Materials for individual work – subject KEI/KT

Each student chooses one of the topics of the semester work by the end of the 4th week of the course at the latest. It is necessary to find and study relevant sources of information on the chosen topic and prepare an oral presentation with slides for about 30 minutes. This is followed by a defense of the presentation with a technical discussion for 10 minutes. Use current conference papers, articles in professional periodicals, technical documentation of technology manufacturers to prepare slides and oral presentation. Focus on current trends in the field or on unusual promising solutions. In the presentations, state the sources of the given information for possible retrieval of details.

Topics of individual work

1) Solutions of mechanical construction of satellites – workout a review of conventional materials, production processes and mechanical arrangement of satellite constructions. Search for the use of composite or other materials used in structures and the possibility of 3D printing of structures. Topic booked for:

2) Power supplies for satellite systems – workout a review of solar cells designed for satellites, their basic materials and the design of the deployable mechanisms. Search for other satellite power supply options (power harvesting, thermoelectric generators, electrodynamic tethers and others). Topic booked for:

3) Attitude determination systems for satellites – workout a review of various sensors for attitude determination systems of satellites (Sun sensor, NADIR sensor, star tracker, horizon detector and others). Introduce products with different degrees of accuracy for orientation determination and for different sizes of satellites. Topic booked for:

4) Attitude control systems for satellites – workout a review of different methods for passive and active stabilization of the satellite's orientation and for its active control. Introduce individual products (magnetic coils, reaction wheels, momentum wheels, gravity gradient stabilization, hysteresis and viscous dampers and others). Topic booked for:

5) Systems for orbital maneuvers of satellites – workout a review of different types of propulsion systems that allow satellites to stabilize or change their orbital trajectory. Introduce the basic parameters of these systems and find the individual products on the market (ion thruster, cold gas thruster, hot gas thruster, solar sail and others). Topic booked for:

6) Satellite communication systems – workout a review of the market for available communication subsystems for satellites of various sizes. Focus not only on radio communication systems in various bands (UHF, L, S, X, Ku, Ka and others), but also on laser subsystems for satellite to satellite and satellite to ground station communication. Topic booked for:

7) Phased array antennas for satellites – workout a review of phased array antennas for satellites and their properties for specific network or services (Iridium, GlobalStar, Starlink, OneWeb,…). Focus on antennas designed for satellite mobile and data communication networks, for navigation systems, or for systems for interplanetary probes. Topic booked for:

8) Radiation protection of satellites in the form of electronic countermeasures – workout a review of methods for the design of electronic systems as a radiation-tolerant. Focus on concepts such as hot-redundancy, cold-redundancy, triple modular redundancy, error correction code, watch-dog circuit and others with examples of their use. Topic booked for:

9) Radiation protection of satellites in the form of shielding materials – workout a review of conventional shielding materials (with a high atomic number) as well as new materials based on plastics and metallized composites (LDPE, Kevlar and others). Search for shielding designs from different layers graded by atomic number. Topic booked for:

10) Facilities for testing of satellites and types of tests – workout a review of tests prescribed for satellites qualification and acceptance and find related standards. Carry out a search of the specialized infrastructure (thermo-vacuum chambers, vibration testbed, EMC chambers and others) in which this testing takes place. Topic booked for:

11) Satellite platforms and their features – workout a review of the satellite platforms available on the market for different satellite sizes. Search for standard available options (selectable subsystems) for these platforms and their technical parameters. Topic booked for:

12) Payload adapters and their properties – workout a review of different payload adapters for different rocket launchers. Also introduce different separation mechanisms and small satellite deployers / dispensers. Topic booked for:

13) Interesting space missions in terms of used technologies – workout a review of interesting space missions (interplanetary missions, asteroid missions, moon missions, etc.) and introduce details about their technical solution in terms of used subsystems (communication, orientation, maneuvering, sensors, actuators and others). Topic booked for:

14) Interesting landing modules in terms of used technologies – workout a review of interesting landing modules (interplanetary missions, missions to the moons, missions to asteroids) and introduce details about their technical solution and landing methods. Topic booked for:

15) Interesting rovers and drones in terms of used technologies – workout a review of interesting rovers and drones used in interplanetary missions or missions to the moons. Introduce details about their technical solution. Topic booked for:

16) Current and future rocket launchers – workout a review of the currently used or developed rocket launchers of space agencies and private companies. Introduce their basic properties. Topic booked for: