NASA's Spaceliner 100 Investment Area Technology Activities

Uwe Hueter[1]
NASA/Marshall Space Flight Center
Huntsville, AL 35812
U.S.A.

NASA's has established long term goals for access-to-space. The third generation launch systems are to be fully reusable and operational around 2025. The goals for the third generation launch system are to reduce cost by a factor of 100 and improve safety by a factor of 10,000 over current conditions. The Advanced Space Transportation Program Office (ASTP) at the NASA's Marshall Space Flight Center in Huntsville, AL has the agency lead to develop space transportation technologies. Within ASTP, under the Spaceliner100 Investment Area, third generation technologies are being pursued in the areas of propulsion, airframes, integrated vehicle health management (IVHM), launch systems, and operations and range. The ASTP program will mature these technologies through ground system testing. Flight testing where required, will be advocated on a case by case basis.

The SL 100 Investment Area has as its primary objectives significant improvement in safety and reduction of payload transportation cost to low earth orbit (LEO) to approximately $100/lb by maturing vehicle technologies. The plan is to substantially increase the design and performance margins of the third generation RLV (the Space Shuttle is the first generation) by incorporating advanced propulsion systems, such as rocket or turbine-based combined cycle (RBCC or TBCC) and advanced materials, structures, thermal protection systems, and avionics. Advancements in design tools and better characterization of the operational environment will improve design margins. Improvements in operational efficiencies will be obtained through the introduction of integrated health management, operations and range technologies. The increase in margins will directly reduce the high operational costs associated with today's vehicles by allowing components to operate well below their design points resulting in improved component operating life, reliability, and safety which in turn reduces both maintenance and refurbishment costs. The introduction of advanced technologies may enable horizontal takeoff by reducing the takeoff weight thus permitting the utilization of existing infrastructure. This would be a major step toward the goal of airline-type operation. These factors in conjunction with increased flight rates from an expanding market will result in significant improvements in safety and reductions in operational costs of future vehicles.

The propulsion projects under Spaceliner 100, are actively developing combination/combined-cycle propulsion technologies, both rocket and turbine based, that utilized airbreathing propulsion during a major portion of the trajectory. System

[1] Manager, Spaceliner 100 Investment Area

integration, design tools, components, materials and advanced rocket technologies are also being pursued. Over the last several years, one of the main thrusts has been to develop rocket-based combined cycle (RBCC) technologies. The focus has been on conducting ground tests of several engine flowpaths to establish the RBCC performance. Vehicle system studies are also being conducted to assess potential operational space access vehicles utilizing combined-cycle propulsion systems. The design, manufacturing, and ground testing of a subscale flight-type engine are planned. A leader follower approach is being taken toward flight testing of these propulsion systems. The leader flight demonstrator is planned to be a RBCC propulsion system and is envisioned to fly around 2006. The follower flight demonstrator has not been selected, however a turbine-based combined cycle is one possibility.

The airframe technologies being pursued are integrated airframe designs, integrated structures and materials, thermal protection system, structures and materials, and aero/aerothermal enhancements.

IVHM is responsible for the system engineering and integration of the health management system for all the subsystems. IVHM will develop the health monitoring technologies for the propulsion, structures, TPS, avionics, power, and ground operations subsystems.

The launch technologies include the avionics, power, and flight control.

The operations and range technologies being pursued are Spaceport range and operations, ground operations, and launch-assisted takeoff.

The paper describes current status, future plans and technologies that are being matured by the SL 100 Investment Area under the Advanced Space Transportation Program Office.