



THE HAWKER ASSOCIATION

NEWSLETTER 48 - SUMMER 2017

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EDITORIAL

In this issue our Annual General Meeting is reported. Our new Chairman was elected, Chris Roberts, well known to many of us as a colleague, he was Chief Test Pilot Dunsfold, and also through the talks he has given to the Association. The retiring Chairman, Ambrose Barber, served us admirably for 14 years, having taken on the job for three! He will be missed.

Yesterday I was at Duxford for the Flying Legends air show. The highlight for me was seeing five, yes five, Hurricanes flying together!

Seventy eight members have not yet paid their subscriptions for 2017 - 2018. Please do!

Now only 12 Members have not paid their 2016-2017 subscriptions! Your names are in bold on the back page. Members unpaid for 2015 - 2016 have been removed from the membership list.

The Editor still needs your stories. Please send them to: The Editor, Chris Farara, 24 Guilddown Road, Guildford, Surrey, GU2 4EN, tel 01483 825955, e-mail cjfarara@ntlworld.com.

PROGRAMME FOR 2017

Wednesday 12th July

“48 years in a rotary dryer” - **Nick Kidd**.

Wednesday 9th August

Social and video.

Saturday 9th & Sunday 10th September

Richmond Road centenary exhibition (Hawker Centre).

Wednesday 13th September

Social and video.

Wednesday 27th September

Summer outing - **RNAS Yeovilton - air side.**

Wednesday 11th October

“UAVs” - **Lambert Dopping-Hepenstal.**

Wednesday 8th November

“Life with the Red Arrows” - **Mark Zanker.**

Wednesday 13th December

Christmas lunch

Nick Kidd flew the Royal Family for several years, **Lambert Dopping-Hepenstal** was a Kingston systems engineer and is now BAE Systems Engineering Director, Systems and Strategy, at Warton, and **Mark Zanker** had a long and varied RAF career flying Harriers and in the Reds. Unless stated otherwise, meetings are at the ‘YMCA Hawker Centre’, Kingston - the old Sports & Social Club - and start at 2.00 pm. Lunch and drinks are available beforehand, tea afterwards, and there is a large, free car park. Visitors are welcome.

VISIT TO ROYAL NAVY HISTORIC FLIGHT RNAS YEOVILTON

The visit will take place on Wednesday September 27th. We will go to the new Navy Wings Heritage Centre Hangar 15 where Swordfish, Sea Fury, Sea Vixen, AT-6 Texan/Harvard, Chipmunk, Sea Harrier and F-4K Phantom aircraft may be inspected and photographed.

Members, who are to make their own way to Yeovilton must arrive in the Fleet Air Arm Museum car park by 11.30 and assemble in the Swordfish Restaurant for a visit arrangements briefing. At 12.00 the party will travel in accompanied convoy to the South Dispersal and Navy Wings Heritage Centre lecture room for a talk on the RN Historic Flight, the Fly Navy Heritage Trust and the programme for the day. At 13.15 the hangar visit will start, finishing about 15.30 with a debrief and return to the Museum. Some refreshments may be available in Hangar 15 and the Swordfish Restaurant is situated next door to the Museum.

For a place (limited to 20) on this visit and information updates please apply to Frank Rainsborough with names and car registrations, preferably by email to frank@rainsborough.me.uk, or by phone 01784 24 7 888. Cheques for the £10 fee are to be payable to the Hawker Association.

Coach hire costs were prohibitive so car sharing is recommended. It's an easy journey to RNAS Yeovilton on the M3 and A303. From Junction 1 of the M3 it's about 110 miles/ 2 - 2 ½ hours.

ANNIVERSARY CELEBRATION OF THE HAM FACTORY

This year marks 100 years since our factory was built and 25 years since it was closed. To mark these events, and 75 years of remarkable achievements, the Kingston Aviation Project and the Hawker Association are mounting an exhibition on the 9th and 10th of September at the YMCA Hawker Centre next to the factory site.

Volunteers are still needed to man the Hawker Association area where ex-employees will be greeted, and perhaps invited to join, and any items brought along examined and logged. Please contact Chris Farara on 01483 825955 or cjfarara@ntlworld.com or speak to any of the committee at an Association meeting.

P.1127 XP984 APPEAL

The response so far to the appeal for funds to help with the restoration of XP984 at the Brooklands Museum has raised £1200. A cheque will be passed to the Brooklands Museum when the appeal is closed at the end of the year - so you still have time!

The contributors, listed below, are thanked for their generosity:
LR Baker, AC Barber, PG Barker, GM Bass, PA Bedford, AT Boyd, DA Byford. CM Chandler, KFS Chard. T Davies. RJ Fairchild, CJ Farara, JP Gardner. G Harris, N Hayler. JM Janes, AN Justin. MD Murray. J O'Sullivan, RC Owen. LA Palmer, BV Pegram, LW Phipps, RJ Poole. PR Rash. EJ Syrad. AB Turner. GE Weller, G Wilsher, GW Wilson.

Please follow the example set by these Members and send your cheques, payable to the Hawker Association, to Chris Farara, 24 Guildown Road, Guildford, Surrey, GU2 4EN.

Corrections to NL 47 item on XP984. The volunteers working on XP984 are led by Dave Cotton and David Collingridge is his deputy. The triangular wing previously fitted to XP984 was not ex XP980 but was of the same shape as XP980's. The Editor apologises for his mistakes.

DONATIONS TO BROOKLANDS

The Association's donations to Brooklands Museum have now been able to include one of £10,000 thanks to a Member who wishes to remain anonymous. In his appreciative letter of thanks to the Association the museum Director and CEO, Allan Winn, has agreed that this will go to the ongoing refurbishment of P1127 XP984 and the maintenance of the Harrier two-seat demonstrator, G-VTOL.

ANNUAL GENERAL MEETING - 12 April 2017

Secretary Barry Pegram opened the meeting and said that, disappointingly, our retiring Chairman, Ambrose Barber, could not be present as he was still recovering from shingles. However, he had sent an address which was read out by Chris Farara, as follows:

"Mr. Vice-President, Mr. Former President, Ladies and Gentlemen, firstly, thank you for attending in support of our Annual General Meeting, and I'm only sorry that this year I'm not welcoming you in person. It is now 14 years since we first assembled here, convened by half a dozen 'movers and shakers' who had formed a steering committee and recruited two or three of us to their ranks.

Barry, our diligent honorary Secretary, will summarise the year's activities for us, and I hope you will agree that, in one way and another, we've been able to continue to pursue our Association's original Aims on all fronts. In this, all credit must go to the doughty members of my Committee, all of whom deserve our thanks and appreciation in their different ways. Neither should we overlook the involvement we have enjoyed from our two successive Presidents, John Glasscock and Sir Colin (Chandler), both of whom left Kingston for 'greater things' but in their retirement have been prepared to return here to support our Hawker Association.

I would just like to end, if I may, by wishing your new Chairman well. In the absence of other candidates I'll be delighted to learn that I am to be succeeded by a fellow Dunsfold man! If your Committee takes as much care of you (*addressing Chris Roberts*) as they have done of me, then you should be in for a treat - at least for MOST of the time!! Thank-you, all".

The Secretary then expressed the Association's thanks to Ambrose for the effort he had put into guiding the progress of the Association over such a long time. He had accepted the post as a three year job, only to serve for fourteen years! The response of the meeting was a very well deserved and hearty round of applause.

The Secretary reported that membership had declined a little in the past year, from 377 to 357 with, sadly, 14 deaths of

Members and 9 non-renewals for two years. Peak Membership was in 2014 at 394. There are 50 lady members, 16 overseas and 21

non-employees. The Christmas lunch attracted 44 Members, the Summer barbecue 28. Of our speakers Peter Bedford attracted 46,

Don Spiers 40, Mark Zanker 34, Ian Townsend, Simon Hargreaves and David Hassard 30 and Jock Heron 28.

The Treasurer, Martin Pennell, presented the independently inspected and verified accounts for 2016. Key points were that the end-of-year balance was slightly down from that at the start largely due to delays in the bank processing receipts. Income followed the expected pattern of subscriptions, raffle takings, summer barbecue and Christmas lunch ticket sales. The principal items of expenditure were liability insurance, venue hire, stationery, postage and printing, raffle prizes and speaker and catering expenses. The Association finances were, Martin said, in an acceptable state with no need foreseen to increase the annual subscription (£5). The bank balance as at December 13th 2016 was £3193.43.

Finally, Chris Roberts was unanimously voted in and welcomed as Chairman. The other Committee Members remain in office.

SUMMER BARBECUE

Organiser, Ken Batstone, who we all thank for his considerable efforts, reports...

On Wednesday, June 14th, the Association's annual barbecue was held, as usual, in the YMCA Hawker Centre. Unusually, the weather this year was very sunny and hot, with temperatures up to 29 deg C (the hottest since records began, as they say). The whole afternoon was spent outside on the patio, mostly in the shade of the large trees that grow along the banks of the Thames in this area.

There were 27 Members and guests in attendance; virtually the same as last year. We assembled at about 12.30 for drinks and chat before the food was ready at 1.15. As usual, the traditional barbecue food was of high quality and served in large portions so few diners returned for second helpings. It was noted that significantly less beer and wine was consumed this year, but this was not due to the abstemiousness of old Hawkerites, but rather to the high cost of alcohol nowadays.

The dessert this year was not the usual gateaux but a very large home-made banoffee pie which proved to be very enjoyable and very filling. In fact, nobody went home that afternoon saying they still felt a bit peckish!

The afternoon concluded with the raffle which had some excellent prizes (according to the organiser!) ranging from a disposable barbecue to a box of chocolates, with the mandatory alcoholic beverages in between.

Thanks to the YMCA providing excellent food and the superb weather, a very enjoyable afternoon was had by all, and for once nobody remarked that " Oohh, it's not long to the Christmas Lunch now". (It is in fact just six months! Oh dear.)

AIRCRAFT NEWS

Sopwith Pup. Two reproductions, with modern wing sections and VW engines have been built using modern materials by Canadian Museum of flight volunteers in Langley, British Columbia. The Pups visited Europe to fly over the Vimy Ridge memorial on the centenary of the WW1 battle in April, and will return home for a trans-Canada aerial tour, demonstrating at Ottawa on the 150th anniversary of Canadian independence.

Sopwith Camel replica, D1851/G-BZSC flew for the first time at Old Warden in May. A Northern Aeroplane Workshops and Shuttleworth project, construction, using original Sopwith drawings, started at Batley, West Yorkshire in 1995 and continued at Old Warden in 2013 to completion. It is powered by a 140 hp Clerget rotary engine.

Hurricane I P2902/G-ROBT will be the first Hurricane to fly from Hawker Restorations' new base with a purpose-built hangar and a 2950 ft runway at Elmsett near Wattisham.

Hurricane I V7497/G-HRLI has also been moved to Elmsett for completion.

Hurricane I P3717/G-HITT made its first post-restoration flight at Turweston in March.

Hurricane I L1639 is being restored to taxiable condition at Little Gransden, St Neots, by the Cambridge Bomber and Fighter Society. It is one of only two surviving Hurricanes with fabric covered wings.

Fury G-CBEL of North Weald Heritage Aviation painted to represent the Fury prototype SR 661, has been moved to Duxford..

Sea Fury T.20, WG655/G-CHFP, operated by The Fighter Collection, is having its Bristol Centaurus replaced by a Pratt & Whitney R-2800 at Duxford. This is a common engine swap in US based Sea Furies.

Sea Fury T.20 WE820/D-COTE/ES-8504/N85SF has flown in the US after restoration to 'standard', except for the Pratt & Whitney R-2800 engine, from clipped wing unlimited class air racer configuration, 'Critical Mass'. The paint scheme will be as it was when the aircraft served with RN 738 Squadron at Lossiemouth.

Gnat TMk1 XR977 is under restoration at Cosford in its Red Arrows livery prior to moving to the RAF Museum, Hendon.

Sea Harrier FA2 ZD610 has been moved to the Bristol Aero Collection Trust's Grade II Listed hangar, part of the new Aerospace Bristol museum at Filton.

Editor's Note. Thanks to Max Fendt and Peter Amos for contributions to the above.

DUNSFOLD PARK DEVELOPMENT

The Dunsfold Park planning application for a new town of 1,800 dwellings has been 'called in' by Sajid Javid, the Secretary of State for Communities and Local Government, for his determination following a public inquiry by a planning inspector.

A GOLDEN THREAD - SHAR TO F-35

Lt Cdr Ian Sloan spoke to the Association on May 10th about his wide ranging career in naval aviation. In fact the talk was something of a finale as Ian was retiring from the Royal Navy the next day and departing for New Zealand.

Having studied civil engineering Ian joined the Royal Navy in 1998, was posted to 801 Naval Air Squadron (NAS) in 2002 where he served in Ark Royal and Invincible, flew Sea Harrier FRS2 AMRAAM trials at Point Mugu, went to RAF Valley as a Hawk instructor, flew RN Harrier GR9s at Cottesmore and operationally in Kandahar, flew RN Hawks on the RN Flying Standards staff at Yeovilton and was commander there of the RN Historic Flight, was an exchange officer with the French Navy flying Super Etendards off the Charles de Gaulle then returned to the UK as the RN Desk Officer for the F-35B programme.

Having flown the Sea Harrier FRS2 for a considerable time Ian missed the radar when he converted to the Harrier GR7 and joined Joint Force 2000 as the Sea Harrier was retired. The task of the Harrier force in Afghanistan was ground attack with mixed stores configurations of bombs, rockets, reconnaissance pods and tanks. Up to two hours could be flown without air to air refuelling. The Harriers operated for six years alternating with the Tornado force back and forth between the UK and Kandahar .

As the fixed wing standards officer Ian was essentially the Central Flying School agent checking up on the skills of the "old and bold" FRADU (Fleet Requirements and Aircraft Direction Unit) Hawk pilots at Culdrose, and giving instruction, a daunting task for a relatively young officer.

Ian flew the Sea Hawk, Swordfish and Sea Fury of the RN Historic Flight and deemed the former his "favourite little jet" with enough speed to get to Scotland from Yeovilton in a reasonable time for an air show. The Swordfish was "a handful; a big, big aeroplane" with such a low cruising speed that sorties away from base required a lot of planning. The Sea Fury was "a great Hawker aircraft".

Then came the.....Super Etendard or 'Super E'. This aircraft came about when the French Navy wanted to buy F-18s. Marcel Dassault said that would make 5,000 of his workers redundant and offered a 75%-new version of the 1950s vintage Etendard instead. Ian said they were still looking for the 75%.

After completing a French language course Ian arrived in France as an exchange officer expecting to fly. However, the French Navy was not expecting this as no funding had arrived, but after some RN-Aeronavale haggling it was agreed that he would become a non-operational but carrier qualified 'Super E' pilot. To achieve this 60 flying hours were needed. An administrative problem was that as the Etendard was nearing the end of its service career there was no longer any training organisation, no operational conversion unit, not even an instructional flight, because no new pilots would be converting to the type! Ground school had manuals in English and the squadron pilots were very helpful. Ian learned 'on the job' covering air combat (a bit - it's not a 'Super E' forte), air to surface attack and flying the Exocet launch profiles. There were no two-seat 'Super Es' so all early sorties were chased. After aggregating 50 hours Ian started on Field Carrier Landing Practice (FCLP) and spent most of the next ten hours in the circuit with the landing safety officers (LSO) until they were satisfied that Ian was safe to land on Charles de Gaulle which had only three arrester wires. Ian became fully carrier qualified and flew 85 hours on the 'Super E' including duties as Air Wing Operations Officer with the squadron deployed on Charles de Gaulle east of Suez, in the Gulf and to Djibouti in the horn of Africa. Whilst with 17 Squadron back at Landivisiau Naval Air Base Ian had the chance to fly 'Super E' No.17 on its last flight before retirement, so to give it a good send-off, Ian took it to all the limits: +8g, -2g, supersonic and so on. He had enjoyed his time with the squadron, a great team, now converted to Rafale.

Ian also told us about his current (until 'tomorrow') work as F-35 Capability Manager in the Queen Elizabeth Class Capability Delivery Team looking at how the ship will support the aircraft and how the aircraft will operate around the ship. He reports directly to an admiral, not to the Lightning Team which includes the RAF whose ideas are centred on operating from land bases. Success depends on relationships which are much improved over the acrimonious Joint Force Harrier days. The STOVL F-35B has a small range deficit when compared with the CTOL F-35A so the RAF would prefer that model. The UK wants 138 aircraft and has committed to 48, enough for four squadrons at two squadrons per ship. The outstanding 90 aircraft may possibly include F-35As to replace Tornados. Of the 48, BK9 (the 9th B model for the UK) has just been delivered.

No. 17 Squadron is flying three UK aircraft with five pilots on Opeval (operational evaluation) at Edwards Air Force Base, California. UK pilots are also flying with the USMC at MCAS (Marine Corps Air Station) Beaufort. No 617 Squadron will form in early 2018 in the US, move to RAF Marham in mid 2018 and achieve IOC (initial operating capability) at the end of the year. Over the next two years the maritime capability will be built up, starting with two aircraft operating on the Queen Elizabeth off the US east coast in late 2018.

Ian has also been flying the Ship Integration (cockpit) Simulator (SIM), flying VLS and SRVLS (short rolling vertical landings) which allow an increase of 2000 lb in landing weight over the VL weight. Adjacent to and integrated with the SIM is the Flyco Simulator where flying controllers can practice their skills. At the RN School of Flight Deck Operations at Culdrose Sea Harrier F/A 2s are being used to train deck crew marshallers etc. Two plastic F-35s, which can be filled with water to reach representative weights, are being used to teach ground handling procedures. RN pilots are also being posted to USN squadrons flying F-18s for carrier experience and to USMC squadrons flying AV-8B Harriers for STOVL work.

Ian had entertained the Members with many anecdotes which can't be adequately reported so the above represents just the more significant parts of his talk. The vote of thanks was given by naval aviation enthusiast Frank Rainsborough.

AIRCRAFT I HAVE FLOWN

On March 8th Simon Hargreaves OBE was going to tell us just what it said in the title about his wide ranging career in aviation but sensibly decided to reduce the scope and give more details, concentrating on the STOVL X-35B.

In the Royal Navy from 1975 to 1996 Simon flew Sea Harriers from HMS Hermes with 800 Naval Air Squadron (NAS) in the Falklands war, attended the Empire Test Pilots School (winning the McKenna Trophy) and was a test pilot for the A&AEE at Boscombe Down. On leaving the navy as CO of 899 NAS he became a test pilot at Dunsfold under CTP Graham Tomlinson and in 2000 joined the Joint Strike Fighter programme flying the X-35 at Lockheed-Martin. He was deputy CTP at Warton from 2002 to 2006, when he retired from BAE Systems and went to Cobham (Flight Refuelling), the Fleet Requirements and Air Direction Unit (FRADU) and Britten-Norman where he is the part-time Director of Flight Operations - with Graham Tomlinson working for him! He is also Operations Director for Hawker Hunter Aviation, founded by managing Director Mat Potulski, where he flies Hunters. In his spare time he flies the Sea Vixen for Naval Aviation Ltd and flies Hawks as a RN Reserve pilot with 736 NAS.

The Joint Strike Fighter (JSF) programme was a competition for a huge aircraft contract. BAe had been teamed with McDonnell-Douglas but they were eliminated before the hardware stage. Consequently BAe joined the Lockheed-Martin (L-M) consortium with Northrop-Grumman, and engine companies Pratt & Whitney, General Electric and Rolls-Royce. Unusually the work share within the team was determined by who had the expertise and not politically. Real trust was placed in BAe for flight controls, flight and engine control integration and STOVL flight. Rolls-Royce were trusted with the lift fan, roll control nozzles and the articulated rear nozzle. Simon (BAe), on the insistence of L-M, was selected to be the first flight pilot for the STOVL X-35B concept demonstration aircraft. The other JSF competitor was Boeing with the X-32.

There were to be three versions of the JSF: conventional take-off and landing (CTOL), short take-off & vertical landing (STOVL), and carrier catapult launch and arrested landing (CV). The CTOL and STOVL types were broadly similar but the CV version was bigger and stronger (and heavier) to cope with carrier operations. L-M built two aircraft: a CTOL version (X-35A) which would be converted to STOVL (X-35B), and a CV version (X-35C). The STOVL X-35B had a maximum take-off weight of 40,000 lb and it could hover at 29,000 lb compared with the Harrier GR9 at 32,000lb and 22,000lb respectively.

The Boeing X-32 rival was a purely vectored thrust type of unappealing chunky appearance. There was a lot of informal exchange of progress information so each team knew the situation - and the X-35 was behind.

Tom Morgenfeld made the first X-35 flight, in A model configuration, on October 24th 2000 taking off from the Lockheed 'Skunk Works' Palmdale facility and flying for 35 minutes to the famous Edwards Air Force Base where the evaluation would take place. The event was "like a football match" with crowds of employees witnessing this very important event as the JSF contract would ensure the future of L-M and partners. The undercarriage failed to retract properly but L-M's public relations dept edited the film record so it didn't show.

Simon flew the X-35A as well as flying chase in an F-16. The X-35A was, he said, nicer to fly than the F-16 and was very easy to flight refuel, a procedure used often to extend sortie times in the very tight programme. In 30 days 27 flights were made by six pilots. Mach 1.05 and 5g were achieved, limited only by lack of time. Excellent flying qualities and engine response were demonstrated. The 35A was then hangared for conversion to B configuration. Meanwhile the X-35C was flying at NAS Patuxent River flying mainly FCLP manoeuvres (Field Carrier Landing Practice).

In STOVL mode the engine in the X-35A delivered 20,000 shaft horsepower to the front fan vertically mounted behind the cockpit, by a continuously driven shaft, gearbox and clutch. Once engaged the clutch was locked mechanically. Air to the fan was provided by an intake, with doors, over the fan. An auxiliary intake on top of the fuselage, analogous to the Harrier suck-in doors, augmented the air flow to the main engine at low air speeds. The single rear swivelling nozzle, which weighed about a ton, could deflect at a very high rate downwards by some 98 degrees and in yaw by +/- 13 degrees. It was driven by 'fueldraulic' motors which generated heat which raised the fuel temperature. The lower the aircraft the fuel state, the higher the fuel temperature went because of the lower fuel mass heat sink capacity. This could lead to serious problems of cavitation in the 'fueldraulic' system. The problem was solved short term by fitting an air scoop and fuel cooler under the aircraft, filling up with refrigerated fuel and returning to base when fuel temperature reached a critical value.

The X-35B also suffered from a ground coupling mode. When the rear nozzle was rotated with the aircraft on the ground, the high angular rate and its large mass swung the aircraft in response. The weight-on-wheels microswitches armed the integrated flight control and propulsion system (IFCPS) as the aircraft rose on its oleos before it had left the ground. Because the aircraft was constrained by the ground the flight control system fought this constraint thus starting a potentially destructive divergent aircraft oscillation.

In the STOVL mode the thrust from the front fan and the rear nozzles was roughly equal at 20,000 lb each. Roll control was from reaction control valves at about half semi-span which added 2,000 lb of thrust. This moment arm was determined by the wing design and led to a deficiency in roll control power which, in conjunction with slow roll valve actuators, caused PIO (pilot induced oscillation) problems. The ground environment was fairly benign and similar to the Harrier due to high mass flows at moderate jet velocities. To achieve the same thrusts with direct lift, like Boeing's X-32, would have required higher jet velocities and/or higher temperatures and given a bad ground environment with surface erosion problems.

Pitch control was achieved by varying the front fan thrust using variable inlet guide vanes (IGVs) and rear nozzle thrust by varying engine speed (rpm), which of course affected the front fan thrust as well. This interaction had to be computer controlled to maintain constant pitch control response with constant total vertical thrust (lift)!

In the cockpit there was a thrust vector lever (analogous to the Harrier nozzle lever), a throttle and a sidestick controller. The latter was expected to cause problems because many control systems studies had shown that sidesticks and STOVL were incompatible; but there were no problems. The aircraft STOVL control mode was attitude command; no command by the pilot, no change in attitude. Stick-free the aircraft just sat there. The purely manual simple Harrier system was acceleration command; move the stick and the aircraft accelerated about the roll, pitch or yaw axes so needed fairly constant attention.

The X-35 hover attitude was 9 deg nose-up, the ground attitude was 0 deg nose-up leading to a rotation on VTO as the aircraft legs extended and the IFCPS was armed. This was to cause problems.

In the decelerating transition at speeds above about 160 kn the airflow could not smoothly turn the 90 degrees downward into the lift fan so the fan would stall; below 160 kn the airflow was satisfactory. Fan engagement gave an almost instantaneous upward thrust of 2,000 lb, its minimum thrust, causing a rapid pitch-up which had to be controlled by a rapid application of nose-down tailplane. However, a few days before first flight it was realised that the satisfactory fan engagement speed was lower than the speed required for tailplane effectiveness which reduces with decrease in speed. By careful analysis it was decided that if the fan was engaged at between 163 and 161 kn the pitch-up transient could be controlled. This proved to be the case. On the F-35 the side hinged X-35 doors were replaced by a rear hinged door which deflected the air into the fan thus widening the fan engagement speed range.

The initial VTO/hover tests were to be carried out over a 'pit', similar to the Dunsfold VTO grid from which the P.1127 had done its initial VTO/hover flying, to keep the aircraft out of the unpredictable ground effects. Due to planning permission problems Lockheed-Martin was constrained in size and position so the 'pit' was too small in plan but just about manageable. Much useful ground running on the 'pit' was carried out including lift fan engagements, proving reliability, and adjustments to the intake doors to reduce lift fan intake airflow distortions. Force and moment sensors on the undercarriage showed that some 2,000 lb more thrust than that predicted was being generated.

No-go 'pit' VTOs with a full fuel load were carried out to investigate control responses with the oleos extended and the IFCPS armed but, because the aircraft couldn't rotate, the hover nozzle positions commanded by the IFCPS gave a forward thrust component which caused the aircraft to shoot off the front of the pit. It was also found that under these conditions the aircraft rolled from wheel to wheel as the IFCPS fought the attitude constraint caused by the ground. This meant that a slow VTO would not be possible.

In the US system the Government is in control, not the contractor design authority as in the UK. Consequently the Government, in this case represented by NAVAIR, could dictate test conditions and they stated that the fuel load for the first cautious VTO would be based on the thrust declared by the engine supplier team. The fact that 2,000 lb more thrust had been measured was not accepted. Also a rapid VTO was essential to avoid the roll mode problem.

The first flight was set at 6 am, not for low air temperature reasons because there was plenty of power, but to ensure light winds to keep inside the 5 kn limitation caused by the 'pit' whose small size made it essentially unidirectional. So, when Simon opened the throttle on the first VTO the X-35 took off like a rocket straight to 30 - 40 ft, instead of the agreed 3 - 4 ft, where Simon gained control over the excess thrust. Meanwhile, one of the literally hundreds of NAVAIR representatives involved in the programme was saying, helpfully, "Shut the throttle, shut the throttle!" It became clear to Simon that the IFCPS was not properly sorting out his pitch control and height (thrust) control demands or the pitch control demands of the IFCPS itself so there was a 50 cycles per second hunting motion as the IFCPS computer failed to solve the problem. This motion could be felt by the pilot, seen on the traces but not on the video. Also evident on this first flight was that roll control power was inadequate and PIO was imminent. Interestingly, later at Edwards with lots of space and no pressure this problem diminished considerably. The undersize 'pit' was a further problem for Simon because at 40 ft it was out of sight so he had to use distant markers to land, a manoeuvre made more difficult because the IFCPS caused 'power bounce' (like the initial Harrier digital engine control system (DECS)) which made it hard to get the power off quickly.

After this "interesting" flight NAVAIR accused Simon of 'showboating' and Lockheed-Martin of breaking the agreed flight test rules to gain a competitive advantage on Boeing who had been incrementally building up to the hover and just achieved it that morning. Relations between Lockheed-Martin and NAVAIR hit an all-time low. In one flight Lockheed-Martin had overtaken their rival.

Simon played some interesting videos including infra-red shots showing conclusively that the cold front fan configuration prevents any reingestion of the hot rear nozzle exhaust, a problem that plagued the Harrier and many other jet V/STOL projects, including Boeing's X-31.

The complete X-35 programme was 39 flights and 21 flying hours of which Simon flew 12 covering all the STOVL development flights. The Mission X requirement to combine an STO, level supersonic flight and a VL was flown at M 1.05.

Simon continued by talking about HHA (Hawker Hunter Aviation) and flying the Sea Vixen but space precludes covering these topics properly. However, the editor intends to report them in a later Newsletter.

After a generous questions and answers session the vote of thanks for this outstanding talk, which was packed with easily understandable technical detail and previously unreported information, was given by Martin Pennell.

HUNTER CRASH AT SHOREHAM

The following is taken from Aircraft Accident Report AAR 1/2017. The full report including an animation of the flight path can be found on the Air Accident Investigations Branch website.

At 1322 BST on 22 August 2015, Hawker Hunter TMk7 G-BXFI crashed on to the A27, Shoreham Bypass, while performing at the Shoreham Airshow, fatally injuring eleven road users and bystanders. A further 13 people, including the pilot, sustained other injuries.

The investigation identified the following causal factors in the accident: the aircraft did not achieve sufficient height at the apex of the accident manoeuvre to complete it before impacting the ground because the combination of low entry speed and low engine thrust in the upward half of the manoeuvre was insufficient. An escape manoeuvre was not carried out, despite the aircraft not achieving the required minimum apex height.

The pilot either did not perceive that an escape manoeuvre was necessary, or did not realise that one was possible at the speed achieved at the apex of the manoeuvre. He had not received formal training to escape from the accident manoeuvre in a Hunter, he had not had his competence to do so assessed, he had not practised the technique for escaping from the accident manoeuvre and did not know the minimum speed from which an escape manoeuvre could be carried out successfully.

Information included in a previous AAIB report indicated that there had been several cases involving the Avon Mk122 engine type fitted to this aircraft where an un-commanded reduction in engine speed had occurred and subsequent engineering investigation had not established a clear cause. This investigation was unable to determine whether a reduction in engine speed recorded during the accident manoeuvre was commanded by the pilot. A test flight on a similar Hunter indicated that any un-commanded reduction in thrust would be difficult to detect.

The Hunter was flying with a valid Permit to Fly but technical issues identified in the investigation indicated that the aircraft was no longer in compliance with the requirements of the Permit. It was also found that defects and exceedences of aircraft operational limits had not been reported to the maintenance organisation and mandatory requirements of its Airworthiness Approval Note had not been met. Also, during prolonged periods of inactivity the engine had not been preserved in accordance with the approved maintenance schedule.

As a result of this investigation all Hunters on the UK civil register are grounded.

T-45 GOSHAWK OBOGS PROBLEMS

In April, following hypoxia-like episodes in T-45s, the US Navy imposed an “operational pause” on the type which, on pressure from aircrew, was extended indefinitely. However, after briefings and discussions with aircrew, the training wing leadership, engineers, and aeromedical experts, a way was found to resume flight operations safely, whilst a permanent solution is sought, by limiting the maximum cabin altitude to below 10,000 feet, avoiding the use of the on-board oxygen generating system (OBOGS). The F/A-18E and F Super Hornet is also affected by similar OBOGS problems.

BOOK REVIEWS

Hawker P.1127 and Harrier.

Another outstanding book by Tony Buttler about “developing the world’s first jet V/STOL combat aircraft” as it is subtitled. This beautifully produced, landscape format book is 152 pages of joy for people like us; and it’s dedicated “To the design and flight-test teams at Kingston and Bristol who made all this possible.” It is a technically biased history, for once, starting with Wibault’s Gyroptere and following Ralph Hooper’s and Gordon Lewis’s design and development work from the initial P.1127 and BE.48 concepts through the BE.53 and Pegasus, Kestrel and P.1127(RAF) to the Harrier GRMk1, pausing to examine the P.1154 and other early Kingston V/STOL projects. The book is illustrated with well produced black and white photographs and original Hawker GA drawings and diagrams augmented by a central colour section. One appendix gives basic aircraft data and a second is a comprehensive photograph album of Kestrel XS690 which will interest modellers as well as engineers. The author lists his sources, the great majority of which are original primary documents, and provides indices by people, aircraft, organisations and ships. John Farley has written the Foreword. Published by The History Press (ISBN 978 7509 6530 9) at £20, this is a reliable account.

The Aviation Historian No.18 has a well illustrated article on Sea Furies awaiting their fate at Lossiemouth in 1962 and the frightening story behind one of Cyril Peckham’s spectacular 1953 Hunter photographs. **No 19** has a piece about building a model of The Last of the Many in its blue air racing livery, the full contents, implications and consequences of Duncan Sandy’s 1957 Defence White Paper and the story of the Fury biplane prototype, the Hornet. All these are of direct interest to Hawker people but, of course, there are dozens of other fascinating aviation articles, all beautifully illustrated.

MEMBERSHIP NEWS

We welcome new members Reg Carden, Graham James, Moira Flint, Michael Richardson, John Tweddell, and Dave Weatherley. Sadly we record the deaths of Bryan Austin, Ken Davies and Colin Flint; our sympathy and condolences go to their family and friends.

MEMBERSHIP LIST - August 2017

Seventy eight Members have not yet paid their 2017 - 2018 subscriptions. Members who still have not yet paid their subscriptions for 2016- 2017 are in bold below. This is the last reminder. Please send cheques payable to The Hawker Association to Barry Pegram, 12 Becket Wood, Newdigate, Surrey, RH5 5AQ. If you are **leaving** please let him know by post or by telephone on 01306 631125. Thank you.

A: Allan Abbott, Ken Alexander, Peter Alexander, John Allen, Peter Amos, Terry Anstey, Steve Apted, John Arthur, Alan Auld. **B:** Brenda Bainbridge, Lyn Baker, Colin Balchin, Ambrose Barber, Derek Barden, Peter Barker, Graham Bass, Donald Bateman, Richard Bateman, Ken Batstone, Dennis Baxter, Colin Bedford, Peter Bedford, Anne Beer, Brian Bickers, John Blackmore, Andy Bloomfield, Melvyn Bluck, Keith Bolland, Paul Boon, Betty Bore, Pat Bott, Steve Bott, Bob Bounden, Mike Bowery, Alan Boyd, Sally Bracher, Roy Braybrook, Laurie Bridges, **Doug Britton**, Arthur Brocklehurst, Peter Brown, Christopher Budgen, Reg Burrell, Robin Burton, Clive Bushrod, **Barry Butcher**, Tony Buttler, Dave Byford. **C:** Richard Cannon, Reg Carden, Chris Carter, Tom Casey, Bob Catterson, Colin Chandler, Keith Chapman, Keith Chard, John Chitty, Martin Churms, Gerry Clapp, JF Clarke, John Cockerill, Hank Cole, David Collingridge, Nigel Cook, Brian Coombes, Jonathan Cooper, Patricia Cosgrove, Ron Cosgrove, 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