The Society’s Honours, Medals and Awards are open to everyone in the global aerospace community — from senior professionals to students and graduates.

Do you know an individual or team that has made an outstanding contribution to aerospace and merit recognition? Nominate them today. The nomination form can be found on our website www.aerosociety.com/medalsandawards. The closing date for the 2014 round is 31 March 2014.

For further information call Anna Banton on +44 (0)20 7670 4312 or email anna.banton@aerosociety.com
Iran: winners and losers

The current international negotiations over Iran’s nuclear ambitions raise the possibility that Tehran’s leadership may be seeking to give up its plans for nuclear weapons — in return for relief from crippling sanctions. It is obviously very early days yet and, given Iran’s history, there is much to be said for Ronald Reagan’s famous maxim ‘trust but verify’ — but the change in attitude is refreshing. Moreover, any breakthrough agreement will have significant implications for the aerospace industry. Should sanctions be lifted, even slightly, this may open up a previously closed or highly restricted market for Western products, skills and services. It may even, as seen on page 32, go in the opposite direction with aerospace talent from Iran now able to market their products and skills to the world.

Yet there also may be a downside for some companies. Military procurement in the Gulf, for example, has been mainly driven by fears of the Iranian threat. Only recently, it has to be remembered, that talk of a joint Israel/US strike on Iranian nuclear facilities (and the potential for a wider war in the Gulf) was presented as a ‘when, not if’ choice.

So was it, therefore, coincidence that the UAE decided against acquiring Eurofighter Typhoon late last year, despite high-level lobbying? Or was it a merely pragmatic move by the UAE that with conciliatory noises emanating from Tehran, there was now no need to be rushed into a decision over an expensive combat aircraft? With a global buyer’s market for fighter aircraft, the UAE can afford to wait and should peace talks with Iran break down — it can be sure that re-opening the wider war in the Gulf) was presented as a ‘when, not if’ choice.

As ever — there are both winners and losers.

Tim Robinson

tim.robinson@aerosociety.com
Self-defence
The Gripen NG features a comprehensive EW self-defence system. Elisra will provide a passive IR missile warning system, while the fighter will be one of the first to offer the Selex BriteCloud Expendable Active Decoy as part of its defence suite.

Extra range
Relocating the undercarriage position allows a 40% increase in fuel capacity, giving a combat radius of 700nm and ferry range of 2,200nm. A retractable IFR probe is now fitted.

More power
The Gripen NG replaces the Volvo RM12/F404 used on the C/D with GE’s F414G engine — as used on the F/A-18 Super Hornet — giving the Gripen NG 20% more thrust and allowing supercruise.
Brazil has selected the Saab Gripen NG to become its air force's new fighter aircraft, beating off competition from the Dassault Rafale and Boeing F/A-18E/F Super Hornet. The $4.5bn F-X2 contract will see 36 Gripens replace ageing Dassault Mirage 2000C fighters and Northrop F-5EMs. The contract is expected to be signed in 10-12 months with first deliveries to follow 48 months later, although older Gripen C/Ds from the Swedish Air Force may be supplied first until the new aircraft are ready.

Sensor fusion
The Gripen NG features a partitioned avionics architecture — separating flight safety and mission functions — allowing from rapid updates. One such upgrade could be replacing the three colour cockpit MFDs with a single giant touchscreen display.

AESA radar
The Gripen NG features the Selex Galileo E505 Raven active electronically scanned array (AESA) radar, with a moving swash plate that allows scan angles up to 100°.

IRST
Sensors also include the Selex Skyward-G passive infrared search and track system (IRST).

More weapons
Relocated landing gear now allows ten external hardpoints for carrying weapons, external fuel tanks, surveillance and targeting pods. For Brazil, integrated air-to-air missiles may include Derby, A-Darter and Meteor.
Brazilian aircraft manufacturer Embraer has announced that it met its planned delivery targets for 2013. During the year, the company delivered a total of 90 commercial aircraft and 119 business jets.

Malaysian carrier AirAsiaX has ordered 25 Airbus A330-300s plus ten options. The airline is planning to use the aircraft for low-cost long-haul operations.

India has cancelled a $770m order for 12 AW101 helicopters from AgustaWestland following allegations of malpractice in the purchase process. (see Pacific Storm p18)

Scientists at ESA have reactivated the Rosetta space probe prior to its planned rendezvous with Comet 67P/Churyumov-Gerasimenko in November 2014. Launched in March 2004, the spacecraft has been in hibernation mode since June 2011.

Remanufactured bizjet specialist Nextant Aerospace has announced that it is to fly its first re-engined and modernised King Air G90XT in the first quarter of this year. The G90XT replaces the original G90 aircraft’s Pratt & Whitney Canada PT6 engines with GE H80s, together with a Garmin G1000 flightdeck and new interiors.

On 4 January Airbus rolled out its fourth A350 flight test aircraft. The first A350 to be fitted with a fully equipped cabin interior, MSN2 features a special ‘all carbon’ black and white chequered livery.

A total of 29 people are reported to have been injured during the evacuation of a Saudi Airlines Boeing 767-300ER after it made an emergency landing in Medina on 5 January after its right landing gear failed to deploy.

The French Defence Ministry has given the go-ahead for Dassault to develop the fourth tranche of Rafale fighters to F3 R standard. The upgraded version will include integration with the MBDA Meteor BVRAAM missile, a Thales PDL-NG laser designation pod and the latest laser homing version of the Sagem AASM Hammer air-to-ground modular weapon, already trialed in Mali. Validation of these new weapons is expected by 2018.

Bombardier has completed a $2.2bn order for 38 business jets from an unidentified customer. The order is for 28 Global and ten Challenger 605 biz-jets.

On 4 January SpaceX launched the Asian communications satellite Thaicom 6 into geosynchronous transfer orbit (GTO) aboard a
Embraer’s latest biz-jet the ‘mid light’ Legacy 450 made its maiden flight on 28 December in a 95 minute test flight from the manufacturer’s facility in Sao Jose dos Campos, Brazil. The full fly-by-wire Legacy 450, a smaller variant of the 500, is expected to achieve certification in 2015.

Falcon 9 rocket. Lift-off took place on 6 January from Cape Canaveral AFB.

US GA manufacturer Mooney is to restart aircraft production following a cash infusion from its new Chinese owners. The Mooney production line was closed in 2008 but could be working again within six months. In January a Boeing 787-9 test aircraft made its first overseas debut with a flight to New Zealand. Flag carrier Air New Zealand is the launch customer for the -9 variant.

Singapore leasing company Aviation has bought five ATR 72-600 regional turboprops plus five options. The new order means that Aviation now has 14 new ATR 72-600s to be delivered before the end of 2015.

Marshall Aerospace and Defence Group has won a long-term contract to sustain the Royal Netherlands Air Force’s fleet of Hercules C-130s. Under the Cockpit Upgrade (CUP) and Cabin Safety Improvements (CSIMP) Sustainment Programme (CCSP), Marshall ADG will provide airworthiness, maintenance and reliability information.

Dutch-based Martian colony space company, Mars One has chosen a shortlist of 1,058 volunteers for a one-way trip to the Red Planet, starting in 2025. The applicants were drawn from some 202,000 people who responded to Mars One’s call for colonists for the ultimate reality TV show.

Bristow Group has received its first fully configured S-76D helicopter from Sikorsky for offshore oil-rig support. The delivery is the first of an order for up to 26 Sikorsky S-76Ds that Bristow placed in March 2013.

Engine manufacturer Snecma has announced that it is to build a prototype open-rotor which will be ground tested in 2016 and flight tested on an Airbus A340 in 2019.

Bombardier has won an order from American Airlines for 30 CRJ900 regional jets plus 40 options.
Textron to buy Beechcraft

The recently rebranded US GA manufacturer Beechcraft is to be bought by Textron, owner of the Cessna GA company and Bell Helicopters. Textron is to buy Beech Holdings, the parent company of Beechcraft for $1.4bn deal, and bring together the Cessna and Beechcraft GA and business aircraft brands. The deal is expected to be completed in the first half of 2014.

London Air Ambulance’s silver jubilee

The London Air Ambulance service has celebrated its first 25 years of operation. Starting in January 1990 flying out of Biggin Hill, the service has come to the aid of over 30,000 patients. The service is now fundraising for a second helicopter.

Is it a truck? Is it a plane?

Advanced Tactics has developed a vertical take-off military transport vehicle. Named the AT Black Knight Transformer, an unmanned technology demonstrator completed driving tests in December 2013 and is scheduled to make its first flight early this year. The vehicle is designed for autonomous casualty evacuation, as well as manned or unmanned cargo resupply.

US aerospace company Reaction Engines has arranged a cooperative research and development agreement with the US Air Force Research Laboratory’s Aerospace Systems Directorate (AFRL/RQ). The tie up will assess the performance, applications and potential future development of Reaction Engines’ SABRE air-breathing rocket engine designed for low-cost space access and high-speed atmospheric flight. The assessment will be used to inform US government stakeholders of SABRE’s potential.

Advanced Tactics

Arianespace has placed an €2bn order for 18 additional Ariane 5 launchers from Airbus Defence & Space. The new Ariane 5s are scheduled to begin launching from 2017 onwards.

A pilot was killed and two others injured when a Canadair Challenger 601 private jet crashed at Aspen/Pitkin County airport in Chicago on 5 January.

The US FAA has announced the six states which will have test sites for the commercial use of UAVs. The six states are Alaska, Nevada, New York, North Dakota, Texas and Virginia. The sites will be used to help develop operational rules for the safe operation of UAVs in commercial airspace by the end of 2015.

The American Airlines Group is to rebrand its American Eagle Airlines subsidiary under the new name of Envoy. Subject to regulatory approval, the name change will take place in the second quarter of 2014.

BAE Systems has said that RAF Tornados have flown with 3D printed or additive layer manufacturing (ALM) parts. BAE predicts this could cut the cost of spares by over £1.2m in the next four years.

ATK has completed hot fire avionics tests on NASA’s new Space Launch System (SLS) heavy lift rocket.

A Kamov Ka-32 helicopter from a Chinese icebreaker has successfully airlifted to safety passengers aboard a research vessel that had been trapped in Antarctic ice.

Members of the Boeing machinists union voted by 51 to 49% on 3 January to accept a new contract which should ensure the continuation of Boeing 777 production in Seattle.

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The USAF and US Coast Guard (USCG) are to swap two aircraft types — with the USCG acquiring 14 surplus USAF C-27J Spartan transports that were put into temporary storage. In exchange, the Air Force is set to receive seven C-130s from the Coast Guard, which will be converted into forestry fire-fighting aircraft.

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In December, BAE Systems reported that the United Arab Emirates (UAE) will not be proceeding any further with a proposed £6bn deal to buy 60 Eurofighter Typhoons, with the company saying: “The UAE have advised that they have elected not to proceed with these proposals at this time.” Meanwhile, the company reported that: “Whilst good progress has been made, a definitive agreement has yet to be reached” over the finalisation of the Salaam deal to supply Typhoons to Saudia Arabia.

US company Flexsys is to test fly its FlexFoil variable geometry control surfaces aboard a Gulfstream GIII in July. Tailoring-edge flaps will be replaced with 14ft FlexFoil surfaces together with 24in transition sections at each end.

ON THE MOVE

Lockheed Martin elected Marilynn Hewson as Chairman of the Board from 1 January.

ADS has announced that its new President for the next two years will be Marcus Bryson.

Emirates president Tim Clark has been awarded a knighthood in the UK New Year Honours List.

Arjan Meijer has been appointed Managing Director of KLM UK Engineering.

Dennis Muilenburg has been named as Boeing’s new Vice Chairman, President and CEO. Raymond Conner is promoted to Boeing Vice Chairman, President and CEO of Boeing Commercial Airplanes. Christopher Chadwick is appointed as Boeing Executive VP, President, President and CEO, Boeing Defense, Space & Security, replacing Muilenburg, while Shelley Lavender will replace Chadwick as leader of Boeing Military Aircraft.

Ethihad Airways has appointed Amina Tahæ as Head of Media Relations.

Jeff Standerski has been appointed Senior VP of Rockwell Collins’ new Information Management Services division.

The Nigerian Air Force has announced that AVM SB Abubakar is to be its new Air Officer Commanding Training Command Kaduna while his predecessor Air Vice Marshal I Umar moves to Defence Headquarters as Chief of Policy & Plans.

Charles Paterson is the new Senior Vice President of Business Development and Strategy for GKN Aerospace, replacing Michael McCann who has become CEO of GKN Aerospace — Engine Systems.

The International Air Transport Association (IATA) has appointed Kevin Hiatt as Senior VP, Safety and Flight Operations.

Walid Abukhaled is to become CEO of Northrop Grumman’s Saudi business.

Raytheon CEO William H Swanson is to step down. He will be succeeded by EVP and COO Dr Thomas A Kennedy, effective from March.
GoCo dead — long live DE&S+!

The potential creation of a GoCo — Government Owned, Contractor Operated — organisation to run defence procurement operation in the UK may now be off the agenda but that does not mean the idea of privatisation of the procurement operation has been permanently ditched. Nevertheless, for now, defence procurement is to be retained in the public sector within what has been defined as a substantially upgraded and yet freed up DE&S+ operation which, as announced by Secretary of State for Defence in December, will be given new powers from April allowing it to break away from current civil service pay restraints.

Poor leadership, low morale and a lack of drive combined with the distinct lack of remuneration incentive lie at the heart of why UK defence procurement is in a mess. There has been too little incentive to succeed and precious little in the way of constructive leadership. There have also been a combination of other factors, including constant changes being made to already agreed programme requirements and differing sections of the military being allowed to interfere on equipment programmes forcing through expensive change without a proper understanding of the consequences. Then, there are the politically based arguments on final numbers, cost, timing and use of available cash — all have played a part in preventing the establishment of a clear cut and efficient system in procurement-based decision-making processes. To be fair, there has already been some improvement in performance of the existing Defence Equipment and Support (DE&S) operation. Under Chief of Defence Materiel, Bernard Gray, operational management has significantly improved. But, set against a background of forced cuts in the number of staff employed combined with the unfortunate loss of highly skilled staff that have chosen to leave DE&S due either to the constant living in fear of losing their job or the very poor levels of pay, many have jumped ship, seizing better opportunities offered in the private sector. No matter whether procurement was to be partially privatised or to remain inside the public sector, it was very clear that large scale change was needed.

The right decisions

With an annual budget of £14bn and responsibility for an already much reduced number of staff employed, currently made up of 16,000 military and civil service posts, making the right decision on the future restructuring of the defence procurement organisation would be crucial to its success. The process of required change had begun as long ago as October 2009 when the independent ‘Review of Acquisition for the Secretary of State for Defence’ was conducted by Bernard Gray. His report was to be largely critical of how defence procurement was conducted and its principal recommendation was that, in future procurement should be outsourced to a government-owned, contractor-operated organisation. Hence, the idea of GoCo was born. Not surprisingly, the outsourcing recommendation met with stiff opposition from the Brown Government. But, with a change of Government in April 2010 and publication six months later of the SDSR, the possibility of creating a GoCo took a giant step forward towards potential reality when the Coalition signalled an intention to seriously consider this as a possibility within the overarching act of defence reform.

While few disagreed that something was very badly wrong with how the system of defence procurement operated, how to resolve the problem and secure a more sound and efficient system that would provide best value for the taxpayer, give the military with what they required on budget and on time while at the same time to work better for the MoD and industry would be fraught with difficulty. Opinions differed and, while the Secretary for Defence and the by now Chief of Defence Materiel, Bernard Gray were firmly behind the GoCo, the decision was made to test the wider views of industry together with those that might potentially choose to compete for the contract to operate AgustaWestland AW159 Wildcat — but is it time for a shake-up in UK defence procurement?
GoCo. Against this background it should be noted that all the way through, on the grounds of fear of potentially increased risk, Whitehall support for GoCo was very limited.

Even if the GoCo idea had real merit as time moved on as the debate and potential concerns widened, it was, I suspect, the personalities involved in the potential creation and running of a future GoCo that gave rise to the largest area of concern. The defence industry itself made plain that it would be happy to work with whatever system of procurement operation was decided by the Defence Minister. In the end, left with only one potential bidder, the increased complexities and perceived risk placed on those within the private sector that had led two other consortium partnerships to withdraw left the Defence Secretary with little choice but to back away from the GoCo option in favour of public sector retention of defence procurement in the form of an upgraded DE&S+ structure that would be given much greater freedom of operation.

Abandoning the GoCo option in favour of moving forward with a public sector-based DE&S+ was to be a bitter blow for Defence Secretary Philip Hammond just as it would also be for its principal advocate, Bernard Gray. And it would be Gray that, to the surprise of some, the Government asked to run the upgraded DE&S+. While it is true that it had been Gray who had given birth to the GoCo option for future defence procurement, given the need for stability through what will be a further process of change, I will no doubt be in the minority when I say that I believe Philip Hammond has made the right decision. Gruff, unpopular perhaps, suffering fools badly and even causing unnecessary internal friction as Gray is often accused, I believe that, given that he has one year of his contract left to run and given his large scale experience in procurement operation, this remaining period should be used wisely in the process of change and transition of DE&S to DE&S+.

Debate far from over

With the House of Commons Defence Select Committee looking at not only why the notional idea of part privatising the operation of defence procurement failed, why the various bidders walked away and, importantly, why the current Chief of Defence Material was given the job of running the proposed DE&S+ operation without there being a competition, the debate on defence procurement is far from over. More sparks may well fly in terms of the personalities involved and the pressure on the Defence Secretary on the handling of procurement debate may well intensify. The bottom line is that, from a would-be private sector stance, the GoCo option failed because those that might have wished to sign up to operate it in partnership with the MoD had no guarantee of being allowed to make profit without realising further substantial cuts in operational cost. That neither the Treasury nor the Cabinet Office had been keen on the GoCo option due to the fear of future risk and probably also that the proposed Trading Fund under which it would operate would not have been a central body of Government should not be ignored.

By the time the GoCo competition was killed off in favour of moving forward with a revised and rejuvenated public sector DE&S+ option, the process had cost the taxpayer £77·4m. Moving forward the DE&S+ option will, according to Gray, cost a further £17·3m to establish.

Three years since the procurement debate started, have we now moved on? DE&S may be weakened through the GoCo stealth process attempt but I do believe that, for now the right decision has been made. In the knowledge that £4bn of programme risk provision is set in stone and, as Hammond confirmed again in December, that the procurement programme has at least been stabilised, the new DE&S+ structure can start from a reasonably clean slate.

Given the value of defence to the national economy, the prospect of future cost overruns is not in my view an excuse for the MoD to attempt further risk reduction through policies of buying off-the-shelf. That would be counterproductive but, by learning to work closer and more efficiently with industry and by improving internal and external communication, DE&S+ should be able to play a much larger part in the overall risk reduction process. The emergence of trust and stability in the relationship between government procurer, supplier and those directly responsible for procurement will be important in the final analysis as to whether DE&S+ will be enduring or not.
LETTERS AND ONLINE

Glider upset training
While reading the December issue of AEROSPACE, I stumbled upon an article entitled The right attitude which summarises the different topics tackled during the September Flight Crew Training Conference on the theme of upset prevention and recovery training. I was very surprised to read about easyJet Captain Sarah Kelman explaining how gliders are capable of teaching stalls, spin and upset situations. I would have liked to have been present at the full presentation in the hope that my doubts are reassured as, in my point of view, this approach is totally against safety.

Although I can understand that gliders can teach a lot about basic aerodynamics, they can certainly not be used as references for commercial aviation when it comes to upset training. I was very surprised that such approach is endorsed in the ‘safety’ tab of your magazine, I would like to suggest that this approach be revised to avoid possible negative training on such a delicate subject.

Peimann Tofighi
Role of Parliamentary Transport Committee

The answer to the question posed by Michael Benoy in AEROSPACE Letters, December 2013 (What value does the Parliamentary Transport Committee add to the AAIB and CAA?) is simple: independent oversight. It is a recent habit to mock politicians and to sneer at the political process but that is to ignore the useful and often valuable work carried out by Parliament’s select committees.

As the Economist wrote in November: Whether drilling answers. Relying on experts alone without oversight, simply isn’t enough. Recent evidence for this assertion include the banking crisis of 2006 onwards and the Mid-Staffs NHS scandal.

Johnny S. Independent airlines aviation professional [on implications of US moves to introduce RPAS into controlled airspace]
Consider this: The words ‘remotely controlled’ indicate that the aircraft is controlled from the ground. Hackers have been able to penetrate right into the Pentagon’s secret files. Sooner or later a similar breakthrough by terrorist hackers could make it possible for them to ‘hijack’ a civil remotely controlled aircraft and use it for their own nefarious means. The safeguards will make this impossible? Try telling that to the military and civilian people who have to counter hacker attacks (like bank frauds) in the present time. A self-destruct system on board may help but it will not apply if, in the future, passengers are carried in such aircraft (see Cybersecurity in aviation, p26).

Paul E. Team Lead, Data Centre at Ark Air You have a valid point Johnny. However, I believe that as every new technology comes with its challenges, system vulnerability to hacks is one of the issues that would most likely lead to the deployment of RPAS (remotely piloted air systems) in fully unmanned civil roles (i.e. cargo, agricultural operations) first. It may take quite a while before we see RPAS deployed in the commercial passenger transport sector. In the initial stages of RPAS deployment in the open airspace, as you clearly point out, control system hacks are quite likely to occur, albeit needing extreme countermeasures to mitigate the fallout. I, however, believe that in (the technology developmental lapse) time, RPAS hacks would be mitigated to a point beyond which they would be a much less significant threat when we eventually have remotely piloted manned aircraft systems in the open airspace. Of course, this is not saying that the aerospace design community will not have to do anything about this potential barrier. Due recognition must be given to this threat in the current design of RPAS systems for civil operations and adequate mitigating measures must be taken.

Johnny Blauth AMRAeS Immediate Network Ltd

Glider on tow.

1. Rupert Murdoch, British spy chiefs or any number of fat cats — bosses of energy firms, failed banks, the BBC — they have provided many of the big political moments in this Parliament. <http://www.economist.com/news/uk/2013-10-04/parliamentary-committees-are-getting-better-holding-governments-feet-fire> The AAIB, the CAA and their colleagues at the DfT are all experts in their field who do vital work on behalf of all UK citizens. It is because of this last point that what they do should be overseen by knowledgeable, though not expert, politicians who are responsible for ensuring that the interests of citizens are taken into account. The Transport Committee’s role is to ask questions that might appear simple, irrelevant or daft but these can deliver important implications of US moves to introduce RPAS into controlled airspace

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Johnny S. Independent airlines aviation professional [on implications of US moves to introduce RPAS into controlled airspace]

Consider this: The words ‘remotely controlled’ indicate that the aircraft is controlled from the ground. Hackers have been able to penetrate right into the Pentagon’s secret files. Sooner or later a similar breakthrough by terrorist hackers could make it possible for them to ‘hijack’ a civil remotely controlled aircraft and use it for their own nefarious means. The safeguards will make this impossible? Try telling that to the military and civilian people who have to counter hacker attacks (like bank frauds) in the present time. A self-destruct system on board may help but it will not apply if, in the future, passengers are carried in such aircraft (see Cybersecurity in aviation, p26).

Paul E. Team Lead, Data Centre at Ark Air You have a valid point Johnny. However, I believe that as every new technology comes with its challenges, system vulnerability to hacks is one of the issues that would most likely lead to the deployment of RPAS (remotely piloted air systems) in fully unmanned civil roles (i.e. cargo, agricultural operations) first. It may take quite a while before we see RPAS deployed in the commercial passenger transport sector. In the initial stages of RPAS deployment in the open airspace, as you clearly point out, control system hacks are quite likely to occur, albeit needing extreme countermeasures to mitigate the fallout. I, however, believe that in (the technology developmental lapse) time, RPAS hacks would be mitigated to a point beyond which they would be a much less significant threat when we eventually have remotely piloted manned aircraft systems in the open airspace. Of course, this is not saying that the aerospace design community will not have to do anything about this potential barrier. Due recognition must be given to this threat in the current design of RPAS systems for civil operations and adequate mitigating measures must be taken.

Johnny Blauth AMRAeS Immediate Network Ltd
Charles G. CFD, 
Fluid Dynamics and 
Engineering Software 
Tool Developer and 
Analyst [On What do you think is in store for the renaissance of UK Aerospace?] I think also having more powerful HPCs (supercomputers) are needed compared to what is in the USA, China and Europe. Since most engineering products are designed virtually and the physics is modelled virtually having the most powerful HPCs is an advantage for modelling coupled aerodynamic/structure/acoustics/combustion/thermal to make the most efficient designs. Developing the necessary software with the most efficient numerical solvers for massively parallel supercomputers is also needed. I believe that the transonic tunnel from DERA Bedford went to ARA. There was also a new low-speed tunnel at Farnborough? The UK also contributed I believe a third of the money towards the cryogenic tunnel at Koln which can reproduce true Reynolds number flows. The wind-tunnels complement and validate the CFD developments. But it is only with updated tools can further developments in aerodynamics, propulsion, systems and design be made.

R&D — the need for supercomputers

Geoffrey W. 
Chartered senior aircraft structural design and development engineering professional. There is a lot of research potential not only in aerodynamics and future configurations but also in lightweight airframe structures (advanced stitched composites), new manufacturing methods, incorporating into existing basic configurations. The issue as always is funding.

@rafscopie [On Space Debris the legal issues] The Cosmos collision the article mentions was 1st reported & catalogued by non other than moi (& my team that night.)

@4tis [On a Belgian school using a quadcopter UAV to monitor students taking exams] I’m guessing it’s a hoax. It’s noisy, disruptive (blowing papers), could injure someone & only ~15 mins flying time. PR stunt?

@sUASNews [On who is winning race to unlock skies for UAVs] Europe already did. At last count there where 1,164 certificated operators. Japan has over 14,000.

@asPavold [On Hawk jet trainer turning 40 this year] great product, proud to have worked on them for 17 years of my career

@MarcusUAV Good to hear the commercial market is finally taking shape there....

@Losscomm [On USAF PaveHawk crash] What’s the protocol for a foreign mil a/c crash on UK soil? Do @aaibgovuk lead, MoD or foreign mil?

@P_H_Images It’s fair to say that comparing the [Hawk] T2 to the T1 is like comparing a British Leyland Mini to the current version!

1. The right attitude, AEROSPACE, December 2013, p.22.
2. Transmission, AEROSPACE, December 2013, p.12
Ten years ago, low-cost carriers (LCCs) were the minor players in the Asia-Pacific region, representing only around 2% of total capacity. However, the market has since experienced a radical reversal with budget airlines now accounting for over 50% of intra-regional capacity in Southeast Asia and 10% in North Asia.

In the past two years, the expansion of LCCs has been continuing to accelerate at an unprecedented rate with more and more new carriers joining the market each year — six in 2012, five in 2013 and a further 11 planned in 2014.

According to statistics published by CAPA Centre for Aviation, there are currently 46 airlines classified as low-cost carriers in the Asia-Pacific region, operating close to 1,000 aircraft, equivalent to 15% of the estimated total 6,800 in-service commercial aircraft fleet in the region (see table on p15). This figure will continue to rise, with an additional 1,500 new LCC aircraft on order, equivalent to 50% of total new orders. The total may actually be even larger, as it does not include aircraft ordered for LCCs which are owned by larger airlines which often utilise aircraft ordered by their parent company.

**Owners and operators**

While many Asia-Pacific LCCs are privately owned, others are operated as subsidiaries of larger LCCs (see table on next page). The largest group operator is AirAsia whose LCC-owned or controlled airlines accounts for a total fleet of 172 aircraft, plus a further 388 on order. AirAsia’s LCC affiliates include Thai AirAsia, Indonesia AirAsia (a 49/51% joint venture between AirAsia and local interests), Philippines’ AirAsia and AirAsia X — the latter specialising in long-haul routes based on low-cost airports. The second largest group is Lion which also operates Jakarta-based regional operator Wings Air. Lion is also unique among LCCs in operating a full-service subsidiary, Batik.

The third largest LCC operator is the Jetstar group with 116 aircraft, while another leading
low-cost carrier is Cebu Pacific Air with 48 A319/320/330 and ATR72-500s operating
domestic and international services within Asia.

To counter the threat of competition from LCCs,
a number of mainstream carriers have created
their own budget airlines. Australian flag carrier
Qantas operates long-haul LCC Jetstar which, in
turn, operates a number of regional joint venture
carriers — Jetstar Asia in Singapore, Jetstar Pacific
in Vietnam, Jetstar Japan and Jetstar Hong Kong.
Air India operates a low cost subsidiary Air India
Express based in Mumbai which flies to both
destinations within India as well as to Asia and
the Middle East. Thai Airlines has a 39% share in
Bangkok-based LCC Nok Air which has domestic
flights within Thailand using a fleet of Boeing
737-800s together with ATR and Saab regional
turboprops. Asiana Airlines operates a subsidiary
called Air Busan while Korean Air has a low-cost
carrier based in Seoul called Jin Air.

Some LCCs are jointly owned by a number of
companies. Singapore-based Tigerair (formerly
Tiger Airways) is owned by Tiger Airways Holdings;
a consortium comprising Singapore Airlines, Indigo
Partners Singapore and RyanAsia. Jetstar Japan
is a joint venture between Qantas Airways, Japan
Airlines and Mitsubishi and sources its aircraft from
Qantas. Japanese low-cost carrier Peach is a joint
venture between All Nippon Airways, Innovation
Network Corporation of Japan and First Eastern
Investment Group. Sri Lanka’s only LCC, Mihin
Lanka, is owned by the Sri Lankan government.

Expansion plans

All the LCCs have ambitions to expand and many
have already invested in new aircraft. Lion Air
recently took delivery of its 100th 737 and is asking
Boeing to increase its rate of future deliveries. The
carrier is also reported to be considering placing
an order for 50 or more Bombardier CSeries 300
regional jets in early 2014. At the 2012 Singapore
Air Show, Lion Air’s regional subsidiary Wings Air
signed a contract for the purchase of 27 additional
ATR 72-600 aircraft. Once these have been added
to its fleet at the end of 2015, Wings will become
the largest operator of ATR aircraft in the world,
with a total fleet of 60 aircraft (20 ATR 72-500s and 40
ATR 72-600s). Meanwhile, South Korean budget
carrier Jeju Air has announced plans to increase its
current 13-strong 737-800 fleet by an additional
six or seven aircraft during 2014, as well as raising
annual sales by 23% from won 340bn to won
530bn. SAI-owned Scoot also plans to increase its
fleet of six 777-200s to 14 aircraft by 2016 while
Thai LCC Nok Air is planning to almost double its
fleet to 30 aircraft by the end of 2015.

New LCCs are continuing to take-off. In March
2013, Lion Air began operating a new 49% owned
Malaysian low-cost budget airline called Malindo

Asia-Pacific low-cost carriers by country

<table>
<thead>
<tr>
<th>Country</th>
<th>LCCs (no. of aircraft*)</th>
<th>new LCCs for 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUSTRALIA</td>
<td>Jetstar Airways (74), Tigerair Australia (12)</td>
<td></td>
</tr>
<tr>
<td>CHINA</td>
<td>Hong Kong Express (4), Lucky Air (17), Spring Airlines (39), West Air (13) + China United, Jetstar Hong Kong, Jiu Yuan China, China United Airlines</td>
<td></td>
</tr>
<tr>
<td>INDIA</td>
<td>Air India Express (21), GoAir (17), IndiGo (73), JetLite (13), SpiceJet (56) + AirAsia India</td>
<td></td>
</tr>
<tr>
<td>INDONESIA</td>
<td>Citilink (24), Indonesia AirAsia (30), Lion Air (94), Lion Air Indonesia, Tigerair Mandala (9), Wings Air (27)</td>
<td></td>
</tr>
<tr>
<td>JAPAN</td>
<td>Air Do (13), Jetstar Japan (18), Peach (11), Skymark Airlines (33), Solaseed (12), Star Flyer (11), Vanilla Air (2) + Spring Japan</td>
<td></td>
</tr>
<tr>
<td>MALAYSIA</td>
<td>AirAsia (74), AirAsia X (19), Malindo Air (10)</td>
<td></td>
</tr>
<tr>
<td>MYANMAR</td>
<td>Golden Myanmar Airlines (2)</td>
<td></td>
</tr>
<tr>
<td>PHILIPPINES</td>
<td>Cebu Pacific Air (48), Philippines AirAsia (2), Tigerair Philippines (6), Zest Air (13)</td>
<td></td>
</tr>
<tr>
<td>SINGAPORE</td>
<td>Scoot (6), Tigerair (26)</td>
<td></td>
</tr>
<tr>
<td>SOUTH KOREA</td>
<td>Air Busan (11), Eastar Jet (9), Jeju Air (13), Jin Air (10), T’way (6)</td>
<td></td>
</tr>
<tr>
<td>SRI LANKA</td>
<td>Mihin Lanka (3)</td>
<td></td>
</tr>
<tr>
<td>TAIWAN -</td>
<td>+ Tigerair Taiwan</td>
<td></td>
</tr>
<tr>
<td>THAILAND</td>
<td>Nok Air (21), Orient Thai Airlines (22), Thai AirAsia (35), Thai Lion Air (2) + NokScoot, Thai AirAsia X, Thai VietJet</td>
<td></td>
</tr>
<tr>
<td>VIETNAM</td>
<td>Jetstar Asia (19), Jetstar Pacific (5), VietJet Air (10)</td>
<td></td>
</tr>
</tbody>
</table>

*Based on CAPA statistics for end 2013

Airlines, followed by a new Thai affiliate, Thai Lion Air, which began flying in December using a fleet of two 737-900ERs. In some cases, new budget carriers are being created by re-launching full-service model airlines. Hong Kong Express is one such example while Vanilla was formerly AirAsia Japan.

In 2014, up to 11 new LCCs may begin flying in the Asia-Pacific region (see table above). In March this year, Lion Air plans to launch a new Indonesia LCC under the name of Batik Airlines. Meanwhile, AirAsia has taken over control of Batavia Airways and is seeking approval from the Indian Directorate General of Civil Aviation (DGCA) to set up AirAsia India, a new low-cost airline to be jointly owned with two Indian investors. Thai carrier Nok Air is planning to begin competing with Air Asia X in the medium/long-haul sector with the launch of NokScoot — a new LCC carrier set up in conjunction with Singapore Airlines’ subsidiary Scoot and due to begin flying in the second quarter of 2014 using two CIA 777-200s.
AEROSPACE / FEBRUARY 2014

Asia-Pacific airlines

Low-cost carriers

While countries in Northern Asia have been slower to adopt the LCC concept than their southern neighbours, the situation is beginning to change. In Taiwan, which currently only has 4-5% LCC market share, China Airways announced plans to launch Tigerair Taiwan in 2014, a new LCC joint-venture with Tigerair. Meanwhile, Vietnamese LCC VietJet, which competes with state-owned Vietnam Airlines Corp and Jetstar Pacific, has declared its aim to double its domestic market share to 50% in three years.

The low-cost model has also reached mainland China. Shanghai-based Spring Airlines, founded in 2005, claims to be China’s first and only low-cost airline — although Hong Kong Express, Lucky and West Air are also operating under the low-cost model with another four to join them in 2014. Spring Airlines, which recently took delivery of its 39th aircraft, is planning to expand with the launch of Spring Airlines Japan in May 2014. In early January, China Eastern Airlines announced plans to convert its China United Airlines subsidiary into a low-cost carrier.

If you can’t beat them

Instead of competing with each other, some Asia-Pacific LCCs have decided to work together instead. Malindo Air recently signed an interline agreement with Thai Lion Air which would allow passengers to book a single combined e-ticket for flights operated by both airlines. Qantas controlled Jetstar Asia is considering joining the Qantas-Emirates airline alliance. In December Tigerair and SpiceJet signed a three-year interline agreement to enable greater connectivity between flights operated by both carriers. Which has an existing agreement with Singapore-Scoot, also announced the two carriers are to form a partnership to further align their commercial activities. In January, it was announced that Tigerair was to sell its 40% stake in Tigerair Philippines to Cebu Pacific, as part of a strategic alliance being set up between the two carriers.

In some cases, too much co-operation can get airlines into trouble. In September, the Malaysian Competition Commission (MyCC) fined its national carrier MAS and AirAsia RM10m each for monopolising four routes during an eight-month pact.

Asia-Pacific low-cost affiliates

Owners
AIR ASIA
AIR INDIA
ANA
ASIANA AIRLINES
CHINA AIRLINES/TIGERAIR
CHINA EASTERN
CHINA EASTERN/JETSTAR
GARUDA
HAINAN AIRLINES
HONG KONG AIRLINES
JET AIRWAYS
JETSTAR
KAM AIR/VIETJET
KOREAN AIR
LION
SINGAPORE AIRLINES
SCOOT/NOK
SPRING AIRLINES
SRILANKAN AIRLINES
TIGERAIR
VIETJET AIR

Affiliates

Lion Air Malaysian and Thai affiliates Malindo Air and Thai Lion Air operate an interline agreement to market joint e-tickets. ATR
Safety concerns

The growth in low-cost operations has not been without its problems. In April 2013, a newly purchased Lion Air 737-800 crashed into the sea after landing short of the runway at Bali Airport. Despite the aircraft breaking into two, all 101 passengers and seven crew were safely evacuated, although four passengers were treated for serious injuries. A preliminary report from Indonesia’s National Transportation Safety Committee called on the airline to tighten up pilot training and safety procedures. The airline was again in the headlines after passengers staged public protests after experiencing a series of delays and cancellations on its flights due to industrial and organisational problems. In October, Lion Air was the subject of a two-week evaluation by the Indonesian Ministry of Transportation.

There have also been safety concerns with other airlines. In August the Civil Aviation Authority of the Philippines (CAAP) grounded Air Asia budget carrier affiliate Zest Air due to a series of safety breaches, including refuelling with passengers onboard. A number of other Asian carriers are also raising safety concerns, as shown by the list of airlines currently banned from flying within the European Union which includes Lion Air, Citilink Indonesia, Air Asia Philippines, Cebu Pacific and Zest Airways.

Future challenges

Although at present the future looks rosy for the Asia-Pacific low-cost airline segment, it might be wise to add a few words of caution. The present buoyant economic conditions may not last forever and there is the risk that there may not be sufficient demand in the future for all the new aircraft capacity currently on order. The Asia-Pacific region has suffered from economic downturns before.

Eleven years ago saw demand for air travel in the region plummet due to the outbreak of SARS with flights to and from China down by 45% at one point. Even if demand does hold up, too much growth can sometimes bring problems of its own — including pilot shortages, airport and air traffic congestion and pollution.

Not all LCCs are finding the going easy. Garuda Indonesia affiliate Citilink had a tough year in 2013 due to the fall of over 20% in the Indonesian rupiah against the US dollar. The airline had announced plans for rapid expansion in 2014 with new routes to Singapore, Kuala Lumpur and Perth but scaled back its investment plans when it announced in December that it was reducing an order for ten Airbus A320s due in 2014 down to eight, with the other two aircraft to follow in 2015.

Although the Indian market has often been reported as having huge potential for LCCs, fierce competition and a lack of sufficient demand have made business difficult for carriers operating in the region. In 2013 IndiGo and GoAir were reported as being the only Indian carriers to report a profit in the previous financial year while, in September, Indian LCC SpiceJet announced a quarterly loss of Rs 559.49 crore.

Airports are also beginning to reach capacity. Airports of Thailand (AOT) is trying to free up more space at Suvarnabhumi Bangkok Airport by offering reduced landing fees to airlines that move their operations to Don Muang 45km away. Not all carriers are keen to make the move, as they face losing connections with other flights. Phuket Airport in Thailand is also running well over capacity, although a $180m airport upgrade is due to be completed in 2015.

There is also the threat of regional politics adversely affecting demand. Recent political conflicts in Thailand have reduced the country’s tourist demand with a knock-on effect on airlines. Thai AirAsia recently reported that its cabin loadings in November fell by 5% to 82% with the biggest decline in demand being from China.

China’s own politics may also have an adverse effect on the Asian-Pacific airlines. Beijing has recently set up a new air defence zone over the East China Sea and is demanding that all foreign aircraft passing through the zone should identify themselves to Chinese authorities. While this edict has largely been ignored by US, Japanese and South Korean military aircraft, Korean Airlines and Asiana Airlines have both begun filing flight plans while the US government has advised US carriers United, American and Delta also to comply, adding that the decision did “not indicate US government acceptance of China’s requirements.” Japan, however, has not complied and civil aircraft operated by ANA and Japan Airlines have continued to fly through the zone without informing China. Military tensions in the area remain high and there are concerns that civil air travel could be adversely affected should the situation escalate (see Pacific Storm, p 18).

Low-cost future

If proof were needed of the growing importance of the Asia-Pacific market, then it can be found in the expansion of its low-cost air transport sector. By how much this sector will grow and whether it will be sustainable is difficult to predict at the moment, as the low-cost revolution is still underway. But the present prospects look good. In the words of Tony Fernandes, CEO of Air Asia X: “There are three billion people in Asia. As long as we keep fares low, people will fly.”
The US pivot to Asia-Pacific and China’s accelerating military capabilities are amid growing tensions in the region. TIM ROBINSON assesses air power and defence in Asia Pacific.

A growing military power, intent on flexing its newly found muscles and proving its status, runs up against the established order. Nationalism and bellicose posturing runs riot. It is no wonder that in the recent months, parallels have been found between 1914 and an inexorable drift to war, and 2014, where a new, confident China is emerging as not only an economic superpower — but a military one at that. Its ‘great leap’ forward in terms of naval expeditory power, precision weapons, UAVs and stealth aircraft, along with its new assertiveness such as unilaterally declaring an air defence zone over disputed islands — has thus increased tensions amongst its regional neighbours.

Despite the US’s public ‘pivot to Asia’ there too is also an unspoken concern by allies in the region that a war-weary, isolationist and budgetary constrained US — now simply cannot be everywhere in the Pacific where it might be needed. The result has seen growth in military spending and procurement in Asia-Pacific with a 5% increase year-on-year fleet size. Let’s take a look at some selected military aviation developments.
Australia

As a key ally of the US in Asia-Pacific — Australia remains firmly committed to the F-35 programme with an aim to purchase 100. The first F-35A for the RAAF is now on the production line, with handover in the middle of this year. Stand-up of the first Australian F-35A will be in 2020. While the RAAF is already operating F/A-18F Super Hornets, in 2017 it will receive the first of 12 F/A-18G Growler electronic warfare/attack variants — giving the RAAF a potent EW capability.

Australia is also expected to follow India’s example and buy the Boeing P-8 Poseidon maritime patrol aircraft — with eight to replace the AP-3C Orions which will retire from 2017. The exact P-8 number may depend on decisions over the required force mix with the MQ-4C Triton maritime UAVs — but could be larger. Meanwhile, in 2012, Australia placed an order for ten Alenia Aermacchi C-27J tactical cargo aircraft. These replace the Caribou which was retired in 2009 and December 2013 saw the first C-27J for the RAAF make its maiden flight in Italy. Initial operating capability is planned to be in 2016.

In helicopters, the Royal Australian Navy is expected to take delivery of the first mission-ready MH-60R ‘Romeo’ Seahawk early this year. The RAN has 24 Romeos on order, with deliveries expected to be completed by 2016.

China

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China

Over the past few years there has come to light a number of new aerospace projects from China with stealth fighters, UAVs and transport aircraft revealed in quick succession. November last year saw images of what appeared to be China’s first UCAV prototype — Lijian (Sharp Sword) making its first flight. Other new UAVs breaking cover include a modified jet-powered diamond-wing design. Just over a year ago saw the first flight in January 2013 of the four-engined Xian Aircraft Y-20 military transporter — another indicator of China’s new emphasis on power-projection capabilities.

But perhaps the most iconic and public expression of Chinese power has been the status of the aircraft carrier Liaoning — which has become a national symbol (to a domestic public) of China’s increasing expeditionary military strength and has undertaken deck trials with J-15 fighters. The country, too, is becoming more transparent about its military forces, with TV reports detailing exercises and training.

However, the steady drip of images leaked on to the Internet also gives clues to newer Chinese capabilities which may be incoming. In recent months we have seen a Longbow-radar mast atop a Z-19 attack helicopter — suggesting a millimetre wave (MMW) radar and improved all-weather capability. A prototype of a new AEW aircraft variant — the KJ-500 also broke cover in late 2013, equipped with a rotordome, the aircraft reportedly using three AESA radars to give 360deg coverage. In addition, late last year also saw the start of series production of China’s J-10B fighter — which features an AESA radar, IRST and low-RCS chin intake. Meanwhile, only last month it was confirmed that China had tested a Mach 10 ‘hypersonic delivery vehicle’ missile — another new capability.

Finally, an image of an Il-76 testbed revealed what appeared to be a new high-bypass turbofan for the Y-20 transport undergoing tests. Powerplants have always been a key weakness for the Chinese aerospace sector — and with advances in space, stealth, cyber and UAVs, now perhaps remain the biggest technological gap between it and western rivals.

India

A large part of the defence growth in Asia-Pacific can be attributed to India’s massive military modernisation programme covering new fighters, transports, special mission aircraft and helicopters. Its annual defence budget is now more than $30bn. As AEROSPACE goes to press, French negotiators are hoping to end the log jam over the $12bn purchase of 126 Dassault Rafale fighters for the Indian Air Force’s MRCA requirement. Winning the contest in 2012, the Rafale deal entered a limbo over workshare arrangements involving local production of all but 18 fighters by Hindustan Aeronautics Limited. With elections in India in May — a new government may mean the deal will not be finalised until the end of the year.

In early 2014, China released photos of its aircraft carrier Liaoning’s first deployment.
Controversy has also dogged the procurement of 12 VVIP helicopters — which last month saw New Dehli terminate a deal with AgustaWestland for AW101s due to allegations of bribery. Three of the 12 AW101s have already been delivered to the IAF.

But other deals are expected to be finalised early this year, including 22 Apache helicopters, 12 Chinooks and six A330MRTT tankers. This builds on earlier deals — with India’s C-17 fleet to reach ten this year, along with ongoing deliveries of P-8I Poseidons to the Indian Navy — the third example having been delivered last November. India will eventually operate 12 P-8Is.

Meanwhile, while all eyes have been on China’s new carrier, India’s much-delayed aircraft carrier, the INS Vikramaditya (ex-Admiral Gorshkov) has been commissioned and is currently working up to operational capability. It will be equipped with MiG-29K fighters. Additionally India’s first indigenous aircraft carrier, the INS Vikrant is expected to be commissioned in 2017. Finally, India is also a partner with Russia on the joint Fifth-Generation Fighter Aircraft (FGFA) — a variant of the Sukhoi T-50 PAK-FA designed for the IAF. This, India’s first stealth fighter, would see local production begin in 2020 for 144 airframes.

Indonesia

For Indonesia, September 2013 saw the first deliveries of KAI T-50i advanced trainers to the air force. First ordered in 2011, Indonesia is getting 16 of the jets. The country is also boosting its COIN capabilities with deliveries underway of Embraer EMB-214 Super Tucanos — with again16 on order. Last year, too, saw Indonesia join the Apache gunship club — with an order for eight AH-64E Guardians in a deal worth $500m.

Japan

The deterioriation in relations between Beijing and Tokyo has resulted in a new focus to keep Japan’s defence forces well-prepared. Tokyo also sees additional threats from the unpredictable state of North Korea — especially from ballistic missiles. To that end, in December 2013 it released its first ever national security strategy which will see it budget for 28 F-35s, three MQ-4 Global Hawks and 17 MV-22 Ospreys over the next five years. This will boost capabilities while also allowing close interoperability with US forces. Japan selected the F-35 in 2011 and will acquire around 40, with the first example to be delivered in 2016.

Meanwhile, although traditionally constrained by its constitution to defence only, Japan has been moving to put the pieces in place for a more expeditionary force-projection capability. Its Izumo-class ‘helicopter destroyers’ are Japan’s largest warships and, in reality, helicopter/assault carriers. Speculation exists that, if needed in the future, these could be quickly converted to operate F-35Bs giving the JMSDF a potent fixed-wing carrier strike force.

Singapore

A city-state with a small but capable military — Singapore is engaged in maintaining its key edge in quality of forces. It is already seeking to upgrade RSAF F-16s in service with a $2·3bn FMS package that includes AESA radar, and helmet-mounted sights. This F-16 modernisation means Singapore has extra time to mull a possible F-35 purchase — a factor that the Defence Minister confirmed in December when he said there ‘was no particular hurry’ to acquire the F-35. A security partner on the JSF programme since 2003, Singapore is expected to acquire the aircraft at some point. Elsewhere, Singapore may also make a decision on a new aerial tanker to replace its four aged KC-135Rs — with a requirement for six aircraft. The last Singapore Air Show in 2012 saw a RAAF Airbus KC-30 tanker visit the show and, in 2013, Airbus along with Boeing with its KC-46 put in bids for the requirement. Could this year’s Singapore air Show see an announcement?

Malaysia

Meanwhile, Malaysia represents the first customer in Asia-Pacific for the Airbus A400M transporter. Four aircraft are on order, with the first expected to be delivered in 2015. However, hopes that the
country could move forward with plans to procure new fighters (to replace MiG-29s) and AEW aircraft appear to be on hold until at least 2015-2020 due to a lack of funds. Meanwhile, the RMAF is set to update its aging C-130H fleet with a glass cockpit retrofit.

Philippines

Devastated by a tropical typhoon in November, military aviation assets, from different nations, such as USMC MV-22s and RAF C-17s, have been engaged in supporting relief efforts in the country. However, despite the crisis, Manila is still hoping to boost its security in the face of changing threats. Its claims on disputed islands such as Scarborough Shoals and the Spratlys, put it in potential conflict with neighbours — including China. Meanwhile, it also faces internal threats from Islamic terrorist groups. To that end it is likely to acquire two CN-235MP maritime patrol aircraft. In 2012 Manila signed for 12 KAI T-50s trainer/light attack aircraft which would restore its fast jet capability that was lost in 2005 when the last F-5s were retired.

Taiwan

Taiwan has reason to intensify its search for weapon updates, especially as some PRC hardliners see taking the island as a necessary stage in shutting out the US from the ‘first chain’ of defensive land bases as part of an overall A2/D2 (Anti-Access/Area Denial) strategy. However, its efforts to acquire newer Block 52 F-16C/Ds for the RoCAF came to naught — leaving it with the second option of upgrading its existing 145 F-16s. A $5·3bn deal agreed in 2011 will see Taiwan piggyback on the USAF’s F-16 modernisation programme to retrofit the F-16s with Northrop Grumman’s SABR AESA radar and other upgrades. However, the RoCAF’s existing fighter aircraft power has been boosted when the first batch of 71 upgraded Ching-kuo Indigenous Defense Fighters (IDF/F-CK-1) were revealed. This mid-life update features avionics and radar upgrades as well as integration with a new indigenous stand-off missile, the Wan Chien. Taiwan is another Asian AH-64E customer, with 30 on order, the first six of which were delivered in November.

South Korea

Seoul is still embarked on a comprehensive revamp of its armed forces, aimed not only at deterring the North but also keeping pace with other powers in the region. In late November it selected the Lockheed Martin F-35 for its FX-II requirement — overturning the previous preference for the Boeing F-15. South Korea will acquire between 40-50 F-35As if all options are taken, with first delivery in 2018. A reduced buy of 40 aircraft potentially may leave the door open to Boeing or even Eurofighter to claim a second prize in a split buy. The country is also keen on further developing its indigenous aerospace capabilities. Its advanced trainer/light attack jet, the KAI/LM T-50, has now been sold to Iraq, Indonesia and the Philippines and, additionally, with LM is now being aimed at the USAF’s T-X trainer requirement. Last year the KAI Surion helicopter, developed in conjunction with Eurocopter, entered service with the country’s army. It will replace Hueys and MD500s currently in service, with the army planning to acquire 200 Surions. South Korea, too, has 36 AH-64Es on order. The next potential project though, ambitiously, would be its own stealth fighter (KF-X). The RoKAF is also modernising older types — in late 2013 it finalised an approx $1bn deal with BAE Systems to upgrade 130KF-16s — which includes Raytheon RCAR AESA radar.

Seoul also has a need for a new MPA/ASW and is mulling refurbished ex-USN S-3 Vikings for this role. Finally, in UAVs, this year may see an agreement for South Korea to acquire four Northrop Grumman RQ-4Bs under a US FMS deal. Boosting South Korea’s ISR capabilities, this would see deliveries begin in 2017.

Summary

There is no doubt that the appetite for defence procurement in Asia-Pacific is closely linked to the fears of a rising China disrupting the status quo. While European air forces shrink, and while the US struggles with budget realities, Asia’s nations are building up their forces.
It’s hip to be square
The CubeSat revolution

With the launch of the UK’s first commercial CubeSat, UKube-1 on the horizon, MALCOLM MACDONALD* and CHRISTOPHER LOWE** look at what the future holds for this standardised space platform.

Just over 56 years ago, the Space Age began with the launch into an elliptical, low-Earth orbit of a 58cm polished metal sphere with four external radio antennas. This metal sphere was named in Russian as Satellite-1. We know it as Sputnik-1.

The launch of a spacecraft today is perhaps not quite mundane or routine, but it is worth recalling that the scale of this achievement by the Union of Soviet Socialist Republics (CCCP or USSR), less than a lifetime ago, triggered a Cold War crisis within the USA and her allies. This crisis led to the use of the same evocative imagery as in the aftermath of major modern-day events such as the series of co-ordinated suicide attacks within the US on 11 September 2001.

In its day, Sputnik-1 and the spacecraft that followed such as the first American spacecraft, Explorer-1, were the reserve of elite, well-funded national programmes. Today, despite the increased accessibility of space from those early days, this perception of the ‘typical’ spacecraft persists as a, typically bespoke, tens to hundreds of millions of pounds development over a number of years by teams of people working in clean rooms and beyond to the highest conceivable quality standards. Yet the reality has moved on.

The CubeSat era
Towards the end of the 1990s a number of university groups were developing student-built pico-satellites. Based on this experience at Stanford University, Bob Twiggs and his co-workers, including Jordi Puig-Suari at California Polytechnic State University (Cal Poly), developed and proposed to the community the concept of a CubeSat ‘as a collaborative effort to continue developing the pico-satellite, provide a convenient low-cost launch interface and co-ordinate launch activities.’(1)

Key to the CubeSat standard is simplicity, standardisation and conformity. The base unit of a CubeSat is a 10cm cube, termed ‘1U’ or ‘1 unit’. The CubeSat is traditionally scalable along a single axis in units of 1U, hence a 3U CubeSat like UKube-1 is approximately the size of a box for a whisky bottle; 30 × 10 × 10cm. Today, this traditional single-axis scalability is possible in units of less than 1U while
also extending into a second, or even third, axis with the development of 6U and even 12U CubeSat concepts.

Inside a CubeSat is, typically, a stack of PC/104 cards, each card contributing a spacecraft subsystem, as shown in the photo below. These PC/104 cards are part of the CubeSat standard, allowing developers to in effect, ‘mix and match’ cards from different suppliers without the traditional integration issues. A further example of this standardisation is in-orbit deployment. CubeSats are deployed from a mechanism called a Pico-satellite Orbital Deployer (POD), this standardisation of the launcher/spacecraft interface significantly reduces the cost and effort typically required to mate a piggyback spacecraft to its launcher, while also de-risking.

These payloads from the launcher perspective as alternative CubeSats, or mass-dummies can be sourced at short-notice and flown with relative ease. The first CubeSats were launched in June 2003 into a Sun-synchronous orbit on-board a Eurockot from Plesetsk, Russia; these CubeSats were from Denmark (two), Japan (two), Canada and the US. Since then, innumerable CubeSats have been launched including the three 1U CubeSats shown on left.

The growth in CubeSat developments and launches has been dramatic. In 2013, over 90 CubeSats were launched (3), and between 19-21 November alone, 52 CubeSats were launched: 28 on-board an Orbital Sciences’ Minotaur rocket from NASA's Wallops Flight Facility (a then record number of spacecraft on-board a single launch vehicle); three from the Kibo laboratory of the International Space Station; and 21 on board a Dnepr rocket from Yasny in Russia, setting a new record of 32 spacecraft on a single launch vehicle.

Among the CubeSats on-board the Minotaur rocket was TJ3Sat from ‘Thomas Jefferson High School for Science and Technology’ in Virginia, USA, the first spacecraft designed, built and flown by school pupils, and PhoneSat 2.4 from NASA which makes the claim to be ‘the first use of a phone as control system for a satellite’. Note, however, that this is not the first time a phone has been used on-board a CubeSat, as the Surrey Space Centre and SSTL used a phone on-board its STRaND-1 3U CubeSat as a secondary computer to a ‘classic’ CubeSat computer.

Meanwhile, on-board the Dnepr rocket were spacecraft with a UK interest, including the ‘Magic’ mini-magnetometer from Imperial College London on-board KHUSat-1 and -2, and the FUNcube-1 developed by Amsat-UK. FUNcube-1 has the aim of increasing interest in radio, space, physics and electronics among schoolchildren. It carries a transponder that transmits signals that can be picked up using a simple USB dongle receiver and small aerial. It is of note that, although FUNcube-1 is a UK development, it is registered in The Netherlands due to the regulatory difficulties in obtaining space licensing in the UK. FUNcube-2 will fly on board UKube-1 and is illustrated above.

Above: A 1U CubeSat with PC/104 stack shown and an integrated battery daughter board at the top.
UKube-1
It is into this mass proliferation of CubeSats that UKube-1 will shortly be launched on board a Soyuz 2-1B rocket from Baikonur Cosmodrome in Kazakhstan, alongside ten other spacecraft, including TechDemoSat-1 built by SSTL and Russia’s first ever private spacecraft, built by Dauria Aerospace group and fully funded by domestic Russian private capital.

Clyde Space, based in Maryhill in Glasgow’s West End, built UKube-1 for the UK Space Agency, with multiple flight tests of low-cost electronic systems and payloads on board. In addition to FUNcube-2, payloads include: TOPCAT, the first GPS device aimed at measuring plasmaspheric space weather; Janus, an experiment to demonstrate the feasibility of using cosmic radiation to improve the security of communications satellites, from Airbus Defence and Space; and, a CMOS Imager Demonstrator from the Centre for Electronic Imaging at Open University and e2v Technologies deploying next generation sensors. Other UK companies involved include Bright Ascension (software) and Steepest Ascent, now part of MathWorks (mission interface computer).

UKube-1, Clyde Space’s first in-house platform development, emerged from a Knowledge Transfer Partnership between Clyde Space and the Advanced Space Concepts Laboratory at the University of Strathclyde, and is seen by the UK Space Agency as a pathfinder mission for the Agency’s proposed national CubeSat programme which would see a mission launched every 12-24 months. The UK Space Agency envisage a national CubeSat programme increasing the UK’s ability to market new space technologies while providing training and research opportunities for the next generation of engineers and scientists.

The next steps
In addition to the original ‘amateur’ or ‘educational’ CubeSat rationale, a spectrum has emerged to span a ‘professional’ rationale. Evidenced by CubeSat developments such as STRaND-1 from SSTL, which had significant input from the University of Surrey, and UKube-1 from Clyde Space, which has a range of academic involvement, through to CubeSats from the US Air Force, NASA and Boeing.

The CubeSat developer’s spectrum now spans high schools to professional engineers and space agencies, with a directly related spectrum of increased (staff) costs and, it must be expected, reduced risk/increased performance. Similarly, companies such as Pumpkin, Innovative Solutions In Space (ISIS) and Clyde Space have emerged to service this complete spectrum of developers with sub-systems, launch services and even complete platform solutions.

UKube-1 is an example platform solution, while those offered by Clyde Space and ISIS for the European Union FP7 project ‘QB50’, a network of up to 50 CubeSats to study temporal and spatial variations in the lower thermosphere due for launch in 2015, are a further example. The National University of Singapore’s Centre for Quantum Technologies, rather than procure the sub-systems and integrate these in-house for perhaps one-third of the incurred cost, in October 2013 placed a $200,000 order with Clyde Space for a QB50 platform solution building on UKube-1 heritage. This is a clear example of the incurred cost versus risk trade that the CubeSat spectrum now enables. Orders such as the NUS QB50 platform are thus attractive to companies like Clyde Space and ISIS, however, it remains to be seen whether this platform market will mature beyond a niche within the CubeSat ecosystem.

The first major CubeSat constellation, Flock 1, by the San Francisco start up Planet Labs, has already launched four 3U CubeSats. The first two of which, Dove-1 and -2, were launched on 21 and 19 April 2013; note that at that time Planet Labs was still operating in ‘stealth mode’ as Cosmogia and was not formally launched until 26 June 2013. An image from Dove-2 is shown opposite.

Dove-3 and -4, with increased performance from -1 and -2 and targeting a ground resolution of three to five metres, were launched on the record breaking Dnepr rocket previously mentioned; early images from Dove-3 were available on the Planet Labs twitter feed (@planetlabs) at the time of writing. Twenty-eight further spacecraft were shipped in November to NASA Wallops, due for onward transportation in December on-board the first space station cargo flight by Orbital’s Antares rocket, with Flock-1 due subsequent orbital deployment in Q1 2014.

At the time of writing that transportation flight had been pushed into early 2014 by the spacewalks necessitated by the failed valve within a pump module on-board the space station.

Planet Labs, much like SpaceX before it, seeks to bring the mentality of Silicon Valley to the space sector, and aims to operate the largest Earth observation constellation in the world; trading improved temporal resolution against spatial resolution. The spatial resolution of less than 5 metres (at 400km altitude) improves or matches significantly larger platforms such as UK-DMC 2 (22 metres at 660km altitude) and RapidEye (6 metres at 630km). However, this resolution is less than newer spacecraft, such as those of Skybox Imaging (SkySat-1 and -2) and the in-development UK-DMC-3, both providing 1m imagery.
The reduction in altitude of Flock-1 partly enables the improved performance over the five-year old UK-DMC-2, however, this reduction also gives a reduction in service lifetime due to increased atmospheric drag. Yet, as Planet Labs point out, this trade necessitates the more frequent upgrade of the relatively low unit cost devices, much like our approach to consumer electronics, enabling the system to benefit from the most advanced available technology at any given time.

That a start-up like Planet Labs, albeit founded by ex-NASA employees, can undertake development of 32 spacecraft with $13m of venture capital funding does question the likelihood of the CubeSat platform market maturing beyond a niche. However, perhaps most eye opening is the ability of Planet Labs, alongside other start-ups like Skybox Imaging, to access such significant quantities of venture capital.

**Future developments**

While the vast majority of current Earth orbiting CubeSat efforts are limited to observation of Earth or some in-situ phenomenon (as in the case of QB50), technology demonstration and science research is underway into their use as communication platforms and navigation systems, among other things.

Meanwhile, launching CubeSats is becoming a fraught issue. The traditional CubeSat secondary payload approach is falling out of favour with some primary payloads and consequently some launch providers have discontinued the use of secondary payloads altogether. Meanwhile, rockets such as the Dnep or Minotaur are incurring organisational difficulties in co-ordinating so many small spacecraft, and their teams. Furthermore, in the US NASAs CubeSat launch initiative has been so successful that it is now struggling to find launch opportunities for all the CubeSats it has spurred.

In August 2013 NASA announced its Launch Services Enabling eXploration & Technology (NEXT) programme/competition to accelerate development of very small launch vehicles (VSLVs). This programme hopes to encourage the development of a launch vehicle capable of putting three 3U CubeSats with a combined mass of 15kg into Sun-synchronous orbit with an altitude of greater than 425km, with a payment of $300,000 per 3U CubeSat carried.

In parallel to this, the UK Space Agency, through its Space Collaborative Innovation Team Initiative (Space CITI) pilot programme, is funding the UKLaunch consortium to study the technical and economic feasibility of a UK-based small satellite launcher (see ‘Reaching for the Stars’ by Adam Baker, AEROSPACE, September 2013, pp 36-40).

Other work is progressing to further enhance the capabilities of these small spacecraft through, for example, the addition of deployable structures and propulsion systems using, for example, ionic liquid(4) or xenon, iodine or water(5). In fact, the potential applications for CubeSats span as wide as for traditional satellites, with interest even extending to interplanetary travel and exploration. An annual workshop(6) on the subject plays host to enabling technologies and applications from advanced autonomous sensor systems to lunar penetrators, indicating that CubeSats of the future could be escaping the clutch of Earth’s gravity field. However, the potential progression of CubeSats beyond the low-Earth orbit environment does raise potentially uncomfortable space debris and planetary protection issues that will need to be addressed (see ‘Space Debris: the Legal Issues’ by Joanne Wheeler, AEROSPACE, January 2014, pp14-17).

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Cybersecurity and aviation

Shared services, in-flight connectivity, and virtual collaboration are bringing new dangers to the aerospace sector from hackers. ANGUS BATEY reports.

Of all the challenges facing the aerospace industry, cybersecurity may be the most complicated. The advent of wirelessly networked computing offers huge potential gains to regulatory and airspace-operating bodies, airframe manufacturers, users of military aircraft (both on the ground and in the air) and to civilian airlines and their passengers — but each new opportunity brings a set of new risks.

Just as in any other walk of life, networked computer systems are now integral to the day-to-day functioning of every aspect of aviation. On-board systems pass data to and from ground terminals during an aircraft’s flight, so the potential for a hostile actor to take control of an aircraft in flight may not be entirely in the realms of science fiction. Disruption of computer systems handling the control of traffic in increasingly busy airspace could have catastrophic consequences. And the complicated and lengthy industrial supply chains that are the norm in the aviation business rely on the public Internet to transfer financial, administrative and design information, each link in the chain introducing new opportunities for attackers to steal intellectual property or commercially sensitive information.

The aviation community understands and recognises these problems just as thoroughly as any other sector but the methods employed by other businesses to safeguard their information-technology systems may not always work in an aerospace context. Businesses and government are still coming to terms with the nature of the threat, and how best to work together to mitigate it. And an industry that has always had safety to the fore is having to come to terms with the realisation that the measures that have served it well for a century may no longer be sufficient to guard against a new generation of threats.

A question of trust

“The aviation industry has generally relied a lot more upon trust mechanisms, so I think it’s probably slightly behind the curve,” says James Wootton, Technical Director of data-security consultants Information Risk Management plc. “The biggest challenge, I think, is that this trust that the aviation industry has always had on its own ability to manually check things has slightly left it behind.”

Perhaps the most obvious example of
aviation’s reliance on trust mechanisms is found in the role of the pilot. The best form of defence against the sort of worst-case scenario a writer of science fiction might be able to conjure — say, a terrorist with a laptop taking remote control of an airliner during flight — is provided by the skilled aviator on board, and in their ability to manually override automated flight-control systems.

“Most communications with air-traffic control on a manned flight is VHF,” explains Gary Clayton, an unmanned air systems expert at Airbus Defence and Space. “There’s some data communications with the aircraft and, in oceanic situations there are satellite communications. At the moment those don’t have any cyber protection on them but you’ve got a very intelligent human being sat between the controls and the incoming data deciding what to do. So [in the event of a rogue instruction arriving] he will say, ‘That doesn’t make sense, let me check.’ ”

“It’s almost like the first, bad old days of the Internet, where everyone assumed that, because it came from academia, that it didn’t really need any controls around it,” says Wootton. “Everyone was a good guy — that was taken as read. And then it got pushed out beyond that little circle of friends in various research laboratories and universities: you started to have bad people, and bad people do what bad people do, and exploited it. Now you’ve got exactly the same analogy within the aviation industry. You trust the pilots, you trust your ATC, you trust your engineers and your back-end systems, and you trust your execs to go away and do their thing. And none of it’s joined up.”

The Advanced Persistent Threat

Just as in any other type of defence or security activity, the first job for information-assurance practitioners is to gather as much data as possible about potential and actual threats. This is a considerable task, as possible attacks may come not just to key mission-critical systems but to every computer in an organisation that has any connection at all with the outside world.

“In the broadest sense, cyber security is a way of actually understanding what threats are out there that we want to protect ourselves against, what the risks are that we have in doing business, and then what mitigations we have in place and want to put in place in the future to minimise them,” explains Gavin Walker, Chief Information Officer of National Air Traffic Services (NATS), the UK’s principal air navigation services provider. “We have operational systems we use which are, by and large, bespoke — but my remit is across the whole business, so that includes the normal business applications and the back-office type stuff.”

Over the past decade, fundamental attitudes towards cyber-security postures across a range of business sectors have first been challenged, then changed. Conventional defences involved the digital equivalents of high walls, deep ditches and sentries facing out, scanning the horizon for incoming threats. But the growing sophistication of targeted cyber attacks — the so-called Advanced Persistent Threat-type of breach, where an adversary manages to find a hidden back-door into information systems and spends a long time undetected inside the network, gathering information or planting seeds of sabotage — means this paradigm is no longer effective. Today, the challenge is generally considered to be less about keeping attackers out, than recognising that when they do get in — because this will inevitably happen, if it hasn’t already — that they’re not able to leave with any useful or important information, or do any damage to the computer systems or any physical machinery they control.

TODAY, THE CHALLENGE IS... LESS ABOUT KEEPING ATTACKERS OUT, THAN RECOGNISING THAT WHEN THEY DO GET IN, THAT THEY’RE NOT ABLE TO LEAVE WITH ANY USEFUL OR IMPORTANT INFORMATION, OR DO ANY DAMAGE
“We’ve got to operate as an organisation knowing that we’re in a constant state of compromise, rather than thinking that it’s all secure,” agrees Walker. “But what we want to do is to recognise that we’re in a constant state of compromise but ensure the impact will be minimal on the business. That’s a different mindset to be in. It has to be a consideration for everybody in the organisation, not just a small number of people.”

**The all-sharing Facebook generation**

Encouraging a security-focused attitude in a large and diverse workforce therefore becomes a priority. This is a particular challenge for today’s businesses, as more and more staff are recruited from the ‘digital native’ generation, who are used to publishing an abundance of personal information on social media, and to many of whom the most important thing is sharing information, not checking beforehand to make sure it will only be made available to trusted recipients.

“One of the things we try to do is make the connection between home life and work life,” Walker explains. “You should be secure with your information in your home life, because you don’t want anybody stealing money out of your bank account: so if you think about information in NATS, you don’t want the same thing to happen. I think it’s about understanding the value of the information. If you can make that clear, and people understand the impact of what that information is, then they won’t or will share it.”

**The supply chain — a weak link?**

One set of information that does need to be shared is intelligence about cyber threats. In today’s interlinked business world, a supply chain’s security may depend on the temp-agency staffer handling reception duties in a sub-systems supplier and whether or not they know not to click on a link in what may appear to be a genuine email from a trusted colleague. Knowing that a particular attempt to compromise security has been detected elsewhere in the chain can help strengthen defences: but this information has to be shared quietly.

Just as a military unit does not want an adversary to know it is under surveillance, so a cyber-security team will not want to alert a threat actor that their moves are being monitored. Profit-making companies, with shareholders to keep happy and reputational issues to consider, have other reasons for carefully handling data-breach information.

**Enter the DCPP**

Ad-hoc networks — sometimes as informal as individuals at senior roles in different companies choosing to phone friends in similar jobs to notify them of a newly discovered threat — have existed for years. But, following publication of the UK’s Cyber Security Strategy by the Cabinet Office in 2011, some more formalised information-sharing networks were established in several areas with key significance for critical national infrastructure. That work has helped inform further developments, one of which — the Defence Cyber Protection Partnership — involves a number of entities active in the aviation industry.

“What came first was a recognition by the major players in the sector that they were experiencing similar things, and also a recognition that this wasn’t a problem that either government or industry would make adequate headway with on their own,” explains Vic Leverett, Business Development Director of Finmeccanica UK, and chair of the DCPP, in the first interview given by any of the organisation’s principals since it was created in February 2013.

“If there could be a forum whereby industry and government could work together, then the whole would be greater than the sum of the parts,” he continues, “both in terms of the nature and the quality of information shared, the mitigation techniques and, in particular, the ability to protect the supply chain in the defence sector. More or less from the beginning, the focus of attention was on three subject areas: our ability to share information in a secure way, our ability to work with the government to help establish a set of cyber standards, and to raise the awareness of, and therefore subsequently protect better, the supply chain.”

The DCPP includes representatives of 12 defence-industry companies — among them aerospace giants BAE Systems, Rolls-Royce and Lockheed Martin, but also including BT from the telecoms industry and Hewlett Packard from the information-technology sector — alongside members from the Ministry of Defence, the signals-intelligence agency GCHQ, the Centre for
the Protection of National Infrastructure and the Department for Business, Innovation and Skills. The aerospace trade association ADS and its equivalent in the IT sector, Tech UK (formerly Intellect), are also represented.

Raising the security level

“Our primary motive is to raise the overall security level of the sector,” Leverett emphasises of the DCPP, which has no funding from government. “This group does not exist specifically to provide market opportunities for any of its members.”

Leverett chairs a monthly executive group meeting which steers working groups active in each of the three areas identified for attention, and says each has made ‘significant steps forward’ since work began. Real-time sharing of threat information takes place through a DCPP node on the Cyber Security Information Sharing Partnership, a system established by the Cabinet Office following publication of the Cyber Security Strategy.

The organisation has addressed the question of how to ensure everyone in the supply chain receives a thorough grounding in the right kind of cyber-security mindset by producing a single supply-chain briefing. It is designed to “raise awareness and to indicate some of the first steps that suppliers would need to take,” Leverett explains. “It can be briefed by any of the DCPP members, or the trade associations, but it is a common briefing — so suppliers, hopefully, will not get confused by having a different set of key messages from different prime contractors and/or government.”

Can UAVs help make manned aviation secure?

The one part of the aviation industry that cannot allow an acceptance that compromise is inevitable is on board an aircraft itself, in unmanned aviation, that challenge is much more pronounced. But it may be that the unmanned sector’s necessary work on securing data transmissions between airframes and their remote pilots will point the way forward for the whole industry.

“In the unmanned world, of course, you don’t have that very intelligent person interpreting every message actually on the aircraft,” Clayton says. “So the security of the communications is actually quite a large security issue. At the same time, coincidentally, you’ve got manned aircraft wanting to be more data-enabled: they want to send and receive more data, they want to offer more customer services in the future. There’s a number of areas that the unmanned world is doing the research on, that the manned world is starting to say, ‘Actually, we can improve our safety by taking on those technologies.’

Clayton points to work done as part of the pan-industry ASTRAEA programme as potentially useful in helping manned aircraft achieve increased data-security standards. It’s a message that has been received well in what could have been unlikely places.

“The ASTRAEA team recently had a meeting with the British Airline Pilots Association,” Clayton says. “We thought that was going to be like telling turkeys about Christmas — but actually they were very supportive because they could see how these different technologies would be able to help their world. If a large aircraft has a system that can automatically detect icing, can detect other things in the environment with a sense-and-avoid system, can communicate securely and can have faster links because the aircraft is networked — that all helps the pilot.”

Obviously, the magnitude of the challenge is reduced — an unmanned aircraft only has to communicate with a small number of other computers, not the entire Internet; and, while feeds from cameras and other on-board payloads may need to be distributed quite widely, those transmissions can be kept separate from the command-and-control systems to maintain safe operations. But the need to achieve total security is a significant piece of work.

“It’s a lot harder than manned aviation,” says Clayton, “because when you close the door and you lock the pilot and co-pilot in, you’ve only got 300 adversaries. But if the pilot is in a bunker on the ground, there are lot more potential threats.”

ASTRAEA test of a robust, secure communication network. Could this have applications for manned aircraft operations?
Defence
Low-cost reconnaissance trainer

Is there a market for a new low-cost military jet in the current US defence market? BILL READ talks to Textron AirLand about the Scorpion fighter.

Scorpion:

- <$20m to buy
- 450kt cruise speed
- 1,360kg internal payload

Given the current depressed state of the US defence industry with its ongoing saga of cancelled acquisition programmes and sequestration cutbacks, the last thing one might expect to see is the maiden flight of a new US-built fighter. Yet this is exactly what happened on 12 December when a new light attack/reconnaissance demonstrator called Scorpion made its first flight. What was even more surprising was that Scorpion was not a product of a mainstream defence manufacturer but was built by Cessna — a company normally associated with business jets and GA aircraft. A third surprise was the time taken to develop the aircraft — a mere 23 months. However, when examined more closely, the Scorpion programme begins to make more sense and could, in fact, be just the right aircraft that is needed for the present economic conditions.

The Scorpion demonstrator was developed by Textron AirLand — a joint venture between the Textron group and investment company AirLand Enterprises. The prototype aircraft was constructed in secret at Textron subsidiary Cessna’s plant in Wichita, Kansas, between April 2012 and September 2013. To create the aircraft, Textron AirLand was able to draw on a variety of expertise and skills already present within the Textron group, which includes Cessna (GA and biz-jets), Bell Helicopter (rotary wing) and AAI (unmanned systems).

“We’ve changed the business model by bringing commercial practice to the military market,” explains Chief Engineer Dale Tutt. “We wanted to use mature technology, so the Scorpion is based on existing Cessna designs and other mature off-the-shelf systems. The airframe and primary structures are all of composite construction. It is fitted with Cobham avionics, while the engines are Honeywell TFE731 turbofans that have been proven on a number of other aircraft. The ice protection and basic systems come from the Citation business jet and the ejection seats are from Martin-Baker. The AirLand team was also able to draw on military engineering experience from Bell Helicopter and from colleagues who had worked with other defence manufacturers.”
The two-seater Scorpion has a cruising speed of 450kt, an internal payload of up to 1,360kg and an endurance of up to six hours. The wing is mounted above the fuselage and is fitted with six hardpoints which can carry a variety of payloads, including intelligence, surveillance and reconnaissance (ISR) equipment or missiles. “The two inboard points can carry external fuel tanks to increase range and in-flight times,” explains Dale Tutt. “We can also fit up to 2,000lb of extra fuel inside the payload bay.”

Customised design

The unit price of a Scorpion has not yet been confirmed but is expected to be less than $20m with direct operating costs of around $3,000 per hour. This compares with an estimated purchase price of $100m and hourly running costs of $24,000-$32,000 for a frontline fighter, such as the Lockheed Martin F-35.

When asked what was the rationale behind investing in a military aircraft when western military expenditure is being cut back, AirLand Vice President, Military & Government Programs, Bill Anderson has a clear objective. “We understand the constraints of current defence budgets” he explains. “Defence forces need to achieve more with less which is why the Scorpion is the right aircraft for today’s security environment. We’re not attempting to compete with fighters such as the F-35 or F-22 but there are still a wide variety of military and other missions carried out by US or overseas forces for which the Scorpion is ideally suited. It has more endurance, speed and better capability than a light attack propeller aircraft, as well as longer range. It could be utilised for a wide variety of tasks, including reconnaissance, light attack, ISR strike, close air support or as a training aircraft. We haven’t made a final decision on all its potential uses yet, as it all depends what the customers want.”

How would the Scorpion cope against an attack from a conventional jet fighter or a surface-to-air missile? “It wouldn’t,” admits Bill Anderson. “The Scorpion can manoeuvre up to 6Gs but it would be best if it wasn’t put in such a situation. However, it could be fitted with countermeasures.”

Unmanned option

Many of the missions suggested for the Scorpion could also be achieved by UAVs and the question arises as to how a manned aircraft could compete in terms of expense and endurance. Bill Anderson has a surprising reply: “Actually, we are also working on plans for an unmanned version of the Scorpion with a different engine, longer wings and additional payload in the cockpit. This would result in a heavier aircraft but one with greatly increased endurance. However, the UAV version would have to be a new build, as it’s not really practical to convert from the manned version.”

Testing the market

Scorpion is now beginning a two-year flight certification programme with around 500 flight test hours planned over the next 12 months. If and when, orders for the Scorpion do come in, where the aircraft might be built would be determined by the level of demand. “We have no plans for production yet until we see what the market response is like,” explains Bill Anderson. “We could build the first 15 aircraft here at Cessna,” adds Dale Tutt. “After that, we will consider our options.”

All that is needed now are some customers …
TIM ROBINSON reports on a unique Iranian general aviation manufacturer hoping to soar on winds of change.

Think ‘aerospace in Iran’ and your mind might naturally turn to IIRAF F-14 Tomcats kept operational by reverse engineering. Perhaps, if you were more uncharitable, you might think of last year’s ‘stealth’ fighter roll-out as an example of a mock-up that drew laughter from some quarters.

However, what is no joke is that, with Iran's new leadership, there now appears to be the possibility of a significant international reproachment with Iran. Though this is still early days, any agreement over restricting the country's nuclear ambitions, could potentially end Iran's international isolation — leading to an influx of business and trade. Such a breakthrough would be of interest to many aerospace companies looking for opportunities in this previously closed market.

One company looking from the inside out and hoping to benefit from the changed political situation is Iran's Dorna Aircraft — a small company of 45 staff focusing on light aircraft — which is now hoping that any future end to sanctions could help its light aircraft designs fly free.

Dorna Aircraft
Dorna Aircraft, based in Tehran, was founded in 1988 by Yaghoub Antesary, who had dreamed of making his own aircraft since he was a teenager. Starting off in his own garage, he went on to study aerospace engineering in the US and in the UK. Since then, Dorna has grown to become the first and only private joint stock general aviation company in Iran. Building his enterprise up, Antesary's Dorna, (which is purely focused on GA) now holds Design Organization Approval Certificate (DOA), Type Certificate (TC) and Production Approval Certificate (PA) qualifications for two GA light aircraft — Blue Bird and Free Bird LSA.

Rather amazingly for a private aviation company in Iran, Dorna also has a city-centre showroom in Tehran on the 23rd floor of a skyscraper — with its latest aircraft design — the Free Bird displayed there. Head of Marketing and Business Development at Dorna, Sajad Entesari is coy about how the aircraft was got up to its high perch, saying; “it was a hard task”, but did reveal the display model lacks an engine.

Free Bird and Blue Bird
Dorna's first product was the Blue Bird which first flew in 1999 and is a two seat light single-engine aircraft in EASA's cs-VLA (Very Light Aircraft) category with a fixed tricycle undercarriage. Aimed at flight training schools, the company has already

FREE BIRD
9·45m WINGSPAN
390kg EMPTY WEIGHT
120kt MAX SPEED
650nm RANGE

Persian eagle
delivered 23 Blue Birds to customers. Meanwhile, Dorna’s latest design, the fully composite Free Bird is a two-place light sport aircraft (LSA) powered by a four-stroke Rotax 100hp engine using unleaded fuel. Development of the Free Bird started in 2010, with its maiden flight taking place in 2012. Serious marketing of the aircraft, however, began in the middle of 2013, with three Free Birds sold so far. However, Entersari says that “demand is increasing. It has smooth and stable flying characteristics that make it good and safe for training and fun for personal and sport use. All of these can be provide at a lower cost than other competitors.”

Interestingly, it has been designed and constructed to US ASTM standards for Light Sport Aircraft. Additionally, the flight manuals and all supporting technical documentation are written to US ATA100 standards for technical writing. For enhanced safety, the aircraft is also capable of being equipped with a ballistic parachute and an emergency locator transmitter.

Says Entersari of the company’s two products: “Blue Bird customers are usually flight training schools but the Free Bird is more interesting for private users or the young generation because it has a reasonable price.” The aircraft retails for €92,500.

He notes of the GA sector in Iran: “Here there are some flight training schools and they have been active for many years. But recently, some air taxi and flying clubs have opened up, so GA is on a growing and progressive path.”

**Coming in from the cold**

The company, is eagerly following international political developments that could open up a far wider market to its rugged, light aircraft. Says Sajad Entesari of Iran’s international isolation: “Most importantly we lost the world market for at least three or four years.” The Free Bird, for example, still lacks LSA certification because a bilateral agreement between the FAA and the Iranian civil aviation organisation would be needed. However, Dorna has already reached out to regulators to discuss how the process could be started.

Should Iran come in from the cold, then the company is already on the lookout for foreign investors and partners for its products — with the aim of a production line for the aircraft outside Iran. Explains Entesari: “We are looking for investors for a new company or assembly line in Europe or America. This is our first priority for the Free Bird project.”

For exports, Dorna sees the Middle East region, with countries like Turkey and the UAE as a key initial market for the aircraft.

Entesari therefore sees a bright future for Dorna. “We are very optimistic with this new political approach and in future we may be able to cut the price of the aircraft further.” He notes: “If we could produce the Free Bird in another country, the price of it with a Garmin glass cockpit could be around $128,000” (compared to the $125,500 (€92,500)) baseline model now. Dorna points to the competitiveness of the Free Bird, some $11,000 cheaper in list price than rival designs.

**Setting the birds free?**

So will high-level international political agreement allow Dorna to fly free? Sajad Entesari is enthusiastic about sharing the dream of flight with as many as possible. “Our goal is to spread the use of general aviation and we think LSA is good category because it satisfies standards and keeps the price low.” There still may be a long way to go — but it is possible that the Free Bird could become Iran’s first civil aviation export success.

> “There is a gap between a good trainer and a good manoeuvrable aircraft and Free Bird can fill this gap”

Sajad Entesari
Head of Marketing and Business Development
Dorna Aircraft
The landscape of the UK space sector has been through an exciting evolution over the past few years, building on the strong growth since the turn of the century (see Fig. 1 opposite). In 2010 an industry-led 20-year vision was set out with the target of capturing a 10% share of the global market by 2030, creating 100,000 new jobs. This would grow revenues from the £6.6bn achieved in 2007 to £40bn in 2030. The published recommendations in that vision have resulted in significant steps forward, with the entities created including:

- A UK Space Agency now responsible for all national civil space policy.
- A new European Space Agency (ESA) Centre at Harwell called ECSAT focusing on Applications, Climate & Robotics.
- The Satellite Applications Catapult, a not-for-profit organisation dedicated to the commercialisation of cutting-edge technology and R&D relevant to the space sector, also located at Harwell.

The new, updated vision published by industry takes account of the new entities and investments now in place and identifies five high value market opportunity areas to meet the 2030 growth targets. Five recommendations have been made which are designed to lower the barriers to opening up these markets. The markets and barriers are shown in the Fig. 2 right.

The new vision also breaks down the £40bn target (and the ~£9bn achieved in 2011) in two independent ways; 1) upstream/downstream; 2) domestic/exports (see Fig. 3).
The most ambitious growth is sought in downstream and exports, with targeted ~4-5-fold and 12-fold increases respectively!

**Market analysis**

The market analysis performed as a precursor to the strategy identified the impact that space services can have on real-world problems, stimulating economic growth and providing environmental and societal benefits. The figure below shows the five key market segments that have been identified. These are broken down into further focus areas, with 15 of these (shown in red text) identified as high growth — each forecast to exceed £1bn of potential UK revenues by 2030.

A selection of the areas where high growth is forecast is briefly outlined below, providing an insight into how space impacts our lives through remote sensing and satellite communications & navigation.

**Maritime surveillance**

A new generation of European and UK radar satellites, such as Sentinel 1 and NovaSAR-S, would enable much more frequent observations of shipping, ice and other maritime objects of interest during both day and night, including during heavy cloud cover conditions (often common in UK waters!). Also, signals transmitted from shipborne automatic identification systems (AIS), which are received by satellite, will continue to allow authorities to track the movement of all ships above 300 tonnes. There is strong British involvement in the build and assembly of such satellites, e.g. from Surrey Satellites. There is ongoing R&D which could enable a particularly interesting application where the AIS data is correlated with radar observations. This would allow possible detection of pirate activity as the radar satellites can still observe the ship in question, even if the criminals have turned off the AIS device.

**Galileo public regulated service**

Galileo is Europe’s new satellite navigation system incorporating several added value features over the US GPS system, including the Public Regulated Service (PRS). PRS provides anti-spoofing capability, encryption and better resilience to jamming for government agencies and emergency services using sensitive and secure applications. UK companies like CGI are helping the European Commission (EC) to build the secure systems involved with PRS, and the UK as a whole (via the Satellite Applications Catapult and others) is taking a lead in stimulating user uptake of the service. Specific applications could involve those in defence, law enforcement, intelligence gathering, maritime safety, peace keeping operations or humanitarian intervention.

**Low-cost access to space**

Virgin Galactic is leading the way in terms of commercial suborbital spaceflights for tourists with SpaceShipTwo operations likely to begin in 2014. Virgin is also in the process of developing the LauncherOne system, which is aimed squarely at changing the paradigm of small satellite development. LauncherOne should enable UK companies like Clyde Space and Surrey Satellites to launch when they want at a price that, Virgin Galactic CEO George Whitesides told AEROSPACE: “promises to be the lowest in the industry.” The future of a UK-developed spaceplane looks brighter with recent news of the government’s £60m investment into the game-changing SABRE technology being developed by the UK’s Reaction Engines. SABRE is an air-breathing rocket propulsion system and the cornerstone of its Skylon spaceplane concept which could reduce launch costs by 80%.

**Persistent surveillance**

This game-changing technology would allow much more frequent observations of any location on the planet from satellites. A constellation of three or more satellites in geostationary orbit would provide continuous coverage of much of the Earth but each satellite would require an extremely large mirror (~8m) to achieve sub metre resolution. Another option is a constellation of ~50 satellites in low-Earth orbit allowing any target on the planet to be observable by at least one satellite. Cloud cover...
could be an obstacle to continuous observations in optical bands and therefore a pragmatic solution could be a combination of multi-spectral optical and radar satellites to enable all weather and day/night observations. Such capability is expected to open up a wealth of new applications using satellite data in areas such as security and defence, border monitoring, traffic congestion, disaster response and rising flash flood water levels. There are already exciting plans from innovative startups, like Planet Labs and Skybox Imaging for new Earth observation satellite constellations.

**Climate applications**

ESA’s Climate Change Initiative is using satellites to measure critical variables that govern the dynamics of the Earth system. Such variables include sea levels and temperature and the prevalence of sea ice at northern latitudes (ocean); land cover and soil moisture (land); prevalence of aerosols and ozone (atmosphere). While new data streams will significantly aid scientific understanding, a new generation of climate-based services that use this data is also expected to be developed by business. These could include information on the likelihood of freak waves for the oil and gas sector or verification of Kyoto-2 treaty compliance for methane and carbon dioxide emissions. Understanding the accuracy of the satellite observations is key and provides an important export opportunity for the UK, with organisations like the National Physical Laboratory bringing world renowned expertise.

**Rail transport**

Train location is mostly derived by technology that only locates trains to a section of the track. By using satellite navigation and communications, every individual train could potentially transmit an accurate location, transforming the way that railways operate by increasing their capacity without laying new track. Also, the ability to measure ground subsidence and forecast landslides can be exploited by using satellite radar data and low-cost in situ movement detectors (which know their position to within 1cm from satellite navigation). Ultimately this means more frequent trains for passengers and better knowledge of potential train delays by the operators and infrastructure providers.

**Smart cities/urban services for local government**

Satellite navigation/communication can enable more efficient road and rail networks through cities, and high resolution optical imaging and spectroscopy can be used to determine optimal locations for green energy infrastructure. Also, remote sensing technology from satellites is improving to potentially allow the monitoring of land surface temperature and air quality, and satellite broadband can be used to augment terrestrial solutions to improve on-the-move access e.g. in trains. The Satellite Applications Catapult is already working with the Future Cities Catapult in the UK to investigate the use of space solutions in a new 21st century vision for Milton Keynes.

**Broadband**

The main broadband market is international, making this area an export target for UK companies like Inmarsat and Avanti Communications. In developing countries a reliable satellite broadband solution can totally transform a region and enable life-saving medical diagnosis through telemedicine; business to flourish through reliable e-connectivity; or training to
Location-based services

Offerings like Google Glass are likely to be part of the evolving use of mobile phones, tablets, etc, with satellite navigation providing key enabling capability. It is expected that such devices will provide seamless access to information as well as taking over many currently paper-bound functions such as rail ticketing. The benefits to the community include significant increases in productivity and better social networking.

The enabling recommendations

The five recommendations of the new strategy propose to set in place governance structures aimed at breaking down the barriers to growth in the identified market areas. Each recommendation is summarised below with the relevant barriers identified:

1. **Grow Space Enabled Markets by £30bn by 2030.**
   **Barriers: Take-up of space services; Export and International**

   The space industry needs to become much more outward focused and work in a targeted way with customers and end users from the priority market sectors to champion the use of space services. To this end the Satellite Applications Catapult will lead a series of marketing campaigns, supported by the UK Space Industry Trade Association (UKspace) and the UK Space Agency, with the first campaign slated for September 2014. The UK will also double the investment in its National Space Applications Programme by 2015 and create a Climate Services Centre for Europe. The centre will ensure the exploitation of remote sensing data from both government and commercially funded satellites. However, this recommendation must go beyond “business as usual” and fully grapple with the barrier of inserting new technology (i.e. space) into end user business processes to achieve the downstream growth.

2. **Make the UK the best place to grow existing and new space business**
   **Barriers: Regulatory**

   For global space companies to want to locate, invest and grow their business in the UK, a business environment must exist which optimally promotes innovation enterprise and minimises the burden of regulation, particularly for SMEs and start-ups. The UK Space Agency will create a Space Regulation group to pursue the right balance between processes and growth stimulation, and broadly address four areas: 1.) Outer Space Act licenses which are required from any organisation launching an object into space; 2.) Spectrum allocation agreements, needed for transmission of satellite communications; 3.) Satellite orbit slots, which needs strong lobbying power from the UK on the global stage; 4.) Spaceplanes, as current UK regulation treats any winged vehicle as an aircraft, not at all suitable for the type of experimental vehicles Virgin Galactic will operate. This recommendation has grabbed many of the headlines as it includes the ambition for the UK to create a spaceport by 2018. Virgin Galactic CEO George Whitesides told AEROSPACE that: “spaceports and spaceflight operations can be a significant catalyst for economic, scientific and tourism growth. The space industry will benefit from commercial space regulation that enables safe, reliable, frequent and cost-efficient space access.”

3. **Increase the UK’s returns from Europe**
   **Barriers: Financial, European partners**

   In 2012 the UK increased its funding for ESA by 25% while many other ESA member states were reducing theirs. This recommendation urges Government to continue to increase its ESA contributions, as well as create a European Space Engagement plan to ensure maximum growth is stimulated from the ESA spend in the UK. Greater influence in key European bodies is also proposed by seconding key staff from UK companies into ESA and the EC, and by securing more UK investment into ESA.
nationals in key ESA staff positions, including at Director level.

4. Grow space exports from £2bn to £25bn by 2030

Barriers: Exports & international, technology investment

The key message from this recommendation is to develop strategic national programmes in collaboration with other nations (so-called bilaterals) to complement ESA’s programmes. To co-ordinate and invest in such programmes to stimulate maximum economic benefit, a National Space Growth Programme will be created which should draw on existing capability and make multi-year commitments to ensure proper planning and continuity. It will also enable the UK to be much more agile should particularly high value opportunities arise. It is recognised that space science can contribute significantly to the UK strategy and a commitment has been made to launch three bilateral missions with nations where the UK can develop future export opportunities. Such projects have a strong history of ‘spin-out’ benefits; for example technology designed to measure water vapour on Mars is now being used to measure food production and industrial gas emissions. They also have the potential to capture a new generation of skilled individuals into the sector. Some see this recommendation as an attempt to emulate China’s use of space programmes to win major business deals in foreign countries, such as in the oil and mineral extraction sectors.

5. Stimulate a vibrant regional space SME sector

Barriers: Skills, financial, Harwell & regions

The dominant growth in the UK economy in general is expected to come from about 15,000 small companies with current headcounts of 50-100 people. Space sector support for SMEs is therefore seen as critical to achieving the £40bn target. The Satellite Applications Catapult will lead the provision of a comprehensive ‘one-stop shop’ of measures for SMEs, including access to finance, business management tools, skills, training and mentoring. However, it is recognised that 95% of all space sector jobs will be far from the Catapult in Harwell and therefore regional centres of excellence will be created with Harwell acting as an interfacing gateway. To ensure an adequate supply of skilled graduates, several initiatives are recommended some of which have already begun. Highest profile among these is a National Schools Challenge to engage school children in the flight of Britain’s first ESA astronaut, Major Tim Peake, to the ISS. The sceptics may see this as largely ‘business as usual’ with little to indicate that it will lead to a dramatic change in economic performance.

Status and conclusions

The Government is planning a formal response to the November 2013 strategy in this month with very positive feedback already received from Science & Universities Minister David Willets, who said there was much to admire in the new document and referred to it as: “forward-looking and ambitious.” This rhetoric has been backed up by action with the recent Autumn Budget Statement announcing significant progress on recommendation 4, viz. £80m allocated over five years for ‘bilaterals aimed at emerging space nations’ which should “help export prospects.”

Outlining the plan is an important first step but difficult challenges lie ahead in its management and delivery which still need to be addressed. Will the private sector make the investments to complement government’s increased spending on space? Who will lead the export drives that are forecast to provide most of the sought-after growth? The road ahead to 2030 should be an exciting time for the UK space sector as it attempts to tackle these issues and make a major impact on the global stage.
After 2012, it didn’t seem possible that Careers in Aerospace LIVE, the Society’s annual recruitment fair, could get any bigger but 2013 proved otherwise! While many employers have expressed concern about the declining interest in the sector, those who queued patiently around Hamilton Place on a rainy day showed there are many people committed to aerospace and aviation careers and looking for opportunities.

2013 also saw the highest number of exhibitors to date with several new exhibitors and including many returnees from previous years. Rolls-Royce were the event’s first Club Class sponsors and thanks to their support the event opened with a VIP and Exhibitor networking business breakfast with Chris Barkey, Engineering and Technology Director, Civil Large Engines, Rolls-Royce, providing a keynote speech which highlighted the huge support Rolls-Royce provides for career development at all levels throughout its UK sites.

Visitor numbers for the day surpassed 800, coming from across the UK and overseas — even as far afield as South Africa — including college and university students, graduates, apprenticeship seekers and experienced professionals making a career move. Not only were visitor numbers higher but once again exhibitors commented on the quality of attendees, showing more awareness and interest in the sector than at many other recruitment fairs they attend and a good balance between early and middle careers.

In addition to the exhibition, a full programme of careers talks, CV workshops and company seminars accompanied the event (Rolls-Royce put on an additional session). Gapan also offered free pilot aptitude tests throughout the day and impartial pilot training advice, and the RAEs Careers team were on hand to provide speedy CV reviews for long-distance visitors.

2013 Exhibitors: Our thanks to the following employers and organisations: Club Class Sponsor: Rolls-Royce. Business Class Sponsors: CTC Wings; EADS (Airbus) and EADS (Astrium) and the Premium Economy exhibitors: Aeropoeple, AgustaWestland, Aircraft Research Association, Atkins, Aviation Skills Partnership, Boeing UK, Cobham, Cranfield University, Danube University Krems, DESG – MoD, DSTL, Hutchinson Stop-Choc, GKN Aerospace, Guild of Air Pilots and Air Navigators, Lockheed Martin, LORD Corporation, Marshall Aerospace and Defence Group, MBDA, Safran Group, QinetiQ, Raytheon UK, Royal Navy, Royal Air Force, RAEs Flight Simulation Group, Strongfield Aviation and Talent Retention Solution.
ANNUAL BANQUET

LONDON / 21 MAY 2014

The Royal Aeronautical Society Annual Banquet is established as a key event in the social calendar of the aviation and aerospace community.

Attracting high level industry attendance, it offers the ideal opportunity for networking and corporate entertainment.

The 2014 event will be held at The InterContinental London Park Lane. Pre-dinner drinks will be served in the Park Lane Suite followed by a four-course dinner in the Ballroom, with fine wines, coffee and liqueurs included.

Individual tickets and corporate tables are available with discounted rates for RAeS Members and Corporate Partners.

**Venue**
The InterContinental London Park Lane,
One Hamilton Place, London W1J 7QY, UK

**Programme**
Reception: 7.15pm
Dinner: 8.00pm

**Dress code**
Dinner jacket and decorations

**Private Receptions at No.4 Hamilton Place**
Book a private pre-dinner drinks reception at No.4 Hamilton Place, historic home to the Royal Aeronautical Society. Located adjacent to The InterContinental London Park Lane, No.4 Hamilton Place offers a choice of elegant rooms for your exclusive reception. Package details are available on request.

**Ticket Prices:**

**Individual tickets**
RAeS Individual members: £145 + VAT per person
RAeS Corporate Partners: £188 + VAT per person
Non members: £208 + VAT per person

**Corporate tables** (to seat 10 guests):
RAeS Corporate Partners: £1,880 + VAT per table
Non members: £2,080 + VAT per table

**Enquiries to:**
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Email: gail.ward@aerosociety.com

www.aerosociety.com/Banquet

GUEST OF HONOUR:
ACM SIR ANDREW PULFORD KCB CBE ADC RAF
CHIEF OF THE AIR STAFF, ROYAL AIR FORCE
Message from RAeS

- President
*The Society is increasingly becomingly involved in two major UK growth initiatives — the Aerospace Growth Partnership and the Defence Growth Partnership.*

- Chief Executive
*January saw the start of our Corporate Partner programme of events with the half-day Corporate Partner seminar, always an excellent opportunity to receive briefings on a range of topics in addition to the usual networking.*

Book Reviews

- High-Flying Women, Transatlantic Betrayal and US Guided Missiles.

Library Additions

- Books submitted to the National Aerospace Library.

K G Wilkinson Papers on Air Transport

- Last summer Roger Wilkinson presented his father’s papers to the NAL. Dr Kenneth Wilkinson had held senior positions in BEA and Rolls-Royce, as well as being a Past-President of the Society.

Honours, Medals & Awards

- A New Year resolution we can all share.

Diary

- 3 February
- Cranwell Branch Whittle Lecture
- Keeping BBMF airworthy
- Richard Oldfield and Kev Ball

*Spitfire XVI TE311 of the RAF Battle of Britain Memorial Flight piloted by Wg Cdr ‘Godders’ Godfrey performs a hot start.*

Crown copyright/SAC Graham Taylor.

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57 102nd Wilbur & Orville Wright Lecture

Dr Tom Enders, CEO of Airbus Group, delivers a compelling message.
As I mentioned last month, my diary for the second half of my year as President includes a good number of Branch visits and I do hope to meet as many members as possible. As ever, the Branches play a crucial role in delivering Society activities at a local and regional level both in the UK and of course overseas and I am particularly looking forward to talking to members from both the Branch and Divisions during my forthcoming visit to the Singapore Air Show.

The Society is increasingly becoming involved in two major UK growth initiatives — the Aerospace Growth Partnership and the Defence Growth Partnership. These collaborations between Government and Industry have been set up to secure the future of the UK aerospace and defence sectors respectively. A particular theme that we will be working on is ‘Skills’, with our existing activities and focus on the skills supply ‘pipeline’ being a key feature. As ever, it is pleasing to see our work being recognised at such a national level.

Finally, I am delighted that the Royal Academy of Engineering has just nominated its first female president — Prof Dame Ann Dowling, who is also a Fellow of this Society and I send her my congratulations.

Jenny Body was taken to the Deutsches Museum Flugwerft Schleißheim at Oberschleißheim during her visit to the Munich Branch early in her Presidential year.

FAST MUSEUM

Farnborough Air Sciences Trust gains National Museum status

We are very proud of this new award which will certainly help future development. It reflects the enormous effort that everyone has put in, week in and week out, to ensure Farnborough’s unique aviation heritage is safeguarded for the future.

Now in its tenth year, the Farnborough Air Sciences Trust (FAST) Museum at Trenchard House on Farnborough Road, has been awarded the highest level of national recognition by the Arts Council as a fully accredited museum. This follows three years of preparation to meet the very high standards demanded under the national museums and galleries accreditation scheme, which is now administered by The Arts Council. Supported in its application by the Science Museum, Rushmoor Borough Council and Hampshire County Council, the FAST Trustees have made significant improvements to the museum in recent years, while at the same time carrying out major projects, including a new artefact storage building and the highly popular Cody Statue which is now in full public view on Farnborough Road. The accreditation inspectors looked in great detail at how the museum is managed, its viability, achievements in recording, archiving and making available data held in its collection, its procedures for keeping, lending and exhibiting reports, historic images and artefacts, its educational programme and at its future plans. Unusually for an all-volunteer organisation operating on such a scale the accreditation was achieved at the first attempt, rather than in stages, which is more often the case.
MEMBERS ARE ENCOURAGED TO CONSIDER OFFERING NOMINATIONS FOR NEXT YEAR’S ROYAL AERONAUTICAL SOCIETY HONOURS, MEDALS AND AWARDS

Simon C Luxmoore

Following on from a most successful Wilbur and Orville Wright Lecture and Dinner in December, we await the outcome of our planning application in support of our major project to enhance access to, and refurbish, the Airbus Business Suite at No.4 Hamilton Place. This is a complex matter since we are hoping to take the opportunity to increase the facilities within the building, which has somewhat hampered our ability when seeking commercial hire opportunities, and also replace some of the air conditioning units which is required to be done by 2015. Airbus is funding this development for which we are all most grateful, so we must hope that the planning applications are met with sympathy and that we are able to complete this very considerable task while continuing with the normal day-to-day business of the Society.

The first few weeks of the year are consumed with preparing our year-end financials. At this stage, and without the full details, I can advise that the Society has met the budgeted surplus, despite the fact that there has been underperformance in some areas, which was more than offset elsewhere, and the difficult trading conditions which prevailed throughout 2013. That said, income from membership subscriptions has remained strong throughout the year with income from conferences exceeding their budget targets for 2013.

As a team, we spend many weeks preparing in great detail the annual budget and 18 months later you reflect on the reality and wonder, in some cases, what on earth you were thinking about! Twas ever thus, as they say and, in spite of hosting, at short notice, the Downton Abbey team (eagle-eyed members will have spotted the Argyll Room during the Christmas special) the commercial hire market is very challenging.

Sir Roger Bone, President of Boeing UK, recently unveiled the refurbishment of the Bill Boeing Lecture Theatre at No.4 Hamilton Place. Apart from a complete redecoration of the facility, new lighting, and upgraded audio visual equipment, three new 80inch LED screens have been added to aid presentations. All those who attend the Society’s lectures and conferences at No.4 will benefit from Boeing’s generous and on-going investment in this facility.

Professors Peter Bearman and Mike Graham recently hosted a lunch for the Associate Editors of The Aeronautical Journal. This is an annual event, and for those who are able to attend, it is a small thank you to our Associate Editors for all the hard work they put in to supporting the production of this excellent publication, as well as providing a brief opportunity for an exchange of views.

January saw the start of our Corporate Partner programme of events with the half-day Corporate Partner seminar, always an excellent opportunity to receive briefings on a range of topics in addition to the usual networking. We have an excellent programme of Corporate Partner events planned throughout 2014 and I would encourage all those eligible to attend to do so.

We have redesigned the Society’s Handbook, bringing it in line with AESPACE and our redesigned Career Flightpath magazine. This revamped Handbook is a useful ready reference for those who prefer to have something ‘on the shelf’, and I would like to further congratulate all those who have worked so hard during 2013 to bring these various publications to a new standard of excellence.

In any dynamic organisation there is regular organisational structure and staff change. The Society is no different and during the December and January period we have seen a number of our colleagues depart to be replaced by new members to the team. To those who have left us, on your behalf, I would like to propose a vote of thanks for their contribution and wish them well for the future. To our new colleagues, most notably in the Conference & Events and Schools Build-a-Plane areas, welcome, and we look forward to working with you to build on the success of previous teams here at the Society.

As previously reported, in collaboration with FRS in Paris and IAI in Rome, in September 2013, the Society was awarded a European Space Agency contract to analyse the structure and operation of the satellite communications industry. The team has successfully delivered its first milestone report and is now beginning the second phase of the programme which entails a series of interviews with companies and other agencies in Europe and the US. The final report will be delivered to ESA in September. In due course, and subject to permission from ESA, the Society hopes to publish a summary of the findings.

Members are encouraged to consider offering nominations for next year’s Royal Aeronautical Society Honours, Medals and Awards. Anyone can nominate and anyone can be nominated — either individual or team — as long as it’s felt that they deserve recognition by the Society for their contribution, achievement or service to the art and science of aeronautics and aerospace. The deadline for receipt of nominations for inclusion in the 2014 round is 31 March 2014 and nomination forms are available on the Society’s website.

Finally, members will note that the deadline for their 2014 subscriptions is 31 March 2014.
Alain Pelletier comments in his introduction that the man in the street would be hard pressed to name just three aviatrixes who have influenced the history of flying. Yet 70 or 80 years ago, names such as Maryse Hilsz, Maryse Bastié, Amelia Earhart, Jean Batten, Amy Johnson, Hélène Boucher and Jacqueline Cochran were on the front pages of the leading newspapers. His mission in writing *High-Flying Women* was to retrieve them from “the obscurity into which the passage of time has threatened to cast them.”

It was an ambitious project, given that he was duty bound to research women pilots throughout the world and source the nearly 500 photographs, which grace the book’s pages. As a result, it is a feast for the eyes, equally a coffee table book and an important addition to a researcher’s library. Naturally, it begins with the pioneers of powered flight and works its way through categories such as the long-distance flyers, the fighting women and the icons.

There are also 50 detailed biographies, usually of the most renowned of these courageous women. It seems almost churlish to quibble with his choice, but there were several I had never heard of and, on reading their achievements, would not have chosen them in preference to others who were much more deserving of inclusion. Sheila Scott is notably missing from the biographies, despite setting hundreds of records, including being the first pilot, male or female, to cross the North Pole in a light aircraft.

Given that the book is jam packed with facts and information, including extensive tables in the appendices, it is not surprising there are some factual errors. For example, Lynn Barton was not Britain’s first airline pilot — several others beat her to it, including Yvonne Sintes, a Captain with Dan Air. The articles can seem like a long list of dates and records, which are not made easier to read by the layout.

But none of that detracts from the fact that this book achieves its author’s stated aim of putting hundreds of female aviators back in the spotlight. Bravo, M Pelletier — an heroic effort!

**Clare Walker**  
CRAeS  
Former Chairman, RAeS Women in Aviation and Aerospace Committee
The RB211 and the Demise of Rolls-Royce Ltd
By A Porter

This is a curious book, not least because the title gives the impression that Rolls-Royce no longer exists, whereas today it is Britain’s largest and most successful engineering company with a reputation for engineering excellence. The main thrust of the book is that Rolls-Royce and the RB211 were the losers in a ‘Faustian Pact’ (author’s phrase) between the Labour Government, with Harold Wilson as the main villain assisted by Wedgewood Benn, and the US administration to ensure that the UK were viewed favourably by the IMF from whom the Labour government required a huge loan.

The first two thirds of the book are a rather disjointed run through the history of jet engine development in Britain up to the 1960s mostly derived from already published books and available sales documents and adds nothing new of significance. It is clear that the author, for whom no CV is given, has a very limited technical ability. The errors or misunderstandings in this section are too numerous to mention. Where he seeks to impress by quoting from a technical paper it is clear that the equation he has extracted from it is wrongly written and he has not the ability to recognise the error.

The final third of the book details the campaign to win orders for the RB211 in the US but it is an extremely one-sided account referring almost exclusively to the DC-10 aircraft — very little mention is made of the Lockheed TriStar. Again most of the information comes from magazine articles and secondary reports — very little from primary sources — and far too much is the author’s speculation with little supporting evidence. To illustrate the point Porter, in support of his ‘Transatlantic Betrayal’, quotes from March/April 1968 issues of Flight magazine on the choice of the GE CF6 by United and American Airlines rather than the RB211 in the DC-10, yet completely ignores a long article in the 4 April issue of the same magazine which loudly proclaims Rolls-Royce’s “winning of the biggest single export order by any section of British industry.” This was for 124 RB211-powered Lockheed TriStar aircraft; in the event Lockheed sold considerably more TriStars than the version of the DC-10 for which the RB211 was suitable.

Further evidence of bias is the fact that the Labour government is condemned frequently throughout whereas the Conservative administration, under which ‘The Demise of Rolls-Royce Ltd’ actually occurred is never mentioned.

Finally, the description of the contents on the back cover of the book include the statement “Andrew Porter tells the story of the RB211, the history of its development and the political and economic factors that saw the company nearly die.” This is just not true — none of these items are covered in the book which in essence stops in 1968 just when development of the engine and the associated problems leading to the demise of Rolls-Royce Ltd in 1971 had just started.

This is a poorly written, technically incompetent, extremely biased and incomplete account of a significant story in British aviation history which deserves much better treatment. Fortunately the real story of the development of the RB211, its problems, including the politics and economic factors has already been written by Phil Ruffles who spent his entire career at Rolls-Royce, from junior engineer to Director of Engineering, dealing with the RB211 and the various successful derivatives of it. It is due to be published by the Rolls-Royce Heritage Trust.

Alec Collins
FRaEeS FI MechE
US GUIDED MISSILES

The definitive reference guide
By BYenne


Since WW2, most major post-war guided missile programmes in the USA have received the ‘M for Missile’ designation in the nomenclature system introduced in 1963. The M designator was mainly assigned to programmes begun before 1963 but still active. These included some inactive programmes, and all USA programmes since.

There are 175 designations described in the main body of this book, starting with the MGM Matador and finishing with the MQM-175 (EADS Do-DT45) aerial target vehicle. It also includes some UAVs, notably the BQM-147 Dragon Drone and the PQM-149 UAV-SR, but not systems like the Predator MQ-1 or the Reaper MQ-9.

In the three Addenda the author covers: ‘classic’ missiles, the B-62 Snark, B-63 Rascal and the B-64 Navaho which he thinks were significant programmes; ‘Operational Anti-Missile Missiles, the Sprint, the Ground-Based Interceptor and THAAD; and the ‘R for Rocket’ designation (for those non-guided missiles produced since 1963). In four Appendices the author lists most other USA-produced missiles outside of the ‘M for Missile’ system, that is, those before 1963. The fifth Appendix is reserved for acronyms. The author describes THAAD as being deployed to South Korea in 2009 to assist the monitoring of North Korean missile testing; this effectively acts as the most current information contained in the book.

The author has at least a paragraph on each M designation, even if it means describing a programme that never reached any sort of maturity. On the other hand, he devotes four pages to the AIM-9 Sidewinder and eight pages to the BGM-109 Tomahawk. It is here that the impressive imagery, excellently reproduced in this high-quality reference book, is lavishly and interestingly displayed. The depth of detail about each type may be thin, but the encyclopaedic nature adopted by the author make this publication a must-have among historians, enthusiasts and modellers — if an M designation isn’t within this compilation, it probably didn’t exist. The details successfully whet the appetite for further research.

It is difficult to believe that today, in military aviation literature, there are any gaps wide enough for a definitive guide but I believe the author has detected one and filled it successfully. He covers the ‘M-for Missile’ range, with some other interesting and related material. However, the book does not go beyond this aim and the author has worked well within this boundary. With, on average, three ‘M designations’ being made every year, it will not be long before a second edition will become needed.

Tim Marshall
FIMechE

Did you know?

On Thursday, 30 May 1940 — at the time of the major Dunkirk evacuation when the fall of France was imminent and the invasion of Britain appeared likely — Harold Roxbee Cox [later to become Lord Kings Norton] delivered the Royal Aeronautical Society’s 28th Wilbur Wright Memorial Lecture entitled ‘Prolegomena for a Detailed Study of the Future of British Civil Aviation’, the meeting being held at the Institution of Electrical Engineers. “Convinced that ultimately the aeroplane will bring about a world understanding …” Captain J L Pritchard, the Society’s Secretary, has previously advised Orville Wright by telegram that the subject of the lecture “was deliberately chosen at a time when the aeroplane is being so grievously misused.”

Although the Society’s wartime lecture programme was much curtailed, the Wilbur Wright Memorial Lecture was delivered each year.
Aircraft Design and Construction


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FEBRUARY 2014 47
K G Wilkinson Papers on Air Transport

On 14 June 2013 the National Aerospace Library at Farnborough was presented by Roger Wilkinson with the papers of his father Dr Kenneth G Wilkinson CBE FRAeS (1917-1990), the Society’s President 1972-73. Beginning his career at the Royal Aircraft Establishment at Farnborough as Senior Scientific Officer in 1945, in 1946 he joined British European Airways and by 1971 he was the airline’s Chief Engineer and Deputy Chief Executive, being appointed Chairman in 1972. In December 1972 Dr Wilkinson was approached to become Managing Director of Rolls-Royce (1971) Limited of which he was later appointed Vice-Chairman, returning to British Airways in 1976 as Engineering Director becoming Deputy Chairman in 1979.

Dr Wilkinson’s papers — which also reflect his lifelong interest in gliding — include a number of key lectures/reports recording the development of air transport and the challenges met over the decades as detailed below:


The Economics of Speed:


The Aircraft Industry — a National Asset. The Operator’s Point of View: The Lord Sempill Paper presented to The Institute of Production Engineers, 16 April 1959 (Advance proof copy). Lord Douglas of Kirtleside. 49pp. Illustrated. Includes tables recording the growth of sales of the Vickers Viscount, the number of US/British transport aircraft in service by aircraft type (deliveries/orders), postwar aircraft types purchased by BOAC/BEA and BEA’s projected fleet size/future orders through to 1966, postwar British civil transport aircraft types (first flight/deliveries/orders), the number of people employed in the British aviation industry and UK total aircraft exports 1946-1958.


Some Engineering Aspects of Air Transport in the World About Us: The First Sholto Douglas Memorial Lecture presented to The Society of Licenced Aircraft Engineers and Technologists, The Excelsior Hotel, Heathrow Airport, 12 October 1971. P Masfield. 28pp. Illustrated. Reviews the aviation career of William Sholto Douglas, the evolution of Croydon and Heathrow airports/airline engineering maintenance costs (including engine maintenance costs)/airliner productivity and acceleration/stop distances for various aircraft types over the decades.


For enquiries regarding this material please contact the librarians at the National Aerospace Library: T +44 (0)1252 701038/701060; E hublibrary@aerosociety.com


2014 MEMBERSHIP SUBSCRIPTIONS

Members, have you paid your 2014 Membership Subscriptions which were due on 1 January 2014?

Membership subscriptions were due on 1 January 2014 and, therefore, all unpaid memberships will lapse on 31 March 2014.

As per the Society’s Regulations, all membership benefits will be suspended where a payment for an individual subscription has not been received after three months of the due date of the subscription. However, this excludes members paying their annual subscriptions by Direct Debits in monthly instalments to October.

To avoid losing your membership benefits (including the use of post nominals, AEROSPACE magazine, reduced rates for conferences, networking opportunities, voting rights (certain grades)); you should choose one of the following methods to pay your 2014 subscription:

Online: Members can log in to their online account to pay at www.aerosociety.com. If they do not have an account, they can register for this on the website as a first time user.

Telephone: Members can contact the Subscriptions Department on +44 (0)20 7670 4304 or 4315 and arrange payment by credit or debit card.

Cheque: Cheques should be made payable to the Royal Aeronautical Society and sent to the Subscriptions Department at No.4 Hamilton Place, London W1J 7BQ, UK.

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Optional Social Supper on 17 June 2014

AEROSPACE GOLF DAY

FOR INDIVIDUAL AND CORPORATE MEMBERS

FRILFORD HEATH GOLF COURSE, OXFORDSHIRE / WEDNESDAY 18 JUNE 2014

18 hole Stableford Points competition
9 hole Texas Scramble competition
Individual and corporate team prizes
Lunch, refreshments and afternoon tea
Optional Social Supper on 17 June 2014

Join us at our 2014 Golf Day for some healthy competition with fellow golfers in the aviation community.

This event is ideal for networking in a relaxed and informal setting.

Enter a corporate 4-ball team or opt to be teamed up with other individual players.

For further details please apply to:
Gail Ward
Events Manager — Corporate and Society
Royal Aeronautical Society
T +44 (0)1491 629912
E gail.ward@aerosociety.com
Honours, Medals & Awards

A NEW YEAR RESOLUTION WE CAN ALL SHARE

Honouring Achievement, Innovation and Excellence

The Royal Aeronautical Society Honours, Medals and Awards are the most prestigious and longstanding awards in global aerospace, honouring achievement, innovation and excellence. Since the Wright brothers received the Society's first Gold Medal in 1909, the Society's awards have highlighted many of the most notable milestones, achievements and innovations marking the progress of the human race from the first manned, powered flight to the development of technologies that may yet realise the vision of a manned mission to Mars and beyond. The total number of Honorary Fellowships, Honorary Companionships, Gold, Silver and Bronze Medals conferred will soon reach 500, with the list of recipients constituting a unique ‘Hall of Fame’ of 20th and early 21st century aerospace pioneers and professionals.

Today, however, UK and US direct employment in aerospace manufacturing alone tops 500,000. Patent filings in the industry total many thousands each year. Global aerospace manufacturing direct employment is many times the US and UK number and, when the innovation rate and the number of those involved in the wider aviation and related professions are also taken into account, it seems clear that much work meriting recognition by the Society must be being overlooked as far as the Society's Awards framework is concerned.

There is therefore huge scope for broadening the reach of the Society's Honours, Medals and Awards scheme more fully to reflect the global and massively diverse character of aerospace and aviation.

This is where we can all share in an eminently achievable New Year Resolution.

That is to ACT NOW to nominate individuals or teams meriting recognition for their achievement, innovation or excellence in aerospace and aviation.

Here is what some of the 2013 award winners had to say about receiving their awards:

“The team was naturally delighted to receive such a prestigious award for its considerable efforts over the years but also recognised that the recognition brought with it a number of benefits. First, the publicity surrounding the award raised the profile of ASTRAEA at senior levels within the companies, making subsequent funding conversations easier to hold. Secondly, the award helped to raise the profile of the project within the public sector funding bodies and provided an important element of peer-recognition and endorsement. Thirdly, the reward helps in the international positioning of ASTRAEA where again the recognition of a globally recognised society can only help to act as an endorsement for the project.” Simon Jewell, Chairman ASTRAEA Steering Board. RAeS Team Silver Medal

“We are delighted to have our work recognised in this way… the honour goes to all those contributed to the project” Joseph Lam, Neptune Development Team, Airbus Operations. RAeS Team Bronze Medal

“It was an honour to win such a prestigious award — especially as the Specialist Gold Award is not made every year. I have been inundated with congratulations from colleagues across the globe following publication in a few Rolls-Royce internal e-magazines and newsletters.” Arthur Rowe, Rolls-Royce plc, Specialist Gold Award

“My first reaction was total surprise as I had not had the slightest inkling that I had been proposed for an award but this was quickly followed by delight and pride in professional recognition. I also very much appreciate the efforts made by all those involved in preparing the submission and I now know that much effort was expended on this by busy people. The two awards have particular resonance for me in that Geoffrey Pardoe was still active in Stevenage in my early years there and that I retired in 2013 after a 30-year career ‘in space’ so I have a most memorable closure. I then found further satisfaction when I realised that I am the first recipient of the Geoffrey Pardoe Space award who is also a member of the Society.” John Thatcher, Astrium, Specialist Bronze Award, accompanied by the Geoffrey Pardoe Space Award

More information about the Society’s Honours, Medals and Awards, is available from the Honour, Medals, and Awards pages of the Society’s website and from articles in the February, March, April, June, August, October, December 2012 and January 2013 issues of The Aerospace Professional.

Anna Banton
Secretary, Medals and Awards Committee
Dr Mike Steeden
Chair, Medals and Awards Committee

NOMINATE NOW — YOUR SOCIETY NEEDS YOU!

The nomination form is downloadable from the Society’s website (www.aerosociety.com/About-Us/medalsawards).

Please complete the form by 31 March 2014 to submit your choice for a worthy recipient or team in the 2014 round. Nominations received after this date will be considered in the 2015 round.

EVENTS www.aerosociety/events

17 February
The Development of RAf Doctrine in the Inter-War Years
Historical Group Lecture

4 March
Clinical Challenges in Aerospace Medicine
Aerospace Medicine Group Conference

4 March
Stewart Lecture: The Changing Roles of Air Traffic Controllers
Dr John Roberts, Chief Medical Officer, NATS Occupational Health and Aero-Medical Centre
Aerospace Medicine Group Named Lecture

25-26 March
Aircraft Commander in the 21st Century: Decision-making, are we on the right path?
Flight Operations Group Conference

27 March
Flight Test Group Lecture

9 April
Alan Bristol Lecture
Rocorcraft Group Named Lecture

28 April
Train Aerodynamics
Prof Chris Baker, Director of the Birmingham Centre for Railway Research and Education
Aerodynamics Group Lecture

29 April
Hendley Page Lecture: Clean Sky Programme
Gareth Williams, VP Head of R&T Business Development and Partnerships, EDT Airbus Central Entity
Named Lecture

21 May
RAeS AGM and Annual Banquet

29 May
Flight Test Group Lecture

4-5 June
Keeping Flight Simulators Current and Capable
Flight Simulation Group Conference

4 June
Edwin A Link Lecture
Flight Simulation Group Named Lecture

9 June
The Introduction of the RAf, Jet Aircraft: Engineering and Supply Issues
Historical Group Lecture

2 July
Air Law Summer Reception

22-24 July
Applied Advanced Aero Concepts, Design and Operations
Aerodynamics Group Conference
University of Bristol, Bristol, UK

All lectures start at 18.00hrs unless otherwise stated. Conference proceedings are available at www.aerosociety.com/news/proceedings

LECTURES www.aerosociety/events

BEDFORD
RAf Social Club, Manton Lane, Bedford. 5.30 pm.
Marylwn Wood, T + 44 (0)1933 353517.

12 February — Missilc and fire control products. David Wilson, Lockheed Martin.

9 April — Branch AGM followed by The Vulcan bomber. Robert Pleming.

BELFAST
Peter Froggatt Centre, Queen’s University Belfast. 7 pm.
20 February — Greenbird land yacht speed record. George Seyfang.

BIRMINGHAM,
WOLVERHAMPTON AND COSSFORD
RAF Social Club Cosford. 7 pm.
Chris Hughes, T + 44 (0)1902 844593.

20 February — Rolls-Royce future projects. Prof Ric Parker, Director, Rolls-Royce Research and Technology.

17 April — Trenchard Lecture. Motion in flight simulation: how realistic and important is it? Bob Young, Environmental Tectonics Corporation.

BOSCOMBE DOWN
Lecture Theatre, Boscobme Down. Refreshments from 5 pm. Lecture 5.15 pm.
Visitors please register at least four days in advance (name and car registration required) E secretary@ BoscobmeDownRAeSorg

11 February — TCAS — history, today’s operations and future. Stanislaw Drozdowski, Eurocontrol.

25 February — Joe Morrell Award lectures. 12.15 pm.
11 March — Catalina operations over the arctic. Tony Dyer.

25 March — A400M, Ian Jaycock and Wg Cdr Taylor. 12.15 pm.
8 April — Branch AGM followed by SESAR and the future of European air travel. Craig Foster.

BRISTOL
Pigleye Lecture Theatre, Queen’s Building, University of Bristol. 5.30 pm. Alessandra Badino, T + 44 (0)751 529 7787.

BRIGHAM
Portcullis Parks Golf & Country Club. 7.30 pm. Ben Groves, T + 44 (0)1482 663938.

12 February — Weapons technology, the story of BROACH, Bernard Gethings, BAE Systems (Retired).
12 March — Trident — the unsung hero. Neil Lomax, Save the Trident.

9 April — Sir George Cayley Lecture. Flying/operating the Hawk AJT aircraft. Wg Cdr Dan Beard. OC IV(R) Squadron RAF. 7 pm.

CAMBRIDGE
Lecture Theatre ‘O’ of the Cambridge University Engineering Department, Trumpington Street, Cambridge. 7.30 pm. Jin-Hyun Yu, T + 44 (0)1223 373129.

13 February — Sir Arthur Marshall Lecture. The F-35 Lightning II programme. AV Malcom BREcht, Chief of Staff for Capability, HQ Air Command, Howard Theatre, Downing College, Cambridge. Lecture 6 pm, Reception 7.30 pm. Please use the nearby multi-story car parks as there is no parking at this venue.

13 March — Skylon Spaceplane, Richard Varvel, Technical Director, Reaction Engines.

10 April — Branch AGM (7.15 pm) followed by ExoMars Rover — engineering for the Red Planet. Abigail Hultry, Astrium.

CAMPBERRY
Sir John Trenchard Lecture.

12 February — Trenchard Lecture. Flying/operating the Hawk AJT aircraft. Wg Cdr Dan Beard. OC IV(R) Squadron RAF. 7 pm.


CHRISTCHURCH
Lecture Theatre Block, Wallisdown Campus, Bournemouth University. 7.30 pm. Roger Sterling, E riger@sterling695@blueinternet.com

27 February — Calshot: the flying years. Colin van Geffen.

12 March — Early flight testing of the F-35B, the STOVL variant of Joint Strike Fighter. Graham Tomlinson, former RAeS Systems test pilot. Joint lecture with IET.

27 March — Farnborough Air Sciences Trust. David Wilson. Lecture 6 pm. The work of the Network Rail Air Operations Unit, Wendy Welsh. Joint lecture with IET.

24 April — Branch AGM followed by Radio-controlled model gliding. Simon Valkievics.

COVENTRY
Lecture Theatre ECG26, Engineering and Computing Building, Coventry University. 7.30 pm. Janet Owen, T + 44 (0)2476 464079.

20 February — Meggitt Lecture and Buffet. Smart engineering for metalised foam application. Stephen Pilling, Holiday Inn, London Road, Ryton on Dunsmore, Coventry.

16 April — Branch AGM followed by Schools Build-a-Plane project update. Helen Noble, Deputy Head requirements, Dr Michael Drane, CASA.

11 March — The P-8A Poseidon patrol aircraft. Wg Cdr Gary Lewis.

CARDIFF
Visitorreum, Building 52, Cranfield University. 6 pm.
1 April — Glider — research, build and fly. Doug Greenwell.

CRAWNEFORD
Cranfield Visitorreum, Building 52, Cranfield University. 6 pm.
1 April — Glider — research, build and fly. Doug Greenwell.

CRANWELL
RAf Cranwell. 7.30 pm.
3 March — Mars Rover update. Peter Rea.
7 April — Trenchard Lecture. Future SDSR, Paul Stoddart, debate chairman.

DERBY
Mondial Park Hall, Moor Lane, Derby. 5.30 pm. Chris Sheaf, T + 44 (0)1332 249474.

12 February — Geoff Wilde Lecture. RR Learning and Development Centre,
HAMBURG
Hochschule für Angewandte Wissenschaften Hamburg, Berliner Tor 5 (Neubau), Hörsaal 01.12, 20059 Hamburg, 6 pm. Richard Sanderson, T +49 (0)4167 92012.
20 March — Rolls-Royce technology for future aircraft engines. Uli (Ulrich) Wengen
Head of Engineering and Technology Rolls-Royce Deutschland. Joint lecture with DGLR and VDI.
3 April — X-Planes of Europe — secret research aircraft from the golden age 1947-1967. Tony Buttery, Joint lecture with DGLR and VDI.

HATFIELD
Room A166, Lindop Building, University of Hertfordshire, Hatfield. 7 pm. Maurice James, T +44 (0)1707 645441.
12 February — The green aircraft. John Fielding, Cranfield University.
13 March — Student lecture competition.
2 April — Sir Geoffrrey de Havilland Lecture.

HEATHROW
Community Learning Centre, Waterside, Harmondsworth. 6.15 pm. For security purposes please contact David Beaumont, E secretary.raes@btinternet.com
13 February — Introducing the Boeing 787 Dreamliner to British Airways service. SOFO Mitch Preston, Boeing 787 Entry into Service Manager.
13 March — The Airbus A400M military transport. Brian Kitson, Head of Aircraft Aerodynamics, Airbus.
10 April — Film Night (subject tba) followed by Branch AGM.

HIGHLAND
The Gallery, Eglinton Library. 7.30 pm. Alex Gray, T +44 (0)1224 319464.
12 February — Role of the UK Aeronautical Rescue Co-ordination Centre. Flt Lt Ben Sola.
12 March — A history of aircraft fatigue from Comet to Dreamliner. Dr Andrew Halfpenny.
16 April — Op Taxable. Prof Richard Morris.

LOUGHBOROUGH
Room U020, Brockington Building, Loughborough University. 7.30 pm. Colin Moss, T +44 (0)1509 239962
4 February — Airbus scaling down reality. Simon Owen, Horney Hobbies.
18 February — Operating the A318 at London City. Capt Tony Payne and Capt David Walsworth, British Airways.

11 March — Airbus to Airbus ACMI operator. Geoff Winterbottom, AirTanker Services.
15 April — Branch AGM followed by Chasing the morning sun. Manuel J A Queroz.

MANCHESTER
Newton Building, Salford University. 7 pm. Bryan Cowin, T +44 (0)161 799 8979.
10 February — Superfighters at Warton. Tony Wilson, BAE Systems.
12 March — Chapdwick Lecture and Dinner. Avro. Derek Empson, Deanwater Hotel, Wilmslow Road, Woodford.
9 April — Mini lectures and Branch AGM. MOS.

MEDWAY
Staff Restaurant, BAE Systems, Maritime Works, Marconi Way, Rochester, Kent. 7 pm. Rob Hopkins, T +44 (0)1634 377973.
18 February — TBD.

MELBOURNE
6.30 pm. E stratoflight.com.au
10 February — Nimrod rise and fall. Tony Blackman, Engineers Australia, 21 Bed ford Street, North Melbourne.

OXFORD
The Magdalen Centre, Oxford Science Park, Oxford. 7 pm. Nigel Randell, E oaktree.cottage@btinternet.com
18 March — Atmospheric research flying. Dr Guy Grattan, Head of the Facility for Atmospheric Measurements (FAAM).

PARIS
PSA Ipy, 7/9 rue Maurice Grangoir, 94200 Ivry-sur-Seine, Paris. 6 pm.

PRESTWICK
Aviator Suite, Terminal Building, Prestwick International Airport. 7.30 pm. John Wragg, T +44 (0)1655 750270.
10 February — The tale of an aircraft carrier. Jim Hood.
10 March — D F McIntyre Lecture. Everest then and now or Everst 1933/2013. Doug McIntyre and George Kerevan.

SHEFFIELD
Knowledge Transfer Centre, University of Sheffield, Brunel Way, Catcliffe, Rotherham. 7 pm.
5 March — Greener by Design. Dr John Green.

SOUTHEND
The Royal Naval Association, ‘79 East Street, Southend-on-Sea. 8 pm. Sean Cor, T +44 (0)20 7788 0566.
11 February — Titan Airways. Alastair Kiernan, Commercial Director, Titan Airways.
11 March — The RAF Battle of Britain Memorial Flight: maintaining historic aircraft — Spitfire, Lancaster and Hurricane. WO Kevin Ball, Joint lecture with I MecHe. Conference Room 10, Southend Council Civic Centre, Victoria Avenue, Southend-on-Sea.
8 April — Branch AGM.

STEVENAGE
The Metropolitan Restaurant, MBDA, Six Hills Way, Stevenage. 6 pm. Matt Cappell, E raesstevenage@gmail.com
11 February — Skylon space plane. Alan Bond, Chief Engineer/ Director, Reaction Engines. The Lunch Pad Restaurant, Airbus Defence and Space, Gannels Wood Road, Stevenage.
11 March — Flying the Typhoon. Stewart Reed, The Lunch Pad Restaurant, Airbus Defence and Space, Gannels Wood Road, Stevenage.
27 March — Young Person’s lecture competition. 5.30 pm.
10 April — Leslie Bedford Lecture.

SWINDON
The Defence Academy of the United Kingdom, Joint Services Command Staff College, Shrivenham. Anyone wishing to attend must provide details of the vehicle they will be using not later than five days before the event. Photo ID will be required at the gate (Driving Licence/Passport). Advise attendance preferably via email to rais@agustawestland.com or Branch Secretary Colin Irvin, T +44 (0)7740 136609.
5 February — Lightning II: the UK’s Joint Combat Aircraft. A VM Graham Farrell.
5 March — Branch AGM followed by Space nuclear power: enabling innovative space exploration missions. Dr Richard Ambrosi, Lecturer, Department of Physics and Astronomy, Space Research Centre. University of Leicester.
2 April — 100 years of naval aviation. Prof Geoffrey Till, Professor of Maritime Studies, Kings College London.

TOULOUSE
Symposium Room, Airbus S A S/HQ, B01, Campus 1, Blagnac. 5 pm. Contact: Pass@R A E-S -T oulouse.org for a security pass.
18 February — Rolls-Royce Mini-Lecture Competition followed by a lecture.
18 March — Facing the unexpected in flight, what must we do? Jean Finet, former Airbus Test Pilot and Head of Aerodynamics/AirTraffic Training.

WASHINGTON DC
British Embassy, 3100 Massachusetts Avenue, NW, Washington, DC. 6 pm.
13 February — Tenth anniversary reception and celebration. Sir Peter Westmacott, Followed by Branch AGM.

WEYBRIDGE
Brooklands Museum, Weybridge. 8.45 pm. Ken Davies, T +44 (0)1932 531529.
26 February — History of Air Accident Investigation. Peter Coombs, Senior Inspector of Air Accidents, AAIB.
19 March — Farnborough Air Show — behind the scenes. Amanda Stainer, Commercial Director, F I L.
16 April — Branch AGM.

YELOW
Dallas Conference Room 1A, AgustaWestland, Yeovil. 6 pm. David McCallum, E david.mccallum@agustawestland. com
20 February — Henson and Stringfellow Dinner and Lecture.
The Royal Aeronautical Society would like to welcome the following as Corporate Partners.

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The US Commercial Service is the trade promotion arm of the US Department of Commerce’s International Trade Administration. Located across the United States and in nearly 80 countries, our global network connects US companies with international buyers, providing them with market intelligence, export counselling, business match-making, assistance at trade shows and advocacy/commercial diplomacy support across all business sectors. We also promote the United States as a destination for inward investment and assist UK companies in making the investment decision that are right for them.

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Julie Clare, Chief Executive

Clear B2B is a specialist business to business marketing and public relations company which works in the UK and internationally with a relatively small number of larger organisations in specific industry sectors including aerospace, defence and security. We advise clients on marketing communications strategies and develop and implement appropriate programmes to achieve their agreed business objectives.

**NEW PARTNERS EVENTS**

**THE AIM OF THE CORPORATE PARTNER SCHEME IS TO BRING TOGETHER ORGANISATIONS TO PROMOTE BEST PRACTICE WITHIN THE INTERNATIONAL AEROSPACE SECTOR**

2013 saw fantastic growth in Corporate Partner membership, with over 30 new companies joining the scheme. That trend looks set to continue with six new Corporate Partners already joining the Society in 2014. 2013 was a busy year for our Corporate Events, seeing record numbers in attendance and we were delighted to see so many Corporate Partners attend our Annual Banquet and Golf Day. Support in advertising and sponsorship across the Society was at a level not seen before and we would like to thank everyone for their continued support and look forward to working with you in 2014. Wishing you a prosperous New Year!

If you would like to find out more about the benefits of becoming a Corporate Partner, please contact Simon Levy, Corporate Partner Manager, E simon.levy@aerosociety.com

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Corporate Partner Manager
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ICKO SZLOMA TENENBAUM

CEng FRAeS
1919–2013

In 1938, at the age of 18, Icko Tenenbaum’s parents moved their family from the eastern border of Poland to Australia via the UK, just before the German invasion of Poland and the outbreak of WW2. Icko enrolled at Melbourne University and was the first student to gain a waiver from the policy at the time of not accepting non-English speaking students. He graduated in 1942 as the Dux of the Engineering course, after learning English and working a number of manual jobs along the way. His grasp of mathematics was of a very high order and of great use during his career.

His service to aviation began in 1942, when he was asked by the Commonwealth government to forego participating in the war and to work instead with the Department of Civil Aviation (DCA) and later the Civil Aviation Authority (CAA). Early tasks included identifying sites for new landing strips in the raw jungles of Papua and New Guinea, a task that required a great understanding of aircraft take-off performance and other critical parameters, including rapidly changing weather conditions. During this period he also invented the first Automatic Runway Selector system for identifying precisely whether an aircraft would exceed crosswind limits and should change runways. He went on to become Chief of the Aerodynamics and Flight Engineering section of the Directorate of Air Navigation and Safety. He later helped in founding the new Certification Branch.

Another important experience, and one that shaped his later career, was the 1945 loss of a modified Avro Stinson due to metal fatigue of the welded steel tube wing spar. Aviation safety became his driving force and he represented Australia at early meetings of the International Civil Aviation Organization (ICAO) in Montreal. In Australia, he was instrumental in developing our unique general aviation safety and airworthiness standards, early standards for airports and the design and certification of the new Melbourne International Airport at Tullamarine in the early 1970s.

Icko joined the Royal Aeronautical Society in 1949 as the Australian Division was forming, and remained a member for 63 years until his death. During 1977-1979 he served as Chairman of the Melbourne Branch but was a Councillor of the Australian Division for a much longer period and also a Trustee until 2013. In 1967, he was made a Life Member of the Association of Architects, Engineers, Surveyors and Draughtsmen Australia, a union of professionals he helped to set up in 1944, and also volunteered in federal and state offices. Icko was ferocious as an advocate for engineers’ rights, pay and conditions and social justice as an idea that needed to be put into practice for all. Icko would represent his Association as an Advocate in the various claims tribunals and was more than able to hold his own against opposing Counsel. On one memorable occasion, when confronted by a QC who was belittling the engineering profession, Icko’s response was ‘you would not be competent to do my job but I, demonstrably, am able to do yours!’ Very typical of the man.

He retired in 1983 having been the Chief Engineer, Aircraft Certification, at CAA since 1977. After his retirement he continued to be involved in CAA and later CASA business and was strongly opposed to the change of direction towards ‘Affordable Safety.’ In the late 1980s he also contributed on a voluntary basis to Federal Government inquiries into aviation safety as an expert witness.

He is survived by his three children, Anna, Linda and David, two grand children and three great-grandchildren.

Murray Stimson
MRAeS
Honorary Secretary Melbourne Branch,
RAeS Australian Division

Material Provided by:
Tenenbaum family, Gary Sunderland, David Rees, Roger Meyer, John Finch and Ross Barkla
Elections

WITH REGRET

The RAeS announces with regret the deaths of the following members:

John Russell Baxter
CEng FRAeS 92

Christopher Nicholas Gilroy
CEng FRAeS 69

Anthony Hodgkinson
IEng AMRAeS 82

Capt Geoffrey Robert John Holder
MRAeS 71

David Charles Hopper
MRAeS 85

John Henry Robert Hurley
MRAeS 85

Brian Risdon Hurman
CEng MRAeS 87

Prof Russell Estcourt Luxton
CEng MRAeS 81

Edward McCluskey
MRAeS 83

Donald Morrison
CEng MRAeS 74

David Ronald Newman
CEng FRAeS 94

Georgina Joan Standing
CEng MRAeS 89

Peter John Stokes
CEng MRAeS 87

Robin Taylor
IEng AMRAeS 78

Gp Capt John Winston Thorpe
AFC FRAeS 68

Percy Whitford
MRAeS 97

SOCIETY OFFICERS

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President-Elect: Air Cdre Bill Tyack

BOARD CHAIRMEN

Audit and Compliance Chairman: Prof David Allerton
Learned Society Chairman: Prof Graham Roe
Membership Services Chairman: Martin Broadhurst
Professional Standards Chairman: Prof Chris Atkin

DIVISION PRESIDENTS

Australia: Air Cdre Noel G Schmidt
New Zealand: Gp Capt Frank Sharp
Pakistan: AM Salim Arshad
South African: Prof Laurent Dala

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The Society welcomes its latest recruits

The following new appointments have been made to the headquarters staff:

From 6 January Richard Nicholl has been promoted to Head of Conferences.

From 9 December Laura Dowling, who previously worked for IMechE,

and Rebecca Webb, who comes from Gafta, have joined the Conference & Events Department as Conference & Events Organisers.

Gordana Micic has accepted a contract as the Schools Build-a-Plane Programme Manager and started on 7 January.

Copy date
Copy date for the next issue of AEROSPACE is 3 February.
Airbus Group CEO Delivers Compelling Message

“A modern economy ignores innovation at its peril”; this stark warning was the theme of Tom Enders’ 102nd Wilbur and Orville Wright Lecture.

The CEO of EADS, now Airbus Group, put forward a compelling case for national investment in advanced technology manufacturing. He naturally focused on the importance of aircraft, defence and space programmes but the message was a timely reminder that Europe and the UK could not rely entirely on services to provide employment and high-value exports. Benefits from aerospace flowed generally into the economy, where a euro spent on R&D would generate two euros of added value.

Dr Enders also forcibly put the case for Britain in Europe. The UK was a powerful defender of free trade and of de-regulation. Without this voice, Europe would close its frontiers; buying short term relief from competition at the expense of long-term competitiveness. Britain was needed in Europe to influence events and to promote best practice.

In the aerospace sector, the UK government had taken several important initiatives to underpin Britain’s contribution to European aerospace. The Aerospace Growth Partnership, the Space Industry Growth Strategy and the current work on the Defence Growth Partnership continued a government-industry partnership that would keep the country in the forefront of world aerospace.

But this would all be for naught unless there was a continued flow of young people coming into the industry. Investment in scientific and technological education was vital. And this had to tap all available talent, especially young women who, he hoped, would emulate the career of the Society’s President, Jenny Body.

The Wilbur and Orville Wright Lecture was established to honour the two pioneering brothers who completed the first successful controlled powered flight on 17 December 1903. In the words of Boeing’s Tony Parasida, who delivered last year’s Lecture, Wilbur and Orville Wright “changed the world through their creativity, innovation and hard work …. wherever we labour in this field, we’re standing on their shoulders, and we’re building upon their legacy.”

Prior to the Lecture, a presentation of RAeS Honours, Medals & the Young Persons’ Achievement Award was made to the winners for 2013. As the most prestigious and long-standing awards in global aerospace, the RAeS Honours, Medals and Awards honour achievements and recognise the innovation and excellence of both individuals and teams. They are conferred for achievements and contributions in all disciplines of the global aerospace industry. Nominations for 2014 are now being accepted and the nomination form is available on our website. Please complete the form by 31 March 2014 to submit your choice for a worthy recipient or team.

The Lecture and Awards were followed by a black tie dinner for over 100 invited guests, including senior figures from the military and industry. The Royal Aeronautical Society is grateful to Airbus Group for their sponsorship of this event.
With memories of Sputnik bleeps and Neil Armstrong’s celestial first footing, space races can be fun — especially if someone else is paying for them. But, having recently read the story of James Webb’s years as head of NASA, any illusions about the romance of human space flight have fully burnt up. The burgeoning Asian ‘space race’ has a sad whiff of déjà vu.

Space — a universal benefit
At the same time, belief in the overall value of space to mankind has strengthened. Remove communications, weather and navigation satellites and the world really would stop, or at least become a much harder and less pleasant place in which to live. You can also make lots of money from space-related activities, although not necessarily from satellites themselves, or especially from getting them into orbit. The technology required for robotic exploration also pushes innovation in spacecraft design — all the better to support more commercial applications — just where the UK space sector happens to be strong.

Still a one-horse race
This brings us to the putative Asian space race. December saw both China and India launch space probes, to the Moon and Mars, respectively. Up went the tabloid headlines of competing space technologies. Although more realistically one might ask space race, what race? In real terms the Indians are hardly out of the starting gate compared to the Chinese with their heavy lift launcher, a mini-manned space station, and a navigation and positioning system almost in place, as well as a budget at least three times as big. India has certainly recognised the economic and security gains to be had from space. There are gains to be had from pushing the pace of development in an area where domestic competence in software will help to encourage a virtuous circle of innovation-led growth. As with China, space-based communications and Earth resource applications will bring broadband to rural areas, help to monitor agriculture and better predict major weather calamities.

Racing is bad for the wallet
This is all to the good: however, questions have to be asked when prestige and regional dominance start to provide a justification for investment in space spectaculars. It should be evident by now that I am not a great fan of human spaceflight; the returns from a huge collective investment (US, Russia and all the other commitments) just do not add up, especially when you consider the opportunity costs (always a prestige party-pooping concept) of depriving other scientific and technological sectors of resources.

Space racing has tended to make things even worse by forcing less than optimal decisions even within the parameters of a human space programme. This takes us back to Webb and the Apollo programme. Whereas Arthur C Clarke had predicted an incremental route to the Moon, with a space station providing a staging post; to beat the Soviets, the US opted for a technological dead-end approach. A wonderful collection of highly specific innovations just to take three astronauts to Moon orbit and two on to the surface for a few days. Not to mention encouraging some of the more egregious politics of lobbying and graft.

China has already begun to go down the space spectacular route. India would waste valuable resources following suit. To make things worse, fear of a Chinese manned flight to the Moon could encourage the Americans to throw money at repeating the journey or going one better to Mars. Using near space brings real benefits, as does robotic exploration (and in passing we should note the real scientific returns coming from the ESA Gaia astronomical satellite); the human stuff can perhaps wait until the economics of access are better.
AEROSPACE MEDICINE SYMPOSIUM

CLINICAL CHALLENGES IN AEROSPACE MEDICINE

LONDON / 4 MARCH 2014

This symposium will act as a forum for a discussion of the latest advances in aerospace medicine. Delegates will get the opportunity to examine clinical cases that present new challenges and dilemmas for the aerospace medicine community, as well as learn about advances in medical knowledge and treatment that have changed management in the context of flying. Sponsorship opportunities are available.

www.aerosociety.com/events

Stewart Named Lecture 2014

This lecture will take place directly after the Aerospace Medicine Symposium and will be given by Dr Roberts, Chief Medical Officer at NATS Occupational Health Services and Aero-Medical Centre. He will discuss the changing roles of air traffic controllers.

THE AIRCRAFT COMMANDER IN THE 21ST CENTURY

DECISION-MAKING, ARE WE ON THE RIGHT PATH?

LONDON / 25 - 26 MARCH 2014

This conference explores the vital task of making consistently sound decisions based upon effective leadership and the efficient management of resources, crew and communications, as well as avoiding the pitfalls associated with unrealistic expectations of aircraft performance or crew competencies.

www.aerosociety.com/events

Sponsorship opportunities are available for this conference. Please contact conference@aerosociety.com for further details.

Rotorcraft Conference

40TH EUROPEAN ROTORCRAFT FORUM

CALL FOR PAPERS NOTIFICATION

SOUTHAMPTON / 2-5 SEPTEMBER 2014

The European Rotorcraft Forum is one of the premier events in the rotorcraft community’s calendar.

The International Committee invites prospective authors to submit abstracts of papers for presentation at the forum.

Forum sessions will cover typical aspects of rotorcraft and will be held simultaneously in parallel sessions.

www.erf2014.com

KEY DATES AND DEADLINES

For full information on abstract submission please visit www.erf2014.com
- Abstracts submitted by: 21 February 2014
- Authors notified by: 4 April 2014
- Programme circulation: May 2014

Please submit abstracts to erf2014@aerosociety.com quoting #725

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- Cabin Crew Training
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- Asia Pacific Security Conference 2014
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- Singapore Aerospace Technology and Engineering Conference (SATEC 2014)
- Business Forums