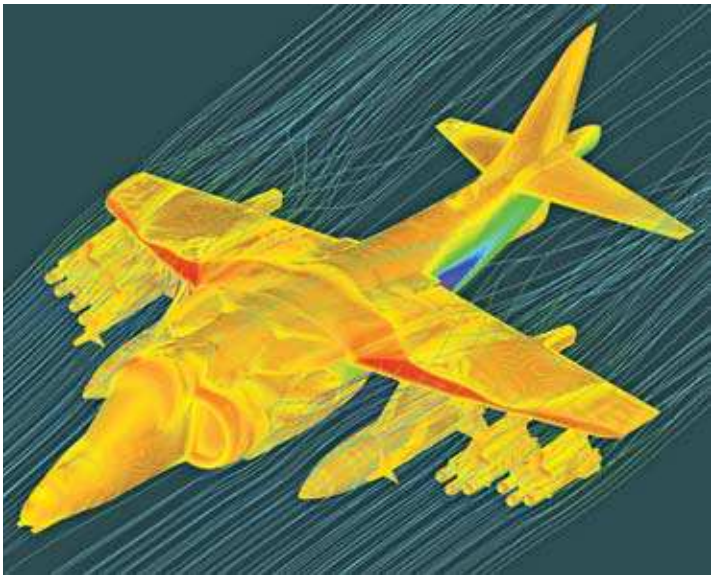
Technology update

BAE Systems improving aerodynamics, sensing corrosion

BAE Systems and **Airbus** are taking key roles in an initiative aimed at making significant advances in the design processes of aerodynamic structures, bringing a major reduction in time between concept and production. Supported by the UK Government's **Department of Trade and Industry** (DTI), it is known as the CFMS (Center for Fluid Mechanics Simulation) Core Program.



Achieving significant advances in the design processes of aerodynamic structures is the focus of companies involved in the CFMS (Center for Fluid Mechanics Simulation) Core Program initiative.

David Standingford, BAE Systems' Technical Program Manager for the initiative, said at the Paris Air Show that "it allows cross-sector industries to share their expertise to help improve the design and efficiency of a multitude of products. Lightweight flexible structures of UAVs present major design challenges; an early program will examine how the key elements in these systems interact."

The initiative is believed to be the largest of its type in the world and will initially focus on reducing the cost of introducing new civil and military equipment. It will also improve speed and accuracy in predicting the performance of in-service modifications to existing aircraft.

An important element of the work is to make use of standard off-the-shelf commodity computing hardware. By changing algorithms and making better use of emerging design program hardware, the initiative would provide a more accessible alternative to expensive computing technology, which "will improve design processes leading to cleaner, greener passenger aircraft," said Standingford.

The CFMS program uses numerical methods to investigate the flow of liquids around complex surfaces. Although CFD can be used to help achieve solutions, these may be approximate, with a need for further tests to validate calculations.

Together with BAE Systems and Airbus, members of the CFMS Core Program consortium are the **Aircraft Research Association**, **BMT Fluids**, **Eurostep**, **Frazer-Nash Consultancy**, **MBDA**, **Microsoft**, **PCA Engineers**, **Quadrics**, **QinetiQ**, **Rolls-Royce**, **Westland Helicopters**, and **Williams F1**. The DTI is providing matched funding for the program.

Also at Paris, BAE Systems highlighted its anti-corrosion development work, stating that advanced corrosion sensing technology could result in very substantial financial savings. The Sentinel corrosion sensor, currently being tested on the **Lockheed Martin** F-35 Lightning II program, alerts engineers to deterioration in coatings to create a "predict-and-prevent" mentality instead of a "find-and-fix" approach, according to BAE Systems. Extended in-service life of many current platforms and the effect of environmental conditions which military aircraft face are leading to rising maintenance costs.

The Sentinel monitors the breakdown of protective systems (chemical and paint) via electrical sensors. "Our sensor is designed to simulate the part of the vehicle being monitored," said BAE Systems' corrosion specialist Steve Harris. "We mimic the structure itself via thin layers of alloy and use the same protective coating. The sensor then has all the same ingredients as the part of the structure that it is monitoring and will face all the same conditions." If the Sentinel tests on the F-35 are successful, the system could become an integral component of the aircraft's health monitoring system.

A different type of monitoring in which BAE Systems is involved concerns aircrew workload. The company announced at Paris that it has implemented a study into areas in which autonomous technology could be deployed to optimize efficiency and reduce workload in both military and civil aircraft. At present, the study is in its early stages and is "looking at the art of the possible," said BAE Systems' specialist Geoff Slater. "We are examining a number of factors including human fatigue and lapses in concentration and the areas where technology can be used, either individually or as part of a combined system, to reduce crew requirements. Ultimately, this could take us into areas where highly advanced materials of machine-based decision making are required; alternatively, we may be looking at implementing far less complex solutions."

He regarded the technological aspects of the issues being addressed as not being particularly challenging because much of it was available. "But one area that we will need to address is the social acceptability of deploying autonomy in certain roles," he said.

Stuart Birch

Testing times for the Fighter Engine Team

Rolls-Royce's involvement in the F136 engine for the **Lockheed Martin** F-35 Lightning II has seen successful completion of testing of its product configuration front fan, with tests also scheduled for later this summer on the augmenter, it was announced at the Paris Air Show. And by the end of this year, the **GE-Aviation** Rolls-Royce **Fighter Engine Team** will have run tests on the powerplant's front fan, low-pressure turbine system, controls systems, and augmenter. If successful, the tests will result in the project's critical design review early next year, which will involve every aspect of the engine design being analyzed and evaluated before the first full development engines are assembled, with their first tests about a year later and first flight in 2010.

The System Development and Demonstration (SDD) phase will continue through 2013. Some 800 engineers and technicians are involved in the F136 program at GE in the U.S., and at Rolls-Royce facilities both in the U.S. and UK. The F136 will be fully interchangeable for the F-35 and was the first powerplant to offer a single-engine configuration for all three versions of the aircraft.

Also at Paris, the Fighter Engine Team announced that it is to collaborate with Canada's **National Research Council Institute for Aerospace Research** (NRCIAR) to collaborate on five key technology areas: combustion system, gearbox prognostic health management, composite material systems, fuel systems, and material characterization systems.

The comprehensive agreement will focus on the performance of specific developmental and certification testing of the F136 engine, using the expertise and capabilities at the NRCIAR facilities in Ottawa and Montreal, it was announced at the show. Rolls-Royce and the NRCIAR have worked together since the 1970s. "This new agreement will bring two high-technology organiza-

Technology update

The F136 engine for the F-35 Lightning II is undergoing a rigorous testing program.

tions even closer together as we seek improvement on this critical engine program," said Mark Rhodes, Senior Vice President of the Fighter Engine Team.

Other news from Rolls-Royce saw the first details emerge of the company's involvement with **Dassault Aviation** to develop a new engine in the 10,000-lb thrust class to power the Falcon super mid-size (SMS) business jet. The engine, developed through the Rolls-Royce technology acquisition programs, is "the first of a new family of engines designed to meet the most stringent performance, reliability, and environmental requirements of the corporate and regional aircraft marketplace," according to Rolls-Royce. The total SMS jet market for propulsion systems and services, in which the Falcon will operate, is estimated to be $40 billion over 20 years.

The program is the first between the two companies in the business sector, but previous collaboration saw Rolls-Royce and **Turbomeca** begin a program last year to use the Adour engine in the nEUROn UCAV (unmanned combat air vehicle) demonstrator. Rolls-Royce also worked with Dassault on the military Jaguar and Atlantique aircraft and in the mid-1960s. Te Dassault-Mirage III-V research aircraft used eight Rolls-Royce RB162 light engines to achieve free hover flight.

Rolls-Royce's research, technology, and product development budget tops $1.4 billion per annum—two-thirds directed at improving its products' environmental performance.

Stuart Birch

Army, Air Force find solution for the 'last tactical mile'—the C-27J

Now that it has been selected by the **U.S. Army** and **U.S. Air Force** to fulfill the requirements of the Joint Cargo Aircraft (JCA) program, the team behind the C-27J Spartan will begin gearing up for production and final assembly of the aircraft at Cecil Field in Jacksonville, FL. Located approximately 15 mi west of downtown Jacksonville, Cecil Field has four 200-ft wide runways, three of which measure 8000 ft. The fourth runway is 12,500 ft in length, one of the longest in Florida.

The JCA contract will be a shot in the arm for the city, which is still recovering from the closing in 1999 of Naval Air Station Cecil Field, the largest military complex in the region, as mandated by the Base Realignment and Closure committee.

The initial order is for 78 aircraft worth $2 billion, split between the Army (54 aircraft) and USAF (24 aircraft).

The aircraft will be produced by a team that includes lead contractor **L-3 Integrated Systems** Group, which will provide systems integration and management; **Alenia North America**, the Italian airframer that is part of **Finmeccanica** and builds the C-27J; **Global Military Aircraft Systems**, a joint venture between L-3 and Alenia Aeronautica, which is pursuing international business opportunities; **Rolls-Royce**, which supplies the engines; and **Boeing** Integrated Defense Systems, which joined the team in mid-2006 and will provide production and final assembly expertise.

Lockheed Martin, which helped develop the "J" version of the C-27 through the addition of new engines and avionics, opted out of its long-term partnership with Alenia to compete for the JCA with its own C-130J, albeit a shortened version of the transport that is equipped with the same avionics and engines as the C-27J.

The C-130J was eventually disqualified from the competition, leaving the contest a two-plane battle between the L-3/Alenia-backed C-27J and an **EADS**/**Raytheon** team that proposed a C-295 built by Spain's EADS Casa. Raytheon is protesting the award to the C-27J, saying that the C-295 would have been cheaper to procure, would have lower life-cycle costs, and burn less fuel than the C-27J, while having almost the same performance characteristics. The General Accounting Office is expected to rule on the protest in October.

The win for L-3 is highly unusual in the pantheon of aircraft procurement programs in that the company has no experience building planes. L-3 CEO Michael Strianese has been quoted as saying that the award is "probably a first for a system integrator and non-plat-

form company like L-3."

The JCA program is a joint service initiative established to address operational shortfalls and ease the airlift burden on other fixed-wing and rotary aircraft. The primary job of the JCA will be to move mission-critical and/or time-sensitive cargo to forward tactical units in remote, austere locations, and land or take off from short unimproved runways less than 1500 ft in length, while transporting up to 10 ton of materials, 62 persons in the passenger configuration, or 36 stretchers and 6 assistants in the medical-evacuation version. It will support troop movement, airdrop operations, humanitarian assistance, and homeland security missions by carrying cargo to the "last tactical mile," according to the Pentagon.

It will replace the Army's C-23 Sherpas (a military derivative of the Short 330), C-12 Hurons (based on the **Beechcraft** King Air), and the C-26 (a military derivative of the **Fairchild Swearingen** Metroliner), and augment the USAF's existing fleet of intra-theater airlifters, particularly the C-130J and C-17. The aircraft will play a key role in providing responsive aerial sustainment and critical re-supply support.

Alenia's decision to build the C-27J Spartan, a wholly military tactical transport, paid off when the U.S. Army and U.S. Air Force chose it to meet its medium-range/ weight airlift requirements.

Army logistics support will come from the **Tobyhanna Army Depot** in Pennsylvania. It is the Army's Center of Industrial and Technical Excellence for communications and electronics systems, and it will identify and implement acquisition, logistics, and program management techniques in support of JCA operational readiness.

USAF support will come from the **Warner Robins Air Logistics Center**

(WR-ALC), Robins Air Force Base, GA. The WR-ALC is the USAF's lead facility for cargo aircraft sustainment, programmed depot maintenance, modernization, and modification for C-5 Galaxy, C-130 Hercules, and C-17 Globemaster aircraft.

The other big winner in the contract award is Rolls-Royce, which will supply its AE 2100D2 turboprops for the twin-engine C-27J. The initial contract award for 78 Spartans includes as many as 180 engines, which Rolls estimates will be worth more than $500 million over the life of the JCA program.

Rolls-Royce produces the AE 2100 turboprop engine line at its manufacturing facility in Indianapolis, IN, and inherited the engine and the facility when it bought **Allison Engine** in 1995. The 6000 shaft hp engine also powers Lockheed Martin's C-130J.

The engine was developed simultaneously with the Allison AE3007 turbofan, which has found great success in business aviation, particularly on **Embraer** regional jets. On the military side, the turbofan provides propulsion for the **Northrop Grumman** Global Hawk unmanned aerial vehicle.

Together, the AE engine line has accumulated more than 25 million flight hours in military and civil applications.

Six customers including the U.S. have now selected the C-27J. They are: the Italian Air Force (12 aircraft), the Greek Air Force (12 aircraft, plus 3 options), the Bulgarian Air Force (5 aircraft, plus 3 options), the Lithuanian Air Force (3 aircraft), and Romania (7 aircraft).

In Canada, the aircraft has been proposed for the renewal of its search and rescue aircraft fleet, and is also under evaluation by Australia, Ireland, Qatar, Saudi Arabia, and new NATO members Slovakia, Slovenia, and the Czech Republic.

Barry Rosenberg

Tornado to deputize for Typhoon in missile trials

QinetiQ has announced that by adopting a strict systems engineering approach to defining the requirements for testing the multi-national Meteor BVRAAM (beyond visual range air-to-air missile) for the **Eurofighter** Typhoon, and designing, implementing, and verifying the solution, fully certified aircraft will be available in time to continue its firing schedule. To do so, it is to use the Tornado F3 as the alternative test platform to the Typhoon to support trials of the missile and take development to the systems preliminary design review in September.

Two Tornados will be converted for carriage and release of the 3.67-m long missile with throttleable ducted rocket motor, produced by **Bayern-Chemie Protac**.

BAE Systems Insyte will handle software modifications to the aircraft's main computer. Modifications to the AI-24 Foxhunter radar will be by **SELEX Sensors and Airborne Systems**, while **Flight Refuelling** will modify the Tornado eject launcher.

Typhoon will be equipped with the new Meteor missile, but Tornado is being engineered to carry out trials.

It was decided in 2005 that the Typhoon might not be available for development trials of the missile, and QinetiQ was asked by the **UK Ministry of Defence** to explore an alternative launch platform; it opted for the Tornado F3. According to QinetiQ, the program of work offered a low-risk and cost-effective option to replace Typhoon in the Meteor trials. This would also protect agreed workshares with the five other European nations involved—together with the UK—collaborating in the program: Sweden, Spain, Germany, Italy, and France.

Only one of the Tornados will be used for any particular firing, the other acting as a backup. It will launch Meteor missiles during guided firing trials from mid-2009 until late 2011. A spokesman for the trials program added: "We are planning at the same time to run a parallel Typhoon integration program to ensure that the Meteor will meet its in-service date as a fully operational weapons system integrated onto Typhoon."

Stuart Birch