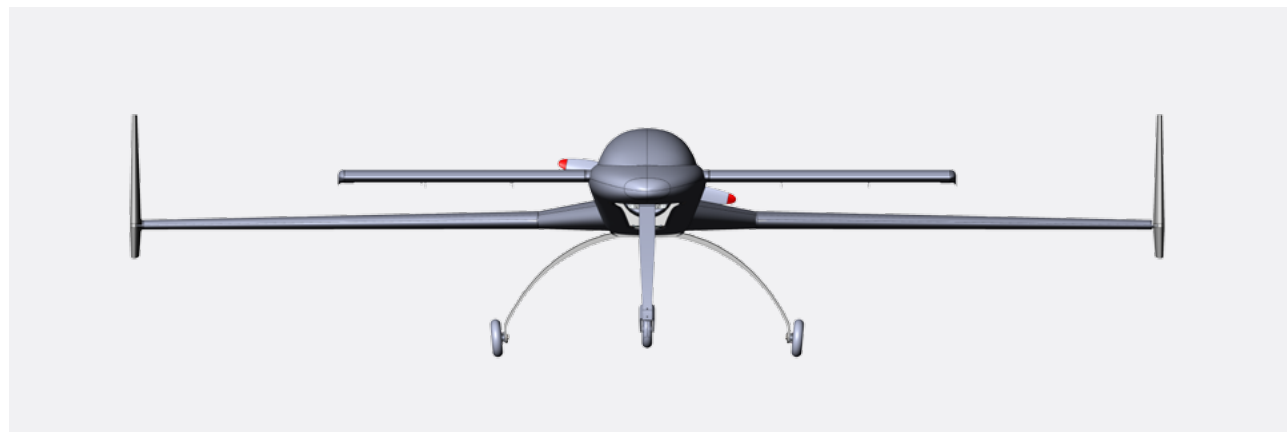
- Vertical Take-Off & Landing (VTOL) or Catapult Launch & Parachute Landing (CLPL) configuration
- Over-the-flight take over control (remote GDT)
- Real time stabilized day/night imagery data for urban operation over-the-hill intelligence
- Preprogrammed fly restrictions
- Terrain digital elevation model on board
- Target acquisition capability
- Able to operate 2 or more aircrafts in the same time, including swarm capability
- Airborne Data Relay (ADR), over-the-hill missions
- Operational below cloud base, in harsh weather conditions
- Mission autonomy, accurate navigation, with or without GPS or datalink
- Weapon integration capability
- Remote Video Terminal (RVT)
- STANAG 4586 compatibility
- STANAG 4609 compatibility

Signus 150

Signus 150 is an advanced, affordable, long endurance Tactical UAS (TUAS).
Signus 150 comprises 3 - 5 aircrafts in a system, installed in one ground shelter.
Can be operated by a team of 3 persons with fixed or portable terminals.

Main Features and Capabilities

- Tri-sensor stabilized EO payload (Day/Night – cooled/uncooled) with laser pointer
- Simple assembly, rapid turnaround
- Fully automated with autonomous flight capability
- Long endurance, extended operational range
- Retractable payload
- Multiple payload capabilities
- Highly transportable vehicle/shelter mounted system
- On wheels Launch & Landing
- Automatic takeoff and recovery



Advanced features

- Over-the-flight take over control (remote GDT)
- Real time stabilized day/night imagery data for urban operation over-the-hill intelligence
- Preprogramed fly restrictions
- Terrain digital elevation model on board
- Target acquisition capability
- Able to operate 2 or more aircrafts in the same time, including swarm capability
- Airborne Data Relay (ADR), over-the-hill missions
- Operational below cloud base, in harsh weather conditions
- Mission autonomy, accurate navigation, with or without GPS or datalink
- Weapon integration capability
- Remote Video Terminal (RVT)
- STANAG 4586 compatibility
- STANAG 4609 compatibility

Data Link

- Direct Line-of-Sight (LOS) data link & Beyond Line-of-Sight (BLOS) using ADR capability



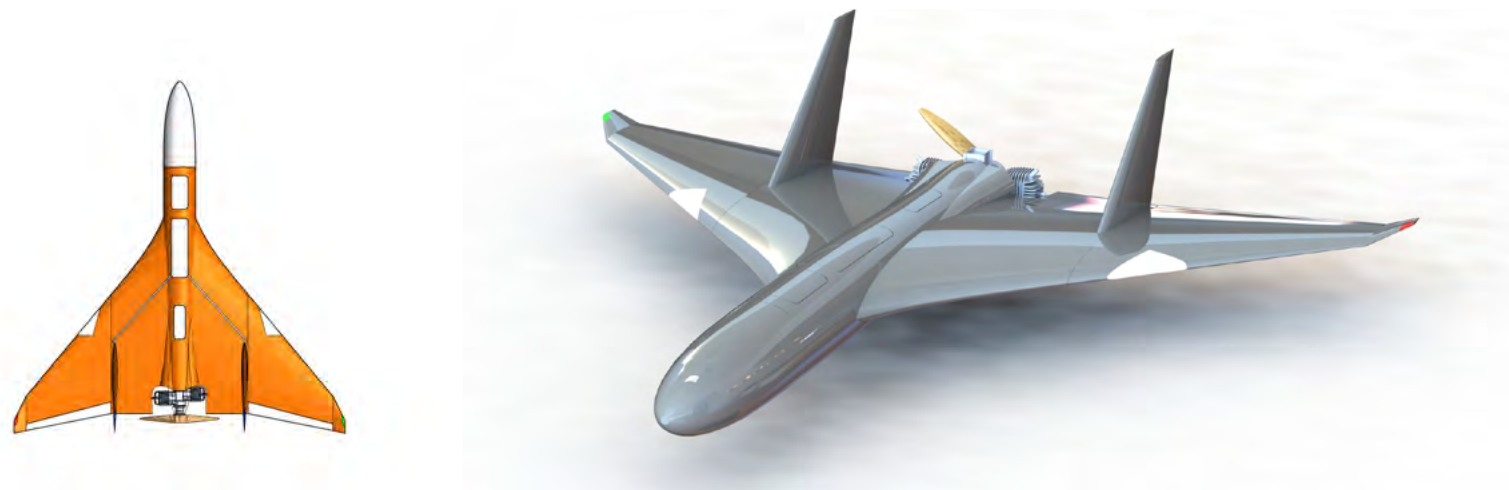
Quarrus 1 / 2 / 3 / 4

Quarrus is an affordable aerial target system.

Quarrus can be delivered with a number of UAVs, as per customer need, to train the anti-aircraft crews, practicing with air defense missiles and artillery, during proving trials or simulation exercises.

Can be operated by a team of 3 persons with fixed or portable terminals.

Proven over many hours of field use, the airframes demonstrate a high degree of modularity, service ease and common features that allow interchangeability of parts and easy interface of payloads and operational electronics. Electronic payloads and subsystems include video and GPS navigation. Sea-skimming and pre-programmed loiter and multi-pattern presentation profiles are standard options.



Main Features and Capabilities

- Automatic take off and landing
- Fully automated with autonomous flight capability
- Night flight lights
- AV can be equipped with various EO and IR sensors
- Remote GCS
- Real-time change of flight parameters
- Integration with command and control systems
- Multiple parameter display terminals

Advanced features

- Able to operate 2 or more aircrafts in the same time, including swarm capability
- Carrying missile for training of the crews on shutting with missile to missile
- Can be used as a carrier for active intervention in the atmosphere
- Ground data and voice communication
- Passive Radar / IR Augmenter and Smoke
- STANAG 4609 compatibility

Data Link

- Direct Line-of-Sight (LOS) data link & Beyond Line-of-Sight (BLOS) using ADR capability



UAS Technical Data

Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) systems

	HIRRUS L	HIRRUS XL	SIGNUS 35V	SIGNUS 150
Wingspan	3.3 m	4.1 m	up to 5.0 m	5.2 m
MTOW	9 kg	18 kg	25-45 kg	150 kg
Payload	900 g	2000-3800 g	4-6 kg	15-25 kg
Take off	Automatic launcher	Automatic launcher	Automatic launcher/ VTOL	Runway (grass, dirt)
Recovery	Parachute	Parachute + Airbag	Parachute + Airbag/ VTOL	Runway (grass, dirt)
Propulsion	Electric	Electric	Internal combustion engine (EFI)	Internal combustion engine (EFI)
Max speed	110 km/h	100 km/h	150-230 km/h**	210 km/h
Cruise speed	70 km/	70 km/h	90-120 km/h	140 km/h
Endurance	180 min	210 min*	12-24 H	24 - 48 H
Video Datalink range:	15 km	15 km	80+ km	100+ Km
Telemetric datalink range:	20 km	20 km	80+ km	100+ Km
Status	Maturity TRL8-9; 1000+ flights	Final stage of development	Under development (ready for testing)	Under development

* at sea level, at 18°C
** with special configuration for speed
*** estimate with high margin of error

Aerial target systems

	QUARRUS 1	QUARRUS 2	QUARRUS 3	QUARRUS 4 or 3+
Wingspan	2.9 m	5.3 m	1.8 m	1.8 m
MTOW	30 kg	150 kg	35 kg	35-45 kg
Payload	Luneburg lens; Smoke and IR flare; Target towing winch.	Rocket station (hardpoint); Luneburg lens; Smoke and IR flare; Target towing winch.	Luneburg lens; Smoke and IR flare.	Luneburg lens; Smoke and IR flare.
Take off	Runway (grass, dirt)	Runway (grass, dirt)	Automatic launcher	Automatic launcher
Recovery	Runway (grass, dirt)	Runway (grass, dirt)	Parachute	Parachute
Propulsion	Internal combustion engine	Internal combustion engine	Internal combustion engine	Jet engine
Max speed	290 km/h	230 km/h	340 km/h	400-500 km/h***
Cruise speed	160 km/h	150 km/h	185 km/h	185 - 200 km/h
Endurance	at cruise speed: 80 min; at max speed: 40 min.	at cruise speed: 4 h; at max speed: 2 h.	at cruise speed: 120 min; at max speed: 60 min.	at cruise speed: 50 min; at max speed: 25 min.***
Video Datalink range:	50 km	50 km	50 km	50 km
Telemetric datalink range:	50 km	50 km	50 km	50 km
Status	Maturity TRL8-9; 1000+ flights 10 years of activity	Has been tested as carrying missile for training of the crews on shutting with missile to missile	Under development	Plans for 2018-2019

* at sea level, at 18°C
** with special configuration for speed
*** estimate with high margin of error

AFT's advanced UAV systems present the ultimate solution for supporting:

1. Military applications, including

- Aerial Reconnaissance
- Artillery Target Acquisition
- Battle Damage Assessment
- Counter Terrorism
- Persistent Surveillance
- Tactical Intelligence
- Battlefield management and more
- Patrol and convoy escort
- Border surveillance
- Coastal surveillance
- Training the anti-aircraft crews

2. Police and special forces, including

- Reconnaissance
- Urban operation
- Counter-terrorism
- Radio relay
- Law enforcement
- First responder
- Border surveillance
- Force / convoy protection
- Security operations
- Strategic infrastructure surveillance
- Crime prevention
- Traffic Control
- Riots Control and more

3. Civilian structures / entities, including

- Disaster control and management operations
- Commercial applications
- Mapping on Demand photogrammetric solutions
- Oil & Gas infrastructures surveillance



About AFT

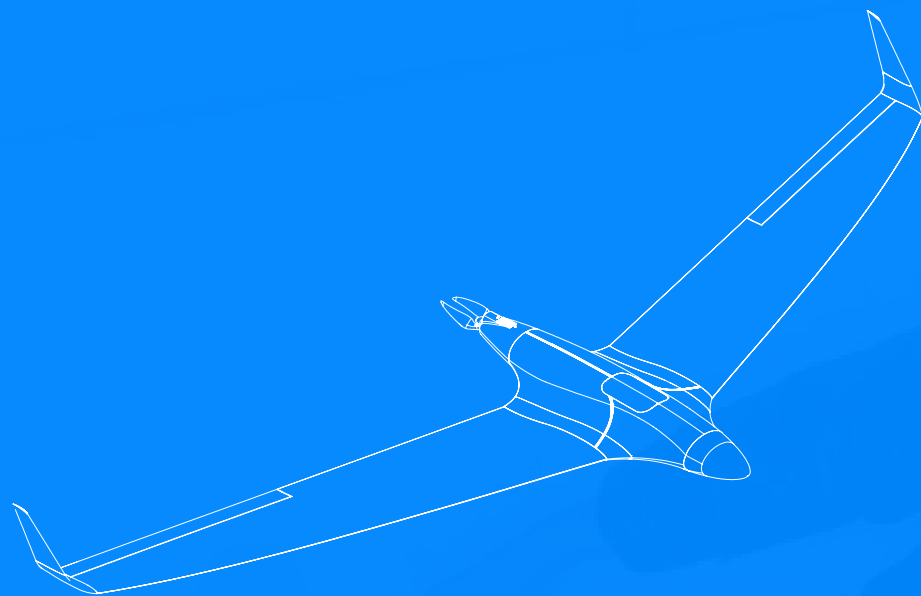
Technological Expertise

At AFT, we maintain the entire infrastructure necessary for development, production, integration, flight-testing, certification, and support of operating UAS throughout their service.

Our professional workforce is involved in design, engineering, manufacturing, sales, and after-sales support. Our employees include UAV operators and technical staff with years of experience in the field, as well as highly skilled engineers from the high-tech industry.

In-House R&D

Our in-house R&D departments are extensive and include a team of experienced engineers from diverse specializations, developing the advanced mission-related capabilities of our unique UAS's, proprietary flight control software, innovative navigation, and security interfaces, and more.



Areas covered by our specialists:

- **Systems engineering**
- **Aerodynamics**
- **Mechanics**
- **Electronics**
- **Composite materials**
- **CAD & CAM**
- **IT**

Competences

Through our in-house R&D, we maintain full control of core UAS technologies, leveraging a unique level of flexibility and independence by:



Design

Structural and aeronautic design
3D modeling and prototyping



Electronics

Electronics and PCB design



Software

Custom software and firmware development



Manufacturing

Composite and metallic structures

Training & Support

To support customers and guarantee reliable and continuous UAS operations, UAS has trainers that provides high quality, in-depth training programs for UAS mission commanders, operators and technicians.

Compliances and Standards

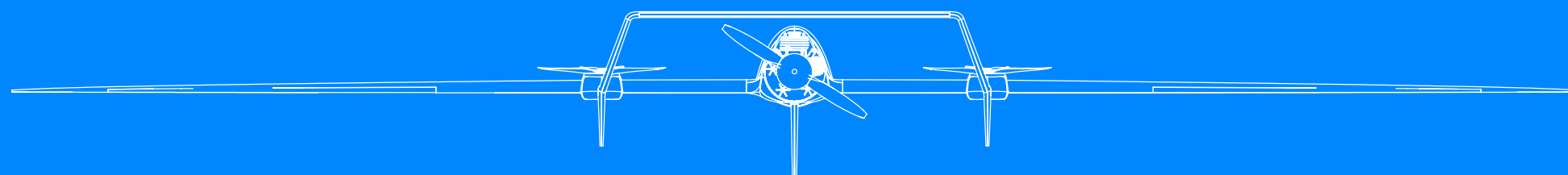
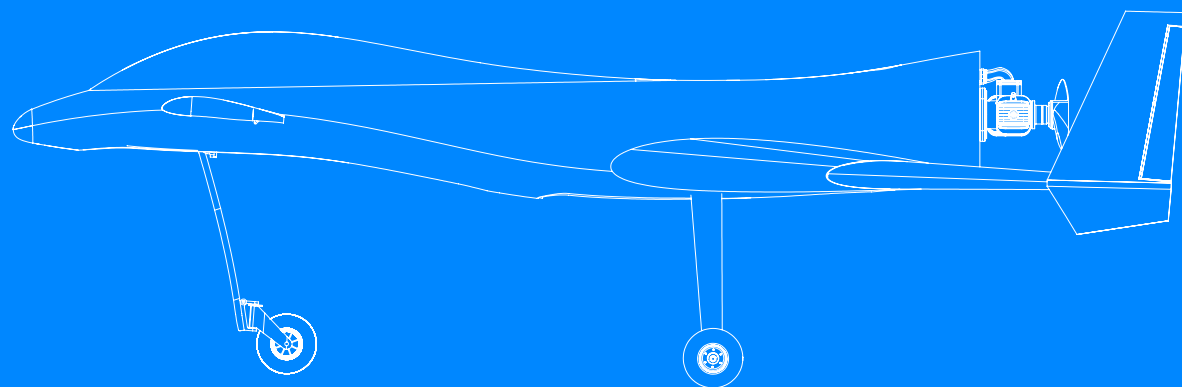
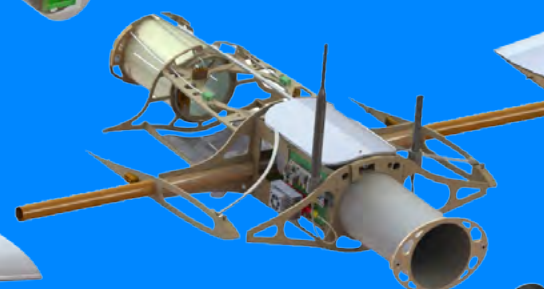
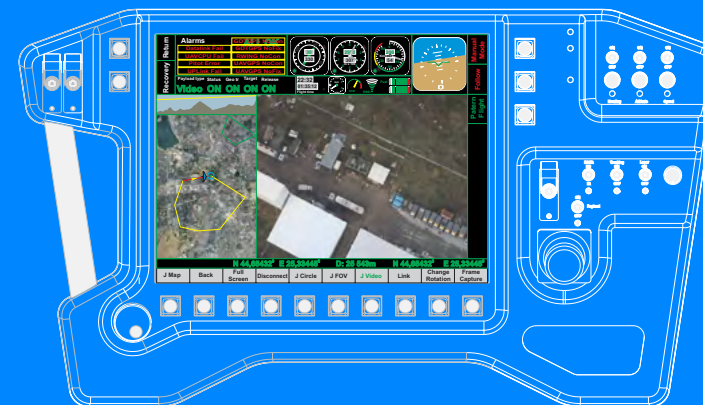
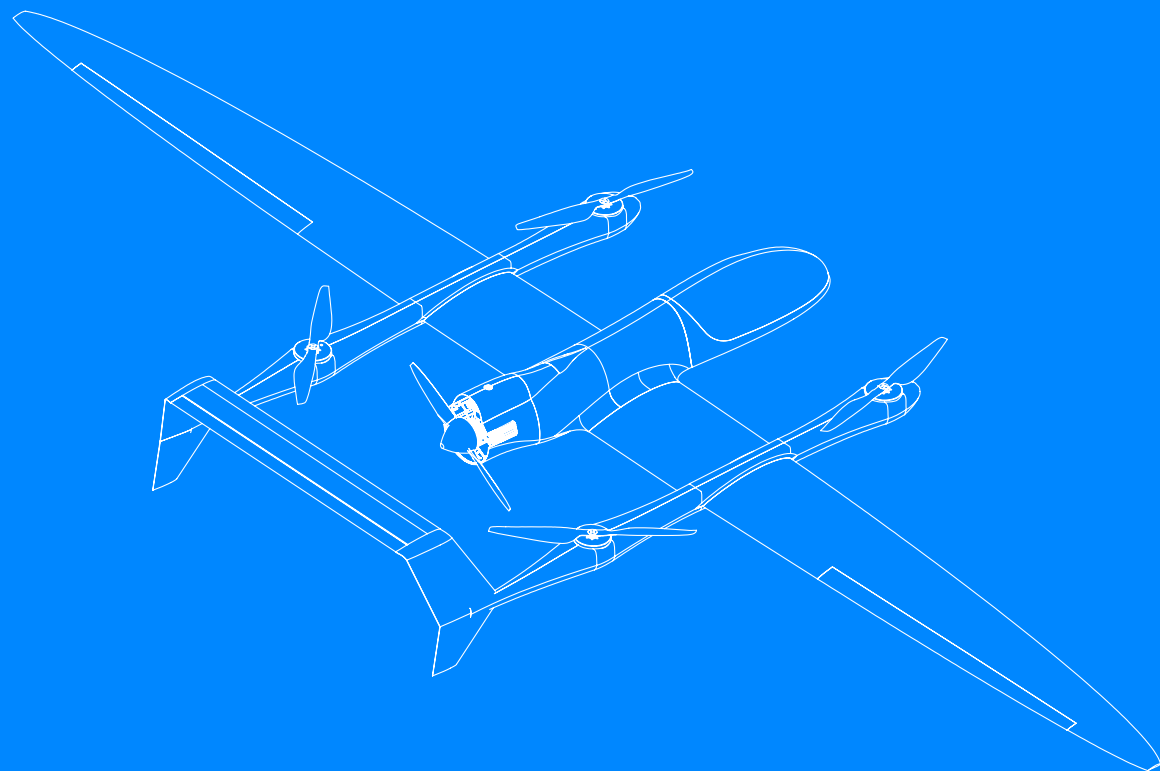
Committed to the highest quality and stringent industry standards, AFT products and services comply with ISO-9001, ISO-14001, STANAG 4586 and STANAG 4609.

As result, our proprietary technologies are:

- **Navigation systems**
- **Autonomous controls – Flight Controls & Autopilot**
- **Automatic Take-Off and Landing (ATOL) system**
- **Command and control, mission support**
- **Man-Machine Interfaces (MMI)**
- **Real-Time Integrated Ground Control Systems (GCS)**
- **Electro-optical EO payloads and stabilization systems**



On the shelf products



AFT Autopilot

The AFT Autopilot is a complete electronic system for controlling all type of UAV, it can be used for “fixed wing”, in all configurations (elevon, flaperon, v-tail, x-tail etc.), or VTOL single and multiple rotor configuration. The Autopilot is designed as a distributed system in order to ease redundancy implementation.

AFT Autopilot provides the following capabilities:

- Control 8/12/24 actuators, configurable thru Bezier mixers
- RC override
- Fully automatic, multi-waypoint, 3D flight-plan following
- Multiple commands per waypoint
- Flight restriction management
- Terrain Digital Elevation Model on board
- Manual flight controlling altitude, heading and speed
- Automatic takeoff and landing
- Complete safety chain
- Multiple AV control from single GCS
- Compatible with AFT GCS software
- Provide high precision attitude angles for payload stabilization
- Continuous sensors sanity check
- Continuous system and servo power monitoring
- Multiple servo per command surface
- Payload control



Software C2

The command and control (C2) software was developed by AFT over 10 years of R&D.

At this time, the software meet all the requirements of complex missions. It has a modularity and level of integration that is rarely found in such systems. This provides great robustness and scalability.

- Cross-platform software
- Scalable software resolution
- Mission planning
- Mission monitoring
- Mission recording
- Multiple inputs support:
 - Custom controllers (joystick, buttons and switches) integrated with an on-board chip developed in our facility
 - Mouse and keyboard
 - Touch screen control
- Metric/imperial units of measurement system
- Decimal/Degrees coordinate system
- STANAG 4586 compliant
- STANAG 4609 compliant

GCS is connected to GDT by using a Cat5e interface cable. Through the GCS, the UAS operator can perform: mission planning, following mission execution in real-time, controlling the payload, visualizing and recording the video image, visualizing the flight parameters (telemetry data), planning and monitoring the automatic launch and recovery procedures.

Multi-GCS control of our UASs is based on interaction between multiple ground control stations, and their operators. One way of using the interactivity quality of a multi-GCS system is when the tasks are dispatched to operators like this: one operator will control at a time the video payload and this will be his only one task, and another operator will keep the control of the UAV. They could switch the roles dynamically, but they should know each one about the other one.



Day payload

This payload is able to provide real time video stream during the flight of the UAV.
The day payload is modular, retractable and stabilized, and includes:

Specifications for day payload (FCB H11)

Weights	930 grams
Dimensions (WxHxD)	160x130x180 mm
Operating temperature	0° to 45°C
Rotation limits	pan: 360° continuous, tilt: ±100°
Slew rate	120°g/sec
Power	15W peak, 7.5W typical
Input voltage	12-35 volts
Control interface	CAN 2.0A, UART TTL
Position resolution	20 µrad
Stabilization	300 µrad
Stabilization rate	300°/sec
Optical zoom	10x
Digital zoom	2x (limited, up to 12)
Effective number of pixels	2MP
Video out	PAL (25 fps) / NTSC (30 fps)



- Sensor, Sony FCB H11
- Stabilized & retractable platform, which accommodate the sensor and is able to provide 2 axes mechanical stabilization of the sensor.

Night payload (IR)

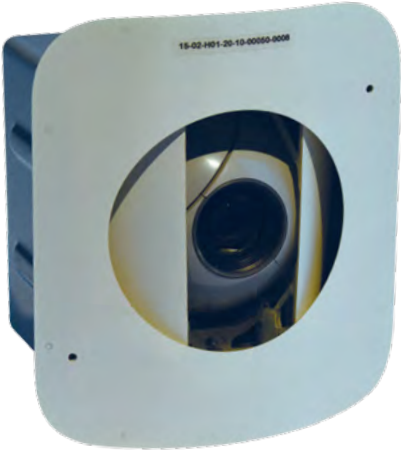
The night payload is able to provide real time video stream during the flight of the UAV, during the night time.

Specifications for night payload (FLIR TAU 2)

Weights	900 grams
Dimensions (WxHxD)	160x130x180 mm
Operating temperature	-40° to +80°C
Rotation limits	pan: 360° continuous, tilt: ±100°
Slew rate	120°/sec
Power	15W peak, 7.5W typical
Input voltage	12-35 volts
Control interface	CAN, UART TTL
Position resolution	20 µrad
Stabilization	300 µrad
Stabilization rate	300°/sec
Optical zoom	-
Digital zoom	2x – 8x
Effective number of pixels	640 x 512 (PAL) / 640 x 480 (NTSC)
Video out	PAL (8.3 fps) / NTSC (7.5 fps)

The night payload is modular, retractable and stabilized, and includes:

- Sensor, FLIR Tau2-640 with 25mm lens
- Stabilized and retractable platform, which accommodate the sensor and is able to provide mechanical stabilization of the sensor for 2 axes.



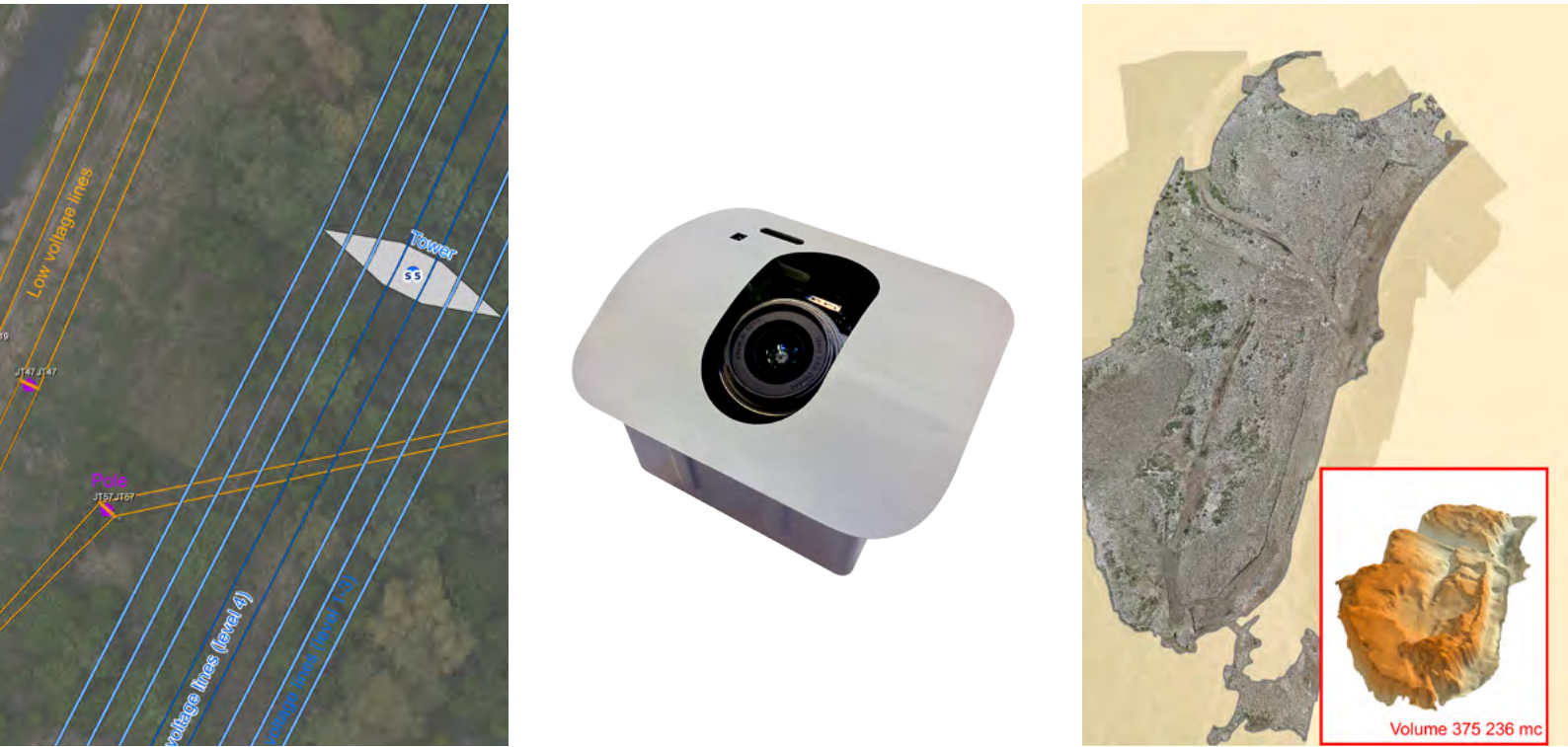
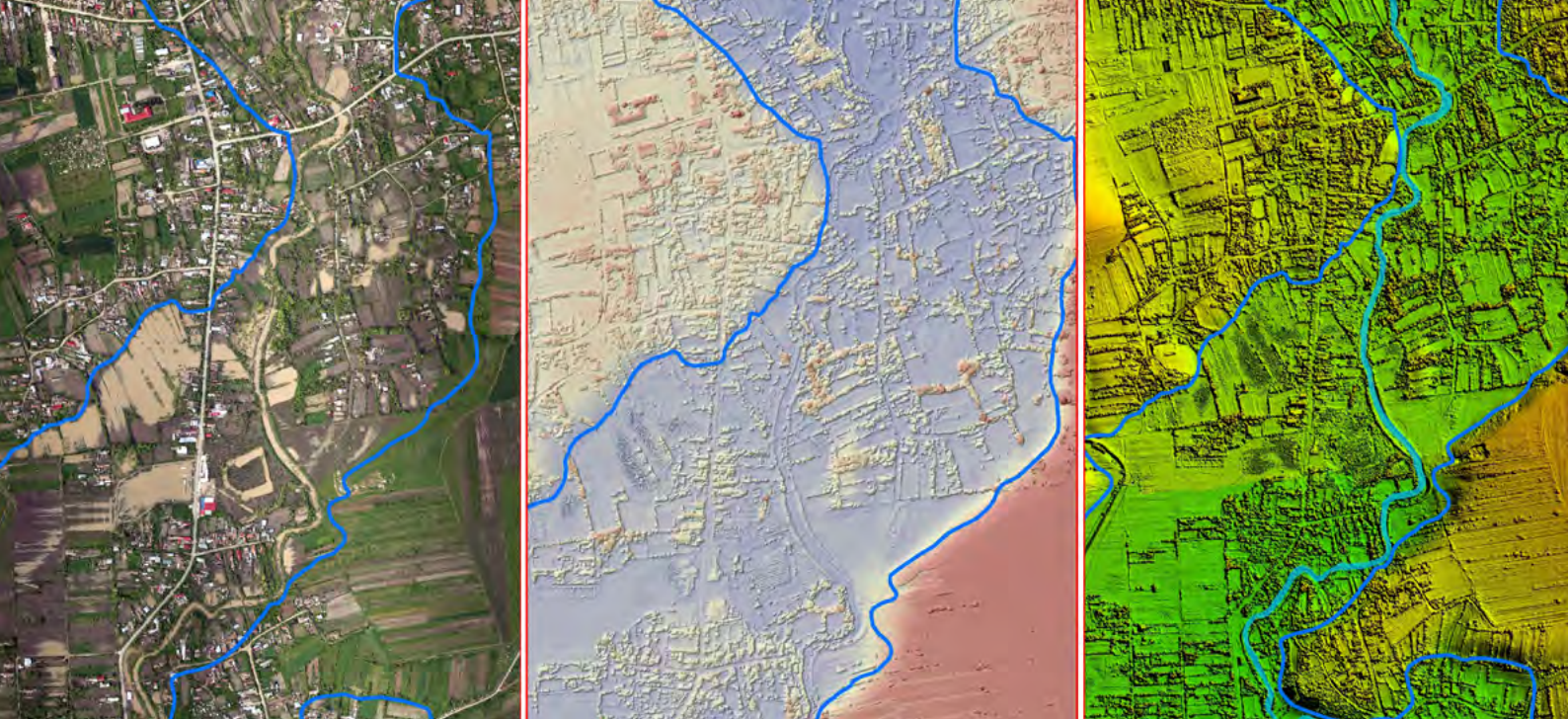
Photogrammetric payload

This payload is built on the roll stabilized platform and is able to collect high resolution pictures during day time.

Considering the large size of the collected pictures, they cannot be transferred to the Ground Control Station in real time or during the flight. After the landing of the airplane, the recorded pictures may be downloaded and processed.

Specifications for photogrammetry payload (Sony A6000)

Weights	700 grams (with Sigma 30 mm lens)
Dimensions (WxHxD)	160x130x180 mm
Operating temperature	0° to 45°C
Rotation limits	Roll ±35
Slew rate	120°/sec
Power	15W peak, 7.5W typical
Input voltage	12-35 volts
Control interface	CAN, UART TTL
Position resolution	20 μrad
Stabilization	300 μrad
Stabilization rate	300°/sec
Optical zoom	-
Digital zoom	-
Effective number of pixels	24.3 MP
Video out	PAL (25 fps) / NTSC (30 fps)



Ground Data Terminal (GDT)

GDT is part of the Data Link System (DLS).
DLS includes the Airborne Data Terminal (located onboard the airplane) and the GDT (located on the ground) which provide the data exchange between the Unmanned Aerial Vehicle (UAV) and the Ground Control Station (GCS) (both telemetry and video data).
GDT include the emitter-receiver, the antennas management terminal and the antennas.

GDT tasks:

- Transmission of the data from the GCS to the aerial vehicle (uplink);
- Reception of the data from the UAV (down-link) and streaming them to the GCS.
- The down-link include telemetry data and video-stream data;
- Provide automatic orientation of the antennas, both in azimuth and elevation, aiming to maximize the gain.
- The GDT consist of:
 - a PAN assembly that contains the gear box that provide the pan movements of the antennas and the entire electronic command and control system.
 - a TILT assembly that contains the tilt gear box and radiofrequency equipment.

The position of the antennas is mainly based on GPS information but can also be determined using RSSI.
The GDT is possible to be equipped with an AHRS module to compensate for movements or alignment errors when it is installed on a vehicle.

Specifications

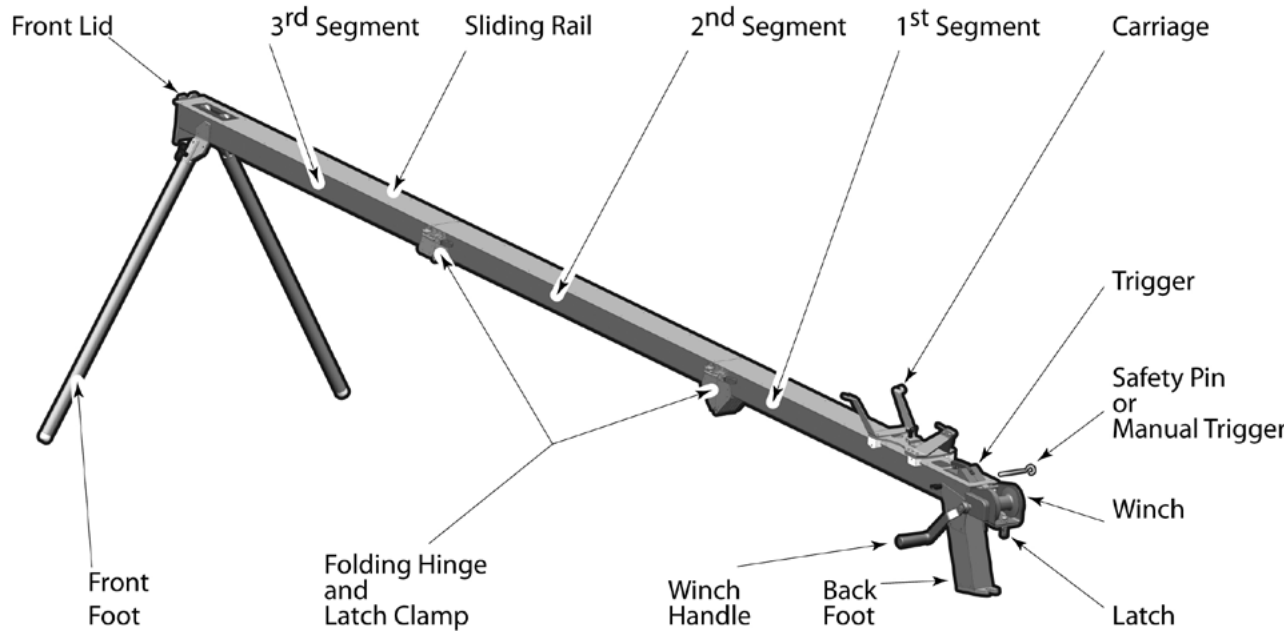
Radio range	<ul style="list-style-type: none">• 15 – 20 km: real time video streaming• 30 km: without real time video streaming – telemetry data only
Real time transmission	<ul style="list-style-type: none">• reception of video data• reception of flight parameters
Size (WxHxD)	<ul style="list-style-type: none">• 600 x330x220 mm (with antennas)• 520 x270x210 mm (without antennas)
Angular Speed	45°/s°
Tilt limit	-10° - +100°
Pan movement	360° (continuous)
Power supply	DC 24V
Communication	<ul style="list-style-type: none">• CAN Bus (standard Hirus DLI)• ETH IP (for H264 encoding)• Analog video complex



Launcher

The equipment is a novel state of the art automatic catapult system designed to launch the mini unmanned aerial vehicles (UAVs). It use as primary energy source a battery of elastomeric (rubber) tubing, which is tensioned prior to performing the take-off, and a carriage to hold and release the UAV when the acceleration exceeds V_s .

The overall structure of the launcher composed of three segments, illustrated below.



For operator’s safety and protection reason, the propulsion unit (elastomeric tubing, tractor blocks, tractor cable) is completely enclosed inside the segments.
Apart from the rubber battery being completely enclosed inside the segments, the launcher exhibit a complex safety system, both mechanical and soft based.
For storage purposes, the launcher is latched in folded state, inside the transport container.



Specifications

Maximum launch energy	1,8 kJ (190 daN force at start)
UAV MTOW	11 kg
Minimum launch speed @ MTOW	17 m/s
Launcher length (unfolded)	4 m
Ramp tilt angle (on horizontal ground)	9°
Footprint	isosceles triangle (base 1 m, height 4 m)
Folded launcher dimensions (WxHxD)	1,4x0,35x0,25 m;
Weight	17,5 kg
Mounting and dismounting time	5 min. / 5 min.
Arming time between two launches	1 min.
Arming	manual winch
Launch command	automatically (from GCS) or manually (trigger)





A trustworthy partner for developing,
integrating and implementing
advanced systems in Romania

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