Aeronautics Technology Theme Awards

Objective: Aviation Safety

Under a NASA Space Act Agreement, NASA Langley Research Center and Unitika Ltd. developed TEEK, a low-density, flame-resistant polyimide foam that provides excellent thermal and acoustic insulation and high-performance structural support. The synthesis of TEEK begins with a salt-like monomeric solution to yield a homogeneous polyimide precursor solid residuum. Utilizing state-of-the-art foaming techniques, the polyimide precursor solid residuum can be reacted into a variety of forms including, but not limited to, neat foam, syntactic foam, foam-filled honeycomb and microspheres. Over 25 different polyimide precursors have been processed into lightweight, high-strength polyimide foam for extreme temperature applications.

Jet Engine Containment Concepts and Blade-Out Simulation Team
NASA Glenn Research Center; Federal Aviation Administration; Rolls-Royce; The Boeing Company; General Electric Company; Honeywell; A&P Technology; Williams International; North Coast Composites; North Coast Tool & Mold; Cincinnati Testing Laboratories; MSC Software; Ohio Aerospace Institute; Ohio State University; University of Akron

Objective: Protect the Environment

The future of gas turbine engines lies in successfully introducing high-temperature, lightweight components that require little or no cooling to improve performance. Ceramic matrix composite (CMC) components meet these requirements while enabling increased efficiency and reduced emissions, thus protecting local and global environmental quality. System studies demonstrate a 400°F increase in thermal capability of a gas turbine hot section results in a reduction of billions of pounds CO and CO2 for a commercial fleet of 300 aircraft. CMC turbine vanes and combustor liners developed under NASA Glenn's Ultra-Efficient Engine Technology Project have demonstrated a 500°F increase in temperature capability over current superalloy and metallic components. CMC components are an enabling technology for the reduction of NOx emission as well. This advanced material system, developed jointly by NASA, General Electric Aircraft Engines, Pratt & Whitney, and CMC manufacturers, consists of a silicon carbide fiber reinforced silicon carbide matrix and an environmental barrier coating to protect the CMC from the gas turbine environment. Coated CMC components appear in engine development plans and program at all gas turbine engine manufacturers and are recognized industry-wide as the solution for emission reduction and efficiency improvements.

Coated Ceramic Matrix Composite Components Team
NASA Glenn Research Center; U.S. Army Research Lab; Department of Energy; GE Aircraft Engines; Pratt & Whitney; United Technologies Research Lab; Solar Turbines, Inc.; GE Power Systems Composites; COI Ceramics, Inc.; Goodrich Corporation; Ohio Aerospace Institute; the University of Toledo; Cleveland State University; QSS Group, Inc.

Objective: Increase Capacity and Mobility

The Surface Management System (SMS) is a decision support tool developed by NASA that will help air traffic controllers and air carriers manage arrivals and departures with greater efficiency, flexibility, and safety. NASA's commitment to improving the air traffic management system by building collaborative tools was again demonstrated in October 2003 during an operational evaluation of SAMS at Memphis Tower, Memphis TRACON, and Memphis Center. Representatives from major airlines and air traffic control participants were involved in this study. The field evaluation indicated that SMS may provide important benefits to a variety of users within the NAS.

Surface Management System Development Team
NASA Ames Research Center; Raytheon Company; Network Centric Systems; FedEx; Metron Aviation, Inc.; Northwest Airlines; the Titan Corporation; Advanced Air Transportation Technologies; Federal Aviation Administration; Booz Allen Hamilton; San Jose State University Foundation

Objective: Partnerships for National Security

The Shaped Sonic Boom Demonstration Team successfully completed the validation for a technique for reducing the intensity of sonic boom noise. This validation paves the way for development of aircraft that could fly overland at supersonic speeds without disturbing people on the ground. Such capability is a clear benefit for civil aircraft, decreasing travel time and improving mobility, and could potentially have benefits to future military aircraft. The Shaped Sonic Boom Demonstration Team was a unique and effective Department of Defense-NASA-industry cooperation, which brought together the best intellectual capability in a pre-competitive effort to produce data of real value to all participants.

Shaped Sonic Boom Demonstration Team
NASA Langley Research Center; Dryden Flight Research Center; NASA Glenn Research Center; NASA Headquarters; Lockheed Martin Aeronautics Company; Defense Advanced Research Projects Agency (DARPA); The Boeing Company; U.S. Air Force Research Laboratory; Northrop Grumman; General Electric; Eagle Aeronautics, Inc.; Gulfstream Aerospace; Naval Air Systems Command; Raytheon Aircraft; Wyle Laboratories; Institute for Defense Analysis; U.S. Air Force Aeronautical Systems Center

Objective: Partnerships for National Security

The AWS project was created in the wake of the wing-drop problem discovered in the F/A-18/EF Super Hornet flight test program. Wing drop, which occurs when either the left or right wing panel stalls before the other, results in significant rolling motion. Technology to reliably predict this type of undesirable flight characteristics in the wind tunnel or with computations did not exist. Moreover, many modern aircraft have experienced similar issues. Consequently, the goal of the AWS project was to be able to predict, and therefore, preclude, uncommanded lateral motions such as sing drop before a new vehicle program would even begin costly developmental flight test. The effort focused on evaluating predictive metrics for the wind tunnel and computations, developing new wind tunnel methodologies, and assessing the ability of computations tools to tackle the complex unsteady, and massively separated, transonic flows associated with stall. Technology developed by this project ahs already benefited the Join Strike Fighter program.

Abrupt Wing Stall (AWS) Team
NASA Langley Research Center; NASA Ames Research Center; Office of Naval Research; Naval Air Systems Command; U.S. Air Force Research Laboratory; The Boeing Company; Lockheed Martin Aeronautics; Ball Aerospace; U.S. Air Force Academy

Objective: Partnerships for National Security

The Active Aeroelastic Wing (AAW) project at NASA's Dryden Flight Research Center is researching active control of lighter-weight flexible wings on a modified F/A-18A to demonstrate aircraft roll control through aerodynamically induced wing twist. A joint effort of the Air Force Research Laboratory, Boeing's Phantom Works and NASA Dryden, AAW has developed aircraft loads and aerodynamic models to aid design of control laws that will take advantage of the lighter, more flexible wing. AAW research could enable thinner, higher aspect-ratio wings on future aircraft, resulting in reduced weight and aerodynamic drag, allowing greater range or payload and improved fuel efficiency.

Active Aeroelastic Wing (AAW) Program
Dryden Flight Research Center; NASA Langley Research Center; The Boeing Company; U.S. Air Force Research Laboratory

Objective: Explore Revolutionary Aeronautics Concepts

The Environmental Research and Sensor Technology (ERAST) project was a joint NASA-industry technology development project directed toward maturing unmanned aerial vehicle (UAV) technology and an industry that could support high-altitude civil applications. During its nine-year span, ERAST evaluated several UAV prototype aircraft technologies such as propulsion, aerodynamics, and structures, and fostered development

of miniaturized sensors. Significant achievements by ERAST included the attainment of altitude and duration records. Major demonstrations included flights in the national airspace, science observations above developing thunderstorms, calibrating satellites, monitoring crops to aid farmers, observing tropical reef health, and serving as a high altitude relay for the next generation of cell phones and digital television.

Environmental Research and Sensor Technology (ERAST) Unmanned Aerial Vehicle UAV Team
Dryden Flight Research Center; NASA Ames Research Center; NASA Glenn Research Center; NASA Langley Research Center; NASA Headquarters; Old Dominion University; New Vistas International; High Technology Solutions, Kauai Office, Aerovironment, Inc.; Modern Technology Solutions, Inc.; Longitude 122 West; Kauai Community College; General Atomics Aeronautical Systems, Inc.; Advanced Soaring Concepts; Thermo Mechanical Systems, Inc.; Niihau Ranch; Hyperspectral Sciences; Morgan Aircraft & Consulting; Scaled Composites; Kauai Airborne Sciences; Pacific Missile Range Facility; U.S. Navy; Aurora Flight Sciences; Association of Unmanned Vehicle Systems International; Technical Analysis & Applications Center/New Mexico State University; American Technology Alliances, Inc.

Space Launch Initiative Theme Awards

Objective: Assured International Space Station Access

"Working Together We Accomplish More"—The Integrated Powerhead Demonstrator Project, a joint Air Force and NASA project, successfully conducted tests on critical components to be used in its upcoming demonstrator engine. The technical and test teams from Aeroject, the Air Force Research Laboratory, Boeing-Rocketdyne Propulsion and Power, NASA Marshall Space Flight Center and NASA Stennis Space Center combined to demonstrate the feasibility of many new rocket engine technologies through a series of cold flow and hot fire tests at NASA Stennis and Aerojet. Truly, this team has proven our motto that "Working Together We Accomplish More."

Integrated Powerhead Demonstrator Technical Staff
NASA Marshall Space Flight Center, NASA Stennis Space Center, Gencorp Aerojet, Air Force Research Laboratory, Boeing–Rocketdyne Propulsion and Power

Objective: Mission Safety and Reliability

Lightweight, high-temperature, actively cooled structures have been identified as a key technology for enabling reliable and low cost space access. Trade studies have shown this to be the case for a variety of launch platforms, including rockets and hypersonic cruise vehicles. Actively cooled carbon and ceramic matrix composite (CMC) structures offer the potential to meet high-performance goals at significantly lower weight, while simultaneously improving safety by operating with a higher margin between design temperature and material upper use temperature. Team dedication to this technology's promise has paid off in the technology demonstration of a 6x30" panel test in a scramjet

engine at United Technologies Research Center (UTRC). It is the world's largest cooled non-metallic matrix composite panel fabricated for a scramjet engine and the first cooled non-metallic composite to be tested in a scramjet facility. Projected weight savings from using this high-temperature heat exchanger in a hypersonic vehicle propulsion system is upward of 50 percent. In addition, it reduces part count and system complexity and offers advantages for off-design operating conditions since it can operate t higher temperatures (2900°F) than current state-of-the-art systems (1800°F).

Cooled Ceramic Matrix Composite Propulsion Structures Team
NASA Glenn Research Center; NASA Langley Research Center; NASA Marshall Space Flight Center; Modern Machine & Tools; Zin Technologies; Pratt & Whitney; United Technologies Research Center; QSS Group

Mission Science Measurement Technology Theme Awards

Objective: Mission Risk Analysis

During FY 2003, the Systems Analysis Project performed and delivered the results of three major studies of advanced space transportation systems to the Next Generation Launch Technology Systems Analysis Project: The Tiger Team Study, which examined conceptual hypersonic airbreathing propulsion-based space access systems for Far Term, (i.e., 2025 initial operational capability) mission applications; the Space Partnership Council Blue Team technical support package, which supported a Red Team review of the Near Term (i.e., 2015 IOC) mission potential of hypersonic space access systems; and the Common Booster Preliminary Study Report, which established the feasibility of a rocket-based Common Booster launch system for the Department of Defense and NASA Near and Mid Term (i.e., 2020 IOC) space lift needs.

Next Generation Launch Technology Systems Analysis Project Team
NASA Langley Research Center; NASA Ames Research Center; NASA Glenn Research Center; NASA Marshall Space Flight Center; NASA Johnson Space Center; NASA Kennedy Space Center; NASA Stennis Space Center; Andrews Space, Inc.; International Space Systems, Inc.; Lockheed Martin; McKinney Associates; Eloret; Northrop Grumman; Science Applications International Corporation (SAIC); Vitech Corporation; Space Propulsion Synergy Team; The Boeing Company; Jacobs Sverdrup; Hernandez Engineering, Inc.; Gormley & Associates; U.S. Air Force Research Lab; University of Alabama–Huntsville

Objective: Science and Engineering–Driven Architectures and Technologies

The first demonstration of NASA's capability to extend powerful computing resources to remote locations was performed on June 25, 2003, in the Utah desert. A team of scientists designed, performed and analyzed results of a ground truthing experiment to demonstrate technologies that will enable new science measurements and scientific missions. Ground truthing is a method of verifying the scientific validity of satellite images and clarifying

irregularities in that imagery. Previously, researchers had little or no near real-time data processing in remote locations and were unable to make informed decisions or maximize return-on-science while in the field. The experiment reduced the turnaround time of collecting/analyzing the data by 97 percent. This work demonstrated the ability of NASA's grid to support research by simultaneously combining data from two distinctly different instruments positioned at very distant locations, one terrestrial, one orbital. Data and orbiting images can be sent simultaneously to distributed computing resources (on Earth or Moon) for analysis and the results fed back to the explorers. This technology will greatly impact space exploration by gathering and synthesizing scientific data during planetary missions involving human and robotic exploration, guiding explorers to increased probability science targets, and even mitigating confusion (via voting) from Earth-based exploration requests initiated during the mission from hundreds of scientists on Earth.

Ground Truthing Team
NASA Glenn Research Center; NASA Ames Research Center; NASA Goddard Space Flight Center; University of Cincinnati; Bowling Green State University; RSIS, Inc.; Verizon; USRA-RIACS; AMTI; United States Geological Society; AKIMA

Innovative Technology Transfer Partnership Theme Awards

Objective: Extending Benefits To Society

Certification and commercialization of the Hybrid Ice Protection System is the culmination of a multi-year NASA effort to foster the development of practical, low-power ice protection technologies. Continued reduction of engine core sizes limits current aircraft designs, allowing less and less power for ice protection systems. Due to this power limitation, ice protection systems used in the past to protect aircraft are no longer viable options. The Hybrid Ice Protection system was developed in response to this lower availability. It operates at 25 percent of the power of an evaporative electro-thermal system, and enables aircraft designers to provide a high level of safety while maintaining the utility of operations in icing conditions. The system is particularly innovative because it is the first Federal Aviation Administration (FAA)-certified system to incorporate an electro-mechanical deicer. Introducing this new technology required the development of new techniques to demonstrate its conformity to established safety criteria. When the Raytheon Premier I aircraft was approved for flight into known icing conditions, the Hybrid Ice Protection System, used on the aircraft's tail, became the first FAA-certified new form of ice protection in 40 years.

Hybrid Ice Protection System Team
NASA Glenn Research Center; QSS Group, Inc.; InDyne, Inc.; Cox and Company; U.S. Army Aviation Systems Command; Raytheon Aircraft Company

Objective: New Sources of Technology for NASA

Turning Composites into Reality with two historic tanks!

A reusable liquid hydrogen propellant cryotank—Lightweight: A Kevlar honeycomb core in a sandwich construction yields 25 percent weight reduction from aluminum tank designs. Multifunction: Vented honeycomb is evacuated for thermal efficiency and permeation checks, or pressurized for flaw inspections. Smart Structure: Fiber optic temperature and strain monitors create real time surface maps to validate structural health.

A non-autoclave manufacturing sale-up cryotank—Advanced Manufacturing: a new process that consolidates material with ultrasonic energy. Reduced Cost: Eliminating the need for the autoclave saves over $30 million in manufacturing costs for large composite tanks and structures.

Composite Cryogenic Tank Team
NASA Langley Research Center; NASA Marshall Space Flight Center; Foster-Miller, Inc.; Northrop Grumman Integrated Systems; ATK

Agency Education and Outreach Goal Awards

Enterprise Contributions To Education and Outreach–Group Award

NASA Glenn Research Center is committed to developing the next generation of scientists and engineers by providing educational products, services, and personnel to learners. Additionally, Glenn is committed to educating the general public by explaining the benefits that are gained by investing in aerospace technology. Toward this end, Glenn participated in a bevy of national and international events, sustaining successful external partnerships and creating a broad repertoire of high quality educational and outreach products. The team has inspired an d motivated students to pursue careers in science, technology, engineering, and mathematics (STEM), and engaged the public in shaping and sharing the experience of exploration and discovery. Glenn's education and outreach is a coordinated effort by the Education and Outreach Initiatives Team (Educational Programs Office, Learning Technologies Project, and Ultra-Efficient Engine Technology Project) using the innovative approach of pooling together limited resources to allow the Center to make a substantial impact on NASA's education and outreach customers. Information technology and NASA's educational resources and multiple dissemination mechanisms were used to reduce the cost (online availability of products) and increase the reach to K-12 mathematics and science audiences and showcase NASA's aerospace technology programs.

NASA Glenn Education and Outreach Initiatives Team
NASA Glenn Research Center; InDyne, Inc.; NCI Information Systems, Inc.; N&R Engineering and Management Services; Integral Systems, Inc.; QSS Group, Inc.; Myriad Design Works; RSIS; Oklahoma State University; Ford Motor Company; University of Toledo; Fairview High School

Enterprise Contributions To Education and Outreach–Project Award

Edgarville Airport-Take Off to the Future of Air Travel is an interactive display developed by NASA's Airspace Systems Program. The display uses a three-dimensional, 180-degree, interactive, immersive environment with animated characters that guide users through a virtual airport. The purpose of this exhibit is to engage, entertain, and educate the public about National Airspace System operations and describe the work performed by the Airspace Systems Program. This exhibit has won numerous awards including a 2004 Telly Award, 2004 Aegis Award, 2004 Communicator Award, and the Houston International Film Festival Award.

Edgarville Airport-Take Off to the Future of Air Travel Team
NASA Ames Research Center; Raytheon Technical Services; Planners Collaborative; QSS Group, Inc.; NASA Airspace Systems Program

Associate Administrator's Choice Award

NASA Ames Research Center's Investigation Organizer (IO) tool provides unique capabilities in knowledge organization, information correlation, and causal analysis to investigation teams by fusing accident investigation methodology with web-based information sharing technology. This award recognizes the team that was dedicated to supporting the Columbia Accident Investigation Board (CAIB). Working under sometimes intense conditions, this team made a significant contribution. With IO, the Board could preserve the CAIB investigation in much greater detail than with just an archived database. In IO the investigation information was structured to provide not only the final report but to tell the entire investigation story.

Investigation Organizer Team Supporting the Columbia Accident Investigation Board
NASA Ames Research Center; Science Applications International Corporation (SAIC); Daniel, Mann, Johnson & Mendenhall; Computer Sciences Corporation; QSS Group, Inc.

Administrator's Award

The Mars Exploration Rover (MER) Mission is NASA's most complex planetary rover mission to date. At JPL's MER mission control, 240 scientists and engineers collaborated daily in shift around the cock to navigate twin rovers across the rocky Martian terrain. In collaboration with JPL mission managers and personnel, NASA Ames Research Center developed automated planning and scheduling, information management and data visualization tools for MER and provided work practice studies to help engineering and science teams better meet the telerobotic mission's technical and logistical challenges.

Advanced Information Technology Infusion Team for the Mars Exploration Rover 2003 Mission Team

NASA Ames Research Center; Jet Propulsion Laboratory; QSS Group, Inc.; Research Institute for Advanced Computer Science; Alertness Solutions; Science Applications International Corporation (SAIC); Deanza College; Computer Sciences Corporation; San Jose State University; Raytheon; Kestrel Institute; Office of Naval Research; Wright State University.