ROBOTIC PLATFORMS

REAL TIME REMOTE CONTROL

REAL TIME TRANSMISSION OF RECONNAISSANCE INFORMATION

DATA BASE FORMATION OF RECEIVED INFORMATION

INTEGRATION INTO C4I SYSTEMS

TECHNOLOGY OF CREATING FLIGHT CONTROL SYSTEMS FOR UAV

COMPLIANCE WITH MILITARY STANDARDS

AGAT
CONTROL SYSTEMS

GRIF -100E

PURPOSE

“Grif - 100E" system is used to perform air optical - electronic and radiation reconnaissance of the terrain, electronic countermeasures, detection of emergencies and their estimation.

TASKS TO BE SOLVED

During the air reconnaissance:

surveillance in the preset area over the ground (water) surface, acquiring thermal and TV picture of the terrain in real time;

automated search and detection of ground (above-water) objects, determining coordinates of selected objects;automatic tracking of ground (above-water) objects

selected by the operator, determining their speed and direction of movement;

providing users with reconnaissance information in real time.Radiation reconnaissance:

provide the detection of gamma sources on the ground surface with the use of the equipment installed on board an unmanned aircraft vehicle.
Eelectronic counter measures:

radio-electronic suppression of the radio-electronic communication means and radio navigation through jamming counter measures.

STRUCTURE

Two to four unmanned aerial vehicles (UAV).
Replaceable payloads, including:

- gyro-stabilized optical and electronic system;
- onboard radiation control equipment;
- jamming equipment JE and JE-3.

Ground control station (GCS).
Means of ground support:

- maintenance vehicle;
- transport vehicle;
- mobile launcher (katapult).

SPECIFICS / ADVANTAGES

The Unmaned Aircraft System has a number of competitive advantages:
- continuous monitoring of the preset area by replacing the UAV promptly;
- equipping with modern hardware the payloads, communication and data transmission, ensuring operative execution of assigned tasks;
- capability to conduct the UAV flight and its onboard equipment functioning beyond direct radio visibility in the automatic mode strictly under the flight mission;
- carrying out assigned tasks in visual and instrument weather conditions, in autonomous mode (if airfield network is not available);
- particularly robust construction of airframes ensuring their application repetition;
- capability of the UAV take-off both from the runway - running take-off, and catapult launched if the runway is missing at the site of the UAV launch.

BASIC CHARACTERISTICS

UAV operating range	up to 250 km
Operating range of GCS radio communication channel with UAV	up to 100 km
UAV takeoff mode	running takeoff, catapult launched
UAV landing mode	running landing, using the parachute
UAV flight ceiling	up to 3000 m
Cruising UAV flight speed	120-140 km/h
Flight time	max 5 hours
UAV weight	up to 180 kg
Number of simultaneously controlled UAV	2 pcs.
Navigation system	inertial, inertial with corrections from space radionavigation systems
Coordinate determination error	max 50 m
Data transmission rate from UAV to GCS	5 Mbit/sec
Data transmission rate from GCS to UAV	0.1 Mbit/sec

BERKUT

PURPOSE

«Berkut» systems are used for equipping tactical units of land forces to solve tasks on optical and electronic terrain reconnaissance in all weather conditions and at day and night time, assigning targets to fire units.

TASKS TO BE SOLVED

Air surveillance over land and water surface in the preset area, acquiring photo, thermal imaging and TV picture of terrain in real time.
Searching and detecting surface (above-water) objects, determining their coordinates.

UAV TECHNICAL CAPABILITIES

Automatic flight mode (suitable to perform the flight in unattended mode in accordance with entered flight task, including landing).

Automated flight mode (under control and on operator’s commands).

UAV emergency flight termination and return to the preset area in automatic mode under inexpediency to further perform the mission, including landing.

SPECIFICS / ADVANTAGES

As a basic configuration, the system contains two UAVs, but more UAVs can be available as option as well.

The parachute system bay is in the upper part of the fuselage, covered with the lid. In the lower part there is the hatch providing necessary access to the onboard equipment, power unit and cabling. The accumulator battery is fixed on the hatch cover.

UAV launching does not require the prepared runway enabling to use the UAV in any hard-to-reach area.

The UAV “Berkut-1E’ design ensures its high flying performances, and it is built as "monoplane with pulling propellers" layout. The payload bay is installed into the nose part.

The UAV “Berkut-2E” design ensures its high flying performances, and it is built as a "flying wing" layout. The motor with the pusher propeller is installed in the tail.

SPECIFICS OF UAV BERKUT-3 PRODUCTION

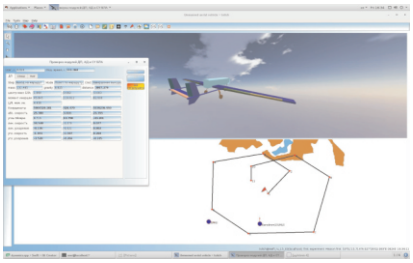
The glider design is made in matrices entirely of composite materials, with insignificant use of wood in power components. The basis is a composite "sandwich" made of fiberglass and special structural foam. Binding material is epoxide resin.
The fiberglass and foam plastics are glued together by vacuum forming in the matrices. The paint coating is made directly in the matrices that allowed avoiding the intermediate priming coating and save weight.
Applied materials:
- fiberglass;
- structural foam;
- carbon fabrics;
- epoxide resin;
- coating materials;
- aircraft plywood.

UAV "Berkut-3" has empty weight no more than 2300 g at lifting surface area 100 square decimeter that allows placing up to 8 kg of the on-board equipment on it.

BASIC CHARACTERISTICS

	BERKUT -1E	BERKUT -2E	BERKUT-3
UAV operating range	up to 15 km	up to 35 km	up to 50 km
UAV takeoff mode	rubber harness	catapult	rubber harness
UAV landing mode	parachuting	parachuting	parashuting
UAV flight ceiling	3500 m	3000 m	4 000 m
Cruising UAV flight speed	65 – 90 km/h	80 – 100 km/h	60 - 120 km/h
UAV flight time	not less 60 min	up to 120 min.	not less 180 min.
UAV weight	up to 5 kg	max 10 kg	up to 11 kg
Version	portable	transportable (in container)	transportable (in container)
Crew	at least 2 people	at least 2 people	at least 2 people

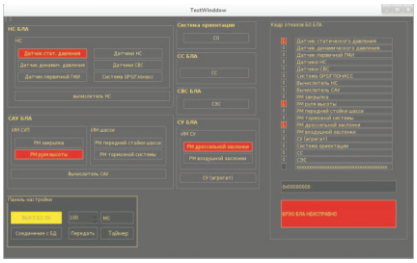
TECHNOLOGY TO CREATE THE SOFTWARE FOR AUTOMATIC FLIGHT CONTROL SYSTEMS OF UAV



Flight control system executes UAV flight control in the automatic mode, UAV control in the automated and manual control, UAV payload control.

GROUND - BASED PART (GBP)

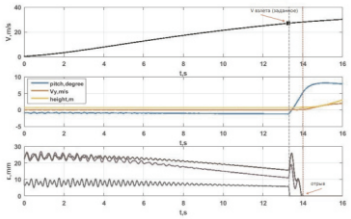
Ensures:
- input of a flight task and execution of the navigation estimations;
- automated flight control;
- telemetry monitoring and displaying at all stages of UAV flight.



Flight control system is based on three main components:
- Ground-based part;
- Air-borne part.

AIR-BORNE PART (ABP)

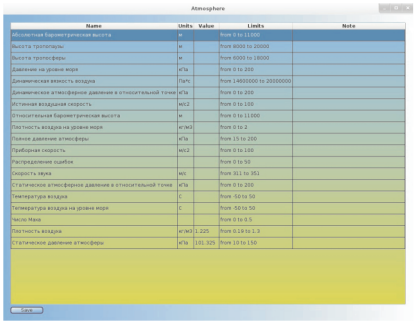
Ensures:
- implementation of UAV element operation logics at all UAV flight stages:
- automatic takeoff from a runway;
- automatic en-route flight;
- UAV running landing to a runway;
- commands transmission to the control mechanisms;
- UAV system functional control.



SIMULATION - MODELING BENCH (SMB)

SMB with high rate of the detailed estimations ensures to select optimal UAV ACS MD (memory device) and ensure stable UAV control during the first test flights.

SMB allows gaining of UAV complete control and operation of its systems, as well as ensuring a semi-natural modeling with connection of the real UAV devices.



COMPOSITION OF THE SIMULATION - MODELING BENCH

WS No.1 has DB with the data on UAV system specifications and parameters used for its flight modeling.

3D- UAV movement model in the space with the simulation of controls deviation at all flights stages, as well as 2D- UAV movement model between intermediate route points is implemented at WS No.2.

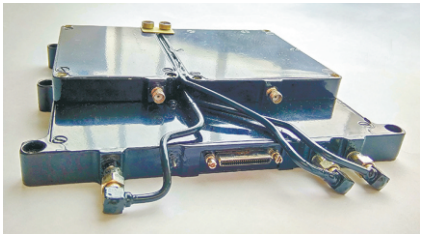
WS No.3 is dedicated to simulate working of control mechanisms and their operation at different flight stages.

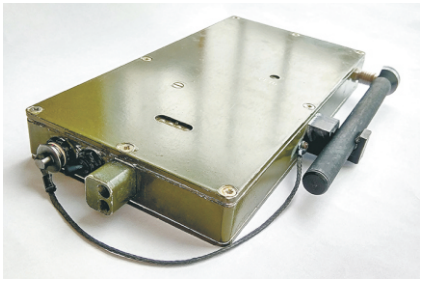
WS No.4 is dedicated to simulate failures of UAV devices and registration of UAV flight telemetric information.

WS No.5 is dedicated to simulate external shok impacts on UAV during a flight and allows:
- setting of wind;
- setting of turbulence;
- setting of earth's gravitational field and etc.

WS for UAV flight dynamics. It is dedicated to estimate UAV angular position and location in the space in the fixed and Earth navigation coordinate systems with reference to the internal forces and external disturbance effects.

RADIO SYSTEM RS-50





PURPOSE

The radio system RS-50 is designed to be used in the unmanned aircraft systems (UAS) for connection with an unmanned aircraft vehicle (UAV)

TASKS TO BE SOLVED

Data transfer from UAV to the ground control post (GCP)
Control commands transfer from GCP to UAV
Data transfer from UAV to the ground terminal (GT)

FEASIBLE FUNCTIONS

Information transmission from the Ground Control Station to the UAV:
-Command transmission (L-band)
Information transmission from the UAV to the Ground Control Station:
-Telemetric, navigational transmission (L-band)
-Broadband (imagery) transmission (S-band)
Communication range between the ground Control Station and the UAV is up to 50 km. The communication range between the UAV and Ground terminal is up to 10 km in the direct line of sight.
Frequency spacing is 1 MHz
Data exchange rate (commands, telemetry and navigational data) in L-band between the on-board radio modem and the ground radio modem is up to 400 kbps.
Data transmission rate from the on-board radio modem of the broadband (imagery) information in S-band is up to 5.5 mbps.

PECULIARITIES

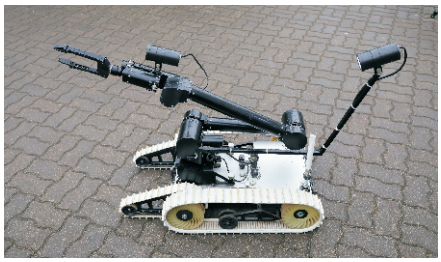
Digitization of analog video signal (PAL) coming from analog video camera, compression of digitized video according to JPEG2000 standard and its transmission via video channel (S-band).
UAV tracking by the ground-based radio modem in the manual mode (upon the commands from the ground control station) and in the automatic mode.
UAV range measurement at the ground-based radio modem allows obtain the information about the UAV position if there no coordinates from the receiver of the UAV satellite navigation systems.
Technical masking based on the open encryption algorithm.
The use of direct spread spectrum to improve noise immunity and security of information exchange in the control channel (L-band).
Availability of the special terminal module as a part of the radio system that ensures unlimited number users with respect to the information received directly from the UAV.

MAIN CHARACTERISTICS

Parameter name	Value		
	Ground radio modem	On-board radio modem	Terminal radio modem
Operating frequency range, MHz	range I - L, range II - S		II - S
Modulation type	BPSK		
Communication range, km	50		5
Operating mode	I - half duplex (TDMA) II - simplex	I - half duplex (TDMA) II - simplex	I - half duplex (TDMA) II - simplex
Data rate (when error probability per bit is no more than $1x10^{-7}$), Mbit/s	I - 0,2 II - 5		II - 5
Transmitter output power, W	I - 8	I*- 0,5 II*- 0,6	
Antenna power gain, dB	I – 11 II - 19	I - 1 II - 4	II - 4
Receiver sensitivity, dBm	I –96 II –90	I – 96	I – II – 90
Encryption	+		
Graphic compression format	JPEG 2000		
Types of supported external interfaces	Fast Ethernet 10/100 RS-485/RS-422	- Fast Ethernet 10/100 - RS-485/RS - 422 - analogue PAL	- Fast Ethernet 10/100
Tracking	automatic; upon the command from external equipment		
Power supply voltage, V	from 24 to 31	from 9 to 31	from 9 to 31
Power consumption no more, W	180	40	10
Overall dimensions, mm	1022x585x215	163x168x33	137x216x27

* Operating frequency range:
L-band (control, telemetry)
Frequency rang II – S-band (broadband imagery information)

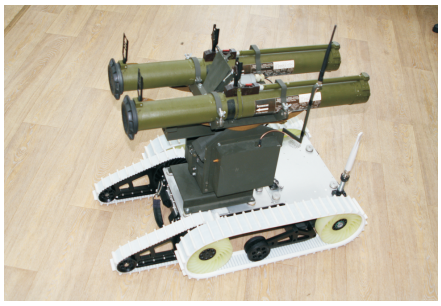
ROBOT-A1 MOBILE ROBOTIC SYSTEM



FUNCTIONS

The system is designed to carry out remote engineering and pioneering tasks using the manipulator and detachable equipment (payloads), visual and audio-visual reconnaissance, detect adverse factors and radiation in the environment, detect explosive vapors, transportation of cargo.

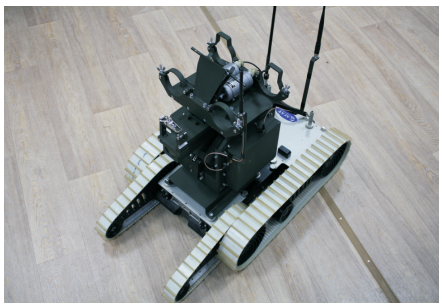
The robotic complex can be used as a mobile platform to mount automated remote-controlled observational and surveillance-fire complexes.



TECHNICAL CAPABILITIES

“Robot-A1” Mobile Robotic System is equipped with a multifunctional multilevel manipulator that may perform precision transporting and primary inspection of suspect items, or may be used for passage of obstacles thus enhancing the MRS terrain performance.

The batteries provide autonomous operation up to 5 hours at the temperature above zero. The batteries may be promptly changed in the field.



FEATURES/ADVANTAGES

The high terrain performance and mobility of the chassis, combined with operation via wireless and optical communication links enable to use the mobile robotic system both outdoors and indoors, as well as in conditions of active jamming, poor visibility and accessibility.

The system software and the wide range of available interfaces enable connection and configuration of new payloads thus enhancing functionality of the mobile robotic system.

AGAT
CONTROL SYSTEMS

OJSC «AGAT-Control Systems-Managing Company of Geoinformation Control Systems Holding»
117 Nezavisimosti Avenue, Minsk 220114 REPUBLIC OF BELARUS
tel. +375 (17) 337 54 55; fax +375 (17) 374 24 50; email: agat@agat.by