Siberian Federal University

School of Space and Information Technologies

An Automatic Test Complex for Unmanned Aerial Vehicle Engines

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Metrological Support of Innovative Technologies

СИБИРСКИЙ ФЕДЕРАЛЬНЫЙ УНИВЕРСИТЕТ

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Tasks of aircraft ground testing:

Ground Autonomous Tests (GAT):

Qualitative performance check and reliability assessment of the main units and systems: engines, control systems, supporting structures, etc.

Ground Complex Tests (GCT):

Comprehensive verification the combined action of individual units and systems in conditions close to flying.

Ground tests for external factors:

- climatic factors;
- vibration effects;
- shock effects;
- linear accelerations;
- acoustic noise;
- combined tests, etc.

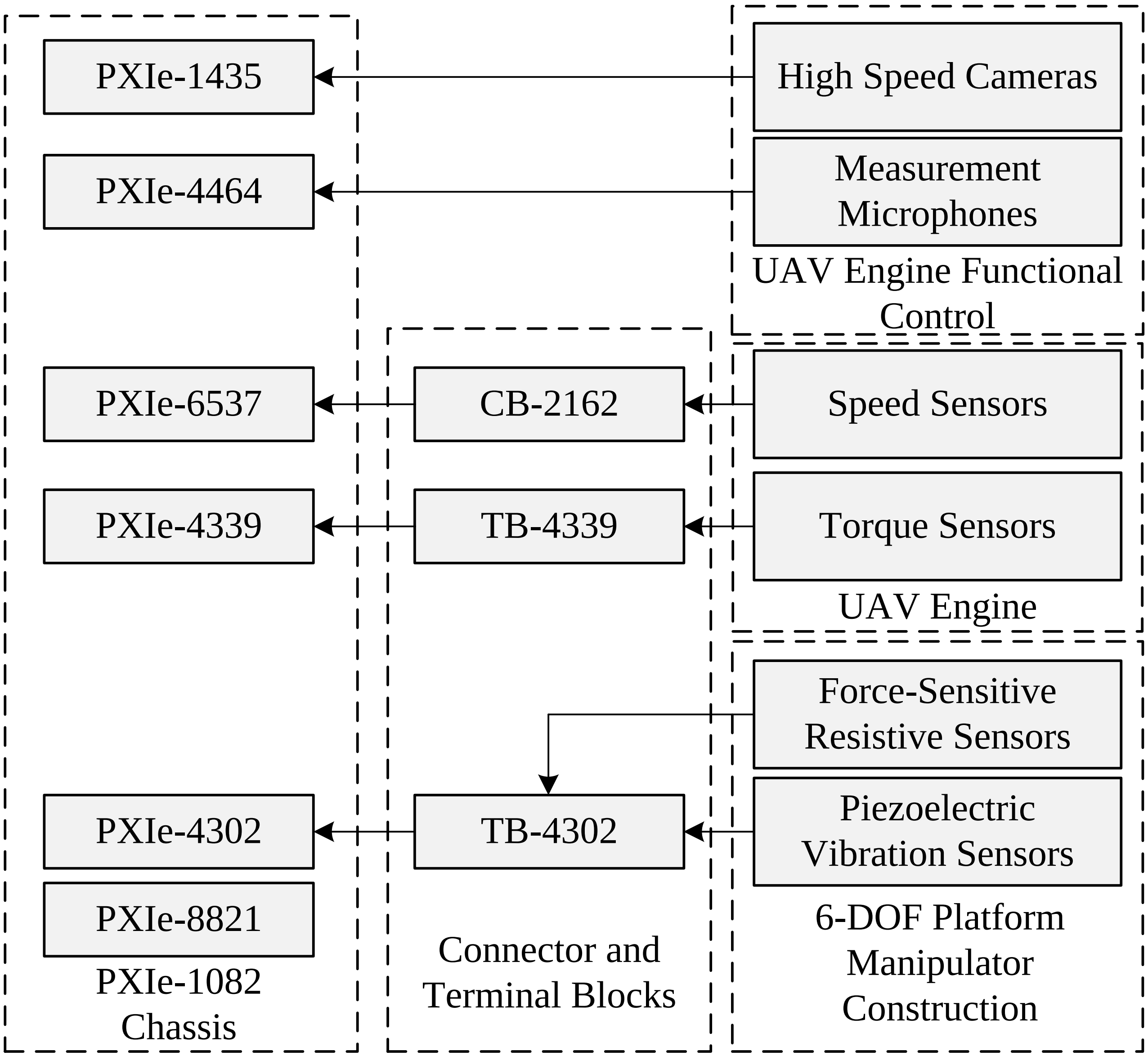
Resource-saving technology for debugging UAV systems:

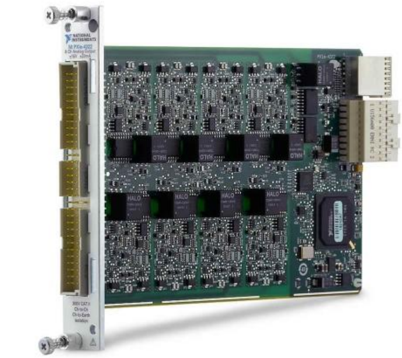
- predominance of mathematical and semi-natural modeling in comparison with field investigation;
- ensuring the reliability and adequacy of ground-based tests of the UAV components to their regular functioning;
- conducting unit testing of on-board software.

Measurements and tests:

- torque, speed and power on the propeller shafts of UAV propulsion devices;
- forces acting along the longitudinal, transverse and vertical axis of the moving platform;
- electric power consumed by the UAV engine;
- UAV vibration and acoustic characteristics;
- video recording of UAV operation process;
- documentation and visualization of measurement results.

The UAV Engine Test Complex:





Technical characteristics and results of tensometric measurement assessment:

Parameters	Values
1. Digital input/output channels	32
2. Analog input channels	32
3. Analog input channels with galvanic isolation	8
4. Analog input channels for bridge-based sensors	8
5. Input frequency range	5 Hz–5 kHz
6. Measuring range of forces acting on the moving platform	5–1000 N
7. Measuring range of moments acting on the longitudinal, transverse and vertical axis of the moving platform	1–100 N·m
8. PVS dynamic acceleration range	up to 500 m/s^2
9. PVS operating frequency range	2 Hz–10 kHz
10. Nominal TS torque	50 N·m
11. Maximum speed of the TS shaft	8000 rpm

Parameter name, measurement conditions, unit	Parameter value
1. Weight applied to the force-sensitive sensors s_1, s_2 mounted on the movable support pair (I), the value of calibration weight is 10 g, N	s_1: 0.0982, s_2: 0.0941
2. Calculation results of the force vector components, the mass distribution at the support attachment points: I – 10 g, II – 20 g, III – 50 g	x-axis: 0.0036, y-axis: 0.0037, z-axis: -0.0320
3. Calculation results of the force moment vector components, the mass distribution at the support attachment points: I – 10 g, II – 20 g, III – 50 g, N·m	x-axis: 0.0034, y-axis: -0.0032, z-axis: 0.0000
4. Mass applied to the center of gravity of the moving platform, the value of calibration weight is 10 g, N	0.1460
5. Duration of the transition process for the force-sensitive sensors, the value of calibration weight placed at the support attachment points I–III is 20 g, s	s_1: 1.78, s_2: 1.87, s_3: 1.80, s_4: 1.85, s_5: 1.82, s_6: 1.80