

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)  
Future Space Transportation Systems Technologies (5)

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TSAGI'S AEROSPACE TECHNOLOGY BASIS FOR INTEGRATED RESEARCH OF NEW SPACE  
TRANSPORTATION SYSTEMS

**Abstract**

Long before the space era its founders connected future space transportation system trends with use of the atmosphere. Today, when aviation has accumulated substantial experience in atmospheric flight, there are no objective barriers to realize these ideas.

Central Aerohydrodynamic Institute (TsAGI) as a key Russian aviation research center with a wide complex of test facilities and schools of thought, has taken an active part in all national and many international space programs: from the first launcher R-7 and reentry vehicle "Vostok" up to STS "Energia - Buran" and new projects of space transportation systems. Distinctive feature of these investigations has been an integrated approach to solution of problems in aerothermodynamics, dynamics and control, strength, acoustics, and reliability of aerospace vehicles at stages of injection, returning separated parts, orbital maneuvers and interplanetary flights, entry into an atmosphere of the Earth and planets, automatic landing.

Directions of further development of the scientific and technological base are determined in TSAGI's Aerospace Research Program approved last December and agreed by ROSCOSMOS.

Studying characteristics of atmosphere and its optimal use are determined as one of promising ways to increase the efficiency, reliability and safety of aerospace vehicles. This work has a complex nature and includes solution of following problems:

- Analysis and modeling global and regional atmosphere, issuing national and international standards
- Fundamental aerothermodynamic problems
- Airbreathing powerplant gasdynamics
- Flight dynamics and control of aerospace vehicles in atmosphere
- Multidisciplinary optimization
- Development and expertise of STS projects
- Investigation of effective aviation means to deliver aerospace vehicles and their parts, etc.

The other direction is connected with optimization of use of unique test facilities of TsAGI and other aeronautical institutes integrated in National Aeronautical Center. Unique technologies of new materials study, remote measurements of aircraft/flow conditions, precision measurements of mass-inertial and frequency characteristics, and CAD/CAM/CAE have been developed.

The third direction is connected with system investigations of future aerospace transport and verification of test facilities and codes. There are considered the development of new technology demonstrators and the use of experimental launch vehicles.

The paper contains a summary of the Program and particular ways of its realization within frameworks of national and international cooperation for development of perspective expendable and reusable space transportation systems.