ROYAL AERONAUTICAL SOCIETY
Loughborough Branch

Minutes of the Annual General Meetings held on Tuesday 23rd April 2013 (including notes on lecture which followed the AGM)

No. attendees – 25.

Apologies for absence – These were received from Graham Kitto and Ivor Amos.

1 Minutes of AGM held on 24th April 2012

These were approved.
Proposer – Mac Maccabee, Seconder – Goff Tearle.

2 Matters Arising

There were none.

3 Secretary's Report

See Appendix 1 (Secretary's Report to the 2012/13 Season AGM held on Tuesday 23rd April 2013).
This was approved.
Proposer – Mike Hirst, Seconder – Barry Jacobson

4 Treasurer's Report

See Appendix 2 (Treasurer's Report to the 2012/13 Season AGM held on Tuesday 23rd April 2013).
This was approved.
Proposer – Goff Tearle, Seconder – Daniel Nutt

5 Election of Officers

5.1 The following committee members indicated that they were willing to stand for re-election for the 2013/14 Season:

Branch Chairman	:	**John Ollerhead**
Branch Secretary	:	**Colin Moss**
Branch Treasurer	:	**Mac Maccabee**
Meetings Secretary	:	**Karpaga Vipran Kannan (Vipran).**
Committee Members	:	**Ivor Amos, Mike Hirst, Barry Jacobson, Daniel Nutt, Goff Tearle.**

5.2 In addition **Philip Littlehales,** present Chairman of Loughborough Students' Flying Club was standing for election**.** N.B. Philip was standing in place of Ben Ward, the now past Chairman of Loughborough Students' Flying Club.

All those standing for election were elected nem con.

6 Any Other Business

There was none.

Colin Moss MRAeS, Branch Secretary

1. Review of the 2012/13 Lecture/Visits Programme

1.1 Lectures

In all a total of nine lectures were planned for the 2012/13 programme (see Table 1 below). N.B. In each case the "Report on the Lecture" is a copy of the notes written for the RAeS Loughborough Branch website.

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
16th Oct. 2012	**The Schneider Trophy Contest 1913** by Mike Marsden, former Head of Wind Tunnels, Airbus, Filton.	**70**	This presentation encapsulated the daring, the technologies, and the politics of the Schneider Trophy. The competition was introduced by Jacques Schneider, who envisaged an annual event with water-borne aircraft flying a multiple-lap course covering 350km (217.4 miles) at the highest speed possible. Organisations represented their nation to win an annual prize plus their nation's right to host the next competition. The ultimate prize was the Schneider Trophy, to be awarded to the first nation to win three competitions consecutively. The first competition was held in 1913 at Monaco, and was won by a French contestant flying a floatplane variant of the Deperdussin Coupe. As he was the only pilot to complete the course France hosted the competition in 1914. The lecture was based on a chronological review of the competition events. These are listed below, with information on each winner.

APPENDIX 1 - Secretary's Report to the 2012/13 Season AGM held on Tuesday 23rd April 2013

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture

Date	Location	Winning Aircraft	Nation	Pilot	Average speed
1913	Monaco	Deperdussin Coupe Schneider	France	Maurice Prevost	45.71 mph
1914	Monaco	Sopwith Tabloid	U.K.	Howard Pixton	86.83 mph
1915-18	no contest				
1920	Venice, Italy	Savoia S.12	Italy	Luigi Bologna	106 mph
1921	Venice, Italy	Macchi M.7bis	Italy	Giovanni de Briganti	117.85 mph
1922	Naples, Italy	Supermarine Sea Lion II	U.S.A.	Henri Biard	145.72 mph
1923	Cowes, U.K.	Curtiss CR-3	U.S.A.	David Rittenhouse	177.27 mph
1924	no contest				
1925	Baltimore, U.S.A.	Curtiss R3C-2	U.S.A.	James Doolittle	232.57 mph
1926	Hampton Roads, U.S.A.	Macchi M.39	Italy	Mario de Bernardi	246.49 mph
1927	Venice, Italy	Supermarine S.5	U.K.	Sidney Webster	281.66 mph
1928	no contest				
1929	Calshot Spit, U.K.	Supermarine S.6	U.K.	Richard Waghorn	328.64 mph
1930	no contest				
1931	Calshot Spit, U.K.	Supermarine S.6B	U.K.	John Boothman	340.08 mph

Summary of the winning contestants throughout the Schneider Trophy 1913-31

The speaker examined each race individually: the highlights only are reported here.

1914 – The French had not expected competition, but the UK's Tommy Sopwith won in his dual float Tabloid.

1919 - At Bournemouth. Italian Guido Janello recorded the fastest time, in a Savoia S13, but this was declared void, as he had flown inside a marker pylon. Although not awarded the prize money, as he was the only contestant to finish, Italy hosted the next event.

1920 – Italian Savoia and Macchi aircraft were both supremely competitive and the Savoia S12 won.

1921 - On home ground, and in Venice for the second year running, the Italians again took the prize, this time the winning aircraft being a Macchi M.7.

1922 – The Italians had only to win to secure the trophy, and they were at Naples, but Britain broke the Italian run of successes, when the Supermarine Sea Lion logged a winning speed that was just 5mph faster than the best Italian competitor.

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			1923 – The race, at Cowes, drew USA contestants for the first time. The streamlined Curtiss CR3 biplane introduced innovations such as surface-cooling radiators, used a metal (aluminium) propeller and won the competition. Only three aircraft finished. **1925** – A two year gap had permitted more innovative designs. The UK took the Gloster III and the Supermarine S4 to Baltimore, the Italians took the Macchi M33, and the Americans rolled out the Curtiss R3C. The European efforts were in vain, and the US test pilot Jimmy Doolittle won convincingly. **1926** – At Hampton Roads in Virginia the Italians challenged America with five examples of the Macchi M39. This sleek low-wing monoplane, that the speaker noted was about the lowest drag coefficient design imaginable in its era, won at an average speed of 246 mph. **1927** – In Italy again, the homeland aircraft were challenged strongly by the British, while the Great Depression prevented American participations. The UK Supermarine S5 used the well-proven Napier Lion, had a wire-braced wing and had surface cooling for the water and the oil systems. Italian hopes were pinned on the Macchi M52, but it was the Supermarine S5 that proved best, winning at an average speed of 282mph. **1929** – Another two-year gap and Cowes hosted, but contestants operated from Calshot. Iin the Supermarine S6, the UK used the new Rolls-Royce V-12 'R' engine, with a powerful concocted fuel, and the Italians challenged with two types: the up-rated Macchi M52R and the newer Macchi M67. Only the S6 (329mph) and the Macchi M52R (284mph) finished. **1931** – Again Cowes and Calshot co-hosted the meeting. The Italians had designed a colossal engine: two V-12 engines in tandem, that delivered power through contra-rotating two-bladed metal propellers. The sleek aircraft had to be a formidable challenger to the UK's Supermarine S6B. Having not been given governmental support, it had been developed using £100,000 of personal support from Lady Houston. Just 10 days before the meeting date the French and Italians requested a one-year postponement. It was up to the UK to deliver a response, and it was decided that as the UK development has been underwritten by a public donation, there should not be a postponement. The contest was not a race as such, as the Supermarine S6B, flying the circuit alone, logged an average speed of 340mph.

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Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			The Schneider Trophy was duly presented to the UK, and is now in the Science Museum. Sadly Jacques Schneider had passed way in 1928, and never saw his challenge completed. In the course of the lecture the speaker discussed engine developments, much of the political interest (or lack of it in some cases), especially in the UK and Italy, and gave time to discuss problems confronting designers and pilots: such as visibility from the small, and over spray-swamped cockpits – the effect of propeller gyroscopic effect that led to one float digging into the water during take-off – and 'unstick' issues, upon which the speaker noted that a choppy sea was essential for take-off, as a glassy-flat sea could prove impossible. The presentation was concluded with a review of benefits attributable to the Schneider Trophy competition, and in the question and answers session penetrating questions proved to be hard to find as the speakers coverage has been so thorough and enjoyable. A vote of thanks generated warm applause from the 70 or so attendees. *Notes written by Mike Hirst, RAeS Loughborough Branch*
6th Nov 2012	**Life with the Red Arrows** by Flt Lt Mike J Child, Red 3, Royal Air Force Aerobatic Team (The Red Arrows)	**160**	**1. Introduction** This lecture described the history of formation display, the Red Arrows team, the selection of new pilots, the Red Arrows aircraft, the methodology behind the training, the displays and finally the wider roles of the Red Arrows. The lecture included a series of video sequences showing both the historical aspects of display flying and the present day Red Arrows demonstration programme.

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			2. History Close formation flying has been taught since the days of the Royal Flying Corps in WWI. Such flying proved to be the most efficient method of getting large numbers of aircraft from A to B. It also encouraged pilots to fly their aircraft to their performance limits. By the 1930s the Royal Air Force (RAF) was fighting for its independence and therefore decided to initiate a series of public demonstrations of its capabilities. These included the now famous Hendon Air Displays in which the RAF showed off both its aerobatics and formation flying skills. At the end of WWII all fast jet squadrons wanted to have a demonstration flight. By the 1950s no fast jet squadron was without a display capability. Famous demonstration flights of that era included the Yellow Jacks, the Black Arrows and the Red Pelicans. However, the cost of maintaining such flights became unacceptable. As a result, in 1964, the Air Council ruled that only training units could include demonstration flights. This resulted in the formation of the Red Arrows. Initially the Red Arrows were made up of just seven Folland Gnat jet trainer aircraft but with nine pilots trained to participate in the flying displays. The number of aircraft was later increased to nine. They gave their first public display in 1965 and, over that year, they went on to give a total of 80 public displays. By the mid 1980s, the Gnat was reaching the end of its useful life and was replaced by the BAe Hawk Mk 1 trainer aircraft.

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			 *A Typical Manoeuvre during a Red Arrows Display with BAe Hawk Mk. 1 Trainer Aircraft* **3. The Red Arrows Team** The team comprises: • Pilots (the Red Team – Red 1 to 9) • Operations and Administration Manager. • Photographic Staff – For safety reasons a video record is taken of all displays. Video records are also used to assist in correcting mistakes during training. • Engineering Staff (the Blue Team) – Responsible for all aircraft servicing, diesel fuel (for "smoke" generation) and dye (red, white and blue to colour the "smoke"). • Safety Equipment Team. • Road Support Team transporting spare parts and responsible for all road vehicle operations.

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			• Commentator (Red 10). All team members work together as a closely knit group. In particular the "engineering circus" comprises a team of engineers who fly in the back seats of aircraft on their way to displays. The "circus" members are then responsible for preparing aircraft prior to each display. **4. The Selection of New Pilots** It is a prerequisite that all pilots applying to join the Red Arrows must have a high level of flying experience which must include at least 1,500 hours fast jet flying (which equates to approximately 10 years service in the RAF) and one front line tour of duty. In addition they must have been consistently assessed as being "above average". Nine such pilots are selected each year from the many applicants. All nine spend one week in the back seat of and aircraft during which their flying skills are assessed by current Red Arrows pilots. These pilots are then assessed for the presentation skills and interviewed by the Commandant of Central Flying. They are also assessed by the current Red Arrows pilots for their ability to "get on" with the Red Arrows team. Finally just three new pilots are selected. Most pilots spend three years with the Red Arrows. They are each given a different position in the flight each year to "avoid complacency". **5. The Aircraft** The Red Arrows use BAe Mk. 1 Hawk Trainer Aircraft. These aircraft have been modified to include: • Smoke generation pod (to contain the diesel fuel used for "smoke" generation). • Dye containers. • Red/White/Blue Smoke/Dye controls on the control column.

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			• Cockpit mounted smoke indicators. • Tail cone smoke pipes (to inject dye and diesel into the jet exhaust). • GPS to facilitate A to B travel between display venues. In addition, the engine control limiters, normally used to prevent engine surges during training, have been removed. The Mk. 1 aircraft, which have proved very reliable in service, are now fast approaching the end of their lives. To counter this, some Mk. 1 aircraft are being put into storage for future use in maintaining the Red Arrows flight. N.B. Mk. 2 aircraft are not suited for use in displays as, unlike the Mk. 1 aircraft, they contain a sophisticated cockpit geared specifically to the training of combat pilots. **6. Training for the Display Season** The display season finishes at the end of October each year and is followed by two weeks leave. The training process then begins. This is a sequence of briefing, flying, de-briefing, noting errors and then repeating the process. Typically, Winter training will involve three sessions per day and take the form of a building block approach leading progressively up to a full flight of all nine aircraft. In its essence the training is about learning a sequence of manoeuvres during which each pilot is required to maintain his aircraft in a given position with respect to adjacent aircraft. Training starts by defining a series of reference points on adjacent aircraft which a pilot can then use as references to maintain the position of his aircraft. In addition pilots must learn to control their aircraft with "smooth flying inputs" to ensure that all manoeuvres by the team are conducted in a seamless and totally coordinated manner. Winter training includes corporate days to obtain support/funding from industry, local supporter days, passenger days (these days almost all passengers are themselves fast jet pilots), presentations and charity visits.

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			Only a certain amount of training is possible during the UK Winter and, for this reason, the training includes a period in Cyprus in the weeks leading up to each new display season. During the Winter pilots wear blue flying suits. Just before the start of each display season the Red Arrows are awarded "public display authority". The pilots then switch to their red flying suits for the 5 month display season. **7. The Red Arrows Display** A typical display will last 24 minutes. There are 3 display options, Full, Rolling and Flat Weather (down to 700 ft cloud base and 3.7 km visibility). Which option is selected depends on the weather conditions, especially the cloud base. The aim is to provide a continuous visual display for the watching crowd. Each display is divided into 2 halves. The first half comprises a series of manoeuvres with all nine aircraft in series of different formations (such as Apollo, Diamond, Phoenix and Swan). A typical formation might be: 1 5 3 2 4 6 9 7 7 in which the three "new" pilots take positions 2, 3 and 5. The second half of the display comprises a series of "splits" and head-to-head passes. These include a vertical break, a synchro pass and a roll back. "Fudges" are used to give the crowds an impression that the aircraft are closer than in reality. These rely on the sightlines from which the crowds are able to view the display.

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			A typical "display day" might comprise: • Transit – Scampton (Red Arrows base) to Bournemouth. • Display – Bournemouth. • Transit – Bournemouth to Newcastle. • Flypast – Great North Run (GNR) Start. • Display - South Shields (GNR). • Transit – South Shields to Scampton. In the case of the above, "dye teams" will be located at both Bournemouth (Hurn) and Newcastle airports. In practise the Red Arrows can do up to 4 displays in one day. 8. The wider Roles and Responsibilities of the Red Arrows These include: • Promoting British industry, especially exports – this has resulted in many displays being given overseas, especially in the Gulf States. • Demonstrating the excellence and professionalism of the UK Armed Forces. • Defence diplomacy. • Recruitment. • On the Ground – meeting the public in the Red Arrows tent, signing autographs and general public relations. As part of the above, the Red Arrows participated in the 2012 Olympics Opening Ceremony, the Queen's Diamond Jubilee (with displays both over Windsor Castle and the Mall in London) and the Farnborough 2012 Flypast. In addition, during 2012, they visited the USA, Egypt and the Middle East.

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			9. Conclusions The Red Arrows demonstrate the excellence of the RAF, inspire a favourable recruitment environment, promote the quality of British defence products abroad and act as ambassadors for the UK. *Joint lecture with the Loughborough University Students Flying Club* *Notes written by Colin Moss, RAeS Loughborough Branch*
20th Nov 2012	**Keeping the Battle of Britain Memorial Fight Airworthy** by Kev Ball BBMF and Richard Oldfield BAE Systems..	**210**	**1. The History, Aircraft, Personnel and Operation of the BBMF – WO Kev Ball** The BBMF plays a major role in enabling us to remember the past. It also serves to promote the modern day RAF and to enthuse new recruits to join the RAF.  *Some of the BBMF Aircraft* The BBMF has its origins in 1957 when a Wing Commander Thompson had the idea for developing an historic flight. By 1963 a flight had been established at RAF Coltishall and comprised a Hurricane Mk IIC LF363 and a Spitfire PR XIX PM631. The flight was moved to RAF Coningsby and, by the early 1970's, included a Lancaster B1 PA474. The flight now comprises 2 Hurricanes, 6 Spitfires, 1 Lancaster, 2 Chipmunks and 1 Dakota. Four different types of engine are used in these aircraft but, each type includes a number of variants.

APPENDIX 1 - Secretary's Report to the 2012/13 Season AGM held on Tuesday 23rd April 2013

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
			Hurricane Mk IIC LF363 was built in Castle Bromwich in 1944 and is believed to be the last Hurricane to enter service with the RAF. Hurricane Mk IIC PZ865 is the last Hurricane ever built. Another BBMF aircraft, a Spitfire Mk IIa P7350, is the oldest airworthy Spitfire and is the only Spitfire still flying which actually fought in the Battle of Britain. Yet another Spitfire, a Mk Vb AB910, flew a remarkable 143 combat sorties in almost 3 years of wartime operations. Spitfire Mk LF XVIE TE311 is a low-back/bubble canopy version of the Mk XVI with "clipped" wingtips. This aircraft has just been restored. The two PR XIX Spitfires are both fitted with the more powerful Griffin engines and incorporate large wing fuel tanks in place of guns. Both PR XIXs were built just too late to see WWII service. Lancaster BI PA474 is one of only two Lancasters to remain in airworthy condition; the other is in Canada. It was completed in late 1945, just after the end of WWII. Currently it bears the markings of Lancaster EE139, "Phantom of the Ruhr", which flew a total of 121 operations during WWII. The C-47 Dakota was manufactured in the USA in 1942 and obtained by the BBMF in 1992. It is now painted to represent Dakota FZ692 around the D-Day period in 1944. It is fully para-drop capable and has been used in this role for special commemorative events. The two Chipmunks were not described in the lecture. Manpower is a big issue with the BBMF as Specially Qualified and Experienced Personnel (SQEP) are needed to maintain its aircraft. The aircraft may be simple compared with present day aircraft, by they require different skills to maintain them. This necessitates a constant training programme as experienced staff move to other RAF posts and are replaced by new staff. Currently the BBMF has 35 personnel and is based at RAF Coningsby. The BBMF Year is divided into two parts; Winter (October – March) and Summer (April – September). During the Winter only the Chipmunks are flown. This is also the time when all of the in-depth maintenance takes place.

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			Anyone can bid for a BBMF display; typically there are 3,000 bids submitted each year leading to 1,000 appearances over the Summer months. Of these there are 5 flypasts for each full display. There is a Visitor Centre at RAF Coningsby. **2. Lancaster Fatigue Management – Richard Oldfield, BAE Systems** The four engined Avro Lancaster was a development of the two engine Manchester. 7,377 Lancasters were built and, like the Manchester, it was designed for mass production using a metal stressed skin method of construction. Lancaster BI PA474 was built in May 1945 at Broughton, Nr. Chester. In the past it has been used in photo-reconnaissance and flight refuelling roles. It was also used at Cranfield for laminar flow trials. This knowledge of its history was crucial in predicting the residual fatigue life of the aircraft. As a result, the 1983 Fatigue Index (FI) of life used was calculated as being 70.3/100. The FI actually relates to the rear spar bottom boom but may be translated to any other location. Additional fatigue life calculations were based on information derived from equivalent parts used on Shackleton aircraft. A 54 minutes flight profile has been assumed for the purpose of present day fatigue life assessments and regular reviews are held to ensure that the actual flight profiles do not compromise this profile. A Mk 18 G Meter, fitted over wing in the centre of the fuselage, is used to provide a record of the vertical G loads experienced during each flight. Regular Non-Destructive Testing (NDT) is carried out on the aircraft. This involves removing selected bolts, for example in the wing spars, and closely inspecting the holes from which the bolts have been removed. *Joint lecture with the Loughborough (University) Alumni* *Notes written by Colin Moss, RAeS Loughborough Branch*

TABLE 1

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11th Dec 2012	**A350XWB – Shaping Efficiency** by Imran Khawaja, Airbus UK	**140**	Airbus employs 55,000 people worldwide and has its headquarters in Toulouse, France. The A350XWB programme has been supported by Airbus development and manufacturing sites spread throughout France, Germany, Spain and the UK. Airbus today consistently captures about half of all commercial airliner orders. Of these the Airbus A320 is the world's best selling passenger aircraft with 5348 sold to date. The A350XWB concept has resulted in a family of three long range, single aisle passenger aircraft; the 800 Series, the 900 Series and the 1000 Series. They are designed to carry 270-350 passengers over a distance typically up to 8,100 nm although more passengers can be carried in high density configurations.  *A350XWB* There is a very high level of commonality between all three variants; essentially the 1000 Series is a 900 Series with extra fuselage sections added and the 800 Series is a 900 Series with

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			some fuselage sections removed. This commonality offers advantages over the Boeing equivalent aircraft where two separate aircraft, the Boeing 777 and the Boeing 787, are needed to cover the same spread of capacities. The A350XWB is an all new aircraft design with a new engine, the Rolls-Royce Trent XWB. Airbus are in fact highly satisfied with the progress that Rolls-Royce has achieved in developing this engine. The aircraft cabin width is 220 inches which is 5 inches wider than that of the Boeing 787. It will have more passenger headroom than previous aircraft, larger overhead bins, wider windows and wider seats (18 inches). Its cabin pressure in flight will correspond to 6,000 ft altitude.  *A350XWB Passenger Cabin* The aircraft structure is made from carbon fibre reinforced plastic (CFRP) (53%), high strength alloys (20%) and titanium (13%). The combined effect of these is to achieve a considerable weight reduction. This, coupled with an advanced wing design and high efficiency engines, has

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resulted in a fuel burn rate which is 25% lower than that of current in-service aircraft. Thus the A350XWB series offers a considerable competitive advantage to the airlines operating it.

Airbus have chosen to construct the aircraft fuselage from CFRP panels. This is unlike Boeing who have used a filament winding method to construct entire fuselage sections for their Boeing 787 aircraft. Airbus consider that their approach offers advantages if repairs are required.

The aircraft systems have been made more reliable, simpler and cheaper by the use of solid state technology. The cockpit incorporates six large screen LCD displays. These are fully interchangeable, thus reducing spares holding requirements. Together they are able to display all the necessary flight systems information. The overall cockpit display design also allows room for growth potential. In addition the cockpit configuration has significant commonality with that of other Airbus aircraft resulting in a reduced duration of conversion courses for pilots transferring from older Airbus aircraft to the A350XWB.


A350XWB Cockpit

The aircraft will be cleaner, quieter (10dB below current generation aircraft on landing) and
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TABLE 1

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			"smarter" than current generation aircraft. The latter means than the aircraft will be more reliable and require less servicing. Airbus' predictions are that, over the period 2011-30, there will be a worldwide requirement for 19,170 single aisle passenger aircraft, 6910 twin aisle and 1780 very large passenger aircraft. The growth rate in terms of total numbers of passenger aircraft is predicted to be 4.8% p.a. which corresponds to a doubling of the number of passenger aircraft every 15 years. Past experience has shown that this growth rate is resistant to events such as the knock-on effects of the attack on the World Trade Centre. It is Airbus' aim that the A350XWB should take a large proportion of the single aisle market. As of the date of the lecture (11/12/2012) Airbus have 562 orders for the aircraft spread 64% (900 Series), 16% (1000 Series) and 20% (800 Series). Entry-into-service is planned for the second half of 2014 and the first flight is due to take place in June 2013. The final assembly of both the first flying aircraft (MSN001) and the ground test bed (N001) is well under way at the Airbus plant in Toulouse, France using major sub-assemblies supplied from Airbus' European factories and sub-contractors . *Joint lecture with the IMechE* *Notes written by Colin Moss, RAeS Loughborough Branch*
22nd Jan 2013	**A View to the Future of Civil UAS** by Lambert Dopping-Hepenstal FREng, CEng, FIET, FRAeS, Engineering Director Systems & Strategy and ASTRAEA Programme Director, Military Air & Information, BAE Systems	**70**	ASTRAEA (Autonomous Systems Technology Related Airborne Evaluation & Assessment) was described in terms of its aims, why it is important, what has been achieved, and what challenges remain. The programme has been running for 6 years during which it has addressed the safe and routine operation of autonomous vehicles in UK civil airspace. It has been a £62 million programme to which seven companies: AOS, BAE Systems, Cassidian, Cobham, QinetiQ, Rolls-Royce and Thales, have contributed resources. The programme was conceived when industry realised that an Unmanned Aircraft System (UAS) - an acronym that combines the airborne, Unmanned Air Vehicle (UAV), component and the ground-based workstation/pilot (or 'operator') component – will play a growing role in

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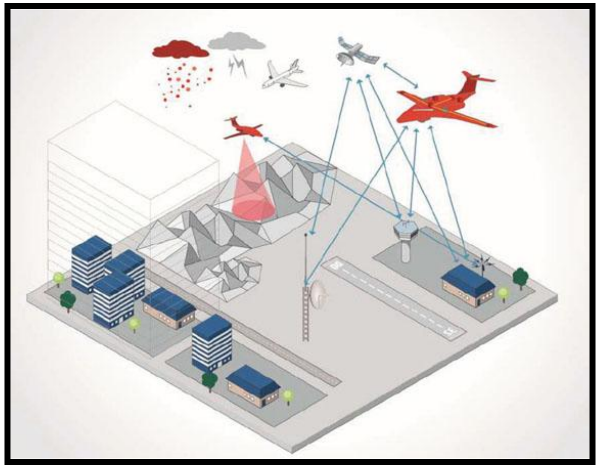
			future peacetime air operations. Examples quoted included search and rescue, environmental monitoring, forest fire fighting and the monitoring of natural activities, such a volcanoes, and the dispersion and composition of volcanic ash clouds. In Britain, the Civil Aviation Authority (CAA) provided guidance through its publication (CAP 722 - Unmanned Aircraft System Operations in UK Airspace) in 2002, but as was explained, this was a 'catch 22' situation with the regulator able to describe certification expectations, but to be looking towards industry for the description of specific requirements. Much of the ASTRAEA programme outcomes have strengthened and extended the scope of the emerging regulations through research that has provided evidence for specific requirements.  This illustration was sub-divided into components, each associated with the four main research aims presented in the lecture. Noteworthy is the wide-range of airborne operations implied, the mixture of ground-level obstacles, and the communication links implied between airborne elements of the complete system. The lecture provided descriptions of four major areas of research: **1. Autonomy and decision-making** The project faced the question 'should autonomy mean not keeping the human-in-the-loop?' In UAS concepts, the operator (ground-based 'pilot') is vested with the ultimate authority, so

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			there will be a human interface, but as airspace management complexity introduces more automation of its prime functions, research attention was devotes to operational interfaces. These were not always as simple as might be supposed, as is the case when an air-to-air refuelling of a vehicle to offer non-stop surveillance is considered. There has been trialling with two or more UAVs sharing airspace during operational trials at Aberporth, West Wales. **2. Ground Operations and Human Systems Interaction (GOSHI)** The research had concentrated on the study of latency issues of collecting and forwarding data, and involving the operator in addressing operational issues. **3. Communications – Security and Spectrum** Useful radio frequencies in the electro-magnetic spectrum are in great demand from expanding radio/mobile phone operations, as nothing was pre-supposed for UAS operations. Communication was highlighted as one of the major issues to address, and novel trials had been conducted using a small fleet of Mini cars (redundant from use in the Olympics), operating in demanding radio-reception conditions in the Brecon beacons. **4. Detect and Avoid** The UAS has to be able to cope with a wide range of potential threats – weather, commercial aircraft, fast jets, general aviation (light aircraft, helicopters and sailplanes), specialist airspace users (such as parachutists), terrain and man-made obstacles (such as masts). The speaker presented film of 'see and avoid' trails conducted with aircraft-mounted cameras in its dedicated Jetstream 31 laboratory. This was operated on trials with a two-man crew, but they performed only monitoring duties during much of each mission's duration.

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Date	Lecture/Lecturer	Attendance	Report on the Lecture
			The BAE Systems Jetstream 31 demonstrator is an aircraft equipped with an extensive range of sensors and on-board processing that can be used on UAVs. In trails the aircraft is manned by pilots (monitoring) and ASTRAEA system flight-test engineers  The aim of the ASTRAEA programme is to enable the routine use of a UAS in all classes of airspace, from fully controlled to free-flight, without the need for restrictive or specialised conditions of operation, and the speaker presented a strong case for continuing to conduct research that will assist in maintaining the pre-ordained safety requirements and separation standards applied throughout all airspace worldwide. This was a well structure presentation that provided a wide-ranging description. It focussed on the major elements of the programme, and provided a very complete coverage, with descriptions to a depth that were within the grasp of a general audience. *Notes written by Mike Hirst, RAeS Loughborough Branch*
5th Feb 2013	**A400M – Towards Entry Into Service** by Brian Kitson, Head of Overall Aircraft Aerodynamics, Airbus	**80**	**1. Overview** The A400M has been developed and built in response to a European Staff Requirement. It has been ordered by Belgium, France, Germany, Luxemburg, Spain, Turkey and the United Kingdom together with Malaysia. These orders total 174 aircraft but there are hopes for further export orders.

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
			 **Fig. 1 – A400M During a Rough Terrain Landing Trial** In terms of payload and range the A400M falls midway between the strategic airlifters such as the C17, which demand fully prepared runways, and the much smaller tactical transport aircraft, such as the C130J, which can use rough take-off/landing strips. As such the A400M is able to fulfil the roles of both these aircraft categories; it has a full tactical/rough field take-off and landing capability yet it is able to fly at altitudes of up to 40,000 ft thereby giving it a significant strategic range. In addition its wingspan of 42.4 M is little larger than the 40.4 M of the C130J hence it is likely to fit into the same hangers as a C130J. **2. Design** The A400M has been designed to carry armoured vehicles, armoured personnel carriers, army trucks and helicopters as well as personnel including paratroopers. Many of the vehicles it can carry are larger than can be carried by a C130J. In addition it can be used for in-flight refuelling of other aircraft as well as being refuelled itself. Other applications include medivac operations.

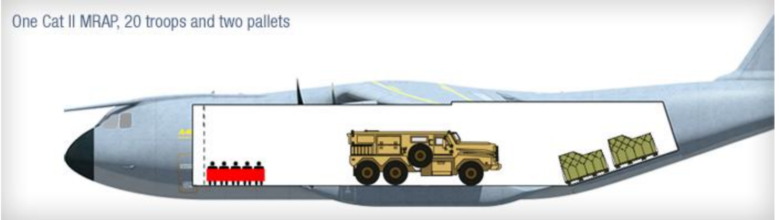
TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			 **Fig. 2 – A400M Carrying Capacity** The A400M carrying capabilities have demanded a fuselage which is close to the ground, partly to facilitate easy loading and off-loading, a high wing, undercarriage sponsons either side of the fuselage, and a large cargo door/ramp at the rear of the fuselage. In addition it has a high trimable T-tail. The aircraft uses high power turboprop power plants. This makes it easy to reverse the pitch of the propeller blades and thereby reverse the aircraft on the ground. The assymetric effects produced by propellers are minimised by having the propellers rotate clockwise (engines 1 and 3) and counter-clockwise (engines 2 and 4). It also minimises the adverse swirl effects of a turbulent airflow passing over the wings and tailplane. A combination of computational fluid dynamics modelling and wind tunnel testing has been used to optimise the design in the presence of the propeller effects. This has resulted in the aircraft having exceptionally good handling characteristics. The FADEC controls both the engines and the propellers and is one of the most complex ever designed. **3. Structural Testing** The A400M wings have been structurally tested to a limit of 1.5 x max. design load. During this testing the wing deflection was small compared with that of an Airbus A380 or a Boeing 787. This is despite the fact that carbon fibre was used extensively in the construction of the aircraft wings. The stiffness is due to the specific geometry of the A400M wings Fatigue testing equal to 5 x annual usage has already been completed and is on-going. **4. Route to Certification, Qualification (Civil and Military) and Manufacture**

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
			The aircraft was first flown at the end of 2009. It received a restricted type certificate during 2012 and is expected to receive full type certification during early 2013. The aircraft’s fly-by-wire control (FbW) system was set at direct law control for the first flight take-off in 2009. Pre-defined flight control laws were then switched in, tested and optimised at altitude. From then on the aircraft’s permitted functionality has increased as further testing proceeded and the FbW control system further optimised. One advantage of such a control system is to allow the setting of protections to prevent pilots unduly stressing the aircraft.  **Fig. 3 – First Completed A400M** **5. Flight Testing** Flight testing has included optimisation of the wing flap take-off and landing settings and the design of the engine nacelle and rear fuselage strakes. The use of strakes has increased aircraft stability and reduced drag. Stall testing has included an evaluation of the buffet loads on the tail and also the effects of a deep stall. The latter was also tested with the engines operating a full power despite this being outside the margins required for type certification. The stall testing was followed by testing over the remainder of the flight envelope up to Mach 0.72 and 40,000 ft.

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
			Certification testing has been concerned with cruise, take-off and landing performance. Here the stall performance has been crucial in obtaining low take-off and landing speeds. Further tests have included the minimum un-stick speed, minimum control speed on the ground and the effects after an engine failure, especially on take-off. Runway testing has included take-offs and landings on unprepared and water soaked runways. Icing tests have been carried out to confirm the aircraft's performance under icing conditions. N.B. In common with most aircraft the bleed air requirements to provide a full anti-icing capability are too high for them to be met by the aircraft's engines. Further testing has included a stepped process leading to paratroopers jumping from the aircraft, a series of in-flight refuelling trials and flying in formation. **6. Conclusions** After some delays during development, the A400M is now fully back on track for production. Significant flight testing has already been completed and has confirmed the aircraft's excellent handling capabilities. *Notes written by Colin Moss, RAeS Loughborough Branch*
19th Feb 2013	**The Astute Submarine** by Simon Purvis, BAE Systems	**155**	**1. Company Overview** BAE Systems Submarines has approximately 3800 employee located on 6 sites in the UK with the majority of its employees being located at Barrow-in-Furness, the site of the UK's only nuclear shipyard. Previous vessels built at this shipyard include the Type 42 Class destroyers, the Invincible Class aircraft carriers and Ocean and Albion Class fleet support vessels. In addition the Swiftsure, Trafalgar, Upholder and Vanguard Class submarines have all been built in the same yard. Some of the technology from these submarines has been carried over into the Astute Class submarines.

TABLE 1

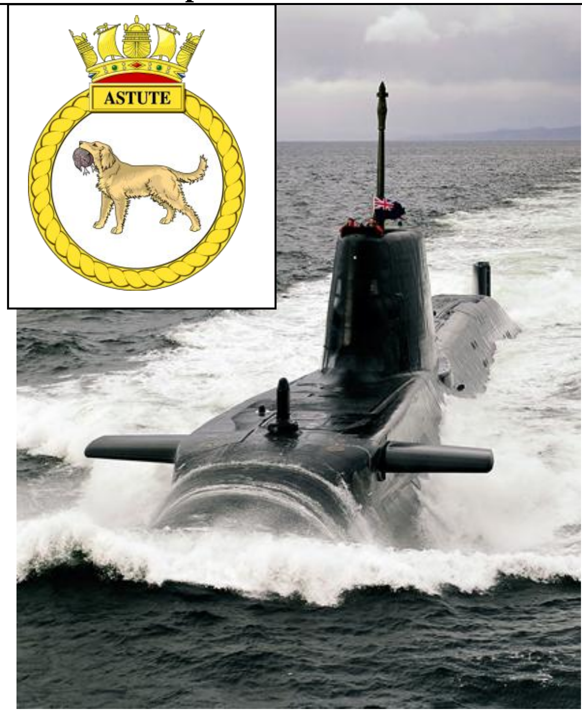
Date	Lecture/Lecturer	Attendance	Report on the Lecture
			 **Fig. 1 – HMS Astute, first of Class, on trials** **2. Astute Project** The UK Ministry of Defence (MoD) issued the Invitation to Tender (ITT) for the Astute Class Submarine in July 1994 and the contract was awarded in March 1997. This contract was for 3 submarines together with support for the initial 8 years of service life. Unusually, the Prime Contractor was made the overall design authority for the project and were therefore responsible for the "whole boat" design and performance. Subsequently a contract was awarded for a further 4 submarines but here the MoD took back some of the responsibility for major design decisions thereby reducing the risks (and hence costs) to the Prime Contractor.

TABLE 1

Date	Lecture/Lecturer	Attendance	Report on the Lecture
			3. Roles for the Astute Class Submarines These include: • The detection and prosecution of other submarines and surface vessels using Spearfish torpedoes. This may be either acting autonomously or in support of a Task Force; • Land attack using tube launched TLAM Block 4 (Tomahawk Land Attack Missiles) 'Cruise' missiles; • Surveillance, Reconnaissance and other Intelligence gathering activities using Radar & Communications Electronic Surveillance Measures, sonar, visual and other systems; • Support to the UK's Continuous At-Sea Deterrent (Trident); • Sea region denial; • Other capabilities (not specified during the lecture). **1. The Programme** The submarine delivery programme is as follows: **Name / Boat / Pennant No. / Status / Laid down / Launched / Commissioned** *Astute* / 1 / S119 / On Sea trials / 31/1/01 / 8/6/07 / 27 Aug 2010 *Ambush* / 2 / S120 / On Sea Trials / 22/10/036/1/11 / / Early 2013 *Artful* / 3 / S121 / In build / 11/3/05 / 2015 / *Audacious* / 4 / S122 / In build / 23/3/09 / 2018 / *Agamemnon* / 5 / S123 / Initial build / 13/10/112020 / / *Anson* / 6 / S124 / On order; long-lead items ordered *Ajax* / 7 / S125 / Planned (confirmed SDSR 10/10) **2. Key Design Features** These include: • New Combat System including a new state-of-the-art 2076 Sonar • Distributed Control & Instrumentation • Improved quieter gearbox (over previous submarine types) • Static converters instead of motor-generators (this saves space and reduces acoustic noise)

<table>
<tr><th colspan="4">TABLE 1</th></tr>
<tr><th>Date</th><th>Lecture/Lecturer</th><th>Attendance</th><th>Report on the Lecture</th></tr>
<tr><td></td><td></td><td></td><td>

- Additional torpedo tube and reloads (over previous submarine types);
- Non-penetrating Optronics Masts (unlike previous submarines where the periscopes penetrate down to the Command Deck. This dramatically improves the flexibility of laying out the Command Deck.)
- External control surface actuation (again reduces the number of hull penetrations)
- Split aft hydroplanes planes (increases reliability)
- Composite control surfaces & Propulsor (reduces the submarines acoustic signature)
- Reverse Osmosis plant for fresh water production
- Electrolysers (O_2 generation) and CO_2 Scrubbers for atmosphere control
- No overboard discharge of garbage – processed, packaged and stored on board for duration of patrol.

The Astute Class compares with its predecessor, the Trafalgar Class, as follows:

<table>
<tr><th></th><th>Trafalgar</th><th>Astute</th></tr>
<tr><td>Length</td><td>86</td><td>97</td></tr>
<tr><td>Beam</td><td>9.8</td><td>10.7</td></tr>
<tr><td>Dived Displacement (tonnes)</td><td>5200</td><td>5200</td></tr>
<tr><td>Complement</td><td>130</td><td>122</td></tr>
<tr><td>Weapons</td><td>Baseline</td><td>+50%</td></tr>
<tr><td>Speed*</td><td>Baseline</td><td>- 1.5 knots</td></tr>
</table>

*It is important to note that absolute speed is not the most significant factor. Stealth is far more important.
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</table>

TABLE 1

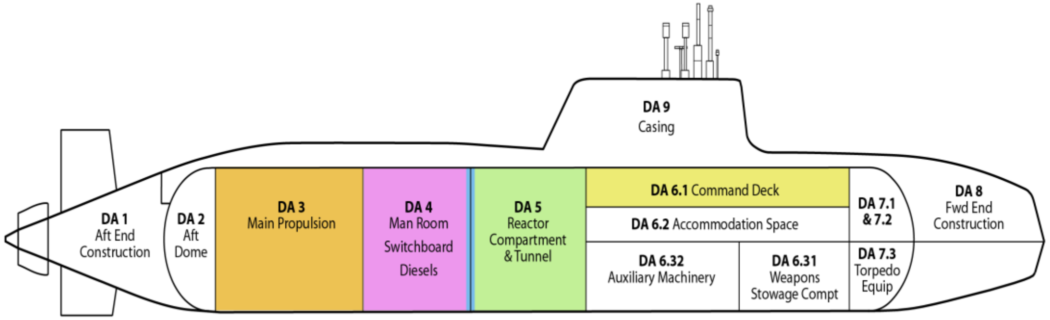
Date	Lecture/Lecturer	Attendance	Report on the Lecture
			 **Fig. 2 – Astute Class Submarine - Configuration** **3. Modular Build Process** Each submarine is being built by a modular build process. Firstly the pressure hull is constructed. Brackets are then welded to the hull to support the internal modules (Fig. 2 above). The various sub-assemblies designed to remain in-situ for the life of the submarine are then added. All of the main modules such as the Command Deck, Reactor Compartment, Main Propulsion etc. (Fig. 2) are fully assembled before being brought to the overall submarine assembly line. These modules are then "slid into" and attached to the main hull. Finally the Bridge Fin and Casing are added to the top of the hull. The submarine is then ready for launching and sea trials before being handed over to the Royal Navy. *Joint lecture with I. Mech. E. and RAeS Loughborough Branch Prestige Lecture* *Notes written by Colin Moss, RAeS Loughborough Branch*

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
12th March 2013	**Aircraft Survivability and the Aerodynamics of Battle Damage** by Dr Peter Render, Loughborough University and Dr Andrew Irwin, BAE Systems.	**80**	**1. Aircraft Survivability Assessments by Dr Andrew Irwin** Survivability is defined as the ability of an aircraft to survive and withstand a hostile combat environment. This excludes natural effects such as weather. Amongst other mechanisms, survivability can be maximised by carrying out a stand-off attack, being aware of the locations of ground defences and making use of the local terrain to prevent detection. In addition, ground threats may be removed or degraded by electronic warfare techniques. The probability of detection may be reduced by reducing the aircraft radar, infra-red, visible and acoustic signatures. A Defensive Aids Suite (DAS) may be used to evade an attack once the aircraft has been detected. DAS includes a missile approach warner to cue the pilot on to an attacking missile and to launch decoy chaff and flares. It may also include Directional Infra-Red Countermeasures (DIRCM), which fire a high power infra-red laser at an approaching missile in order to "blind" the missile's infra-red homing systems. Finally defensive manoeuvring may be used. The ability of an aircraft to survive an attack may be increased by minimising the effects of any damage. One example of this is to make certain non-critical parts of the aircraft "sacrificial" in order to protect other more critical parts such as the engines. This is a design feature of the A10 Warthog ground attack aircraft (Fig. 1). Incorporating well-spaced duplex and triplex systems is another example. Threats include ground based small arms fire, anti-aircraft gun batteries, e.g. the Soviet ZSU23-4, shoulder launched missiles, surface-to-air missiles and, finally, air-to-air missiles. The resultant damage may be highly localised or be spread over a number of impact points. The damage will also depend on the type of material being impacted. It can also include hydrodynamic ram effects damage, especially to a fuel tank.

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			 **Fig. 1 – Battle Damaged A10 Warthog ground attack aircraft** The damage to an aircraft's structure, its flight systems and its mission systems must all be assessed before the overall vulnerability of an aircraft can be established. The work being carried out at Loughborough University is concentrated on providing a flexible predictive method for determining the aerodynamic consequences of aircraft damage. This is especially in respect of the probability of an aircraft remaining sufficiently airworthy to allow it to be flown back to base. **2. Effects of Battlefield Damage on Aircraft Aerodynamics by Dr Peter Render** Battlefield damage to an aerofoil section is random in shape, impact angle and location. Damage holes are often "petalled" around their circumference. The effects of this damage have been simulated by cutting circular holes into aerofoil sections, and then coating the sections with a suspension of French chalk and placing the sections in a wind tunnel. The French chalk was used to visualise the flow. Balance measurements were done to provide information on lift, drag and pitching moment.

TABLE 1

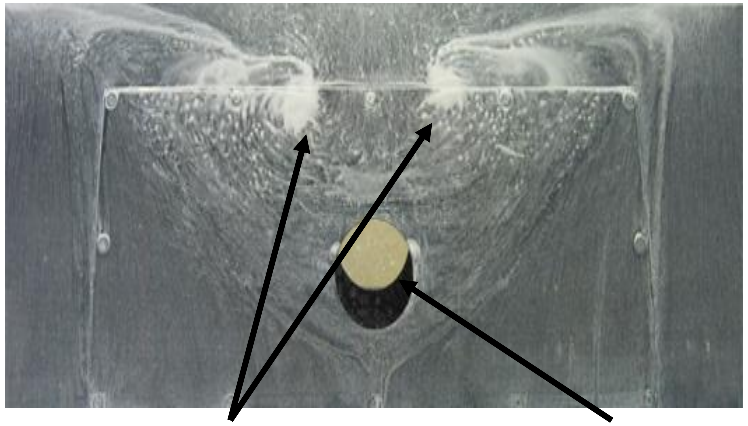
Date	Lecture/Lecturer	Attendance	Report on the Lecture
			The hole diameters were 5-40% of the aerofoil chords. The higher figure was considered to be the limiting hole diameter for there to be a reasonable probability of an aircraft being sufficiently airworthy to be flown back to base. The aerofoil sections included representative cavities inside the sections. Limited tests were also carried out with holes in the form of a Star of David to simulate any effects due to petalling. The tests were an attempt to simulate the random non-circular shape. Both 2D and 3D wind tunnel tests were carried out. In the 2D tests, the aerofoil sections were positioned across the width of the wind tunnel with the two vertical walls of the wind tunnel forming null points. The holes in the aerofoil sections were sufficiently far away from the nulls for the hole related aerodynamic perturbations not to be influenced by the null points. For the 3D tests, aerofoil sections were mounted vertically from the wind tunnel base with the top of the aerofoil section well clear of the wind tunnel top.  **Fig. 2 – Vortices behind aerofoil damage hole** Fig. 2 shows a typical result. The air passing over aerofoil section deviates either side of the hole and combines with the air from the hole to form a "horse shoe" vortex behind the hole. The magnitude of these vortices depends very much on the hole diameter, with those

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			associated with smaller holes being very much less pronounced than those for larger holes. As expected, the effects of the holes were much more significant at a high incidence angle than at low angles. Air flowed through the holes from the high to the low pressure surface of the aerofoil section. At low angles of incidence this air formed a "weak" jet and hence caused relatively little turbulence and relatively small vortices. Conversely at high angles of incidence, the air formed a "strong" jet which penetrated significantly into the free stream air passing over the low pressure surface of the aerofoil section. The result was a very pronounced vortex. These tests also showed that the effects were influenced by the relative positions of the hole in the upper surface of the aerofoil section to its corresponding position in the lower surface: this means that the effect is dependent on the direction of attack. Tests were also carried out on an aerofoil section looking like a "cheese grater"; incorporating a large number of small holes to simulate the effects of fragmentation damage. Such aerofoil sections were found to still produce lift but with a significant increase in drag. The aerodynamic effects of damage may be expressed in terms of the aerofoil section lift coefficient (C_L), drag coefficient (C_D) and pitching moment (C_M). The delta changes to these values (ΔC_L, ΔC_D and ΔC_M) as a function of damage level may be used as inputs to the predictive method for assessing aircraft vulnerability. A reduction in lift coefficient (negative ΔC_L) means an increased stall speed. This makes the aircraft more difficult to land, indeed some battle damaged aircraft have been lost on landing approach for this very reason. An increase in the drag coefficient (positive ΔC_D) results in increased fuel burn, which means that an aircraft may run out of fuel before reaching base. Similarly changes to the pitching moment (ΔC_M) make the aircraft less stable and hence more difficult to fly. *Notes written by Colin Moss, RAeS Loughborough Branch*

<table>
<tr><th colspan="4">TABLE 1</th></tr>
<tr><th>Date</th><th>Lecture/Lecturer</th><th>Attendance</th><th>Report on the Lecture</th></tr>
<tr><td>23rd April 2013</td><td>Shannon International Airport - from Foynes to the Future by Joe Buckley, Cargo and Technical Traffic Development Manager, Shannon Airport</td><td>80</td><td>
The speaker, Joe Buckley, has held responsibilities in airport operations, as Terminal Manager, and is currently Cargo and Technical Traffic Development Manager at the airport. He devoted the lecture to looking at how Shannon evolved from flying boat operations in the 1930s, to the airport it is today, taking in many innovative, and often unique, developments.
Foynes, a small town on the south side of the Shannon estuary was used by flying boats in 1935. Subsequently Foynes was used for North Atlantic air services that were frequented by many of the world's leading politicians and most famous entertainers. Between 1941 and 1945 around 48,000 passengers used Foynes: meanwhile, a grass aerodrome at Rineanna, on the north side of the river and slightly further inland, was established. It was this site that became Shannon Airport, taking on landplane aviation demand after WW2.
THE ORIGINS OF 'IRISH COFFEE'
In the winter of 1943 a flight returned to Foynes, due to bad weather, and as staff welcomed the returning flight, the airport restaurant Chef, Joe Sheridan, having been asked to prepare something warm, put some good Irish Whiskey into their coffees, and after sampling the drink one of the passengers approached Sheridan and asked if he had used Brazilian Coffee. Joe jokingly answered, "No that was Irish Coffee!!"
Shannon does not boast a large population catchment, and many of the earliest innovative developments to boost demand that have subsequently characterised Shannon's development are attributed to Brendan O'Regan. After starting at Foynes he moved to the airport, setting up of the World's first Duty Free shop. In 1951 he also created the Shannon College of Hotel Management, as he regarded well-trained and educated Hotel Managers as essential to successful tourism. The College (in 2013) is a part of the National University of Ireland, and has 27 staff and 404 students (181 are international from 19 countries).
Traffic grew at Shannon in the 1940s because as much as 85% of transatlantic traffic stopped there to refuel, but the advent of long-haul jet airliners changed that and also threatened
</td></tr>
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TABLE 1			
Date	Lecture/Lecturer	Attendance	Report on the Lecture
			Shannon's future. The Irish Government's response, with O'Regan's support, was to create a regional development agency, the Shannon Free Airport Development Company, in 1959, to promote regional tourism and industrial development in the region. The Shannon Free Industrial Zone became the world's first export processing zone in 1960, and today this site is used by over 100 companies, sustains 7,700 jobs and contributes €600m in payroll, local materials and services. The Soviet Union still needed a trans-Atlantic service stopover, as destinations such as New York and Cuba could not be reached non-stop from Moscow, Shannon signed a bilateral agreement with the USSR in 1980 for the handling of Aeroflot flights. All the airport charges, even crew accommodation, were paid by a barter arrangement which involved the USSR supplying aviation fuel to Shannon. The Airport received the fuel by ship which docked at a jetty connected to an 11 million gallons capacity fuel farm. A hydrant system was (and still is) used to distribute fuel on the apron, and the airport has never imposed restrictions on its customers nor limited the supply of fuel required. Aeroflot utilisation peaked in 1991, but already the airport's expertise had been utilised in a 1988 accord to enter into a joint-venture, Aer Rianta International, to operate Duty Free shops at Moscow Airport. Aeroflot's share of the profits paid for the painting and refurbishment of their aircraft at Shannon. A very significant development was the establishment, in 1988, of a US Immigration Pre-Inspection facility. This allowed passengers flying to the US to complete US entry procedures while still in Europe. In 2009, and involving a €22m terminal redevelopment, this was up-dated to fully meet post 9/11 US Homeland Security requirements, and in 2010 the pre-clearance capability was extended to business jet operations. Shannon is the only non-US airport with the latter capability, and one of very few with passenger airliner capability. With pre-clearance, operators can fly directly to 220 US Airports, use domestic terminals at International airports, and provide seamless passenger connections, If a passenger is denied US entry, as it occurs before they are in the US homeland, fines (imposed on the airline) are avoided. The pre-clearance process is brief enough to be achievable during a refuelling.

TABLE 1			
Date	**Lecture/Lecturer**	**Attendance**	**Report on the Lecture**
			UNIQUE LONDON-NEW YORK SERVICE *The US pre-clearance service is utilised by a British Airways service (BA003) operated using an Airbus A318 (nominally a 100-seat airliner, but with just 32 luxurious seats) from London City Airport to New York Kennedy. This means departure from London is from within a few miles of the city district. The airport has the UK's shortest check-in time requirement – 20 minutes. The operation schedule is for departure at 16:15, arriving at Shannon for a 45-minute technical/passenger pre-clearance stop (17:30-18:15), and arriving at New York at 20:15 local time – elapsed flying time is 8.5 hours.* Since January 2013, Shannon has been an independent airport authority incorporating the Shannon Industrial Estate and a number of industrial parks in the Mid-West region. It processed 1.4 million passenger in 2012, and aims to be handling up to 2.5 million passengers within five years. Increase range of long-haul and transit flights, both passenger and cargo, making use of Shannon's favourable geographical position and US pre-clearance, plus a planned extension of the US pre-clearance process to include Cargo are cited as making such ambitious plans achievable. The International Aviation Services Centre (IASC), a significant cluster of international businesses, primarily conducts aircraft maintenance, repair and overhaul, provides aircraft technical support (even recycling), handle corporate and business aviation, and provides training and education is also developing. The airport plans to add new hangars, state of the art cargo facilities, and a corporate jet centre, potentially creating an additional 3,500 jobs within five years. *Notes written by Mike Hirst, RAeS Loughborough Branch*

The above table confirms that, without doubt, the Loughborough Branch has had another excellent season.

Our lectures have covered all aspects of aerospace - historical, the present and the future; reminiscences and modern technology. The average attendance for the **2012/13 season was 116. 4 of the lectures were joint lectures with other organisations.**

1.2 Visits

There was one visit during the 2012/13 season. This was on 23rd January 2013 to the A350 Wing Assembly Line at Airbus, Broughton, Nr. Chester. 20 RAeS Members, Branch Friends and others associated with the RAeS Loughborough Branch participated in the visit. The visit was a resounding success and all attendees were enthusiastic for the Branch to arrange similar visits. Airbus UK were thanked for their hospitality and for allowing the Branch to tour their state-of-the-art production facilities.

2. Review of the 2013/14 Lecture/Visits Programme

2.1 Lectures

The following lectures shown in Table 2 below have been planned for the 2013/14 Season:

Table 2

Date	Lecture	Lecturer
15th Oct. 2013	**F-35B JSF**	Graham Tomlinson, BAE Systems.
5th Nov 2013	**The Lost Lancaster – Two Came Home**	Laurie Tillen (Branch Friend and cousin of a crew member who was killed at the time).
19th Nov 2013	**Early Military Flying in the UK and the Building of a replica of British Army Aeroplane No. 1** *Joint lecture with the Loughborough (University)Alumni*	David Wilson, ex NATO Chief Engineer Tornado/Typhoon and leader of the replica project.
10th Dec 2013	**The Kegworth Air Accident – Safety Lessons Learned** *Possible joint lecture with the Loughborough Students Flying Club* .	Mike Bromfield and Prof. Mike Blundell, Vehicle Dynamics and Safety (VDAS) Applied Research Group, Coventry University.
21st Jan 2014	**Airbus A380 – Taking a 21st Century Flagship from Concept to Reality** *Possible joint lecture with I. Mech. E. and RAeS Loughborough Branch Prestige Lecture?*	Ryan Green, A380 UK Chief Engineers Team – Head of Structures and Systems Installation, Airbus UK
4th Feb 2014	**Airfix: Scaling Down Reality**	Simon Owen, Hornby Hobbies.
18th Feb 2014	**Operating the A318 from London City Airport**	Captain Jon Smith, Training Standards, British Airways.
11th March 2014	**TBD – possibly a lecture given by Embraer**	TBD
15th April 2014	**AGM +** **Chasing the Morning Sun – the story of a Round the World Flight in a Home Built Aircraft**	Manuel Quelroz

1.2 Visits

Post meeting note – A possible visit to the Rolls-Royce "Engine Repository", Derby is also being considered.

APPENDIX 2 - Treasurer's Report to the 2012/13 Season AGM held on Tuesday 23rd April 2013

STATEMENT OF ACCOUNTS : SEASON 2012/13 -- 16/04/2012 to 22/04/2013

A. INCOME AND EXPENDITURE ACCOUNT

	£ 2012/13	£ 2011/12
INCOME.		
1. Grant from RAeS Headquarters	2750.00	2600.00
2. Subscriptions from Friends @ £10 each, with one of £35.00	775.00	494.00
3. Donations (collections) at lectures	512.37	566.91
4. Net interest on accounts	0.00	0.00
5. Rebate from I.Mech.E. (shared lecture)	71.50	71.50
6. Subscriptions for visit to Vulcan at Doncaster	0.00	321.00
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TOTALS	4108.87	4053.41
EXPENDITURE.		
1. Lecture expenses (travel, accommodation and hospitality)	1018.95	660.80
2. Room bookings	756.00	900.00
3. Use of audio-visual aids	420.00	500.00
4. Secretarial and publicity, including programmes	102.99	390.66
5. Branches conference and forum	85.82	326.80
6. Website renewal fee	0.00	7.18
7. Payment for visit to Vulcan at Doncaster	321.00	0.00
	---------	---------
TOTALS	2704.76	2785.44
SURPLUS ON YEAR (Note 1)	1404.11	1267.97

B. STATEMENT OF BALANCE AT 22 APRIL, 2013

Brought forward:		
Current account at 12/4/12		4135.75
Capital account at 12/4/12		2.34

	=	**4138.09**
Plus surplus		1404.11

	=	**5542.20**
Represented by		
Current account at 23/4/13		5539.86
Capital account at 23/4/13		2.34

	=	5542.20

Notes:

1. Cheque for income of £38.47 and expenditure of £319.70 had not been cashed before these accounts were prepared; thus, effective the surplus was £1124 approx. (cf £915 in previous year), and **the effective balance is £5262 approx.**

Francis Maccabee, Hon. Treasurer 22/04/2013