

“Multirotor UAV in project 14.B37.21.1243”

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UAV developed in MIIGAiK

- SCB “Impulse”






- SCB “Krechet”

SCB "Krechet" is working on several platforms for use in cartographic monitoring

| № | Features | Krechet Aircraft | Krechet Aerostat |
|----|--|------------------|-------------------|
| 1 | Deployed size, length*width*height, mm | 1800*1500*430 | 2000*2000*4000 |
| 2 | Transport size, length*width*height, mm | 350*1500*430 | 400*400*400 |
| 3 | Speed of level flight, km/h | 40...100 | 0..max wind speed |
| 4 | Operating altitude, m | 60...1000 | 0...300 |
| 5 | Flight duration, min | Up to 50 | Unlimited |
| 6 | Maximum take-off weight, kg | 3,5 | 8 |
| 7 | Maximum payload, kg | 1,2 | 5 |
| 8 | Working temperature, °C | -25°.. +50°C | -20°.. +50°C |
| 9 | Wind speed at launch, not more than, m/sec | 8 | 12 |
| 10 | Wind speed at an altitude of 300 m, not more than, m/sec | 15 | 12 |
| 12 | Size of landing area, not less than, m*m | 2*30 | 3*3 |
| 13 | Servicemen | 2-3 | 2-3 |
| 14 | Engine (electric power), item | 1 | - |



| Feature | Quadcopter "Schmidt" | Hexacopter "Juggernaut" | Octocopter Topocopter "Dreadnought" | |
|---|-----------------------------|----------------------------|---|---|
| Deployed size, length×width×height, mm | 350x350x270 | 825x825x325 | 1100×1100×450 |  |
| Transport size, length×width×height, mm | 350x350x150 | 825x300x325 | 1100×1100×250 | |
| Speed of level flight, km/h | 0÷55 | 0÷45 | 0÷50 | |
| Operating altitude, m | 5÷250 | 10÷350 | 10÷450 |  |
| Maximum altitude, km | 2 | 2 | 2 | |
| Flight duration, min | Up to 25 | Up to 20 | Up to 20 | |
| Maximum take-off weight, kg | 2,5 | 6 | 10 | |
| Maximum payload, kg | 0,8 | 2,5 | 4 | |
| Take-off weight, kg | 1,4 | 3 | 5 | |
| Working temperature, °C | -25 ÷ +50 | -20 ÷ +40 | -25 ÷ +50 | |
| Wind speed at launch, not more than, m/sec | 6 | 8 | 10 | |
| Wind speed at an altitude, not more than, m/sec | 8 | 10 | 12 | |
| Size of landing area, not less than, m*m | 1×1 | 2×2 | 3×3 | |
| Servicemen | 1-2 | 1-2 | 2 |  |
| Engine (electric power), item | 4 | 6 | 8 | |
| Additional route camera (resolution) (Control of the axes) | No | No | Yes, (752x582), (2 axes) | |
| Portable | No | Yes | No | |
| Application | Monitoring, security forces | Monitoring | Cartography, Monitoring | |

Multicopter UAV, which is developed in SCB MIIGAiK «Krechet», – octocopter «Dreadnought». This drone can be used to receive snapshots, applicable in map (or site plan) creating/updating, forming of digital terrain model, making 3D-models of buildings and objects, thermographic maps, panoramic surveying and also monitoring of natural and manmade emergencies development.



Functions & elements of ground control

When we use multirotor UAV in cartographic monitoring, it must be considered as a complex with its equipment (instrumentation) and payload. Its called UAS – Unmanned Aircraft System. UAS consist of payload and ground control.

What is it for?

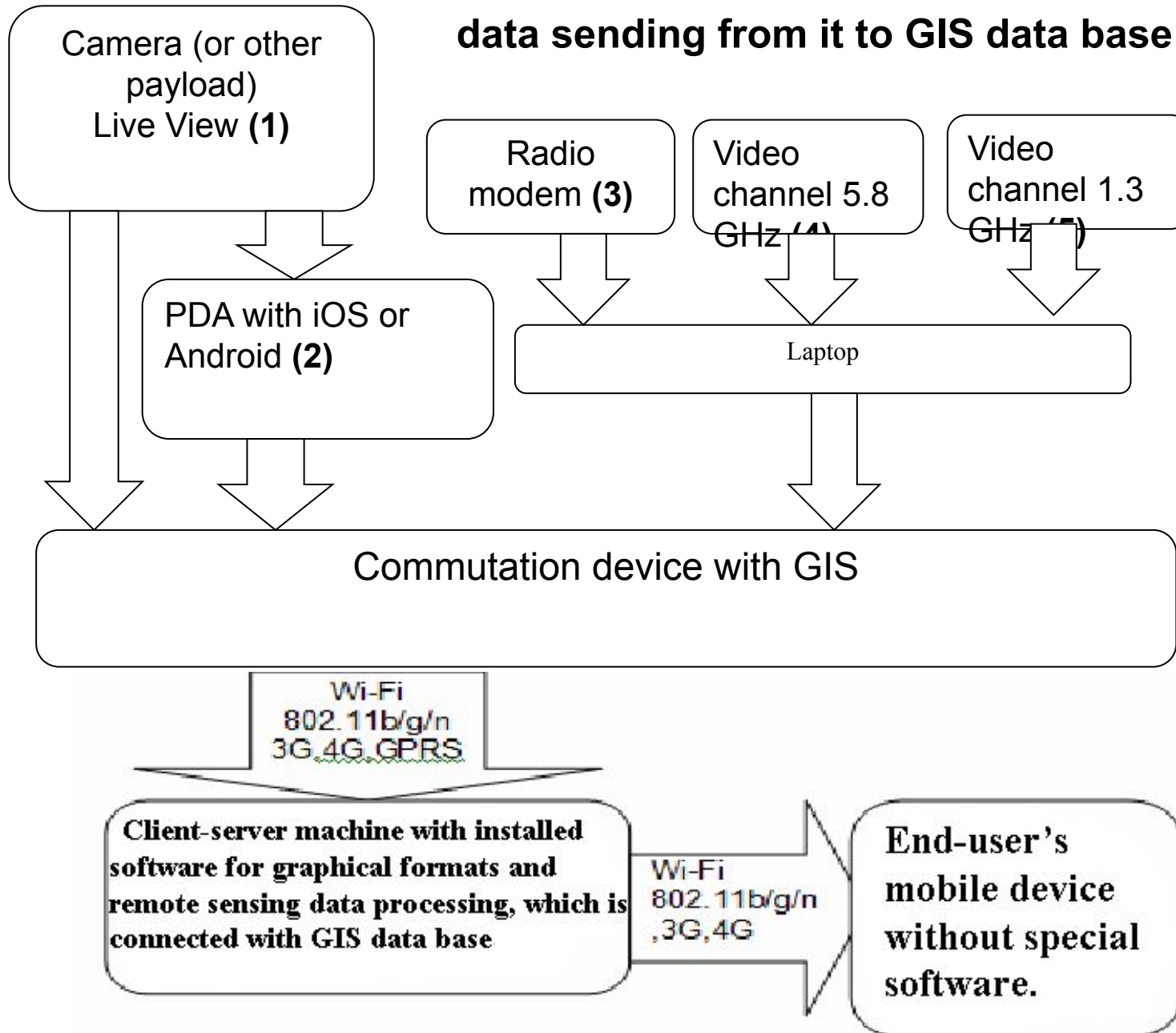
- Automatic flight control;
- Flight navigation;
- Flight task input and processing;
- Setting up a wireless link with an operator;
- Data receiving, processing and storage (Video and Telemetry);
- Input of UAV control signals.



Data, which is receiving by operators



Flowchart of multicopter UAV «Dreadnought» data sending from it to GIS data base & end-user



What can you find in UAV payload?

- Digital camera (including Video camera)
- Thermographic camera
- IR-camera
- Radiolocation equipment (Sonar)
- Geiger counter



Examples of UAV “Dreadnought” survey:

Altitude: 100 meters

Camera: Canon 550D

Camera lens: 18 mm

Overlap: 65%

Flight duration: 8 minutes

Flight speed on a route: 5 meters/sec



Geodesic range



3D terrain model. Perspective view

Some tests were carried out in
IR-survey



Survey of fires in Smolensk region, near town Gagarin, with wide-angle camera lens



The ways of multirotor UAV usage in environment monitoring:

- Cartographic monitoring
- Topographic survey
- Multispectral survey
- Thermographic survey
- Geology
- Cadastre (stereo image)
- Emergency control
- Tasks of agro-industrial complex
- Snapshots for 3D modeling
- Agriculture: control of farms & fields condition
- Ecological monitoring:
 - radiation;
 - chemical pollution;
 - bacteriological pollution.

Usage of results in studying & education

- Experience of UAV development, its usage and data processing embeds in educational program of MIIGAiK.
- One of the main tasks of our project (ГИОК ДЗЧС) is a development of special educational courses.