Technology update

Boeing showcases UCAV

Built for an advanced technology demonstrator program under a $131 million, 42-month cost-share agreement with the Defense Advanced Projects Research Agency (DARPA) and the U.S. Air Force, The Boeing Co. showcased major elements of its unmanned combat air vehicle (UCAV) demonstrator system. Components completed include the first of two unmanned air vehicles, a mission control console, and a storage container. System work is being carried out at company facilities in Seattle, St. Louis, Southern California, and Mesa, AZ. The company is funding $21 million of the program.

The program was awarded to the company in March 1999. It is designed to prove the technological feasibility of multiple UCAVs autonomously performing extremely dangerous and high-priority combat missions to augment the manned fighter strike force. The first such mission envisioned is the suppression of enemy air defenses.

The UCAV air vehicle features a stealthy, tailless, 27-ft airframe with a 34-ft wingspan. It has an empty weight of 8000 lb and can carry up to 3000 lb of payload. The system's reconfigurable mission control station features robust and secure satellite-relay and line-of-sight communications links for distributed control in air combat situations.

Because of their small size, lack of pilot interfaces and training requirements, reusability, and long-term storage capability, UCAVs are projected to cost up to 65% less to produce than future manned combat aircraft and up to 75% less to operate than current systems.

Boeing celebrates the completion of the first of two unmanned air vehicles for its UCAV system.

Future UCAV systems are envisioned to have multiple unmanned aircraft equipped with preprogrammed objectives and preliminary targeting information by ground-based mission planners. The missions can then be carried out autonomously but also managed interactively or revised en route by controllers should new objectives or targeting information dictate.

Following the return of the vehicle, it can be immediately prepared for another mission or dismantled and placed into a container for shipment elsewhere or storage up to 10 years. Container interfaces allow for periodic maintenance monitoring and software updating of the vehicle inside, which can be reassembled and prepared for combat within an hour.

Flight testing of the system's first vehicle is scheduled to begin in spring 2001. System testing with both air vehicles performing simulated suppression of air defenses missions is scheduled to begin in mid-2002.

Frank Bokulich

Interesting? Circle 5
Not interesting? Circle 6

Freeing up room on the 777

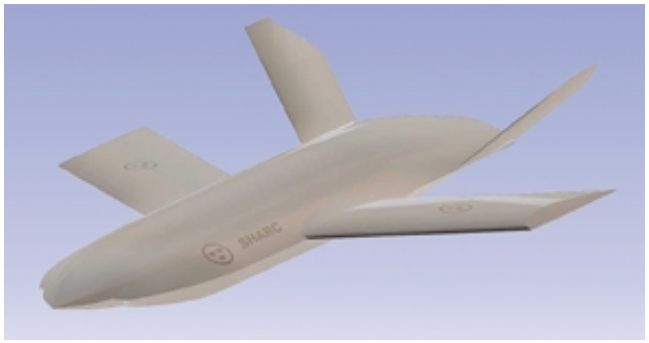
B/E Aerospace has shipped its first flight crew rest compartments for the Boeing 777 to British Airways, which is retrofitting 16 of its existing 777 aircraft. The new compartments house eight sleeping bunks and two seats in the overhead space in the aircraft's midsection. The overhead location frees up valuable cargo space because it replaces an existing crew rest area located in the cargo section of the aircraft. The compartment also weighs about half as much as the one it replaces, contributing to reduced fuel consumption.

Frank Bokulich

Interesting? Circle 7
Not interesting? Circle 8

UAV testing

Wind tunnel testing of a Saab Aerospace unmanned aircraft model has begun at the FFA (the Aeronautical Research Institute of Sweden) facility in Stockholm. Testing is part of an unmanned aerial vehicle (UAV) development project being carried out by Saab, the FFA, Ericsson, Saab Avionics, and Saab Dynamics. The UAV, called SHARC (Swedish Highly Advanced Research Configuration) measures 10 m long and has a wingspan of 8 m. The object of the wind tunnel tests is to provide a better understanding of the UAV's flight envelope.



Saab Aerospace's UAV, called SHARC, measures 10 m long and has a wingspan of 8 m.

Saab Aerospace has begun wind tunnel testing of an unmanned aerial vehicle concept at the Aeronautical Research Institute of Sweden facility in Stockholm.

The aim of the program is to develop and demonstrate a low-cost, stealthy UAV configuration for combat missions. By designing the vehicle with a low radar signature, it is possible to avoid detection and counterattack from anti-aircraft units and interceptors. No weapon sensors are needed to detect enemy fire or countermeasures and the aircraft does not need to be capable of evasive maneuvers in the range of 20 *g*. This all contributes to reduced costs, a major goal of the program.

During the introductory phase of the program in 1998, nine configurations were defined, representing different construction philosophies. To be able to use existing weapons, which are not of stealth type, an internal weapons bay is required. Therefore, in March 1999, low-speed model testing and weapons deployment testing were conducted in the FFA wind tunnels.

Frank Bokulich

Interesting? Circle 9
Not interesting? Circle 10

Detecting lightning

NASA Kennedy Space Center developed a new lightning strike locating technology to determine ground strike point of lightning in the vicinity of the space shuttle launch pad. Because of the susceptibility of electronic equipment to lightning strike damage, the system was developed to determine the strike point to alert engineers of what systems need to be re-tested.

Dr. Pedro Medelius of Dynacs Inc. designed the system for NASA. The prototype consists of a network of one electric field antenna and three or more sonic sensors separated from each other by about 30 ft and located at different places within the perimeter of the observation area.

Another company, Consumer Lightning Products (CLP) in Asheville, NC, is developing a new system called Precision Lightning Strike Location System (PLSLS). It is designed not only to detect lightning, but also offer some reason why it's striking in a particular area. This will enable users to remove or neutralize the attraction, minimizing the frequency of strikes.

"CLP's initial research was focused on airports and, specifically, airport runway lighting systems," said CLP President Sam Gasque. "Larger airports may have thousands of miles of cable underground. Airports that were formerly U.S. military air bases could have 10 times more wire and cable underground than needed. This old, abandoned cable could easily draw a lightning strike and provide a path for lightning to the other side of the facility, where it destroys all electronics in its path." CLP has also developed a lightning retardant cable with the help of Kennedy Space Center and the Southern Technology Applications Center to help protect electrical wires and cables from strikes.

Initial applications for the PLSLS and lightning retardant cable will be airports. From there the system could be employed in power utilities, sports facilities, defense, industry, and government. The first prototype is planned for testing sometime this year.

Information was obtained from *Aerospace Technology Innovation*, a publication of the NASA Office of Aerospace Technology.

Interesting? Circle 11
Not interesting? Circle 12

Climatic testing of S-92 prototype

Moving closer to its certification, the Sikorsky S-92 prototype Aircraft 3 was tested in the McKinley Climatic Laboratory at Eglin Air Force Base, FL. The aircraft was subjected to temperatures ranging from -40 to +122°F in the cavernous main test chamber at McKinley.

During most of the month of July, Sikorsky tested the aircraft in the laboratory's 252 x 260 x 70-ft main test chamber. A joint U.S. Air Force- and Sikorsky-designed support system allowed flight crews to operate the aircraft at maximum engine power while firmly suspending it inches above the chamber floor.

"The 20 h of rotor-turning engine runs and system tests in the climatic chamber validated the S-92 design decisions and systems analysis," said Tommy Thomason, Sikorsky Vice President of Civil Programs. "This should give our customers the confidence that it will perform in actual arctic or desert climates."

The S-92 successfully completed FAA-approved fuel icing tests. Sikorsky pilots, engineers, and ground crew members evaluated nearly all systems in extreme cold and hot conditions. The testing included cold weather starts, power checks, landing gear cycling, engine, heating and cooling systems, and main gearbox and hydraulic cooling.

To prepare the S-92 for testing, engineers "soaked" the aircraft at the designated temperature for at least 12 h. The temperature soak was designed to simulate the range of temperatures the aircraft may face during its operations — the extreme cold of Alaskan nights to the sweltering hot afternoons in Saudia Arabia. All applicable aircraft systems were operated at each temperature. In addition to this testing, the aircraft was submitted to a blizzard generated by two large snow blowers identical to those used to create snow for ski resorts.

During the tests, the CT7-8 engines that power the S-92 were started on the first try in all climate conditions. The combined fuel-engine system passed an FAA mandated fuel-icing test in which water-saturated fuel was supercooled, put into the fuel tanks, and then burned by the engines.

Actual cold-weather testing will be conducted in Alaska and Canada during the winter of 2001/2002. This will cover type certification requirements for cold weather and snow conditions.

Sikorsky plans to offer the S-92 as a replacement for Sea King helicopters currently in service with the Canadian forces. Other opportunities are military, patrol, and search-and-rescue applications. Sikorsky leads the international team that is developing the S-92 — Embraer of Brazil, Gamesa of Spain, Mitsubishi Heavy Industries of Japan, Jingdezhen Helicopter Group/CATIC of the People's Republic of China, and Aerospace Industrial Development Corporation of Taiwan. Major subcontractors include Hamilton Sundstrand, General Electric, and Rockwell Collins.

Frank Bokulich

Interesting? Circle 13
Not interesting? Circle 14

Monitoring aircraft brakes

To get even more capability out of the F-16, the military has been adding new weapons systems and fuel pods to the aircraft, causing its weight to increase. This increased weight has made it necessary for pilots to sometimes brake harder during landings, causing heat buildup in the wheels. A new sensor system under development at the Department of Energy's Pacific Northwest National Laboratory will enable ground crews to measure an F-16's brake temperature as it lands. The system is designed to minimize the risk of rupturing tires or igniting fuel during refueling due to heat buildup during landing.

"Pilots need to know the level of risk they face during a landing so they can determine if they should taxi away from other aircraft," said Jim Skorpik, Pacific Northwest Chief Engineer. "And once a fighter plane is safely down, if ground crews need to refuel for the next mission, they can check the sensor system to see if the brakes have cooled sufficiently."

The sensor system combines a temperature sensor with a radio-frequency tag. The sensor, which is capable of measuring temperatures up to 2000°F, will be inserted into an existing wear pin the size of a large nail that is used to monitor brake pad wear. The accompanying wheel-mounted RF tag is made up of a tiny silicon chip and an antenna connected to the sensor by an industrial cable.

When the aircraft lands, ground crews can use a wireless handheld device called an interrogator, which beams radio waves to one or more RF tags from up to 100 ft away. The radio waves activate the RF tag, which collects a temperature reading from the sensor. The information is sent back to the interrogator via the tag.

Pacific Northwest engineers have ground tested the sensor system to ensure the wheel-mounted tag can communicate properly with the interrogator. Tests were conducted with the support of the 388th Fighter Wing stationed at Hill Air Force Base near Ogden, UT. Additional testing will be conducted on a prototype system later this year.

Frank Bokulich

Interesting? Circle 14
Not interesting? Circle 15

Boeing JSF makes first flight

The Boeing Joint Strike Fighter (JSF) X-32A concept demonstrator made its initial flight Sept. 18 from Palmdale and landed at Edwards Air Force Base, CA. The first flight marks the aircraft's entry into a five-month flight-test program at Edwards with approximately 50 test flights, totaling about 100 h, to validate the JSF's flying qualities and performance for conventional and aircraft carrier operations.

During the flight, Boeing JSF Chief Test Pilot Fred Knox put the X-32A through some initial airworthiness tests, including flying qualities and subsystems checkout. "It (the X-32A) is already showing the precise handling qualities we expected based on the simulator work," he said.

The X-32A is one of two concept demonstrators Boeing is building to demonstrate conventional takeoff and landing (CTOL) for the U.S. Air Force and carrier approach flying qualities for the U.S. Navy. The X-32B, which is expected to fly in the first quarter of 2001, will demonstrate short takeoff and vertical landing (STOVL) requirements for the U.S. Marine Corps and the UK Royal Air Force and Royal Navy. Boeing recently installed the propulsion system in the X-32B aircraft at the Palmdale test site.

Boeing's X-32A JSF demonstrator made its initial flight in September from Palmdale to Edwards Air Force Base, CA.

Frank Statkus, Boeing Vice President and JSF General Manager, said both X-32 concept demonstrators will validate simulations and predictive tools that will give Boeing total confidence in the flight-performance characteristics of its design for the operational JSF.

"Our team used the same advanced tools and processes to design, build, and test the X-32 concept demonstrators that it will use in the next phase of the program," Statkus said. "By using these tools and processes now, we generate verifiable cost data that give our affordability projections a very high confidence factor."

Frank Bokulich

Interesting? Circle 16
Not interesting? Circle 17

Flight simulators for training

ALSIM, a French supplier of flight training systems, has received JAR STD 3A certification for its line of flight simulators. These simulators are designed for both instrument rating and multicrew cooperation training and can be easily reconfigured with knobs and controls located in the same positions as the simulated aircraft. This allows it to simulate several aircraft using the same hardware.

High-quality simulation programs and modern navigation systems, such as HIS with DME capabilities, facilitate a range of learning opportunities. All models provide electrical control force feedback, synthetic instruments, and a graphical instructor station with a touch screen. Visual systems come from a single CRT channel that offers up to a 200° panoramic view using projectors and a cylindrical screen.

Designed for the initial phase of professional pilot training, the AL 100 provides the necessary functions for commercial pilot license and instrument rating (IR) lessons. The AL 200 is a more advanced trainer and allows for the maximum 40-h credit time on the IR course, according to JAR FCL 1. It is equipped with active breakers and a single channel projected on a flat screen.

French company ALSIM provides a range of flight simulators designed for both instrument rating and multicrew cooperation training.

The AL 200 MCC flight trainer simulates the cockpit of small twin turboprop aircraft like the Piper PA31T Cheyenne. The AL 200 MCC ATR does the same for commercial twin turboprops like the ATR 42/72, making it a complement to full flight simulators used by the airlines. The system can also be certified as a FNPT 2 in its twin piston aircraft configuration, and as an FNPT 2 MCC in its twin turboprop configuration. It allows up to 55 h of training during an IR/MCC course.

These simulators are designed for two pilots and can be used for MCC training. The systems are LOFT oriented when equipped with GPS and EFIS systems.

Frank Bokulich

Interesting? Circle 18
Not interesting? Circle 19

F-16s get smart

The U.S. Air Force recently released a software upgrade that significantly increases the combat capability of its F-16 Block 50 aircraft by including the latest U.S. "smart weapons."

Three new families of inertially aided munitions, often referred to as "smart weapons," are fully integrated in this software release. They are the GBU-31 Joint Direct Attack Munition (JDAM), the AGM-154 Joint Stand-Off Weapon (JSOW), and the CBU-103/104/105 Wind-Corrected Munitions Dispenser (WCMD) series. All of these weapons employ an inertial guidance system for improved accuracy, with JDAM and JSOW also equipped with a Global Positioning System for even better accuracy.

"These new weapons address a major airpower deficiency identified during the 1991 Gulf War — the inability to strike targets accurately through clouds and smoke or from safe distances away from intense terminal enemy air defenses," said Col. Mark Shackelford, Director of the F-16 Systems Program Office at Wright-Patterson Air Force Base, Ohio. "These all-weather precision weapons allow the delivery aircraft to 'launch and leave,' or be free to maneuver, thus remaining at safer altitudes and distances from the targeted area. These weapons greatly increase the versatility, lethality, and survivability of the F-16."

The F-16 is the first USAF aircraft to become operational with JSOW and WCMD and is the first USAF fighter to field the JDAM. The aircraft was also instrumental in the development flight testing of all three new weapons.

The 20th Fighter Wing at Shaw Air Force Base, SC, is the first USAF unit to field a software update that fully integrates the new family of "smart weapons," including JSOW.

"We integrated all three weapons as a package, with a high degree of commonality in the interfaces," said Donald W. Jones, Vice President of F-16 programs. "This provided savings both in the initial integration and in future upgrades, plus simplifies the cockpit mechanization training for the pilot."

The software upgrade, known as 50T5, is the fifth such release for USAF's fleet of approximately 240 Block 50/52 F-16s. It also includes major enhancements to the aircraft's ability in one of its primary roles— suppression of enemy air defenses. The modified aircraft will be compatible with the upgraded ASQ-213 HARM Targeting System (HTS) pod.

Other improvements enabled by the software upgrade include the use of: AGM-68 fire control radar, AGM-88 High-speed Anti-Radiation Missile (HARM), AGM-65 Maverick missile, AIM-120 Advanced Air-to-Air Medium Range Missile (AMRAAM), Improved Data Modem, Digital Terrain System, and ALE-50 towed decoy.

The Improved Data Modem, a device that provides data-link capability using existing radios, previously had the capability to transmit and receive only enemy air-defense target messages as configured on USAF Block 50 aircraft. The software has been expanded to include standard close air support target messages and an intra-flight datalink function for data sharing among flight members. The intra-flight datalink capability was first introduced in the F-16A/B Mid-Life Update for the European Participating Air Forces and was successfully employed in Operation Allied Force in 1999.

The main improvement to the digital terrain system is the inclusion of the predictive ground collision avoidance warning based on the digital elevation database. This will significantly improve flight safety when operating over hills and known man-made obstructions such as towers.

Development of the software update began in 1996. The added capabilities represent the largest update yet fielded for the Block 50 aircraft. Developmental flight testing was conducted at Edwards Air Force Base, CA, from February 1998 to April 2000 and involved approximately 300 flights, compiling about 625 flight h using four F-16 aircraft. In addition, many operational-test-and-evaluation flights and tactics development flights were conducted at Eglin AFB, FL, and Nellis AFB, NV.

Block 50 F-16s at the 20th Fighter Wing, Shaw AFB, SC, were the first to receive the software upgrade. Incorporation in the rest of the USAF Block 50 fleet is being paced by the hardware upgrade to the HTS pod and will occur over the next 14 months.

Frank Bokulich

Interesting? Circle 20
Not interesting? Circle 21

Remote input/output unit for JSF vehicle management system

The Lockheed Martin Joint Strike Fighter (JSF) team has selected Smiths Industries Aerospace's remote input / output (RIO) unit for the aircraft's vehicle management system. The RIO units are designed to provide affordable, distributed, and flexible interfacing to a variety of aircraft sensors and effectors on the JSF.

The JSF RIO was derived from the RIU-100 commercial off-the-shelf (COTS) product developed by Smiths. The unit will be designed, developed, and manufactured at the company's Cheltenham, England, facility.

Smiths also supplies Lockheed Martin with tactical data equipment (TDE) for the JSF program. This equipment is based on COTS hardware in the areas of solid-state flight data / voice / video recorders and portable mass memory systems. This system will be designed and developed at the company's facility in Grand Rapids, MI. The company currently has more than 10,000 recording, monitoring, and data-transfer systems installed with more than 75 applications on both civil and military aircraft.

Smiths Industries Aerospace developed a remote input/output unit for the Lockheed Martin JSF vehicle management system.

Smiths has also been involved with the Israel Air Force (IAF) on the development and aircraft integration of the health and usage monitoring system (HUMS) and ground proximity warning system (GPWS) for the CH-53D helicopter. This joint effort has resulted in the successful flight test of these systems on board an IAF CH-53D.

HUMS monitors the "health" of critical systems on board the aircraft such as engines, transmissions, bearings, and rotors. It analyzes the data in real time, and stores the data in a removable memory cartridge on board the aircraft for subsequent transfer of the data to a ground station. This data aids maintenance personnel in determining and isolating premature deterioration of air-vehicle-system components, thus contributing to increased safety. Usage data gathered can also extend the scheduled replacement of known good components, reducing life cycle maintenance and spare parts costs.

GPWS monitors critical flight data parameters and provides aural warnings to the flight crew to prevent controlled flight into terrain (CFIT) accidents, which can easily arise in both combat and training situations.

The HUMS and GPWS functions were easily incorporated by the addition of two circuit cards to the baseline Smiths cockpit voice recorder / flight data recorder (CVFDR) unit plus associated aircraft wiring and sensors.

During flight testing the HUMS system worked, with all data acquisitions performed successfully at each flight condition. After only one test flight, HUMS recommended adjustments that would reduce multi-axis vibration 60-98% across all flight conditions. Main rotor gearbox lateral vibration was also reduced in forward flight regimes and overall track split was reduced from 135 mm to below 44 mm. Airborne tail rotor vertical vibration was consistently measured at all flight regimes, a task that could not be previously performed using current balancing equipment and procedures.

The company has also been involved with the Israel Air Force in the development and aircraft integration of health and usage monitoring systems and ground proximity warning systems for the CH-53D helicopter.

The GPWS system performed well on all flights and demonstrated the benefits of the audible alerts in providing pilots the reaction time necessary to help avoid controlled flight into terrain (CFIT) accidents. The system was evaluated during low-level operation flights and exhibited an acceptable level of nuisance alarm. Additional GPWS warning features were tested covering altitude loss following takeoff, potential tail-strike situations, unsafe gear positioning, excessive bank angle, descent below the radar altimeter low warning settings, and voice messaging unit warning capabilities for master caution and low-rotor rpm warnings.

Frank Bokulich

Interesting? Circle 22
Not interesting? Circle 23

Titanium melting at CDC

A new precision casting facility at CDC Sheffield has been built for the development of materials and casting manufacturing technologies for the aerospace and motorsport sectors. CDC has ordered a large-scale vacuum melting and pouring system from ALD Vacuum Technologies AG of Germany for the facility. The facility, which will come online in March / April 2001, is to be installed in the new 650 m^2 precision casting bay. Currently the facilities are in place in this bay to make accurate, very thin wall aluminum castings with good mechanical properties. The new vacuum system will supplement these operations in providing a capability of melting and pouring up to 25 kg titanium alloys and up to 100 kg superalloys, high alloy steel (duplex and super-duplex), high nickel alloys (Hastelloys, Monel, Inconels, and Incoloy), and aluminum bronzes.

After commissioning, a broad range of research projects will be undertaken that will lead to the development of material and process technologies relevant to the manufacture of targeted components.

Frank Bokulich

Interesting? Circle 24
Not interesting? Circle 25

728JET production begins

Technicians at SABCA in Belgium have begun fabricating the first aluminum components of the Fairchild Dornier 728JET fuselage. SABCA is producing the cockpit structure and a portion of the aircraft's rear fuselage. Prototype production began in September.

The 728JET is the first in a new family of aircraft designed for the 55-100 seat market. The aircraft will accommodate 70-85 passengers in a variety of interior arrangements, some featuring two-class configurations.

Wings and empennages will be built and assembled by CASA / EADS in Spain before being shipped to Germany for mating with the 728JET fuselage. Wing fabrication was scheduled to begin in October, with center wing box production to begin in January 2001, the outer wing box in February, and final assembly of the wing in May. Delivery of the first wing to Fairchild Dornier is set for August 2001.

Fairchild Dornier has begun production of the 728JET aircraft.

The full-scale test rig, called the "Iron Bird," will begin testing of the 728JET's digital fly-by-wire control system, landing gear, and thrust reverser actuation systems in conjunction with the cockpit simulator this month. The fly-by-wire control system development team is made up of Honeywell, Parker Aerospace, and Hamilton Sundstrand. Using the test rig, engineers will be able to simulate a variety of required profiles with actual hardware a year prior to first flight.

Engineering work with the cockpit simulator has led to the definition and design of control laws and forces and the preliminary definition of the aircraft's handling qualities. The cockpit simulator is also being used in preparation of flight testing in the required evaluation of flight control failure modes.

First flight of the 728 prototype is scheduled for 2002, followed by flight test, certification, and entry into service in 2003.

Frank Bokulich

Interesting? Circle 26
Not interesting? Circle 27

Hunter UAV completes flight test

TRW Inc. and Israel Aircraft Industries conducted a test flight of the Hunter UAV in which command and control over the aircraft was passed from its usual ground control station to the cockpit of an airborne U.S. Army AH-64D Apache Longbow helicopter. This successful flight test and demonstration of the Airborne Manned-Unmanned System Technology (AMUST) program took place this summer near Ft. Huachuca, AZ. AMUST is sponsored by the U.S. Army Aviation Applied Technology Directorate at Ft. Eustis, VA, and the Army Tactical UAV Program Office at Redstone Arsenal, AL. The program is charged with developing technology that will allow helicopters and UAVs to team together in flight.

"This link between manned and unmanned vehicles extends the 'eyes' of the aircraft's crew, leaving them in a safer position and setting the stage for risk reduction in future systems," said Nick Yorio, TRW Hunger UAV Program Manager.

Flight testing was conducted over a three-day period in which the Boeing Apache AH-64D helicopter successfully sent mission and payload control commands such as altitude, airspeed, heading, and destination to the Hunter while receiving video and telemetry data directly onto its display system from the UAV. The Apache also demonstrated some emergency procedures such as datalink signal reacquisition ability after loss of link.

Frank Bokulich

Interesting? Circle 28
Not interesting? Circle 29

C-5 pylon and nacelle systems

Lockheed Martin has awarded BFGoodrich a $600 million contract to supply pylons and nacelle systems for the C-5 Reliability Enhancement and Re-engining Program (RERP).

The Aerostructures Group of BFGoodrich will supply pylons for the program to retrofit the U.S. Air Force's C-5 fleet. The contract includes an estimated 504 pylon systems, and first deliveries are scheduled for January 2003. BFGoodrich will also be providing an estimated 504 nacelles components for the C-5's new powerplant, the GE CF6-80C2.

The re-engining program is an initiative valued at approximately $8 billion to modernize the USAF's Galaxy fleet of 126 C5-A/-B aircraft. The program involves a powerplant replacement and a series of system and structural upgrades designed to improve the capability, reliability, and maintainability of the aircraft.

The company has already supplied more than 500 pylons for the original C-5A/-B programs. To retain the pylon development and fabrication business, the company implemented new technologies and a lean design/manufacturing approach. As an example the company incorporated its new GRIDLOCK structural technology, which makes complex parts out of a few interlocking pieces, reducing the cost and weight of the parts.

BFGoodrich is supplying pylons and nacelle systems for the C-5 reliability enhancement and re-engining program.

To ensure cost-effectiveness, the company implemented an innovative tooling assembly approach to the pylon design for the C-5 program. By designing "self-locating" parts for the pylon, engineers eliminated a significant number of tools used for locating parts on assemblies. BFGoodrich had undertaken a three-month producibility demonstration of the self-locating assembly approach in 1999 to reduce the potential for technical risks when entering pylon production. This approach along with using a new flat bed laser technology decreased manufacturing costs and cycle times.

"By applying lean methodology throughout all phases of the project — from design to tooling to manufacturing — we were able to submit a very competitive proposal for the production of a high-quality, cost-effective pylon," said Bud Wetzler, President of Aero structures and Aviation Services Group of BFGoodrich Aerospace. Lean methodologies also enabled the company to remain extremely competitive with its C-5 nacelle production.

Frank Bokulich

Interesting? Circle 30
Not interesting? Circle 31

New stereolithography resin

DSM Somos announced its release of a new grade of stereolithographic resin, Somos 9120, for use with solid-state laser equipped stereolithography machines. The new resin is part of a series designed to mimic polypropylene's tensile strength, elongation at yield, and Young's modulus. It offers enough durability to allow functional prototyping but also has the rigidity and robustness required to withstand the RTV tooling process. Parts made with Somos 9100 series resins exhibit good performance as prototypes and patterns, and can be substituted for injection-molded parts in short-run production applications. Somos 9100 resins, optimized for the Argon ion laser, were announced earlier this year.

Somos subjected its resins to an extensive beta test program designed to ensure trouble-free performance in commercial use. Official domestic beta testing sites included Express Pattern, Scicon Technologies (Valencia, CA), Dynacept Corp. (Brewster, NY) and the U.S. Army (Aberdeen, MD).

"We are well pleased with the unprecedented success of the 9120 beta testing, emphasized by material re-orders from test sites prior to the conclusion of the testing," said Jim Reitz, DSM Somos Business Manager.

DSM Somos resins range from the industry's first flexible resins to the latest generation of heat-resistant, humidity-tolerant, high-accuracy epoxy resins suitable for investment casting and direct tooling applications.

Frank Bokulich

Interesting? Circle 32
Not interesting? Circle 33

B-2 upgrades flight tested

Northrop Grumman Corp.'s Integrated Systems Sector has begun a flight test program to evaluate a series of upgrades to the B-2 stealth bomber. The upgrades, which will be evaluated over the next several years during two separate flight-test periods, will improve the B-2's maintainability, communications, and weapons capability. The first test aircraft arrived at Edwards Air Force Base to begin the first flight-test period.

The first upgrade to be evaluated is the application of magnetic radar-absorbing materials on surface panels, which will improve maintainability by providing technicians more rapid access for scheduled and unscheduled repairs. The new materials will reduce the time necessary to access aircraft systems behind the panels from hours to minutes.

During the second flight-test period several other upgrades will be evaluated. One upgrade will be improved satellite links to increase communication speed, security, and resistance to enemy jamming. The links will also enable an entire mission to be uploaded while the aircraft is en route to a target.

Software upgrades to increase situational awareness and reduce crew workload will also be tested during this second set of tests. These upgrades will enhance the capabilities of the radar and navigation systems and improve maintainability.

Another upgrade is the integration of the Joint Air to Surface Standoff Missile using the company's integrated software package. The package, called the Generic Weapons Interface System, was introduced to the fleet this year and is designed to lower overall cost and cycle time for rapid integration of newer weapons. It enables these weapons to be integrated with minimal or no aircraft flight software changes.

Frank Bokulich

Interesting? Circle 34
Not interesting? Circle 35

Harvard Mark IV used for testing

At the flight research laboratory hanger at National Research Council Canada's (NRC) Institute for Aerospace Research (IAR), the Harvard Mark IV aircraft has been prepared for its new role as a trainer and experimental platform for avionics research such as advanced flat panel displays. Initial experiments will focus on the role that instrument design plays in pilot orientation.

NRC's Harvard Mark IV will be used to flight test advanced flat-panel display equipment.

A significant cause of aircraft accidents is spatial disorientation. According to NRC, current displays do not do enough to help pilots recover from an unusual attitude. They can be flipped by turbulence in which they must be able to right themselves and continue on safely. One of the areas under investigation by NRC is what symbology format will be best understood and interpreted by the typical pilot.

To perform this in-flight simulator work, the Harvard's engine was overhauled and instrumentation replaced. However, the most challenging task in preparing the Harvard for these tests, according to NRC, was finding the space and power on board the aircraft to place and run two computers required for the display's graphics program. These changes had to be incorporated within the space of a two-seat aircraft and without moving its center of gravity.

To accomplish these changes, engineers placed part of the system under the pilot's feet and the other behind the pilot's back. An oversized generator was installed behind the engine to power all the project-related computer equipment.

Although the Harvard is almost 50 years old, the aircraft will enable test pilots to perform aggressive and unusual maneuvers, enabling the equipment to be tested under real flight conditions.

Information was obtained from the *IAR Flyer*, a publication of the National Research Council Canada.

Interesting? Circle 36
Not interesting? Circle 37