ROYAL AIR FORCE

RAF 2004

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Foreword

Welcome to RAF 2004, the annual corporate communication publication of the RAF, which is the third element of a family of publications that includes 'Presenting the Royal Air Force' and 'Aircraft & Weapons'. 2003 proved to be a momentous year for air power and aviation in general. Early in the year, the RAF made a major contribution to the air campaign in the Gulf War. At the very end of the year we played our full part in celebrating the 100th anniversary of manned powered flight and the RAF's contribution to the tremendous achievements over most of that time.

RAF 2004 provides an insight into the battle-winning capabilities that the RAF front line committed to the successful shaping of the battlespace over Iraq during Operation TELIC, which was the code name given to the war in Iraq. It is impossible to cover all the RAF's roles in any depth and most of our focus in this year's edition is on elements of the fast-jet fleet and the other assets that contribute to combined air operations. Having written about the air transport role, and the C17 in particular, and the support helicopter force in 2002, we have chosen to highlight the work of some of the other combat support force elements on the ground. No. 1 ACC for example, was an integral part of the total RAF air campaign force of over 8000 personnel. However, notwithstanding operations in the Middle East, work also continued apace in the UK and our coverage of Operation TELIC is complemented with articles such as the QRA role in the UK, 100 Squadron's training role at RAF Leeming and the value of flight simulators as a vital part of the RAF's integrated training system.

2004 will be the 40th display season of the Red Arrows and to mark the event we take a look at how one team member made the transition from the front line to the world's premier aerobatic team. But, as we highlight regularly, the RAF continues to promote adventurous sporting activities and this year we take a close look at Sport Gliding. We are also acutely aware of our place as a Service in society at large and I am particularly pleased to include an article on the Heartstone Festival of Flight, which aims to exhibit RAF life to an audience that we do not always have the opportunity to contact.

After some 2½ years as DCC(RAF), I am soon to move on to my next appointment and I would like to record my gratitude to the Editor, Squadron Leader Brian Handy, and all those who have contributed to articles and images over the previous three editions. We have been able to show how the RAF of today recruits and trains ordinary people to do extraordinary things, in a diverse range of roles and with capabilities that are at the leading edge of technology. Most importantly, we train and fight as a team, to win.

Further information on the RAF and copies of our other publications can be found on our website at www.raf.mod.uk, or you can write to the Editor RAF 2004 at RAF Uxbridge, Middlesex, UB10 0RZ. Alternatively, if you are interested in a career in the RAF, you can find out more by calling 0845 605 5555 or by visiting the RAF careers website at www.rafcareers.com.

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RAF Museum Hendon

Ajay Srivastava

On 17 December 2003, as the world looked back on the first 100 years of powered flight, the Royal Air Force Museum led the celebrations in the UK with the opening of two new permanent exhibition halls celebrating the history of aviation: 'Milestones of Flight' and the 'Grahame-White Factory'.

His Royal Highness The Prince Philip, Duke of Edinburgh, performed the opening ceremony at Hendon amongst a selection of international VIPs and distinguished RAF guests. Events on the day included a flypast by the Red Arrows in diamond nine formation, a full guard of honour by the Queen's Colour Squadron and a multi-media show depicting the progress of aviation through the history of the RAF.

With its exciting new expansion, the RAF Museum pays a spectacular tribute to the RAF as well as to aviation history itself, and is a necessary visit for everyone connected to the RAF or to the wider aviation community. Visitors are greeted with a dramatic display of suspended aircraft, split-level viewing, touch-screen plinths, a timeline wall and cutting-edge screen displays. The new, silver, barrel-vaulted stainless steel clad building (partly funded by the Heritage Lottery Fund) revolutionises the way aircraft are exhibited. Some of the most important RAF aircraft, along with classic aircraft from the USA, Germany, Japan and France, have been given the 'Milestones' treatment, which is guaranteed to change concepts and ideas about aviation museums.

The drama begins at the entrance itself, which is highlighted by 'Sky Dance', a landmark sculpture reaching over 80 feet into the sky. The solid steel structure captures the exhilaration of powered flight and encapsulates aspects of aircraft structure, airflow, speed and aerodynamics. Stepping into the reception area, visitors come face-to-face with the unmistakable profile of a shining, silver, Mk IX Spitfire attached to the wall. The replica Spitfire is placed next to a display of roundels through the ages. Inside the exhibition hall itself is a groundbreaking display of aircraft, which spans the history of powered flight from the Bleriot XI to the Typhoon. Highlights include the Mosquito, Sopwith Camel, Kawasaki Ki 100, P51D Mustang, Me 262, Harrier, Messerschmitt Bf 109G and many more. Each aircraft represents a historic milestone in the history of aviation and the way in which they are presented allows the visitor to appreciate every aspect of their brilliance.

Milestones of Flight is tailored to an audience that demands to be entertained while being educated; therefore, in addition to the aircraft, there are a number of features that allow visitors to get fully involved in the displays. The touch-screen plinths give a full history of each of the aircraft on display with digitised 3-D images, archive film footage and important facts. The 100 years timeline wall is an extraordinary review of the first 100 years of powered flight and highlights RAF and aviation history alongside major social and political events. Other features include a gripping 3-D film of the Typhoon in flight (complete with 3-D spectacles) and a Typhoon simulator ride in the RAF Today section. An additional attraction on the first floor is The Century, which is a 10-minute awe-inspiring film, specially commissioned by the Museum, that uses all the modern facilities of split-screen and fast-paced editing to make a fantastic tribute to 100 years of powered flight. Projected onto a huge screen, it sets the mood for what the visitor is about to experience. There is also an Air Traffic Control Tower on the top floor, where younger visitors can be interactive and land a range of civilian aircraft at Heathrow Airport.

The Grahame-White Factory - an historic gem

Aviation fans will already know that the RAF Museum stands on the old London Aerodrome, which was once the cradle of the aviation world. Developed by Claude Grahame-White in the early part of the last century it was constantly busy with aircraft factories, hangars and runways. In the 1920s and 1930s, the Air Pageants held at Hendon were a clear rival to Henley and Ascot as important social occasions. It is quite fitting that as part of the centenary celebrations the Museum should pay tribute to its own personal heritage.

The historic, Grade II listed, Grahame-White Factory, the first purpose-built aircraft factory in

Milestones of Flight

the country and part of Claude Grahame-White's original works, has been dismantled and reconstructed on RAF Museum land to become a new exhibition hall. Through careful restoration, it stands as a breathtaking example of an important industrial building of the time. The building, with its three-storey office overlooking the main floor, has been painstakingly restored, using as many of the original light switches, radiators, doors, window frames and paint colours as possible. It stands structurally complete, with its five huge timber 'Belfast Trusses', spanning the full width of the building. Even the toilets (or should we say water closets!?) and urinal stalls have been carefully restored, complete with authentic 'Crapper' pull chains and re-enamelled 100 year old washbasins!

The restoration work obviously took into account modern building regulations, otherwise the site would be inaccessible to the public. So, whilst externally identical to the original building, internal differences include a lift, a second staircase and an internal wall. English Heritage and other bodies have been particularly helpful throughout the rebuilding process. In its new position it sits with other period buildings left from the inter-war years when Hendon was an important RAF Station. It displays the RAF Museum's collection of early aircraft and associated exhibits in a setting similar to its original purpose. Walking into the Grahame-White factory is like taking a trip back in time to the early days of aviation and is an absolutely authentic and romantic experience. However, it is not just the sight of classics such as the Sopwith Triplane, Caudron GIII, Avro 504K or Vickers Vimy, which takes the visitor back in time, but the pure essence of the building itself.

The changes to the Hendon site have meant that the older displays have been given a fresh lease of life. The historic hangars now have themed areas that include 'Wings Over Water' and 'RAF Around the World', while the Bomber Hall now stands with an even greater sense of gravitas. With the extra display space available, the aircraft radiate far more dynamism. Another new addition is the expanded Aeronauts Interactive Centre. It is a further example of how the RAF Museum is consistently updating itself to attract newer and younger visitors. The interactive centre is designed as a fun and hands-on way of learning about the principles of flight and aeronautical engineering. It includes a 'Drop Zone'; 'Hot Air Balloon'; 'Jet-Pilot Test'; Anti-Gravity Ball and more. It is a delightful area and a gallery the visitor will not want to leave!

The Hendon site now stands as a magnificent landmark for London, as well as for aviation itself. In total, the new developments are the result of six years of work, a £7.4 million development budget, over 150 aircraft movements and 100 years of aviation history. The Milestones of Flight building and the adjacent Grahame-White Factory make a striking juxtaposition. The futuristic and the historic - both combining forces to create a world-class home for the best air force museum in the world.

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-WHITE COMP
Triple Jump

HARRIER GR7

Operation

Woken yet again by the sound of after-burners. Well, I guess I shouldn't complain, as I will be making a similar racket in a few hours time. Can't help but wonder where they are going. Is their mission the same as mine?

As a member of 1 (Fighter) Squadron, I was part of a Harrier GR7 detachment based in Kuwait, along with our sister IV(AC) Squadron. We left our families and homes at RAF Cottesmore on a foggy Saturday morning in February 2003. At the time, I had been on the Squadron for nearly six months and was one of the more junior members of the team. During Operation TELIC, our mission, along with many other RAF and multinational aircraft, was to fly into Iraq to engage specified targets and provide air support for ground operations. Nothing could ever give a full account of the feelings and sights of the missions we flew, although this article attempts to give a flavour of what the aircrew who flew strike aircraft into Iraq went through.

As a day 'player', my working routine normally started just after midnight, waking bleary-eyed to the screech of the alarm clock. With 24-hour operations, the base was never quiet but you got used to it. A quick shower, slip on the flying suit and straight out of the door to breakfast, to eat whatever your body could stomach at that time in the morning. On arrival in operations for the meteorological brief, you would greet the other pilots that would either be flying in the formation with you or would be airborne around the same time. You and your wingman were then handed a folder, which would contain the mission for that day. Finding a quiet corner, you begin to break out the information: who you were working with, the Army, the Marines or the Americans; air refuelling or not; specific targets or in support of ground troops. The sortie planning process stayed the same, much like the way we train, only with far more external input and real-world interest.

Target work started a long time before we got to see it, as it was controlled centrally. Tasked by the Coalition joint

TELIC

Flight Lieutenant Dominic Hurley

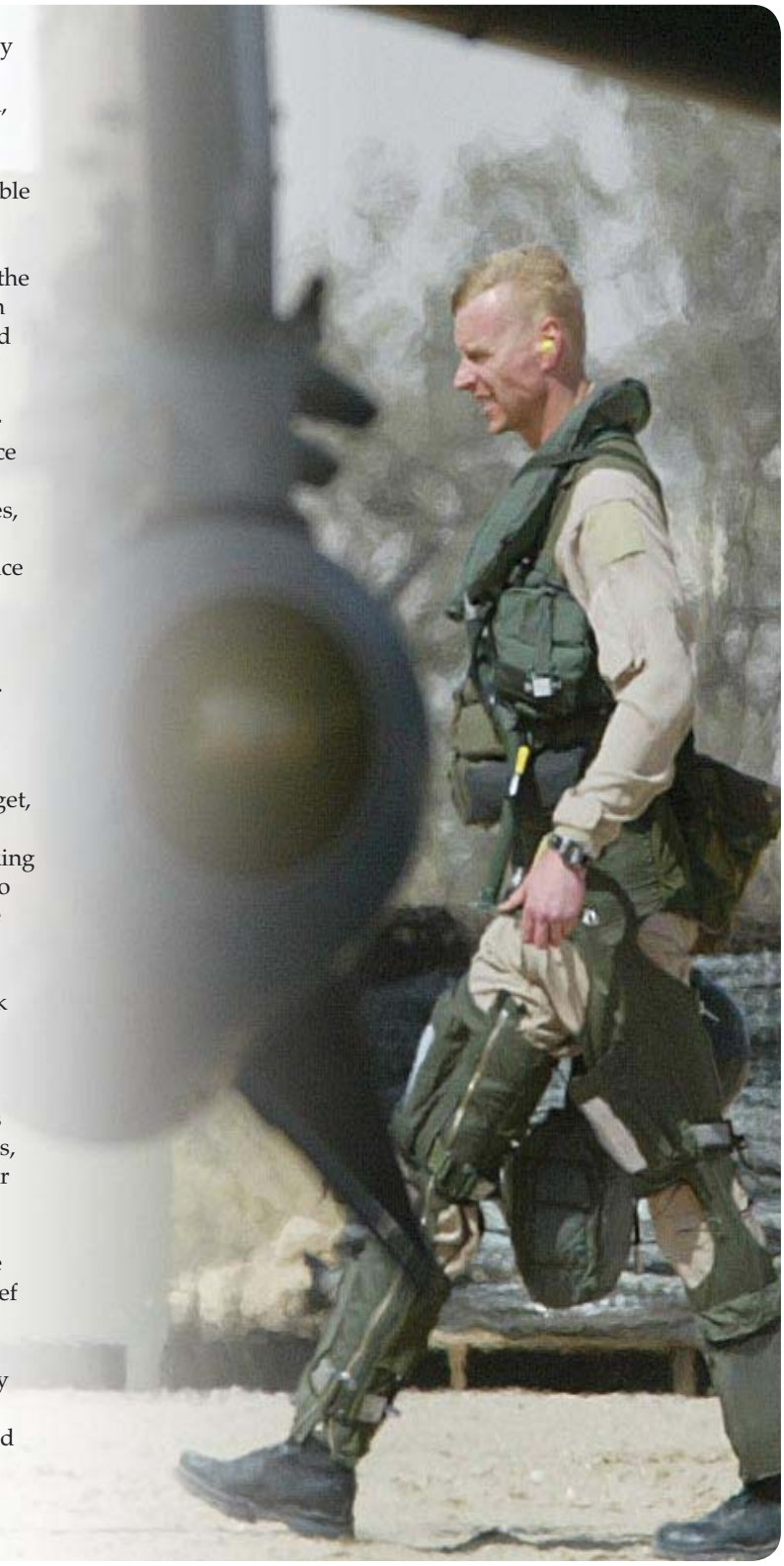
headquarters, we were given a very specific target or area that would have been cleared both militarily and politically. Targets were chosen to achieve an overall effect, as opposed to individual destruction, and we pilots were the last link in a long decision-making chain. That did not release us from our responsibilities and we needed all the hours available to study the plan in detail before we got anywhere near the aircraft.

The first task was to establish the big picture of the package of aircraft that we would be involved with - who else would be out there, what capabilities did they have, what was expected from my formation? Then came the task of ensuring that all the aircraft would be de-conflicted from each other. With over 100 aircraft going to the same area of sky, the chance of hitting another (friendly) aircraft was very real, unless a solid plan was in force and all eventualities, such as poor weather, had been considered. There would be little opportunity to sort anything out once in the air.

Harrier combat flying is usually carried out as a pair of aircraft and so is the planning. We would need to work closely to complete the plan in time. Just as it will be in the air, we must trust and rely on each other during the planning phase, as there isn't time to check everything that the other pilot does. The majority time is concentrated on the target, or likely target area. Although the target and its environment had already undergone intense checking before being presented to us, there was still work to be done. How could we ensure the most accurate weapon delivery? Had all the collateral damage considerations been met? Were there civilians or friendly forces nearby? Were we achieving the task in the most effective, proportional and efficient way? We were also concerned about the dangers to our own formation and so the latest intelligence on enemy defences was vital. With these decisions made, we could then coordinate with our engineers, to allow them time to set up the aircraft to meet our requirements.

The last link in the chain before flying was the briefing, both by the formation leader and the supervisory chain. With sufficient training, the brief could concentrate on the nuances of our particular mission, with 'standard operating procedures' covering the rest. A senior pilot, not flying that day but acting in a purely supervisory role, acted as a spot checker, to make sure nothing had been missed and that the formation understood its place in the operational plan.

With the briefing complete, it was onto a bus to drive across the desert sand to the flying side. We



were greeted by the 'squippers', the flying clothing specialists, with the standard cutting banter required before all sorties. 'Kitting up' would take about 20 minutes with anti-G trousers, combat survival waistcoat, life jacket, gloves and helmet. Being handed rounds for your pistol reminded us that this was not just some routine training mission. Any nerves usually appeared in the few quiet moments whilst walking out to the aircraft.

Approaching the aircraft shelter, an aircraft slowly appeared, looking war hardened from all the flights and dust storms that it had had to endure. Markings of bombs or weapons dropped were painted on the side of the aircraft, as has always been the way of the RAF. Weapons hung off each pylon with red warning flags attached, waiting to be removed: an aircraft built for one purpose and one purpose alone.

The ground crew appeared from wherever they had managed to find shade with a smile on their face but it was always a sober atmosphere. A quick check that everything on the outside of the aircraft was OK before climbing the ladder and surveying 'the office'. A few more checks before easing down onto the seat and strapping in. Now there were only thoughts of the task in hand. With the aircraft ready, there were a few minutes of silent contemplation before the initial radio check-in. A chance for a quick run through of the memorised targets, actions if threatened, my responsibilities to the formation and to the overall package. From check-in onwards, there was little time to reflect, everything was focussed on the task ahead.

With so many aircraft taxying, completing final armament checks, and taking off and landing, the airfield was an exceptionally busy place. There was no place for poor ground manoeuvring through a lack of concentration, even while checking and double checking the aircraft and its systems. As we approached the departure end of the runway, the canopy was slammed shut and the final checks were completed. Sealed in the cockpit, alone, you took a deep breath and waited for your wingman to call ready. On his call, we rolled onto the runway and slammed the engine to full power. The engine, which had just been a quiet reverberation in the background of your concentration, now exploded into a roar as the take-off roll began. Your scan was split between watching the speed build, the runway, your wingman ahead and checking everything was working as it should. Happy that the engine was giving all it could, the left hand moved an inch to the right and held the nozzle lever. On reaching the predetermined speed, the nozzles were moved and the aircraft leaped into the air. Slowly the nozzles were pushed forward, the gear selected up and the aircraft climbed away from the ground. You were airborne, and on the way to Iraq.

The sortie would run in just the same way as when we trained in big packages at home - establishing radio communications with the relevant agencies, checking weapons and self-defence systems, and ensuring that we

were playing our part in the overall plan. As such, we were passed from agency to agency to confirm we were aware of the latest intelligence, and to check all of our systems were functioning correctly with them. A double click on the radio made you look at your wingman to check his defensive-aids systems as flares dropped from his aircraft. You in turn double clicked and checked your own defensive suite. With all agencies satisfied, and the aircraft systems working, the formation committed across the border.

The transit to the tanker was always quiet, listening to other 'players' coming and going. Slowly but surely you approached the refuel area and started searching the sky for your fellow RAF colleagues flying their airborne 'Texaco'. The faintest glint in the distance would catch your eye and the formation would fly an intercept to meet the refueller. With its refuelling hoses trailed, the tanker's full size did not become apparent until you approached it from underneath. With a no-communications rule in force, you slide past the rear of the refuelling aircraft and approach silently abeam the cockpit. A friendly face or two would appear in the window and give you a wave of acknowledgement. With the 'hellos' over, you returned to the back of the aircraft, plugging into the basket and refuelling to full. Once complete, you would ease up the other side of the tanker and wave goodbye and, with full power on, climb away to see the tanker's next 'trade' joining on the other side.

Now came the whole point of the sortie, the route to the target area. Heightened concentration always accompanied leaving the tanker, as you knew things were about to get more dangerous. Flying in battle formation, a couple of miles abeam your wingman, eyes were permanently looking out of the cockpit, checking your wingman, the ground for threats, the surrounding sky for other aircraft, missiles and Anti-Aircraft Artillery and only fleetingly looking back to the cockpit to check your own aircraft systems. Ears, meanwhile, were being bombarded with information from controlling agencies, others on the ground and information from the aircraft's defensive aids, telling you that you were being interrogated by some radar, be it friend or foe.

Depending on the ferocity of the ground operations, we were allocated to those in most need of our assistance. The formation changed from frequency to frequency until we spoke to a Forward Air Controller (FAC). The stress in a FAC's voice could tell us what was going on as he came up on frequency. Some were just visual with the enemy, some were unsure of enemy positions and some were under continuous fire from opposing forces or snipers. The sound of ricochets or explosions coming through on the FAC's radio always

reminded you just how serious the task was. Now the years of training kicked in and you knew what was required. You started to think about which weapon to use for best effect, the collateral implications of the enemy's surroundings, the best direction to attack to minimise danger to civilians and friendly forces and how to be sure you were going to hit the exact point. A quick check with your wingman would normally confirm we were both thinking along the same lines. With everything confirmed, the formation would set up for the attack run. A call would be made to inform the FAC we were inbound, with every thought focussed on helping the 'boys on the ground'. Approaching the target, the pressure started to build. Could I fully identify my target to fulfil the rules of engagement before weapon release? Were there any unexpected problems in the target area that would cause me not to release the weapons? With everything clear, the weapons could be delivered. A quick beep on the radio indicated to every one that the weapons were in the air. The pressure remained throughout the attack, having to confirm there was nothing untoward in the target area, as options remained open until the last seconds to guide the bomb into a safe area. Final checks were made within the formation to confirm that the precision guided weapons and the systems were working as advertised. Depending on the situation facing the FAC, all this could have happened in a couple of minutes from first contact. With that target complete, we offered the FAC any other assistance before returning to the initial controlling agency to await further tasking. This form of tasking would continue until either one of the aircraft became short of fuel or you ran out of weapons.

Then began the long transit home. Unable to move around on the ejector seat and unable to talk freely on the radio, your mind wandered as you returned to safer areas. Now, thoughts turned to what had just happened. What could have been improved to help the FAC, and could we have speeded things up? When people are being shot at, time is everything. There would always be things to raise at the debrief. As you approached the border, the formation began to check in with familiar agencies and the pressure started to ease. Any remaining weapons were made safe and we prepared the aircraft for recovery, something we had done every day of our flying careers. Other aircraft were on frequency, having just landed or still waiting to take off. As the airfield came into view you could see aircraft all over it, arming, de-arming, bringing things in and taking things out. As you touched down, the pressure finally eased: slowing the aircraft down, making the ejector seat safe, and throwing open the canopy to feel the warm breeze across your face for the first time in five hours. With the oxygen mask away from your face, a deep breath of the fresh air felt very good indeed. On arrival at the dispersal area, you were met by the smiling faces of the engineers, always pleased to see you home (although they would never say that!). As soon as you shut down, the 'banter' started to fly. It was good to be 'home'. We would de-kit and return to the intelligence staff for debriefing.

With this complete, each formation and the package as a whole would be debriefed, to analyse every aspect of the sortie, from getting to work to the debrief itself but, most of all, concentrating on the target work. Any lessons learned were fed back to improve the system. Meanwhile, the engineers worked furiously to prepare the jets for the next sortie: refuelling, rearming if necessary and checking them thoroughly.

Then, relax.....until the next sortie!

INTO THE HORNET'S

Flight Lieutenant Gareth Prendergast

Based at RAF Leeming in North Yorkshire and equipped with Hawk fast-jet training aircraft, 100 Squadron, colloquially known as 'The Ton', is home to the Navigator Training Unit (NTU) and also provides airborne support to the rest of the Air Force through A and B Flights.

Based at RAF Leeming, in North Yorkshire, and equipped with Hawk fast-jet training aircraft, 100 Squadron, colloquially known as 'The Ton', is home to the RAF's Navigator Training Unit, which produces Weapons Systems Officers (WSOs) for the front-line Tornado squadrons. In addition, two of the Squadron's other Flights, A and B Flights, provide support flying for the rest of the RAF. They can simulate a wide variety of aircraft and tactics required for specific training purposes and they regularly provide agile, visual fighters for air combat training, thus making a vital contribution to the operational training programmes of all front-line squadrons. In a typical day, the wide variety of tasking could include sending a pair of Hawks to engage in air-combat training with Jaguar aircraft; providing a 'bounce' aircraft to act as an enemy to attack a formation of Tornado GR4s on a low-level bombing sortie; or completing affiliation training with multi-engine or rotary-wing aircraft to enable their crews to gain experience of operating against fast-jet aggressors. Further to this, the Squadron assists in the training of Fighter Controllers by generating 'friendly' and 'enemy' aircraft to allow trainee Fighter Controllers to direct real-time intercepts and visual identification procedures. As a junior officer WSO student on the Squadron, in addition to my WSO training, I have the opportunity to fly sorties with both A and B Flights.

With so much going on, it is a busy and vibrant environment at The Ton; but today my attention is focused on my next trip, which will take me one step closer to graduation and the WSO brevet. At present, I am three weeks from graduation and entering the final stages of the Hawk Ground Attack course, which concentrates on the skills needed to plan and execute successful missions in a high-stress, high-workload environment. But, for every hour in the air there are many hours of careful planning on the ground beforehand.....

8:00 am. Into the daily meteorological briefing, where we discover not only the weather for the coming 24 hours but also the serviceability state of the aircraft, the status of the airfield and its nominated diversion airfields, and any other information essential to the safe conduct of flight operations. As far as my sortie is concerned, the best weather conditions are in north west England and into south west Scotland - great visibility on a gin-clear day.

8:30 am. Flight Lieutenant Mark 'Boulty' Boulton is the navigation specialist who has been designated to give me my tasking for today's sortie. I am to lead a formation of two Hawks against two targets - a bridge in the Lake District - deemed to be a vital communications link - and a small building in south west Scotland, which intelligence reports have indicated is being used as a command and control centre. The building - my most important target - must be attacked at 12:40 pm exactly.

8:40 am. I quickly formulate a general plan, which allows for a low-level approach to and exit from the targets to maintain tactical integrity and make use of terrain masking in the operating area. This general plan is briefed to my wingman, who will assist in the detailed planning. I then check the day's avoidance and warning notices to ensure there are no obvious conflicts; and then move on, to consider the targets in more detail.

8:50 am. Target planning is conducted using 1:50000 Ordnance Survey maps which allow

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high levels of accuracy and a greater appreciation of the terrain in the target area. First, the target is identified; and then I look for a suitable Initial Point (IP), which is where the run-in to the target begins - it has to be large, obvious and, ideally, have vertical extent - a hilltop wood looks promising. From there, the run to target is about 60 seconds long, with a fix after 25 seconds to confirm tracking and timing. My laydown attack will destroy or suppress any enemy defences in the target area, just five seconds before my wingman will use a dive-attack profile to give increased penetration for the weapon - perfect for a concrete structure such as the bridge.

9:10 am. The second target, the building, requires a more complicated profile - the 40 second split. With this profile, the leader and the wingman split apart three minutes before the target is reached and use completely different IPs, running-in to hit the target from two directions, maximising both weapon effectiveness and the element of surprise, before rejoining into formation two minutes after the attack. This target presents more problems, however; there is a notified avoidance area close to the target that must not be encroached on and there are several villages in the area, none of which are to be over flown, in accordance with RAF policy. After a couple of minutes thinking, I decide on the best compromise, and hand over the target planning for my wingman to complete.

9:20 am. With the final target planning underway, my next priority is to plan the route to and from the target. This is done on a 1:500000 chart, which gives sufficient detail to enable accurate navigation while flying at 420 kts (about eight miles per minute). Again, I am constrained by the rules for low flying (for example staying clear of towns and other avoidance areas such as nature reserves) and tactical considerations such as the preference for using valleys rather than exposing the formation by flying over high ground. A usual route lasts for about an hour, covering around 400 miles. At this stage, planning must be meticulous, especially with regard to timing, in order to achieve the objective.

9:40 am. Having completed the target planning, my wingman makes the necessary bookings for low-level flight and ensures that there is no conflict with other sorties in our intended operating area. He then begins photocopying the target maps for all members of the formation.

10:00 am. With the route planning complete, I turn my attention to the fuel plan. Fuel calculations depend upon both how much fuel is needed to fly the route and how much fuel is required to divert from base if we return but cannot land for any reason. From these figures, a planned fuel requirement is calculated and is annotated onto the map at intervals of time of no greater than ten minutes. As soon as you are airborne, fuel is one of the most important considerations.

10:15 am. The final 45 minutes before the flight briefing is taken up with photocopying the route maps, completing briefing slides, entering the waypoints of the route into our Global Positioning System (GPS) units, gathering latest weather information and airfield states and studying the route and the targets. Good target study enables you to have a clear mental picture of the run-in to the target and dramatically increases the chances of success.

11:00 am. After a time check to ensure synchronisation for the target runs, the briefing begins. At this stage, the two crews are assembled and all information for the sortie is considered. This may be the first time that some members of the crew have seen the route and targets and so each aspect must be covered in detail - including relevant avoidance areas. As leader, I brief the way I want the sortie to be conducted and the contingency plans for bad weather, emergencies or enemy engagement.

11:30 am. With half an hour to 'strap in', it is time for a final brief. Once more, we check anything that may have an impact on our sortie - this time in front of an authorising officer, who will give us the legal clearance to fly. Three hours after the initial tasking it is finally time to walk to the jets.

12:00 am. The kitting up, start up and check-in have gone without a hitch but, while waiting to take-off we are ordered to hold for a Tornado returning to base with a fuel problem. By the time we finally depart we are three minutes late, so I quickly brief my wingman on a plan to cut short through the valleys of the Lake District after the first target.

12:10 pm. Into 'battle formation' over the Yorkshire Dales, settling into low-level flight. Eyes out on stalks for potential threats.

12:15 pm. Happy with my navigation, the first fuel check shows that systems are fine. We are

getting close to the first target and so I turn my attention to the target brief for my pilot: 'Target X-ray is a laydown attack on a bridge on a track of 285 degrees for one minute five seconds. The IP is a large hilltop wood on the far side of the M6. Your 12 O'clock, 5 miles NOW. Are you visual?' As the pilot replies.....'Yes'..... I look across to my wingman to see him positioning himself for his dive profile.

12:17 pm. Off the IP and looking well ahead to the target area, I see vehicles on the road and by following these my eyes are led onto the bridge. Another look sideways confirms my wingman is safe and so I talk my pilot's eyes onto the target. It is a good hit and a call from my wingman informs me that he, too, was successful.

12:19 pm. With the first target behind us and the fuel checked, I call my wingman in close and turn the formation up Lake Windermere to cut the corner and get back on time to hit the primary target. Staying low, in tactical formation, we flash above the lake, well below walkers on the higher peaks. No time to admire the scenery though, as we pull hard around the crags to drop into the next valley.

12:21 pm. Level over Thirlmere, a quick check of the fuel and my eyes are looking outside again, scanning for other aircraft. As we turn hard to stay clear of Keswick, I remind the pilot of an avoidance area down the next valley and so we manoeuvre to hug the contours of the mountains.

12:23 pm. Out of the valleys and a brief respite, the formation widens back into battle formation and crosses the Solway Firth. Back on time, we can fly the route as planned.

12:28 pm. My wingman spots a formation of Tornados and calls it over the radio. I spot them and we 'wing waggle' to let them know that we have seen them. They return the gesture and continue south towards their own objectives.

12:35 pm. Approaching the split point - the corner of a large wood - I confirm from the GPS that timing for the target is good.

12:36 pm. My wingman splits from the formation and heads for his IP. I come around onto my IP heading. By the time we rejoin in six minutes time, we will both have attacked the target.

12:37 pm. 'Target Yankee is a laydown attack on a Command and Control facility on a track of 080 degrees for one minute ten seconds. The IP is the corner of a wooded hill. COME RIGHT; IP is on the nose now. Are you visual?' The pilot picks out the corner and directs the aircraft towards it. I check the timings. 'Running five seconds late. Speed up ten knots'. I feel the engine respond as the pilot pushes the throttle forward. I remind myself of the target area: white building, framed by trees, on a facing slope with a road running in front.....

12:39:30 pm. Thirty seconds to go and my mouth is getting dry. The building is not obvious in front of me, but my GPS confirms I am on track.

12:39:45 pm. Close, but still no sign of the target. I see several buildings but they are far too close and have none of the features I am expecting. I look beyond them.....'Wood, just left of the nose, two miles'. The pilot shifts the aircraft and places the woods on the nose. 'Target is concealed. Standby.....Got the chimneys! White building on the nose, your target'.
12:40 pm. We scream over the target on time, but the elation gives way to determination; we must now get back into formation and return to base safely. There is no time to relax - the mission is not over until you are sat in the bar!
12:42 pm. The formation rejoin goes as planned and we turn south for home.....
13:05 pm. Hot, sweaty but satisfied, both crews walk back to the Operations Block to debrief with the authorising officer. Pleased with my performance, I head for the debrief with my pilot who will assess my five-hour long performance in over 50 different areas. The sortie is not over yet.....
And in typical 100 Squadron fashion, my day is not over yet, either.....
14:00 pm. The debrief from my morning sortie now over, I'm enjoying a light and nutritious lunch of pie and chips in the aircrew feeder. Next to me are the unmistakable, chiseled features of a hardened 'fighter jock'; well, OK, former Tornado F3 pilot - Flight Lieutenant Colin 'Bruffy' Brough. He offers me a back-seat trip on an air-combat sortie launching at 15:30 pm. The day never stops on 100 Squadron!
14:10 pm. We re-convene at the operations desk where Bruffy gives me a quick overview of the sortie. We are tasked to act as a bandit, flying against two Tornado F3s from 43 Squadron, based at RAF Leuchars. Fighter Controllers will direct the aircraft to a pre-arranged location over the North Sea. The Tornados will then use their radar to detect and engage our aircraft, entering into air combat at close range.
14:15 pm. I collect the relevant maps and check the operations boards for avoidance areas or warnings in our operating area. A call comes through from 43 Squadron and we confirm details for the sortie, including the radio frequencies we will use and procedures that will be employed in the event of an emergency. Such liaison is essential to ensure the safe conduct of the sortie.
15:00 pm. We complete our final brief and head for the locker room where we don immersion suits and G-pants. Both items of kit are essential; the suit protects the body if we have to eject into the cold sea and the G-pants prevent G-induced loss of consciousness when performing high-energy manoeuvres.
15:31 pm. Lined up on the runway, a quick check of the systems confirms we are 'good to go'. Bruffy selects maximum power and we take off into the burning blue.....
15:45 pm. On transfer to the Fighter Controllers we are directed to our area and positioned to allow the Tornados to begin their intercept.
15:50 pm. Over the radio we hear the Tornado crews and Fighter Controllers confirm our position.....' Threat East, 30 miles. Suspected bandit. Commit'. They are on their way.....
15:54 pm. I catch a glimpse of a Tornado as the sun glints off its canopy - but they've seen us too! 'Blacksmith One IDs one bandit heading West'. The Fighter Controller responds immediately: 'Hostile. Clear to engage'.
15:55 pm. The fight is on! We pull into a hard left turn to deny the Tornado a shot and use our energy to climb. I can feel my neck straining under the G force as I strive to keep visual contact with the Tornado now in our rear sector. I keep a running commentary to Bruffy informing him of the Tornado's position as we manoeuvre hard to prevent a missile engagement.
15:56 pm. Bruffy sees a chance to 'turn the tables' and we dive for the deck, turning and burning, re-committing onto the Tornado. The greater agility of the Hawk gives us a slight advantage and we position for a guns kill.....
15:56:30 pm. ..... Just one more second.....A flash in the mirrors and I am aware of the second Tornado - an instant before the simulated missile is in the air: 'Blacksmith 2, Fox 2'. We had well and truly taken the bait, making us an easy target for the second Tornado.
15:57 pm. 'Blacksmith terminate'. The engagement over, we reposition for the next run.
16:20 pm. After three more high-speed, high-energy engagements, the 43 Squadron jets have achieved their training objectives and we return to base.
16:45 pm. After a quick telephone debrief with the Tornado crews it is time, finally, to head for the bar. It has been a typical day on The Ton: hard work, hectic but enjoyable. Now, where's that pint I ordered?

E-3D SENTRY Operation

It is 8:40 am and we are somewhere over Northern Saudi Arabia, having just crossed the border from Iraq, and three minutes from 'bingo': the point at which we have to head for home if we do not get more fuel. "11 o'clock, 3 miles", says the weapons systems operator, looking at the screen of his weather radar. "That looks good Skipper, he's in the left turn, rolling out in front", says one of the weapons controllers sitting some 30ft in the cabin behind me and looking intently at the radar display in front of him. We pop out of a patch of cloud into bright morning sunshine and almost immediately the co-pilot calls, "Visual". Two minutes later, with the flight engineer having run through the necessary checklists and the tactical director confirming that everything is ready, we sit 30ft behind the USAF KC135 tanker. I take control from the co-pilot who has been flying up to this point, settle myself down, and having received clearance to make contact, gently push the throttles to start moving forward. "15.....10.....8....5....4...3...2, stabilise there, CONTACT", announces the co-pilot. "Fuel flows", calls the flight engineer; and there is an audible sigh of relief. Fourteen minutes later, having managed to maintain contact, the 65,000lb off-load is complete. "Request disconnect", the co-pilot transmits to the tanker crew, and we hear the 'clunk' as the flying boom unplugs from the roof a few feet behind us. We move back and down from the tanker to gain safe separation and begin preparing to return to our orbit area over Iraq for the second half of our eight-hour 'on-station' period. It is over 10 hours since we got on the crew bus to make the journey from our accommodation to work; it will be another eight hours before we arrive back there. So, what are we doing, why are we doing it and how did we get here?

Background

As the Iraqi political situation continued to deteriorate during the latter part of 2002, the E-3D Component at RAF Waddington was already busy planning its possible involvement in any potential military campaign. This was particularly challenging, as the Component was still actively involved in Operation ORACLE, in support of which, crews had flown daily missions over Afghanistan since October 2001. This commitment was finally lifted and, as a result, the last crews were back at RAF Waddington by the end of January 2003, allowing attention to be turned fully towards the Iraq theatre of operations.

RAF Waddington became a veritable hive of activity with the whole Station pulling together to ensure that those personnel liable to deploy were fully prepared for all foreseeable eventualities. In the best traditions of the RAF, the challenge was met and nine operational crews and four E-3D aircraft were made available, with the aim of offering a 24-hours-a-day E-3D presence for as long as was necessary. These crews consisted of personnel from 8 Squadron, 23 Squadron and the Sentry Standards Unit, together with former crewmembers who had been recalled and re-qualified specifically to support the Operation. In the end, space available at our deployed operating base dictated that only six crews would be able to deploy, so the workload would be increased significantly. Eventually, the order to deploy arrived and, during the last week of February and the first week of March 2003, all six crews, together with a large number of support personnel, made their way by various means to Prince Sultan Air Base (PSAB) in the Kingdom of Saudi Arabia. Once there, preparations continued both on the ground and in the air, with work-up training beginning in earnest. When Operation TELIC commenced on 20 March, the E-3D Component was ready for the challenge that lay ahead.

The Task

The E-3D Sentry is known to many as the AWACS, which stands for Airborne Early Warning and Control System; however, this name only reflects part of the role played by the aircraft in a modern air battle. There are a number of roles undertaken simultaneously by each crew, that can, in simple terms, be described as airborne air traffic control, airborne early warning of potential threats, front-line command and control of airborne assets, the provision of close-air-support to ground units and also communications relay. In general, the role of the E-3D is to act as the focal point for the management of the air battle. Within Operation TELIC, the RAF E-3Ds shared these tasks with the USAF E-3Cs and the US Navy E-2s, with each 'on-station' aircraft being responsible for a different geographical area and therefore having slightly different operational responsibilities.

TELIC

Flight Lieutenant Loz Rushmere

With the requirement to provide a continuous E-3D presence over the theatre of operations, the day was split into three eight-hour on-station periods, with each crew handing the tasks over directly to the next one. With two-hour transits to and from PSAB at either end of the on-station period, this resulted in an average flight time of 12 hours for each mission flown; and with six crews deployed, each crew flew on one day, with the next day off, throughout the Operation.

A Day In The Life

It is 9:30 pm and my working 'day' is just about to start. I head on over to the US 'chow hall' to grab a meal (open 24 hours a day, but breakfast is not on the menu at this time of night!) I then grab my kit, which consists of my normal flight bags together with my chemical protection suit, respirator, kevlar helmet and survival 'grab-bag' (in case of an unplanned walk in the desert). By the time I have done this it is 10:30 pm and time to get on the crew bus which will take me and the other 17 crew members to the operations complex, a 30-minute drive from the accommodation.

Once at 'ops', it is time to get on with the preparations for the forthcoming mission. The aircraft engineers have been working around the clock to ensure that a serviceable aircraft is available for this and every other mission. With only a fraction of the equipment and spares that they would normally be able to draw on back at RAF Waddington, their achievements in the extremely hot and dusty desert conditions have earned them the nickname 'the magicians'! (No E-3D mission was lost during the entire Operation: a clear testimony to their tireless work). A quick chat with the engineers tells us which will be tonight's aircraft and any limitations it might have. The flight engineer then sets about his pre-flight preparations while I, the co-pilot and the weapons systems operator take a look at the weather forecast and the flight plan.

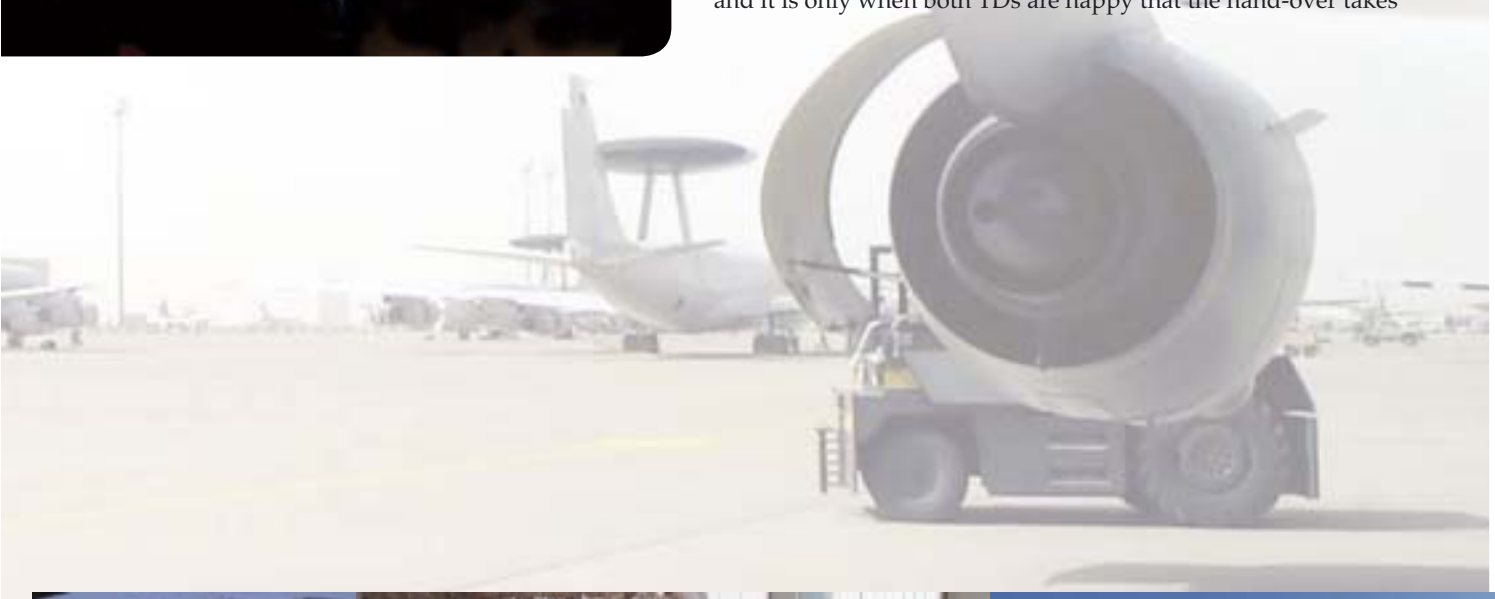
Meanwhile, the mission crew is busy with their own preparations. During the day, the intelligence and briefing staff from RAF Waddington's Operations Support Squadron have been busy obtaining and preparing the many documents essential to the mission. Documents such as the 'Air Tasking Order', which outlines all planned sorties during our on-station period and the 'Airspace Control Order' which explains the many rules for operating within the theatre, together with the daily 'Special Instructions'. It is now time for the mission crew to examine these documents in detail and come up with a working plan. We also receive a crew intelligence-briefing from the intelligence staff who have also deployed with us. Among other things, the briefing gives an idea of where potential threats might exist.

Shortly after midnight, the flight engineer, communications operator, and the communications, displays, and radar technicians head out to the aircraft to start their pre-flight checks. The three airborne technicians are unique to the E-3D, and allow the potential to solve technical problems whilst airborne. They have on many occasions saved a mission that would otherwise have been lost.

Meanwhile, the remainder of the crew gets together for a final mission brief to ensure that everything has been covered and that a sensible plan exists. At 0:45 am we climb on board the crew bus for the 15-minute trip to the aeroplane. Once there, everybody gets on with individual pre-flight checks. As the captain, I liaise with the crew chief and his team, examine the aircraft documentation and complete the necessary paperwork, whilst the co-pilot, weapons systems officer and flight engineer continue with the cockpit checks. I also liaise

with the tactical director (TD), who is in charge of mission control, to ensure that everything is ready. At 1:40 am, we commence engine start and five minutes later our four CFM-56 engines are humming quietly. The taxy out to the runway is not to be taken lightly, as the airfield is incredibly busy and a ground collision is a distinct possibility in the dark. We wait to enter the runway, while other aircraft land, their bright landing-lights appearing out of nowhere as they are switched on at the last minute before landing. As the last aircraft clears the runway we are given clearance to take-off. A few final checks and it's time to push open the throttles and unleash the 24,000lbs of thrust provided by each of our four engines. Very soon, despite weighing some 332,000lbs, our aircraft has reached take-off speed; I ease back on the control column and a couple of seconds later we are airborne, climbing into the night sky.

Whilst I work with the flight-deck crew to get us safely to our designated orbit area, the mission crew are busy setting up their kit. Each console must be brought to life, communications and data links have to be established and the main mission-radar has to be brought on-line. Our job on the flight deck is helped by ground agencies, the USAF E-3s and, once our own radar is up and running, our own mission crew, all helping to ensure that we transit safely through some very busy airspace. Once the inevitable technical problems have been resolved, the mission crew take a few minutes to relax and perhaps grab a bite to eat as they know that once we are on-station, the opportunities to take a break will be limited. Before long we are preparing to take over the mission from the E-3D which has been on-station for the previous eight hours. Aircraft-to-aircraft briefings are undertaken so that all assets under control experience a seamless transition and it is only when both TDs are happy that the hand-over takes



place. The 'on-station' call is made and the day's work begins in earnest.

The majority of the task will be taken up with ensuring the safe passage of Coalition aircraft in and out of the area of operations. To achieve this, all aircraft movements have to be coordinated, threat warnings and other vital information have to be broadcast and aircraft requiring fuel have to be provided with the right type of tanker, in the right place and at the right time. In addition, we must always be ready to react to other events as they occur, such as troops on the ground needing immediate close-air-support or other aircraft with emergencies. We are also one of the main ways that the Combined Air Operations Centre can communicate with its people in the front line, so we also act as an on-site command and control post. This is an essential role, as the tactical situation can change rapidly in modern warfare.

As captain, I am responsible for the safety of the aircraft and those on board, and for liaising with the TD to ensure that the mission is achieved to the highest standard. However, in practical terms, once on-station, the TD runs the show and I get the opportunity to sit back and listen in. The surveillance team and the weapons team work extremely closely together under the guidance of the TD, with the communications team and our airborne technicians providing essential, time-critical support. Whilst there is often much light-hearted 'banter' during quieter moments, the level of professionalism is extremely high. The E-3D Component prides itself in providing the very best service possible to all we work with and the exceptional teamwork demonstrated by the crews ensures that this is achieved.

As far as the flight deck is concerned, the air refuelling (AR) slot in the middle of the mission is the period of highest workload. The successful completion of this AR task is again down to the whole crew, not to mention the skills of the tanker crews involved, without whose support we would have been unable to achieve our mission. During the Operation, the E-3Ds were refuelled, both by day and by night, by USAF and Air National Guard KC135s, USAF KC10s, and RAF Tristar and VC10 tankers, possible because the E-3D is the only RAF aircraft to be fitted for both the Probe and Drogue (UK) and Boom and Receptacle (US) AR methods.

After AR, we return on-station for the second half of the mission and then at the end of the eight-hour period, we have to ensure a smooth hand-over to the aircraft taking over from us. Once off-station, the mission crew start to relax whilst the flight-deck crew deals with the recovery to base. After a two-hour transit, dodging thunderstorms on the way, we make our approach to PSAB, having to peer through blowing dust to see the runway. Landing at 2:00 pm, we experience the full heat of the Saudi Arabian afternoon, always a shock after 12 hours spent in an air-conditioned tube!

After the flight, there is still plenty of work to be done. The ground engineers have to be told of any problems with the aircraft and the post-mission report and all the mission paperwork has to be completed and handed back to operations. There is also the crew debrief to be held, to discuss what has occurred during the mission and to look at any ways we might be able to improve our performance for the next time. Finally, with all the work complete, we board the crew bus back to the accommodation area, arriving there at 4:30 pm in time for a quick non-alcoholic beer, a meal, a shower and, most importantly of all, a chance to sleep after our 20-hour day. Rest is now the most important thing because, in 28 hours time, my alarm will be going off again at the start of another working day as an E-3D crewmember on Operation TELIC.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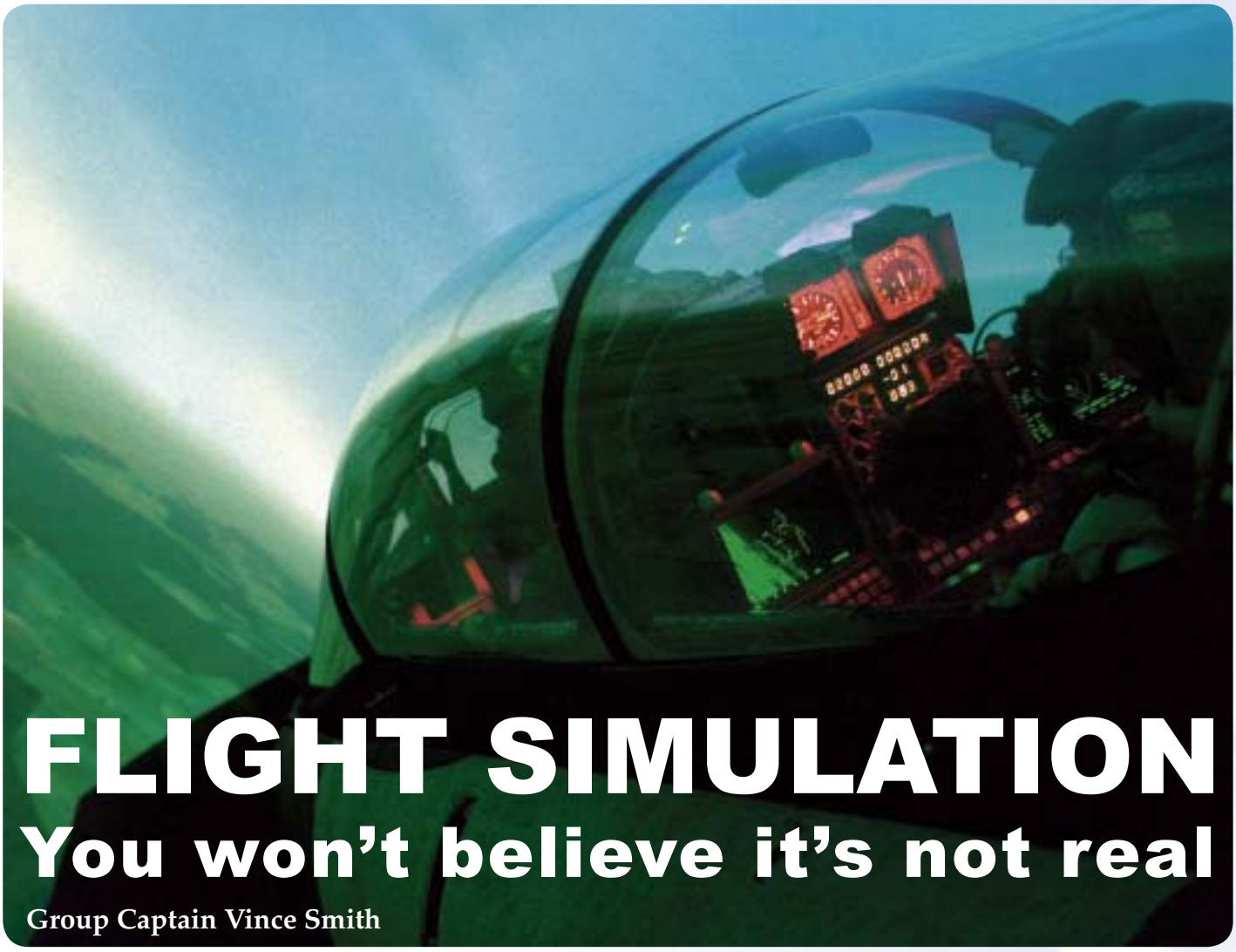


FLIGHT SIMULATION

You won't believe it's not real

Group Captain Vince Smith

You're at low altitude, miles into enemy territory on a night mission to destroy a key installation. Everything appears an eerie green colour through your night-vision goggles. Senses are heightened as you monitor the aircraft's systems and displays. The mission has been uneventful so far and there are only minutes to go to weapon release. You turn at the final waypoint onto the attack heading. One final check, all systems are functioning, attack mode selected and the target coordinates confirmed. The weapon package is selected, committed and then launched.

Suddenly the Electronic Warfare warning receiver alarm sounds and the hairs on the back of your neck stand on end in response. It's a surface-to-air missile site to starboard - the intelligence brief had warned that the enemy had mobile missile-launchers. You take evasive action and the defensive-aids system fires chaff in an attempt to lure the missile away but you reacted just too late and the missile detonates off your port wing. The airframe shudders and a number of primary and secondary warnings illuminate on the aircraft's Central Warning Panel. You cancel the audio warnings, pick a good escape heading and follow the immediate-action drills associated with each warning - they are second nature after all of the training you've undertaken! You take stock of the situation: the aircraft has sustained damage but still flying and you have full control. You set a course for home, when the voice of the instructor comes over the intercom telling you that the training has been completed, he has control and you are to leave the..... simulator!

What is a Simulator?

The type of sortie already described can only be undertaken on expensive high-fidelity, full-mission simulators. However, the term 'simulation' covers a wide range of synthetic training-devices, from small desk-top trainers, such as those in an automated classroom, through to high-fidelity, real-time machines like those currently being used in the development of the Typhoon F2 and the Joint Combat Aircraft. In between these limits there are a range of part-task trainers that are used for teaching specific aspects of flying, such as developing motor skills for Hands On Throttle And Stick control systems.

In fact, we all encounter simulators on a regular basis, probably without realising it. The flight simulation programme for your PC or the funfair ride offering you a trip with the Red Arrows are both examples of flight simulators, albeit used for entertainment rather than in a training role.

Development of the Flight Simulator

Since the beginning of heavier-than-air flight, would-be aviators have struggled with the difficulties of learning the necessary skills. Various training devices were developed in the period up to and during the First World War but it was not until the late 1920s that the first truly successful trainer was built.

Edwin Link had a desire to fly, but could not realise his dream due to the high costs of flying lessons in the period of the Great Depression. He saw the potential to develop flying skills in a ground-based trainer so long as that device could mimic an aircraft's response to joystick movement. He used the technology of his father's organ company to develop a pneumatically-powered device, and the forerunner of the modern-day flight simulator was born. It was not an overnight success, however, and initially it was bought by fair owners as an amusement device for people to experience 'flying'. The Link Trainer, as it became known, was finally employed in its designed role when, in 1934, the US Army Air Corps bought a number of the machines to be used for pilot training. Now, the flight simulator had arrived!

Over the subsequent years, the development of the flight simulator has been dependent upon other technological developments. The rise of the science of aeronautics led to the development of mathematical models that encapsulated an aircraft's flight characteristics. The hit-and-miss adjustments of early devices could now be replaced with a scientific application of accurately defined metrics. Development of the analogue, and subsequently the digital, computer produced huge advances in simulator capability. These developments continue as computers increase in power but decrease in both cost and size. A modern flight simulator may well be driven by a collection of PCs instead of racks of electronics and mainframe computers that would have been the case not too many years ago.

Perhaps the single most significant development in flight-simulator technology came in the 1960s, with the introduction of visual systems. The early systems involved cameras tracking across a scale model supplying a picture which was displayed to the aircrew on a screen. Now, the image is computer generated,

taking into account variables such as the time of day and prevailing weather conditions. For aircraft that are used for night operations, the system has had to provide the out-of-the-window visual scene compatible with that seen through night-vision goggles. The display systems have been developed so that the aircrew may see a multi-channel image projected onto a display screen that has been 'wrapped around', to form a dome encapsulating the cockpit. Further developments can put the image directly onto the aircrew helmet visor so, no matter where the pilot or weapons systems officer looks, the correct view of the simulated outside world is portrayed.

Simulation's place in RAF training

No matter how far simulators are developed, and how 'real' they become, there is no substitute for getting your hands on the real thing. This is equally true for the aircraft technician being trained in propulsion systems, who needs training time on real engines, as it is for the fast-jet pilot who needs training time on the real aircraft. Synthetic trainers are particularly useful at introducing the trainee to new concepts, running systems at slower than real-time to allow the demonstration of sequences of events in complex systems, developing skills in the trainee such as hand-eye coordination, revision and practice. Due to these particular capabilities, synthetic devices are employed throughout the RAF as part of integrated training systems that balance classroom, synthetic and live training.

The flight simulator's role is twofold; firstly, getting a trainee to a particular standard of ability and, secondly, maintaining that individual's standard during operational employment. Within these roles simulators have training functions which fall into a number of categories:

- Operation of the system in normal modes.
- Operation of the system in degraded modes.
- Dealing with emergencies, such as fire and engine flame-out.
- Practising system mission-capability.

To accomplish all of these tasks, the simulation has to be sufficiently accurate or real for the trainee to gain the required level of training from the device. A shortfall in the required level of realism will fail to achieve the required level of training and in some cases could result in a negative training effect, resulting in a particular aspect having to be re-taught in the real aircraft.

How real is real?

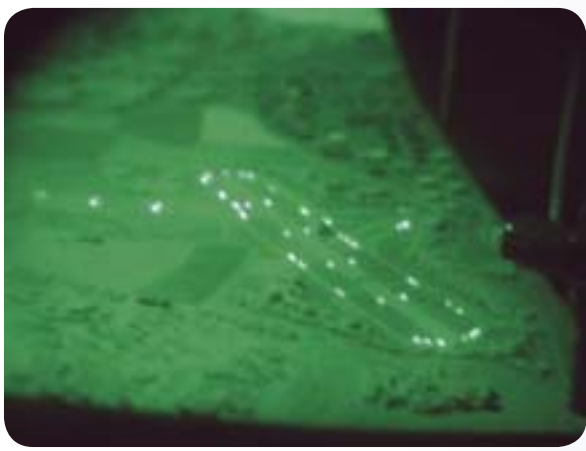
If the real environment is not always the best one for training, then why do we strive for realism? The short answer is that we do not. There are degrees of realism depending upon the training task. If you are attempting to teach a concept such as radar interception, then you do not require a device with a multi-channel, day-night visual system. However, if the training task is to undertake a night attack over hostile territory, then every aspect of that device's operation needs to be as true a representation of the real world as possible. The switches, controls and displays must be as those on the real aircraft; if the aircraft is hot and uncomfortable, then the simulator must be hot and uncomfortable; if a particular mission requires the crew to wear Nuclear Biological and Chemical clothing and night-vision goggles, then the simulator must provide the necessary air-feed and the correct visual display.

No matter what the training task, the equipment or system that is being taught must be faithfully represented by the synthetic device. A part-task trainer used to teach navigation or weapons systems may not have a full cockpit display, but the system being simulated must operate as it does in the aircraft. The switches must be in the same position, they must feel the same, and have the same effect as they do on the real aircraft. However, it is not quite so critical for cockpit displays. An instrument may be the real analogue device but could equally be a computer-generated display on a screen; what is important is that the instrument looks and operates like the real thing.

There are degrees of reality dependent upon the requirement for the trainer but what must be avoided is a device receiving comments such as 'Well, it's only the simulator' or 'Of course, you don't do it like that in the real aircraft'.

Simulation or Live Training?

Aircrew do not join the RAF to fly simulators and ground crew do not join to work on electronic facsimiles of engines or radar units. Pilots want to fly and technicians want to get their hands dirty. However, for training purposes, the real equipment does not necessarily provide the ideal training



environment. There is a balance to be struck between synthetic and live training, a balance that is dependent upon a number of factors:

- **Cost.** Typically, the costs of operating a simulator are approximately 10% of those associated with operating a real aircraft. If the training task involved firing weapons, then the figure would be significantly reduced to less than 1% of the live cost.

- **Operational Capability.** Using an aircraft for training purposes may reduce a squadron's operational capability, or additional aircraft may have to be purchased to ensure availability to meet its training role.

- **Feasibility.** Is it possible to undertake the training in the simulator, or must it be undertaken in the real aircraft - or vice versa?

- **Emergencies.** It would not be practical to train for emergencies in a real aircraft, especially if the exercise involved an engine fire that resulted in the crew having to eject!

- **War Role.** Simulation allows for some unique opportunities when training for hostilities. New tactics and techniques can be practised in complete secrecy without worrying about potential enemy forces eavesdropping on your communications or monitoring your electronic warfare emissions.

- **Environment Protection.** The RAF takes very seriously its obligation to reduce the environmental impact of operations. Using simulators rather than the real aircraft goes some way to reducing both noise and exhaust-gas pollution.

- **Airspace.** With the ever-increasing amount of air travel, the skies are becoming more and more congested. Any training undertaken on a simulator assists in reducing this congestion.

- **Aircraft Fatigue.** Aircraft fatigue is measured by the amount of stress and the number of hours flown. Reducing stress and the number of flying hours extends the operational life of aircraft.

Simulator Operation

Since the end of the Cold War, there has been emphasis on reducing the size of our armed forces. Priority has been to utilise uniformed personnel in front-line roles and, where possible, place support roles with contractors. Flight-simulator training is one such support activity that is now wholly supported by industry. The process for involving industry is with the use of long-term, service-provision contracts under the Government's Public Private Partnerships and Private Finance Initiatives. Such contracts result in a pay-as-you-go type of service, where each sortie is costed and paid for at the time of use. Gone are the days of

high capital expenditure and running-costs being borne by the RAF - industry now takes on a shared responsibility for providing a professional training service.

Major UK Simulation programmes

The RAF, as well as the other Services, places a heavy reliance on having flight-simulation devices to support the majority of current aircraft operations. Some flight simulators have been in existence for a number of years and some are still in the planning phase. Major contracts provide synthetic flying-training services, taking aircrew from elementary flying through the various routes of multi-engine, fast jet or rotary wing operations to the associated Operational Conversion Unit stage. Whether aircrew are employed on Hercules transport aircraft, Tornado GR4 fast-jet aircraft or Sea King Search and Rescue helicopters, their training will have involved the use of a number of flight-simulation devices. There are several major projects, in various acquisition phases, which will provide synthetic training to support new aircraft as they enter service in the RAF. These projects include:

- Typhoon F2
- Airborne Stand-Off Radar
- A400M Transport
- Military Flying Training Service
- Future Strategic Tanker Aircraft
- Merlin Helicopter

The future for Simulation

Industry strives constantly for improvements in realism, and these improvements will undoubtedly manifest themselves in ever-better visual systems and more accurate databases that can be developed at short notice. This rapid generation of scenarios is required to support current operational criteria. We have moved away from a time of knowing our enemy and using a specified series of operational scenarios, to an era requiring rapid reaction to threats as they arise anywhere in the world. These newer operations, which involve the RAF working alongside other forces within a coalition, give rise to a situation whereby a ground controller from one nation controls an AWACs aircraft from another, directing attack aircraft from a third nation in support of ground forces from a fourth.

The greatest change in flight-simulator usage will be to simulate this type of multi-national coalition operation. It will require devices to be inter-linked via a Wide-area Network, such that they are all involved in the same scenario. Initially, this will involve devices within a nation's forces but, ultimately, will result in linking forces from all of a coalition's nations. Technology-demonstration projects in this area have met with some success, but there are a large number of challenges for both the engineers and national force commanders to overcome. Problems such as passing data thousands of miles in real-time, in a format that can be understood by the target machine, may well prove easier to solve than the collective agreement of force commanders to share the resultant intelligence.

The MOD's involvement in this future role for flight simulators is the Military Training through Distributed Systems project, that is seeking to determine the future of collective air-environment training using assets currently in existence, some of which were never designed to be linked. Once this linking has been achieved, future projects will look to provide Joint Collective Training to link air, sea and ground forces; and, still further ahead, the goal will be Joint Collaborated Training that links all coalition forces in one large synthetic environment. As these projects progress, additional synthetic training devices will be required; the primary requirement of which will be the ability to connect to other platform-type devices or networks of devices.

Whatever the outcome, the future's bright, the future's simulation!

GR4 Reconnaissance

Operation

TELIC

Flight Lieutenant Andy Wright

The five-minute drive on the crew bus from the operations building to my Tornado GR4 had not struck me as remarkable at the time. If I had known this was to be my final RAPTOR (Reconnaissance Airborne Pod for Tornado) sortie of the Iraq War, I might have reflected on the reconnaissance missions that I had flown during the last two months, or considered what impact my contribution had made to the war. But this was not the time for reflection or consideration. The only thing on my mind was what I always thought about during the final quiet moments preceding a hectic war sortie: the task ahead.

Reconnaissance was one of the most crucial roles the fast-jet force could offer the Coalition Commanders in the Gulf, and RAPTOR boasted two attributes that appealed to the Chiefs. Firstly, even when working tens of miles away from a subject being photographed, RAPTOR is capable of capturing startlingly high-resolution images, even at night. Secondly, it doesn't take a great deal of training to teach absolute beginners how to use RAPTOR effectively. Even a first tourist 'stick monkey' from a bomber squadron is capable of putting the RAPTOR into the right bit of sky to meet the parameters required for successful reconnaissance.

I had arrived at Ali Al Salem airfield, in Kuwait, on 27 January 2003, having flown an aircraft out from the UK via Cyprus. By mid-March, 31 Squadron was reinforced with crews from II(AC), XIII, IX(B) and 617 Squadrons: a total of 72 pilots and weapons systems officers (WSOs) had amalgamated to establish a new, multi-role, Combat Air Wing. On 18 March 2003, OC 31 Squadron addressed the Wing. With war just two days away, he explained that in addition to their conventional bombing roles, each GR4 squadron would undertake specific speciality missions. As the tasking was revealed, I couldn't help feeling like the last kid to get picked for playground football. Whilst the other squadrons would be carrying out additional 'sexier' jobs, including firing Air Launched Anti-Radiation Missiles (ALARMs), launching the brand new Storm Shadow Cruise missile, or carrying out low-level, Scud-hunting sorties, 31 Squadron was to maintain its medium-level reconnaissance role! And so it had come to pass that, by day 22 of Operation TELIC, I had flown 15 war sorties, of which 10 had been dedicated reconnaissance flights. Time had blurred since Night One, when I had flown my first mission, a night RAPTOR sortie; however, today would stand out in my memory more readily than any other reconnaissance sortie I had flown. The five-hour epic that lay ahead would take me over the majority of populated Iraq and, although I did not know it at the time, this trip would mark the end of the war task that I had started only 10 weeks previously.

I had woken to the drone of an unseen C-130 Hercules, which was taxying a few hundred yards from my accommodation block. The morning had already seen the daily gathering of our four-man squad. The twelve 31 Squadron crews had been split into six pairs, with each pair always operating together as a team. My wingman pilot, 'Bones', and his WSO, 'Crawfs', were our team's official leaders, although the flight-lead was generally split with my WSO, 'H-S', and me. Today, Bones was leading the mission and my job would be to fly in cover position as a lookout and in constant readiness to take the lead should anything happen to his aircraft or its equipment.

The working day had begun with a meteorological briefing, followed by an intelligence overview. US marines were already patrolling Baghdad and Saddam had reputedly fled north to his hometown of Tikrit, leaving only a few of his acolytes to offer resistance in his absence. Following the briefings, we set about our planning task. The pilots always took care of the domestics of flying, along with the communications plan and de-confliction from the numerous other Coalition aircraft. We were also responsible for contacting the USAF F16 pilots who would be escorting and protecting us during the high-risk portion of our mission. The WSOs had the onerous task of analysing the reconnaissance tasking and then planning where we would have to fly to collect all of the images required from our sortie.

With the plan finished, we moved into the main briefing, which covered the sortie route, our formation procedures, other players, surface-to-air-missile (SAM) threat areas, defensive tactics, radio frequencies and the secret Combat Search and Rescue codes of the day. We then sanitised our clothing (removing all trace of personal identity other than dog tags and an ID card) and pulled on our war suits. The Combat Survival Waistcoats, packed with survival goodies, were the last things to go on. As well as a personal GPS, Morphine, a Walther PPK pistol, and around two litres of water, there was a plethora of location aids and even a supply of gold coins that were meant to buy our freedom from, hopefully, a corruptible captor.

After a final 'out-brief' from the War Lord, we climbed onto the crew bus and travelled down to the jets. Thankfully, the aeroplane was fully serviceable, which meant no last-minute dash across the site, in searing 40ºC temperatures, to launch rapidly in a pre-prepared spare aircraft. Following a secure radio check and final checks of the avionics, it was time to navigate around the narrow, winding taxiway to the 10,000 feet long runway. The take-off into the turmeric yellow haze was uneventful and as we climbed above the inversion layer of the atmosphere, the visibility picked up and we established ourselves in formation, ready to cross the Iraq border. We would only cross into Iraq once all our defence aids had been verified as functional and we had established contact with the airborne 'eye-in-the-sky' - the patrolling AWACS aircraft. With all the ticks in the right boxes, we headed north west towards Baghdad, across the flat, featureless sandpit that constitutes Southern Iraq. By now, most of the enemy Anti-Aircraft Artillery (AAA) operators had fled the area: too scared by the proximity of so many Coalition troops.

The medium-level transit to our rendezvous (RV) with our first refuelling tanker took us overhead Talil airfield, which had already been annexed by American A-10 'Tankbusters'; and we were soon flying at 20,000 feet behind an RAF Tristar tanker above one of the seven wonders of the world: The Hanging Gardens of Babylon. As we were now refuelling over enemy territory I was particularly tense. On a previous night sortie I had spent 30 minutes trying to connect with an unlit US KC10 tanker in pitch darkness, which had set up a towline in the middle of a squall line of thunderstorms. Following a lot of effort, a lot of perspiration, and some 'colourful' language, H-S and I eventually had to fly home with just enough fuel to reach Ali Al Salem. I had never failed to hit the basket before, and today I was determined to make amends. This time, my refuelling probe hit the drogue at the first attempt. Twenty minutes later, Bones and I were on our way north with full fuel tanks for the first part of our reconnaissance task.

Our first section of filming would occur around the outskirts of Baghdad, an area we had become very familiar with over the last few weeks. Today, Crawfs would be using his RAPTOR to complete the task, whilst I flew my jet on a parallel track, approximately 5 kilometres away. My job was to act as a lookout and to provide cover as they flew through a relatively high-risk area. When operating RAPTOR, the aircraft has to be flown straight and level for a significant period to record the target images. This forces the Tornado to fly a highly predictable flight-profile, which was arguably the strongest reason for our dislike of the task. Even with a sharp-eyed wingman at your side, there is no denying the fact that when you are taking photos you are, quite simply, a sitting duck! Earlier in the war we had been extremely nervous about flying close to Baghdad, as Saddam had located most of his SAMs in the city

creating a huge Missile Engagement Zone. But, once Baghdad had been taken by American ground forces, most of Saddam's tactical SAMs had fallen silent. Today, we were escorted by two F16 'Wild Weasels'. Our Yankee protectors would be carrying extremely sensitive missile-warning and jamming equipment, along with High-speed Anti-Radiation Missiles (HARM), which can destroy any threatening SAM radar within a matter of minutes of its transmitting. In fact, the previous week, Bones and I had been flying a similar mission when the F16s had fired HARMs over our heads at a SAM system that could quite easily have ruined our day!

The Wild Weasels sat above and behind us as we flew an anti-clockwise circle all the way around the outskirts of the city, passing to the north over the heavily-cratered military airfield at Ballad SE, and then over Saddam International airfield to the west. Six nights before, Bones and I had been on a Close Air Support (CAS) mission in support of the Coalition assault on Saddam International. We had watched a fearsome firefight through our night-vision goggles, ready to use our Enhanced Paveway II laser-guided bombs against enemy emplacements in support of the team on the ground doing all the hard work. The mission had actually turned out to be one of the most frightening sorties that Bones and Crawfs had flown; not because we had been engaged, but because their oxygen system had failed and we had been forced to run home to Kuwait at a much lower altitude, which happened to be in the heart of the envelope for many Iraqi SAMs. The hour-long journey back to Ali Al Salem proved to be a very tense time indeed.

The completion of the huge circle saw us move into uncharted territory for the first time. As we reached Taqaddum airfield to the south of the city, we turned north to overfly Baghdad 'High Street': something that would have been unthinkable two weeks ago and plain suicide at the beginning of the war! With our eyes peeled, we pressed on. We had seen Baghdad on a number of occasions over the past two weeks, both from the outskirts of the city and on the numerous television reports that were dominating the 24-hour news. However, it didn't prevent us from experiencing a rather surreal feeling of flying over the centre of the city and seeing the impressive parade square with its crossed scimitars; of watching the Ministry of Information smouldering away, days after it had been bombed; and of realising how organised the suburbs looked, with their US style block-street system. It was almost like some perverse sightseeing tour of a significant historical site.

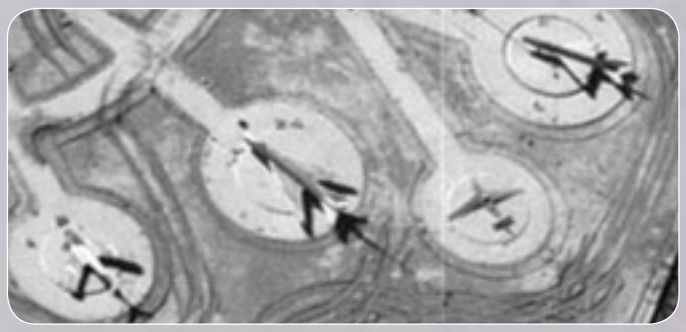
Baghdad was soon behind us. We bid farewell to our F16 escort aircraft and moved north, towards the town of Tikrit. This was the furthest north any of us had travelled from Ali Al Salem and, with over half of our reconnaissance mission completed, my mind began to turn to the next task: the second of our refuelling tanker brackets. However, it had seemed that I had jumped the gun slightly as Crawfs' voice crackled over the airwaves. His RAPTOR pod had failed and H-S and I were going to have to pick up the rest of the task. I muttered a little curse to myself as I realised that the roles were to be reversed and Bones had the luxury of being free to manoeuvre, whilst I had to revert to flying straight and level to take my pictures.

We only took a couple more swathes of images prior to

our RV with the USAF KC10 over the southern Turkish mountains. We had been forced to climb to meet the tanker, as there was a possibility that the Iraqis might carry a lightweight, handheld SAM up a hill for a cheeky 'pot shot' at us while we were tanking. Whilst this gain in altitude made tactical sense, it made my GR4 even harder to handle. The Tornado is a superb aircraft but, it does not like operating 'Hot and High', and it took a great deal of coercion to coax my aeroplane towards the tanker's refuelling hose. However, both Bones and I were again successful, despite the distraction of a tanker crew who seemed more interested in photographing the artwork on our nose than giving us fuel.

The trip south proved a good deal simpler than our outward journey and after completing a task near Mosul, we headed south east towards Kirkuk. Rather incongruously, I suddenly realised how fortunate I was to have seen this region, which, as H-S pointed out to me, had been the location of the birth of civilisation.

By now we had been airborne for around four hours and my bladder was beginning to feel the strain. However, there was no time to switch off as we knew we were about to fly close to one of Iraq's most potent SAM sites: a French Roland-missile system. Despite their short range, these SAMs certainly warranted caution. Both Bones and I had been 'illuminated' by various Roland target-tracking radars since Night One and neither of us was interested in repeating the experience. Our lookout was intensified as we skirted our way around the Roland Missile Engagement Zone before continuing our journey south. Before long we had passed between Mandalay and Baghdad and had turned south east, to follow the Tigris River as it gently meandered towards the Persian Gulf. The journey would take us past Al Kut, the home of Saddam's infamous Republican Guard and the location of some of the fiercest fighting encountered by the Coalition during the conflict. The Basrah road was now leading us back to Kuwait and as we shadowed it away from Al Kut, the road hit Al Amarah and then, like us, turned south towards Iraq's second city. This final leg of our journey had certainly become a familiar area over the previous month. We had worked here by night and by day; taken photographs; struggled to get images in bad weather; dropped bombs; reacted to AAA; and fretted about the Patriot Missile Battery indications on our radar warning receivers. Soon after we had passed Basrah, I felt a wave of relieved nonchalance pass over me as H-S informed the AWACS controller that we were safely back inside Kuwaiti airspace.



As usual, the same engineers who had seen us off greeted us for the aircraft shut down. Before I had unstrapped and reached the bottom of the steps, the team from the Tactical Imagery Wing (TIW) had removed the tape from our RAPTOR pod. TIW comprises a number of photographic imagery experts who would spend the next few hours scrutinising our photographic efforts. Although the analysts' task was only just beginning, RAPTOR's job for this mission was complete. More importantly, so was ours.

If I had known I wasn't going to fly with RAPTOR again, I might have taken one last look over my shoulder at the world's most expensive 'Box Brownie'. I might even have regarded it with some peculiar affection. After all, despite our dislike of the task, the work that 31 Squadron had completed with RAPTOR had provided an essential input to both the land and air battles of Operation TELIC. However, for me, RAPTOR had offered a much greater privilege: despite the difficulties and the danger, my reconnaissance missions had taken me over the length and breadth of the country of Iraq and allowed me to see some of its geography and appreciate some of its fascinating history. Without RAPTOR, this would probably never have occurred and my memories of the Gulf would be confined to night CAS missions and dropping laser-guided bombs onto unseen targets.

For now, though, I was to retain my resentment for the cursed thing. My back ached, I was dehydrated and my bladder was the size of a football. As I greeted Bones at the engineers' hut, we consoled ourselves with the thought that after the usual round of debriefs our day would be over. The first debrief was usually carried out with our intelligence team before the jets were even signed back to the engineers. However, as the Squadron Intelligence Officer made his way towards me, pen in hand, I realised that I had a much more pressing engagement, having been strapped to a 'bang seat' for six hours. I made my excuses and headed for the bathroom!

QUICK REACTION ALERT

Flight Lieutenants Phil Stewart & Rory Hederman

On Christmas Day 2003, a Tupolev Tu-95 Bear maritime reconnaissance aircraft takes off from its base in the Baltic and climbs to its cruise altitude of 35,000 feet. Flying at 400 mph, it is armed with air-to-surface missiles and rearward facing, radar-guided 23mm cannons. It has a range that can take it to Cuba and most of the way back, and has been the mainstay of Soviet naval aviation since before the Cold War. Now flying under the Russian flag, its capacity to carry sonar-buoys and torpedoes, capable of finding and destroying submarines, or to launch a nuclear cruise missile, has not diminished. As it rounds Norway, the Bear descends below radar coverage and continues on its mission, to test Britain's air defences. Now at low level and pointing straight at Scotland's capital it is only a matter of time before it reaches simulated firing range for its cruise missiles. Suddenly the aircraft's radar-warning receiver sounds its alarm. Looking outside, a fully armed Tornado F3 Fighter sits just off the wing, flying at the same speed, holding formation. The Bear climbs and turns back to home escorted by the Tornado F3; Britain has passed the test! This, however, is no Tom Clancy novel, nor a Steven Spielberg film, but is very much reality. It is a game of cat-and-mouse that has been played many times throughout the Cold War, and, it may surprise many readers to know, it is still being played today.

So what happened between the Bear taking off and being intercepted by the Quick Reaction Alert (QRA) aircraft?

The History

Whilst the use of a military reaction force, capable of responding to an enemy's actions, has been around for centuries, its first use in the airborne environment occurred during the First World War. The arrival of airships over Britain from 1915 onwards made a deep impression on the civilian population and, in response, British night-flying aircraft were deployed to try to intercept them. On 3 September 1916, a BE2c biplane piloted by Lieutenant William Leefe Robinson shot down Zeppelin SL11, and this heralded one of the very first recorded intercepts against an enemy aircraft. In 1917, German Gotha bombers began formation bombing raids over London, leaving air defences totally unprepared. Consequently, tactics were further developed to enable our aircraft to intercept them.

World War II saw a vital shift in the role of air power, and it soon became apparent that the use of air power could have a significant influence on an enemy's ability to wage war. This was demonstrated during the German Blitzkrieg strategy in which aircraft were used as 'flying artillery', and overwhelmed the Allied defences. In response, Britain developed the world's

- RAF LEUCHARS

most sophisticated air defence network. This, although very basic by modern standards, consisted initially of lookout posts manned by the Royal Observer Corps, which were set up along the coastlines, in cities and around other strategic areas of importance in the UK. By the start of the Second World War, the forefront of our defences was our new secret weapon - RADAR. Known as Chain Home Stations, these aerial farms were dotted all around our vulnerable coastline and could pick up enemy aircraft up to 120 miles away. Radar operators sent information into a central Headquarters where it was forwarded to people in an operations room. Members of the Women's Auxiliary Air Force used this information to build a strategic air picture by moving wooden blocks around a map. Controllers who stood above these maps then decided when and where our forces would meet the Luftwaffe and in what strength. Controllers at sector level could then scramble Hurricane and Spitfire squadrons and direct them onto their targets by radio. This system came into its own during the Battle of Britain, and enabled the RAF to utilise its scarce resources and defeat the numerically superior Luftwaffe. World War II had shown exactly what a country could do to its enemies with command of the air.

Following the end of the Second World War, air defence squadrons assumed a much more relaxed status. However, as the Cold War advanced there became an impetus for the development of a more substantial air defence system. With the advent of jet technology, QRA took on an extra dimension. Not only did QRA involve launching aircraft to intercept an enemy, but also to launch waves of aircraft, such as the Vulcan bomber, to unleash a nuclear salvo upon the Warsaw Pact. From 1950 onwards, aircraft were placed on 30-minutes readiness to intercept intruders, which had been spotted by radar. Initially Meteor aircraft performed the task, and then the Hunter; however, these aircraft had a very limited range and endurance. 1951 saw the advent of night jet-fighter interception flights with the introduction of the De Havilland Vampire NF10. In addition to the Vampire, the night-fighter flights were undertaken by Meteor NF 11-14 and latterly Javelin FAW5-9 aircraft.

QRA as we know it today was developed after the introduction of the Lightning in the early 1960s. 74 Squadron formed at RAF Leuchars in February 1964, converting to the Lightning Mk6 in August 1966. The QRA 'sheds', where the QRA aircraft stood on readiness at the side of the runway, facing east, were constructed in 1965. Shortly after this, the maximum scramble time was reduced to just 10 minutes. In 1966, 74 Squadron introduced the use of 35mm still photography to keep a record of anything that was intercepted, which could be

used as a source of intelligence. The QRA aircraft at Leuchars still carry wet-film cameras today for exactly this purpose.

By the early 1970s, Northern and Southern Air Defence Regions had been established, the Northern being patrolled by aircraft from RAFs Leuchars and Binbrook and the Southern from RAFs Coningsby and Wattisham. The McDonnell Douglas Phantom was the next aircraft to hold QRA, serving with 43 and 111 Squadrons at RAF Leuchars. In the late 1990s, the number of QRA bases was reduced to just two in support of the NATO QRA commitment, equipped with the Panavia Tornado F3.

The Modern Solution

So how is QRA done today at RAF Leuchars? The idea itself sounds really simple; you have a fighter crew connected by telephone to a radar operator. If a potentially hostile aircraft crosses a certain airspace boundary, then the order to scramble is given, pilots and weapons systems officers run to their aircraft and launch into the sky. All you need is a fighter aircraft, a ground based radar and enough people on duty to operate them. Unfortunately the task at hand is not that simple! A fast jet will take a finite amount of time to travel across the UK's airspace, and it requires more than one radar-head to coordinate and scan an area the size of the UK.

There are radar sites all across the UK, tracking all incoming air traffic. Let's put that into perspective: at Heathrow an aircraft is taking off or landing every minute, so that is 600 aircraft in a 10-hour period, you also have Gatwick, Luton, Stansted, Manchester and Newcastle International airports to name a few, as well as all the smaller regional airports. Now take all the aircraft that are just over-flying the UK to destinations in Europe or North America. Add that to all the recreational traffic, oilrig ferry flights, police and air ambulance helicopters and the number becomes more in the region of 6000 in 10 hours. Now try and spot the Bear! Well that's exactly what a fighter controller has to do.

NATO airspace and the responsibilities for it are divided up into Command Air Operation Centres (CAOCs) and the UK portion of that airspace is controlled by CAOC 9, a department located in the depths of Headquarters Strike Command at High Wycombe. Commanded at Air Marshal level, the instructions and policy regarding the defence of our airspace originate here. However, it is the radar stations manned at RAF Buchan, in Scotland, and RAF Neatishead, in Norfolk, that are the all-seeing eyes, watching over the airspace. Fighter controllers are on duty 24 hours a day. The Master Controller at the duty Control Reporting Centre (CRC) would be alerted first by a fighter controller who had spotted something untoward. What is it? Where has it come from?

Who should be in radio contact with it? Where is it heading? If the contact warrants further investigation the Master Controller would then contact the QRA station, by telephone initially, to alert the crew. Then, CAOC 9 would be contacted by data link, shown the track information, and they would then formulate a plan. Should the situation be more urgent, the crew would be scrambled immediately and be given details by Telebrief, a fixed line, that broadcasts direct to the Station Operations room, Air Traffic Control, the QRA building and the QRA aircraft cockpit simultaneously.

Fortunately, the lessons learnt over the past 100 years have left us in good stead. Everyone concerned now knows what to do and the well-oiled machine winds up. If the aircrew are given prior warning of a possible scramble this allows them to come to 'Cockpit ready' status. Fully kitted-up and strapped in, the pilot and weapons systems officer have the aircraft powered up, ready to start the engines and taxy right away. This would happen if a radar contact was made by the CRC but too far away to be of concern, or if another country had made contact and was expecting to hand over control of the incident to the UK once the unknown aircraft approached our airspace. The message to scramble comes in a fixed format and contains all the initial information the QRA crew need to start heading in the right direction. This message also contains one of the following instructions:

1. Intercept: to get into a favourable position relative to the unidentified (bogey) aircraft and await further instructions.
2. Shadow: follow the bogey at a safe distance.
3. Identify: to close to a distance that allows visual identification of the bogey, its type, markings, and weapon load.
4. Intervene: to actively demonstrate to the bogey that he is to comply with the internationally recognised procedures for interception.
5. Engage: the aircraft is hostile or is known to have hostile intentions and must be destroyed.

QRA: A Day In The Life

The day for the aircrew starts at nine am and lasts for 24 hours; however, the engineers allocated to QRA will be on duty for 7 days. All three Tornado F3 squadrons at RAF Leuchars, Nos 43, 111 and 56(R), share the aircrew and engineering manning. The first event is the handover brief: the on-going crew is briefed on the current airfield, weather and intelligence states that could be a factor should a scramble be declared. Once this handover process is complete, the aircrew don or pre-position equipment near the aircraft and the waiting begins.

QRA operates from a purpose-built site that encompasses everything required by the whole team. With the set-up centred on the necessity to get an aircraft airborne in a very short time, the aircrew and ground crew remain on site for the duration of their duty, ready to spring into action at any time of the day or night. They therefore rely on the rest of the sections to provide the necessary support. The QRA building, located next to the Hardened Aircraft Shelter, has a crew room, bedrooms, and places for personnel to relax by watching TV, reading or playing games and also offices where the paperwork mountain can be tackled during the quiet hours. Since journeys across the airfield to the shop or to the Mess for lunch are not an option, the meals are prepared in the QRA kitchen by a resident chef and eaten on-site. Dry rations are available at other times for snacks.

Not only are there people ready at the aircraft site, but also there are a host of sections on duty, or on call, at RAF Leuchars to contribute towards the QRA process at any given time. These include Air Traffic Control and the Station Operations Room, which are manned permanently and have similar facilities to the QRA building to accommodate duty personnel at all times. Safety Equipment fitters are ready to replace or repair any of the aircrew equipment assembly, such as microphones or oxygen masks. The Meteorological Office updates the aircrew on the weather situation they are likely to encounter should they scramble. The Bird Control Unit keeps the airfield clear of birds so it is safe to operate from when called for, and the Airfield Arrestor-cable Team and Ground Radio Section maintain the airfield facilities. Fire and Crash Rescue cover is available should the worst happen as the aircraft gets airborne or as it recovers and, after landing, the Photographic Section is at hand to develop any film the crew has of the intercepted aircraft.

Assuming there is no prior warning, then the scramble can come as a surprise. The Telebrief blares out the scramble message; the aircrew jump from their seats in front of the TV or throw down their book and wrestle with immersion suits and life jackets that are only ever an arm's length away. With the intercept location potentially several hundred miles out over the sea, any chance of ejecting from the aircraft is not taken lightly and crews must always be fully dressed to survive the most unlikely of events. Regardless of the weather, a scramble sortie with air refuelling can last about eight hours. The full airborne outfit constitutes thermal underwear, a full body 'woolly bear' suit, internal anti-G trousers, external immersion suit and a life jacket. The helmet and gloves complete the set. However, any time spent donning cumbersome clothing after the scramble message is time wasted. Crews typically wear the undergarments with the outer immersion suit near by or donned, but tied around the waist, while waiting. During warmer weather, thermals and immersion suit are a minimum as survival times in the sea near the Arctic Circle can be short, even at the peak of Summer. Meanwhile, the ground crew rush to the 'shed' in preparation for the crew-in and rapid start-up; the clock is still ticking. QRA is being launched and has only a few minutes to get airborne.

The Scramble!

"Leuchars 69. Scramble. Vector 010, climb angels 200. Contact Buchan primary tad 026, secondary 070. Scramble. Scramble. Scramble. Acknowledge".

The crews acknowledge the scramble call, and run to their aircraft wrestling with their survival equipment. Minutes later they are accelerating through 150 mph and smoothly rotate the fighter off the runway, turning and climbing as directed by the scramble message. Within seconds, their aircraft has accelerated to intercept speed and further information is received about the unknown aircraft approaching the UK's airspace.

"Leuchars 69, Buchan. Bogey, east, bullseye 070/25, fast, low, interrogate".

The crew position the aircraft behind the unknown aircraft and move up into a position to identify it.

"Leuchars 69 tally. Identify one TU-95 Bear. Request instructions".

Moments later the fighter eases itself onto the left wing of the Bear and the one-time Cold War enemies are close enough to see each other. The Bear crew acknowledge the intercept, this is peacetime and they turn for home, the cat and mouse game has been played again. Once more, the Air Defence network of the UK has passed the test.

For the foreseeable future, this round-the-clock vigil is maintained by a coordinated team, ready to implement a process that has been evolving since the advent of aircraft. Today we know it as QRA and regular practice ensures that the system of protecting our skies is as efficient as we can make it. The not-too-distant future will see the introduction of Typhoon F2 aircraft in the QRA role, allowing the practice of defending the Nation's airspace to evolve in line with the more capable aircraft. Until then, and for every minute in-between, the RAF's Tornado F3 crews, the fighter controllers and a whole variety of other support staff sit and wait.

VC10 TANKER

Operation

In late February 2003, the VC10 Air Refuelling (AR) Wing, made up of crews from 10 and 101 Squadrons based at RAF Brize Norton, deployed seven aircraft and 10 crews to the Prince Sultan Royal Saudi Air Force Base, 60 miles south east of Riyadh, to support offensive operations in the Gulf. Because of the superb forward planning, good prioritising, and can-do attitude of the RAF detachment which was already there, we were able to declare ourselves operational on 3 March 2003.

Prior to the outbreak of hostilities, the Wing had been flying in support of the policing operations of the southern Iraq No-fly Zone, but our first war mission on the evening of 19 March signalled a rapid increase in our tasking rate. The daily average increased from three missions to eight or nine a day, as we helped to provide 24-hour AR support to the Coalition air forces. We were also down to six aircraft and nine crews, as one aircraft had been transferred to RAF Akrotiri, in Cyprus, to operate in the aeromedical evacuation role. By the end of the month, our tankers were routinely operating across the Iraqi border, which was a radical change from the first Gulf War, when the VC10's lack of missile-warning equipment and little or no self-defence equipment meant we always operated on the friendly side of the border. Although the airspace north of the border was deemed to be safe, the 'concentrated thrust' of the ground campaign meant we were operating over ground which had not been completely cleared by friendly forces. Surface-to-air firing by roaming enemy troops was always a risk, but such events were fairly unusual and rarely very accurate. Day-by-day, the AR tracks moved further and further north until we were operating close to Baghdad and could see in the distance the fighting around the city.

As the war progressed, our tasking in support of Coalition air forces became more varied and we were required to respond, often at short notice, to constantly changing patterns in the air picture. Missions were always pre-planned, but it was the AR flexibility we were able to offer that made life so interesting, as we never knew what was 'around-the-corner' once we were airborne. No two sorties were ever the same, but a typical sortie would have been conducted along the following lines.

11:30 pm. The accommodation area is away from the airfield, so the crew take a 25-minute shuttle-bus trip to 'Operations Town', where the main briefing facilities are situated.
0:10 am. The mission folder is collected from Operations and initial mission planning is completed.
0:20 am. Prior to finishing the mission planning, we attend a USAF intelligence briefing, which brings us up-to-date with the latest war situation both on the ground and in the air.
0:45 am. With mission planning complete, we remove all personal effects from our clothing, hand in our RAF ID cards, collect our War ID cards and complete the Combat Search and Rescue documentation.
1:10 am. The final crew briefing is carried out in the presence of the authorising officer. The authorising officer is normally on duty in the operations room for a 12-hr period and is fully up-to-speed with the latest developments of the war and the nature of our mission. His role is to ensure our mission preparation is correct and thorough and that crews are in good physical and mental condition to fly.
1:15 am. The crew bus takes us across the airfield to the flight line, to board the aircraft allocated for tonight's mission.
1:20-1:50 am. Pre-flight checks of the aircraft are completed, engines started and we taxy out at the allotted time, making sure we are in the correct position in the take-off queue.
2:00 am. Airborne. We join the designated air-transit routes detailed in our mission plan and start the transit flight to our AR operating area.
2:10 am. The Joint Tactical Information Distribution System (JTIDS) is switched on. Most of the transit time is spent monitoring both the onboard aircraft radar display and the JTIDS, to ensure we do not collide with other friendly aircraft in what is a very busy piece of airspace.
2:20 am. We change radio frequency to our Airborne Early Warning and Control System (AWACS) aircraft and contact its commander with our callsign and our mission details.
2:30 am. As we approach the Iraqi border we carry out the 'hostile-action' checklist, but leave the aircraft lights on full brightness (at this stage, the risk of collision with a friendly aircraft is a higher risk than that posed by enemy ground fire).

TELIC

Squadron Leader Hugh Davis

3:10 am. We are now established on our AR track north of the Iraqi border. JTIDS is used to spot our in-coming fast-jet receiver aircraft; on this occasion, they are four RAF Tornados heading north for a strike mission near Baghdad. Once we identify the formation we make sure we are in the correct position to effect a speedy join-up.
3:30 am. The first refuelling serial is complete and the Tornados leave to continue with their mission. As the Tornados are due to come back to us after they have completed their task, they are tracked with JTIDS. As long as the Tornados stay in AWACS cover we will be able to maintain a range and bearing on them, allowing us to follow them wherever they go. The JTIDS can also be loaded with the airspace plan to give us an instant pictorial presentation of the airspace, including our own position and that of other aircraft.
3:40 am. We hear a pair of fighter aircraft returning that are very short of fuel and are urgently looking for a probe-and-drogue tanker. As we have spare fuel onboard and are in a good position to help, we offer our services to the controlling AWACS aircraft. The AWACS commander gives the fighter aircraft vectors to our position, but the weather is poor and the fighters are having trouble finding us. The JTIDS chooses this moment to fail and has to be reset. After a lot of weaving about the sky, we finally manage to get the fighters on our wing, but the join-up has taken too long and the fighters do not have enough fuel to attempt an AR contact. So, with a 'thanks, but no thanks', they head off to their diversion airfield. We watch them go with a heavy heart, and a feeling of frustration at not being able to make a timely contact. We sit back to wait for our next trade: two US Navy EA6B Prowler aircraft on a pre-strike serial, but they are not due to be with us until 4:00 am.
4:00 am. One of our two EA6Bs arrives; there is no sign of his buddy, but two F18 Hornets are asking if they can join with him. A chat over the radio reveals we will only be getting one EA6B, and that the two F18s are on their way home and want a small top-up to give them some extra holding time when they get back to their aircraft carrier. As the F18s do not want much more than the missing EA6B was going to take, we are happy to oblige. The EA6B plugs in and we start doing some calculations to work out when we need to turn north during the refuelling so that the EA6B is fully topped up at the northern end of the AR track. The F18s are very laid-back, and are happy to sit on our wing waiting for the EA6B to finish. As soon as the Prowler has departed, we start turning south again and signal with our lights for the Hornets to go astern. They quickly make contact and we continue the turn to roll-out southbound so they can join their transit route back to their carrier after they have finished refuelling.
4:18 am. The F18s have had their gas and gone. Time for a cup of tea while we wait for our next set of receivers (the RAF Tornados we refuelled earlier) to come back to us at 6:30 am.
4:20 am. JTIDS tells us that our receivers are inbound. They are coming back early. We start heading towards the northern end of the track to shorten the distance they have to fly to join up with us.
4:24 am. Our first group of receivers are now back on our wing and one pair still have their weapons on board. Change of plan. The first pair want to go home as planned, but the second pair want as much gas as we can spare, so they can go back on task and then return 45 minutes later for a post-strike refuel on the way home. Rapid calculation shows we can just about manage to refuel the second pair before they go back on task, but we know that we will not have enough fuel to wait for them to come back again after their mission.
4:26 am. The guys going back on task are getting a bit low on gas, so we agree to give them 1000kgs each to enable them to hold with us while we fill up the homeward-bound pair and try to work out where we are going to get the extra fuel from. The AWACS controllers have their hands full at the moment sorting out another problem following a surface-to-air firing incident on an adjacent AR track, so they are too busy to help us sort out our problem.
4:30 am. We swap the receivers around to pass fuel to the pair heading home. Meanwhile, the captain is studying the Air Tasking Order (ATO) to try to find another tanker with spare gas; we always carry the entire ATO for our mission period, plus a bit either side, for exactly this eventuality. Our weapons systems officer (WSO) has resurrected the JTIDS, and is busy searching for other RAF tankers that may be able to help.
4:37 am. One pair of Tornados is now on the way home; the other pair is back in contact again taking on more fuel. The copy of the ATO we

carry shows another VC10 tanker is airborne, but it seems unlikely that he will have any spare gas - a radio call confirms our thoughts. The WSO searching the JTIDS spots a Tristar tanker heading home to Bahrain - a check of the ATO finds a callsign for him and we give him a call; no luck again - he has very little fuel left and he needs to get back on the ground as quickly as possible to refuel and turn around for the next task. We banter with him about being more interested in getting back to the bar (we live in a very non-alcohol environment in Saudi Arabia, while the Tristar crews based in Bahrain can retire to a bar when they are off duty), and bid him farewell. We start examining the ATO again: there is nothing else showing on JTIDS except two USAF KC135s and the ATO shows they are both 'Flying Boom' tankers, which are not suitable for our Tornados. The only other VC10 we can find on the ATO will just be getting airborne from Prince Sultan Air Base (AB). We see from JTIDS that a towline north of us is empty at our height, and ask the Tornados if they want to head north so we can leave them full of fuel as far to the north as we can go. They agree. Our AWACS commander still has his own problems, but gives us permission to head north.

As we turn north, the WSO scans the JTIDS picture south of us to see if he can see the other VC10 tanker climbing out from Prince Sultan AB. Amazingly, it's already halfway up the transit corridor, and must be running at least 15 to 20 minutes early. We measure his range on JTIDS and decide he is close enough for a radio call. It seems the Combined Air Operations Centre scrambled him early to meet some other receivers and he has the gas and the time to refuel our Tornados after their strike mission as most of his original AR plan has been cancelled. We ask him to confirm that he is still going to the AR track stated in the ATO, but we find he is going to another track. We pass the information to the Tornados. They are happy with the change in arrangements, so we confirm with both the tanker and the Tornados the

details of the new rendezvous time and position and fuel load required to make sure they are all 'singing from the same hymn sheet'. The JTIDS picture is now scanned north again to cover our entry into the new AR track. There is a USAF KC135 flying 4,000 feet above our level with a pair of F15s inbound to him. Further north and out to the east we can see more fighters on combat air patrol, and below them more fast-jets inbound to targets around Baghdad.

4:42 am. The Tornados are still taking gas, but we are fast approaching our own minimum fuel state. A quick decision is made to abandon the holding-fuel requirement for our return to Prince Sultan AB, and, as the weather there is good, we also nominate a diversion airfield which is closer to Prince Sultan AB than our original, planned, diversion airfield. This enables us to give more fuel to the Tornados. We check to see how much more fuel they think they are going to want and are relieved to find that the extra fuel we have allocated them will meet their needs.

4:45 am. The Tornados are full and depart on their mission. We are down to 500kgs above our minimum fuel requirement, so we get permission from the AWACS to head home after giving him details of the new AR rendezvous we have arranged for our departing fighters. We start climbing to a higher level to save fuel (jet engines are much more fuel-efficient at high levels) and to make any trigger-happy Iraqi's job harder, and head south to join the transit corridors home.

5:45 am. During the recovery to Prince Sultan AB we are told we are number seven in the queue to land and that we are to enter the holding pattern to await our final approach clearance. We advise the controller that we only have eight minutes holding fuel remaining and that by the time we actually get to the hold we will not have any holding fuel left. Immediately, we are told we are now number two to land and are given vectors for the final approach to the runway to follow behind an EA6 aircraft which has been cleared to land.

6:05 am. We finally land and after taxying to the refuelling pits we hand the jet over to our ground crew. Fortuitously, we have not broken anything so the engineers are in a good mood! They are more pleased than we are that our landing was not delayed, as one of our other VC10s needs an engine change, so our aircraft is needed urgently for a quick turn-round.

6:30-6:50 am. We complete the post-mission report and final debriefing in Operations, collect our personal effects, wallets and ID cards, and walk to the bus stop to catch the shuttle-bus home for breakfast. Another busy day is over.

By the end of the war, the six aircraft of the VC10 tanker detachment had flown a total of 223 missions over a period of 46 days, with an average sortie length of 4 hours 35 minutes. Our success rate was 100% - we did not lose any sorties due to aircraft unserviceabilities, which is a deserved tribute to the hard work and dedication of our ground crews, who kept these old aircraft flying in very difficult conditions. We flew a total of 1,024 hours and transferred 3,715 tonnes of fuel, a quarter of which was given to the US forces. JTIDS was a great success, but software failures made it lock-up far more frequently than we would have wished; however, on two occasions it saved us from possible mid-air collisions, so I remain an ardent JTIDS fan! From a personal point of view, it was a great pleasure to have taken part in an operation, which was well led and well supported. Furthermore, one aspect that was appreciated by all members of the RAF AR Wing, both aircrew and ground crew alike, was the sense of identity generated by being one unit with a common purpose.

As a final comment, I must pay tribute to the support staff at Prince Sultan AB. We tend to forget how reliant we are on their support to help us get our job done. Guys, you were really great; you got it absolutely right and we owe you a big thank you.

JOINING

Acknowledged as one of the world's premier aerobatic teams, the RAF Aerobatic Team, more commonly known as the Red Arrows, exists to promote the RAF's corporate image, to contribute to Defence Diplomacy and to support wider British interests through the promotion of British industry overseas.

THE REDS

Rachel Voigt

Commanded by Squadron Leader Carl 'Spike' Jepson, the Squadron consists of over 100 officers and airmen or airwomen who are selected from personnel serving in the RAF. Approaching their 40th display season, the Team has now performed over 3,700 displays in 52 different countries. All nine Red Arrows display pilots are fast-jet pilots selected from front-line RAF squadrons. The current Team includes pilots from Jaguar GR3, Tornado GR4, Tornado F3 and Harrier GR7 squadrons. To be eligible for selection, pilots must have flown a minimum of 1,500 fast-jet flying hours, have completed at least one tour of duty with a front-line RAF squadron and have been assessed as above average pilots in previous flying reports. Competition is intense; between 35 and 40 pilots apply each year for the two or three display-pilot vacancies.

The selection process is unlike any other in the RAF as the decisions are made democratically by the Team members, guided by the Team Leader. To reduce the 35 to 40 applicants to a more manageable shortlist of nine candidates, the Team Leader first reviews the flying reports of every applicant, dating back to their very first RAF flying sortie. This gives a reliable overview of each candidate's capabilities, strengths and weaknesses. Following this initial review, each candidate is discussed in detail by the Team members and nine are chosen for the next stage of the selection procedure.

The nine shortlisted candidates are invited to spend a week on the Squadron with the Team. This 'Shortlist Week' enables the Team to examine potential candidates for their suitability as Team pilots, as suitable ambassadors for the RAF and as team players. The Shortlist Week can be somewhat daunting as it means that the candidates are under constant examination, both professionally and personally, throughout the period. For Flight Lieutenant Dan Simmons, who was a first-year pilot with the Red Arrows in 2003, the experience of Shortlist Week is a vivid memory. 'You feel as if you are under a microscope, 24 hours a day, for seven days solid. I remember being incredibly self-conscious the whole time, knowing that my every word and action was being analysed. I lay in bed every night re-living

everything I had said, thinking of the far more intelligent contributions I could have made!'

An important part of Shortlist Week is the flying test. Skill and experience have already been determined by detailed examination of previous flying reports; therefore, the flying test is designed to measure the applicant's aptitude for formation aerobatic flying and to measure their capacity for learning. With a limited period of Winter training available

to prepare for the following year's season, it is vital that all pilots can learn the display sequence in that same limited period. Candidates are put through their paces by the Team Leader and the Squadron's Executive Officer. 'I was extremely nervous', remembers Dan Simmons, 'all nine pilots on the shortlist were given the same tasks. We began by being shown the correct formation references to fly a loop in 'Diamond' formation. We were then asked to perform the manoeuvre again, and it was our learning curve that was being assessed: in short, how quickly were we able to improve our performance. This was followed by two rolls, also in Diamond formation, and two loops and two rolls in 'Battle' formation. The whole process is somewhat alien to normal fast-jet pilot operations because you are flying from the back seat of the aircraft, a position that is unfamiliar to most of us. RAF pilots are always taught to be exceptionally self-critical and, as a result, all of us were absolutely convinced we had not done very well at all.'

Another major event during Shortlist Week is the formal interview. The interview panel consists of the Commandant of the Central Flying School (CFS) (as the Red Arrows' operations fall within his area of responsibility), the CFS staff Wing Commander who acts as senior flying supervisor for the Team, and the Team Leader. The interview is designed to explore the candidate's motivation for wanting to join the Team, their understanding of the Team's role, and their ability to act as ambassadors for the RAF. 'The last formal interview I underwent was when I applied to join the RAF, over 10 years before', said Dan, 'so I was not particularly looking forward to the experience. The kind of difficult questions that you get asked at a Red Arrows interview have become part of RAF folklore, so I was well aware that it would not be an easy part of the selection process.'

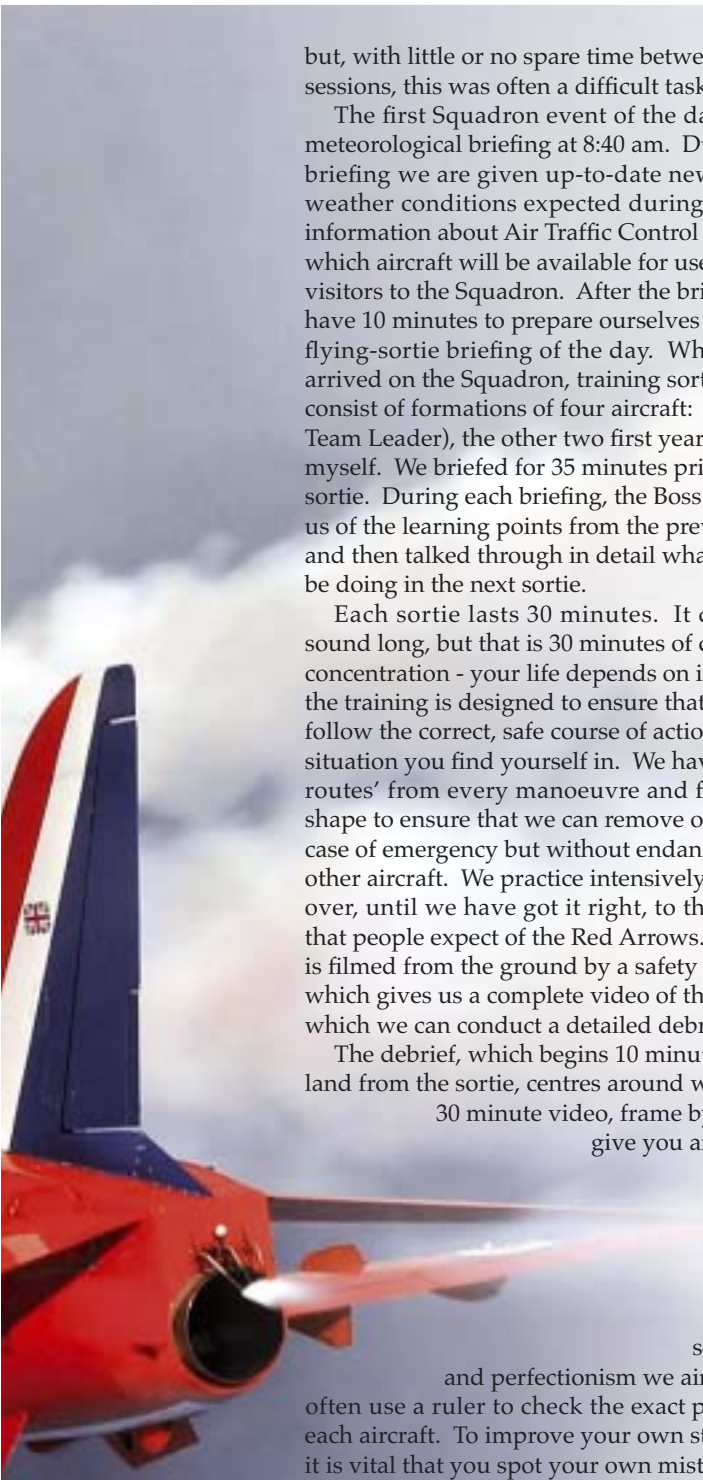
During the week spent with the Team, the candidates also fly three times a day as passengers during the current Team's practice sessions. This gives the candidates a better idea of the kind of flying they would experience if they were successful in joining the Team, and it tests their ability to cope with an intensive and physically-exhausting flying schedule. After the working day finishes, the candidates participate in a carefully-designed social schedule with the current Team pilots. 'Teamwork is just as important an element as flying skill in completing a safe and successful season of displays', says Team Leader, Squadron Leader Spike Jepson. 'When you are flying high-speed aerobatics as close as six feet apart, you must have absolute faith and trust in your team-mates; and when you spend a huge proportion of your time together on the ground, you must have good personal relationships. For these reasons, an essential aspect of Shortlist Week is social time, getting to know the candidates personally. Spending time with them for seven days is a good way of ensuring that you get to see the real person, rather than seeing an 'interview persona'.'

After the seven days are over, the candidates return to their squadrons and the thorough and sometimes-difficult process of democratic Team decision-making begins. No outsider has ever been admitted to this process. Once a final selection of three pilots has been made, all the candidates are telephoned personally by the Team Leader to inform them of the decision. 'I heard that I had been successful five days after Shortlist Week ended', said Dan. 'I had wanted to join the Red Arrows since the age of five, and it was the most amazing feeling. I was convinced that I would not be selected and it took a long time for it to sink in - for most of my first year on the Team in fact!'

The next stage for the three new team members is a period of refresher training at RAF Valley. All RAF advanced fast-jet training is done on the Hawk TMk1, the aircraft also flown by the Red Arrows, so all new Red Arrows pilots will have flown the aircraft intensively earlier in their RAF careers. However, they will have flown a different front-line aircraft since then, and a degree of re-familiarisation with the Hawk is necessary. Once this conversion course is complete, the pilots join the existing Team for the last few weeks of the current display season. This gives them useful experience of the life of a display pilot, and of some of the Red Arrows' standard operating procedures.

Training begins in earnest the day after the three departing pilots leave the Team, generally in mid-November. Winter training is intensive, and lasts for between six and seven months, until the beginning of the display season in May of the following year. Dan remembers his first Winter training season: 'I can honestly say that the Winter training period was the hardest I had ever worked in my life. I spent most of the time thinking "I am never going to be able to master this; I am going to be the only Red Arrows pilot who did not make the grade." It is difficult to explain how physically and mentally exhausting the whole process is.'

'During Winter training my day started at 7:15 am when I left home to drive to work. I then spent the first few minutes in the office catching up with some of my secondary duties. We are each given tasks unrelated to flying, but which assist with the general running of the Squadron. The most time-consuming secondary duty I had last Winter was coordinating the supply of framed prints which the Team Leader presents to the visitors we host each day, and ensuring that the other pilots provided the hundreds of autographs that are requested from the Team each week. It sounds fairly simple and straightforward



but, with little or no spare time between training sessions, this was often a difficult task!

The first Squadron event of the day is the meteorological briefing at 8:40 am. During the briefing we are given up-to-date news of the weather conditions expected during the day, information about Air Traffic Control procedures, which aircraft will be available for use and any visitors to the Squadron. After the briefing we have 10 minutes to prepare ourselves for the first flying-sortie briefing of the day. When I first arrived on the Squadron, training sorties would consist of formations of four aircraft: the Boss (the Team Leader), the other two first year pilots and myself. We briefed for 35 minutes prior to each sortie. During each briefing, the Boss reminded us of the learning points from the previous sortie, and then talked through in detail what we would be doing in the next sortie.

Each sortie lasts 30 minutes. It does not sound long, but that is 30 minutes of complete concentration - your life depends on it. A lot of the training is designed to ensure that you can follow the correct, safe course of action whatever situation you find yourself in. We have 'escape routes' from every manoeuvre and formation shape to ensure that we can remove ourselves in case of emergency but without endangering any other aircraft. We practice intensively, over and over, until we have got it right, to the standard that people expect of the Red Arrows. Each sortie is filmed from the ground by a safety cameraman, which gives us a complete video of the flight from which we can conduct a detailed debrief.

The debrief, which begins 10 minutes after we land from the sortie, centres around watching the 30 minute video, frame by frame. To give you an idea of the level of self-criticism and perfectionism we aim for, we often use a ruler to check the exact position of each aircraft. To improve your own standards, it is vital that you spot your own mistakes, and the culture of the debrief is of full, frank, honest appraisal. It is in your interests to hold up your hand for your mistakes - and if you have not spotted something, someone else will have! I think that visitors who sit in on a debrief are quite shocked sometimes about how frank we are with each other; it is certainly not a process for shrinking violets. But it is a professional discussion; personality does not enter into it.

We then have about 30 minutes before the process starts again; a process we complete three times each day. Lunch is generally a tuna sandwich on the run! After the last sortie of the day, I take the opportunity to catch up again on my secondary duties, before leaving for home. I was not great company for my family during those first few months of Winter training. My standard procedure was to arrive home, complain about how badly I thought I had done that day, and then immediately fall asleep at the dinner table.

The training routine continues throughout the Winter and most days we have visitors spending the day with us to get an insight into the work behind the scenes. It is always a privilege to explain to visitors how we put together the display, but it definitely adds pressure due to the heavy demands on our time. As our four-ship formation improves, more aircraft are added into the formation and we begin to put individual manoeuvres together to start to build the display sequence for the following Summer's display season. The final sequence is chosen just before Christmas by the Team members. An important milestone is when all nine aircraft fly together for the first time. I remember it as being quite an emotional experience; it was the first glimmer of hope that I actually might be up to the job!

The majority of Winter training is done at our home base of RAF Scampton, in Lincolnshire. However, the weather in the UK is not always compatible with the training we need to do. To practise the looping manoeuvres, for example, we need a minimum cloud base of 4,500 feet. So, to guarantee suitable weather conditions we complete two training detachments at RAF Akrotiri, in Cyprus, where we can be sure of clear-blue skies. Going away as a team also enables us to concentrate entirely on our display flying, without the distractions of 'real life' back home at Scampton.

The second of the two training detachments, known as Exercise SPRINGHAWK, occurs in April and forms the last major period of training before the start of the Summer display season. During this detachment we put the final polish on the display and complete the final work-up prior to our bid to be awarded Public Display Authority (PDA) by our Commander-in-Chief. We need to be granted this display authority before we are able to perform before the public during the Summer months. The Commander-in-Chief spends several days with the Team, both flying as a passenger during training sorties, and then watching the display from the ground. If he is satisfied that our performance is safe, and up to the high standards expected of the Team, he grants PDA. It would be an understatement to say that this is a big occasion for us. As soon as PDA has been granted, it is traditional for the Team to change into the red flying suits worn only during the Summer display season. After six months of self-doubt and worry, sometimes verging on despair, I began to feel like a 'proper' Red Arrow for the first time.'

Post Script: After a successful first year on the Red Arrows, Flight Lieutenant Dan Simmons was chosen to become one of the prestigious 'Synchro Pair', and will fly as Red 7 in the 2004 season.

Number 1 ACC

Operation

So there we were, deployed to the highest point in Cyprus, in mid-Winter, before being re-tasked to southern central Iraq just as the desert conditions reached their most inhospitable. Just another year in the life of Number 1 Air Control Centre!

(How to go from -17ºC to +56ºC in nine weeks!)

TELIC

Wing Commander Bob Jones

To start at the beginning, Number 1 Air Control Centre, or as it is more commonly known 1ACC, was first formed some 39 years ago, but within six months found itself on an operational deployment in support of the British Government's response to the Rhodesian Unilateral Declaration of Independence of 11 November 1965. The Unit deployed to Lusaka, Zambia, from December 1965 to August 1966 and conducted surveillance of the border airspace and controlled the Javelins of 29 Squadron, based at Lusaka and Ndola. And that was it; apart from a brief excursion to support the Falklands War in 1982, there were no more operational deployments! Consequently, the Unit was disbanded in November 1982 and reverted, eventually, to being called Number 144 Signals Unit. However, one of the lessons identified from the Gulf War in 1991 was that the RAF lacked a truly expeditionary air capability. One of many organizational changes that followed saw Number 144 Signals Unit relocate to RAF Boulmer in Northumberland and 1ACC was finally re-established there in 1996.

Today, 1ACC is declared to the UK's Joint Rapid Reaction Force, which means that the Unit's personnel and equipment are constantly held at a high state of readiness so that they can deploy rapidly anywhere in the world to provide a ground-based tactical air command and control capability. For those of you who are familiar with the RAF's E-3D Airborne Warning and Control System, or AWACS, 1ACC has a similar role, but we keep our feet firmly on the ground!

1ACC is now equipped with two Type 101 long-range surveillance radars, data-link capabilities (which provide the ability to send and receive digital data with other ground-based and airborne radar platforms), a wide range of communication facilities and a brand new Tactical Air Control Centre (TACC). This is a state-of-the-art, environmentally protected facility that represents a quantum leap in capability for the Unit. Housed in 10 container-sized steel boxes, the TACC, which was only delivered to us in December 2002, has up to 19 operator positions. We can also take in data-link feeds from numerous other surface-based or air platforms. More importantly, the TACC enables 1ACC to support any long-term operation. All this equipment has transformed 1ACC into a highly capable Unit, able to provide a high level of support and real-time battlespace information to assist an air commander in the vital decision-making process.

So with all this equipment, what is it that we actually do? Our primary purpose is to compile a

Recognized Air Picture (RAP), which means knowing what every flying air-platform is in our designated airspace. If anything flies through our airspace, we will know what it is, where it has come from and where it is going. If we don't, then we use our Weapons Controllers to direct fighter aircraft towards any unknown air-platforms so that the pilots can make a visual identification. To control the fighter aircraft we need to make sure that we have suitable communications and we need to apply the rules of engagement that dictate exactly what we can and cannot do to any unknown air-platform that enters our airspace. Using the integrated data-link facilities, we then pass the air picture to other adjacent units, including naval ships, air platforms (like the AWACS) and higher command centres. With the experience levels on the Unit, we can also provide a tactical air command and control facility to direct the real-time air battle as it unfolds, which has been particularly important during our deployment to Iraq.

So that takes care of who we are and what we do. So how did we find ourselves in Cyprus in January 2003? Well, truthfully - and for once - luck was on our side. With the 'Second Gulf War' military preparations well under way, political developments resulted in the facilities of some neighbouring countries to Iraq not being available to Coalition partners; in turn, this meant that the AWACS could not operate from its established Mediterranean bases. The result was a requirement to provide a surveillance radar in Cyprus, where RAF Akrotiri was to play such a pivotal role as a Forward Mounting Base. Fortunately, 1ACC had already

deployed one of its radars to Mount Olympus, in Cyprus, a number of years ago; and so it was decided that the Unit should deploy to provide a RAP, two Weapons Control operator positions and early warning of any potential air attack against RAF Akrotiri. On 28 January 2003, 1ACC embarked on its first operational deployment for 37 years and 11 months.....

There was something quite surreal about deploying to Mount Olympus in deepest winter, when 99% of all other forces embarking on Operation TELIC were being sent into hot, desert conditions. Nonetheless, the snow-fall (incidentally, the worst on Cyprus for 15 years) was something different, although days upon days of blizzard and 'white-out' conditions provided just as much of a challenge as working in desert sandstorms. The coldest temperature that we endured, in the wind-chill, was recorded at -17°C. However, the work routine was quickly established and we declared a Full Operating Capability on 12 February 2003. From then on, we provided an air picture to the higher command headquarters in Cyprus, the Wing Operations Centre at RAF Akrotiri and to the US Navy's 6th Fleet which was operating in the eastern Mediterranean. Initially, we had expected to provide an aircraft control service to the small contingent of RAF aircraft based at Akrotiri. However, the unavailability of bases in Turkey resulted in a large proportion of the USAF's air refuelling aircraft relocating to Cyprus which, in turn, provided considerably more control work for 1ACC than we had anticipated. With two US Navy Nimitz-class aircraft carriers in the area, each with its own combat air group on board, the work-up (the phase of the Operation leading up to hostilities) was intense, but through good coordination with the US Navy, we provided all that they required. For much of the war-fighting period we continued to provide a RAP and controlled all wide-bodied military aircraft operating from RAF Akrotiri and, in the space of six weeks, controlled over 1500 missions.

Meanwhile, as the fighting continued, 1ACC was already being considered for a further task in the post-conflict phase of the Operation. The US Central Command was eager to stand-down a number of the US ground-radar units that had been heavily tasked since the beginning of the 'War on Terrorism' in October 2001. Through the UK's Permanent Joint Headquarters, the order came for 1ACC to deploy to Iraq. With 1ACC's task in Cyprus complete, the Unit returned to RAF Boulmer, on 30 April 2003, for a quick period of recuperation, training and re-kitting before redeploying to Iraq in mid-May 2003.

Tallil Air Base, a former Iraqi Air Force airfield, was to be our next destination. Tallil sits on the edge of the Euphrates River flood plains and is surrounded by arable land. Tallil, however, sits in a dust bowl - dust that is frequently whipped up into what the locals refer to as 'simooms', tornado-like winds that provide a fascinating sight. The same cannot be said for the sandstorms, which at that time of year can last for days at a time and reduce visibility to 200 metres or less. Just to the

north of Tallil Air Base is the temple of Ur, a fine Mesopotamian example of a Ziggurat (a stepped temple platform) and is purportedly the birthplace of Abraham (the 'Great Man of the Old Testament').

Within the airfield, the infrastructure had been heavily damaged over the course of both Gulf Wars, but the runways were left in remarkably good condition. US forces entered Tallil towards the end of March, secured the airfield and pushed the battle on through the local town of An Nasiriyah, six kilometres north of Tallil. By the time 1ACC arrived, the official war-fighting had finished, although no one seemed to have told the Iraqi forces, and sporadic fighting was still going on 'outside the wire', although becoming more and more sporadic. The threat was still very real, witnessed by the constant movement of armoured road-convoys moving into and out of the Air Base and aircraft crews using the airfield at night with only night-vision goggles to assist them.

The 1ACC advance party was deployed to Tallil Air Base on 16 May, with the main party of personnel and equipment deploying between 21 May and 3 June 2003. We sited the radar in the north west sector of the airfield and placed the TACC inside one of the disused Hardened Aircraft Shelters that had been damaged during the First Gulf War, about half-a-mile south of the radar. With the trickle feed of equipment, the detachment was quickly able to build the radar, establish the TACC and concentrate on getting the equipment into a serviceable condition. One of the most significant challenges facing us was the incessant heat. Not the high 30°C to low 40°C temperatures we had been told to expect, but the high 40s and low 50s we found ourselves working in. We needed to drink a minimum of six to eight litres of water a day to avoid dehydration and we lived off 50-man ration packs - food designed without flavour but to stop you from feeling hungry three times a day! It is a credit to all the pre-deployment training that 1ACC and attached personnel undertook, that no one suffered the effects of heat stress or dehydration.

Through all this, our engineering crews managed to get the radar working so I could declare an Initial Operating Capability on 31 May. It took another week to get the last elements in place and we declared a Full Operating Capability at 4:00 am on 8 June. The following days were not without significant engineering challenges as, in those early days in Tallil, the air temperature consistently reached over 50°C. In fact, on the afternoon of 13 June, the ambient air temperature on the airfield reached a staggeringly hot 56°C by 2:00 pm. With a foretaste of the Summer to come, everyone realised that it would be a constant fight to keep the sensitive equipment cool enough to function. By 10 June, the Combined Air Operations Centre (CAOC) was confident enough in our ability to perform our tasks reliably that they took the decision to stand-down the US Marine Corps Unit we had been sent out to replace.

Over the following days - and nights - and with much ingenuity and guile (many of the solutions would have had Heath Robinson beaming with

pride), our engineers worked wonders and managed to keep the Unit operational. We knew we were in for a difficult time when just as one set of problems was resolved, then another set would appear. Consequently, the numerous air conditioning units that we were using to cool down outside work areas were, one by one, diverted to keep essential equipment operating.

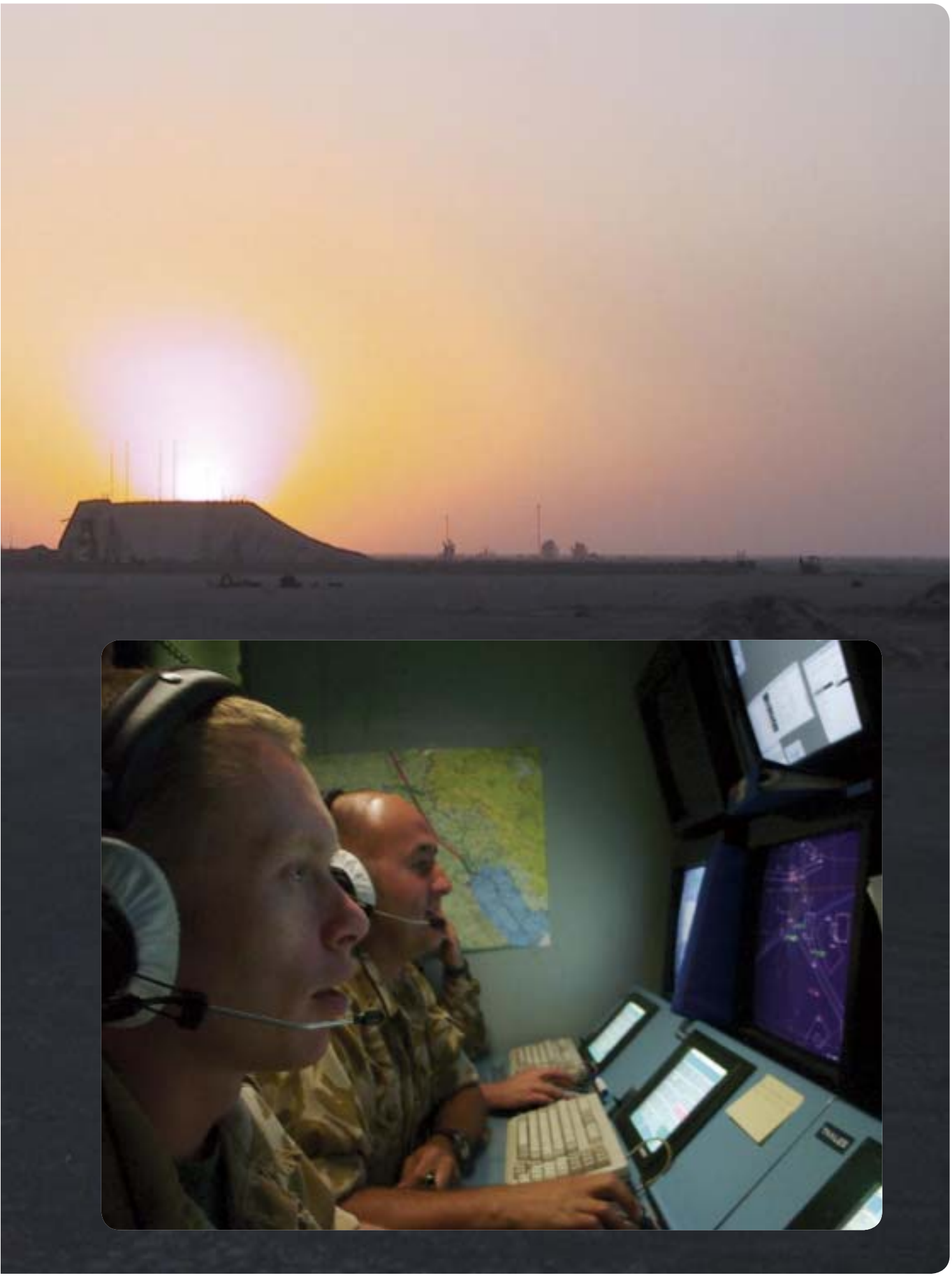
The operational task was demanding but straightforward. It was, after all, what the operations staff had been trained throughout their careers to cope with. The CAOC required us to produce a RAP by conducting a continuous 24-hour surveillance of the southern third of Iraq and provide a control service to all Coalition aircraft operating in that area. The vast numbers of combat and combat-support aircraft that were flying in support of the US ground forces, that were still encountering large pockets of resistance in the central and northern regions of Iraq, needed everyone to be particularly focused on their task. We were also allocated two air refuelling areas to control and much of the non-combat support traffic (such as military air-transport aircraft) also called up 'Crowbar', 1ACC's operational callsign, for a service.

All this provided valuable preparation for the events of 24 June 2003, when a ground incident was reported in the north east of our area of operations. We were tasked by the CAOC to control F-15E and F-18A fighter-bomber aircraft to assist with a situation that had developed to the south of Al Amarah, approximately 80 kilometres north of Basra. By using the air refuelling aircraft to act as a communications relay platform, we were able to stay in contact with the fighter aircraft for much of their sorties and, through an atmospheric quirk, we were also able to speak directly to a British Army helicopter that was also working in the area in support of the mission. The fighter aircraft were instructed on the rules of engagement in force but were only cleared to provide a show of force at low altitude. As the incident had occurred in a built-up area, weapons could not be released by the aircraft because of the high risk of unnecessary harm to civilians or damage to civil buildings.

The weapons control team also dealt with a variety of other incidents that they would not normally be expected to control: such as assisting with Combat Search and Rescue missions for two US Army helicopters and playing a pivotal role in a similar mission that followed the loss of an F-16 fighter-bomber. At the time of writing, we had provided a control service to over 3,500 missions, but it was noticeable that the level of military traffic was beginning to recede as the ground conditions became more benign. As a result, the number of civilian airspace users began to increase and, at last, a degree of normality started to return. However, there was still a significant amount of instability throughout Iraq and there was the possibility that resistance could flare up again and we might be called upon to provide air power to support ground forces.

As our American colleagues would say, 'it's been one helluva year'. 1ACC will continue to support Operation TELIC until our presence is no longer required. The Unit's successful contribution to the Operation has shown that the RAF has another 'string to its bow' to offer a Coalition force of the future. The whole experience has been hugely rewarding for anyone that has been directly involved and we have proved that, under the most testing of conditions in a demanding operational theatre, 1ACC is up to the job.

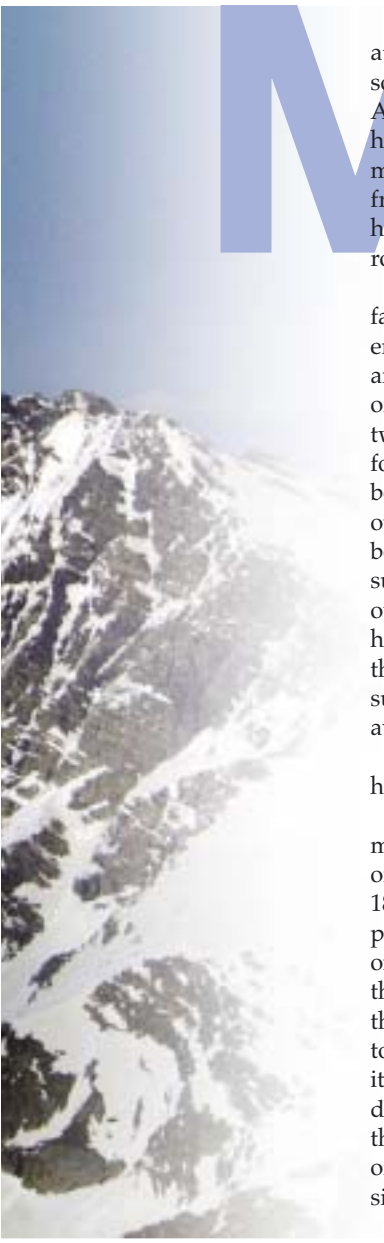
So, that's how you get from -17°C to +56°C in nine weeks.....



SPORT GLIDING WITH

Sergeant Pete Stratten

Gliding silently alongside a sheer, granite rock-face at 7000 feet and glancing across the narrow valley to the deserted, greying ski slopes, Corporal Matt Smith, an RAF technician, ponders his next move.



Matt is on the return leg of a five-hour cross-country soaring flight through the Southern French Alps. Although the 15-metre span, ultra-modern glider he is flying will travel around 40 km for every 1000 metres loss of height, Matt is still some 200 km from his base airfield and needs to cross a 10,000ft-high ridge to progress into the next valley on his route south.

The wind deflected upwards by his chosen rock-face is keeping him airborne, but it is not strong enough to lift him that extra 3000 feet. His options are severely limited. An emergency landing at one of the few remote strips in this area would mean a two-day road recovery via Grenoble; so it is time for maximum concentration. Suddenly, he spots a beautiful sight: an eagle turning effortlessly, wings outstretched, above a nearby rocky outcrop. Even better, the magnificent creature is climbing fast - a sure sign of the up-current that Matt needs. As he over-flies the same south-facing rock, Matt feels his glider surge upwards. Immediately, he mirrors the eagle's turn and as they both spiral up in the sun-warmed rising air he watches the mountain fall away beneath him.

But how does he stay airborne, and travel hundreds of miles without power?

The air flowing over the wings of an aircraft moving through the sky provides the up-force, or lift, that supports the weight of the aircraft. A 180-tonne jumbo jet will need to fly at 200 mph to provide enough lift, whereas a 900-lb glider may only need to fly at 40 mph. But unlike a jumbo that is equipped with powerful engines to push it through the air, a glider has to fly a downhill path to keep the air flowing at a sufficient speed over its wings. So, if a glider is always flying a gentle downhill slope, how can it stay airborne for longer than a few minutes at a time, let alone fly hundreds of miles without landing? The answer is fairly simple. If the air is rising faster than the glider is descending, the net result is a glider that is rising. The faster the air rises, the greater the glider's rate of ascent. The tricky bit is understanding why and where air rises in the atmosphere.

In most parts of the world, even occasionally in the UK, the sun shines and heats the ground (and everything on it) at different rates, which in turn heats the atmosphere immediately above the ground, thereby forming a bubble of warm air known as a thermal. The temperature of the atmosphere reduces with height (about 2 degrees Centigrade per thousand feet), so the bubble of warmer air will rise through the surrounding cooler atmosphere. All a glider pilot has to do, after disconnecting from the towing aircraft, is to circle the glider within a nearby thermal and up she goes! After gaining a few thousand feet of height, the pilot flies straight for a few miles, sometimes in sinking air, but hopefully in rising air and, eventually, having converted the height gained into distance flown (a typical ratio is 45 miles for every 6000 feet of height lost), the pilot again circles in a thermal to regain height and so the flight continues.

Of course, seeing rising air is next to impossible. Glider pilots rely on visual cues, like the tell-tale, cotton-wool-like clouds that mark the top of columns of rising thermals, or by noting birds spiralling upwards without flapping their wings, like the eagle mentioned earlier. Instruments in the glider show whether the glider is descending or rising. So by combining the big-picture cues, like clouds and other users of thermals, with instrument readings in the glider, an experienced glider pilot can build a mental picture of where the thermals are rising. It is not uncommon for glider pilots in the UK to utilise thermals during an afternoon to fly planned routes of more than 300 miles without landing. In countries that enjoy stronger sunlight, the more powerful thermals enable gliders to climb higher

THE RAF

and faster, allowing much greater distances to be covered in a similar time.

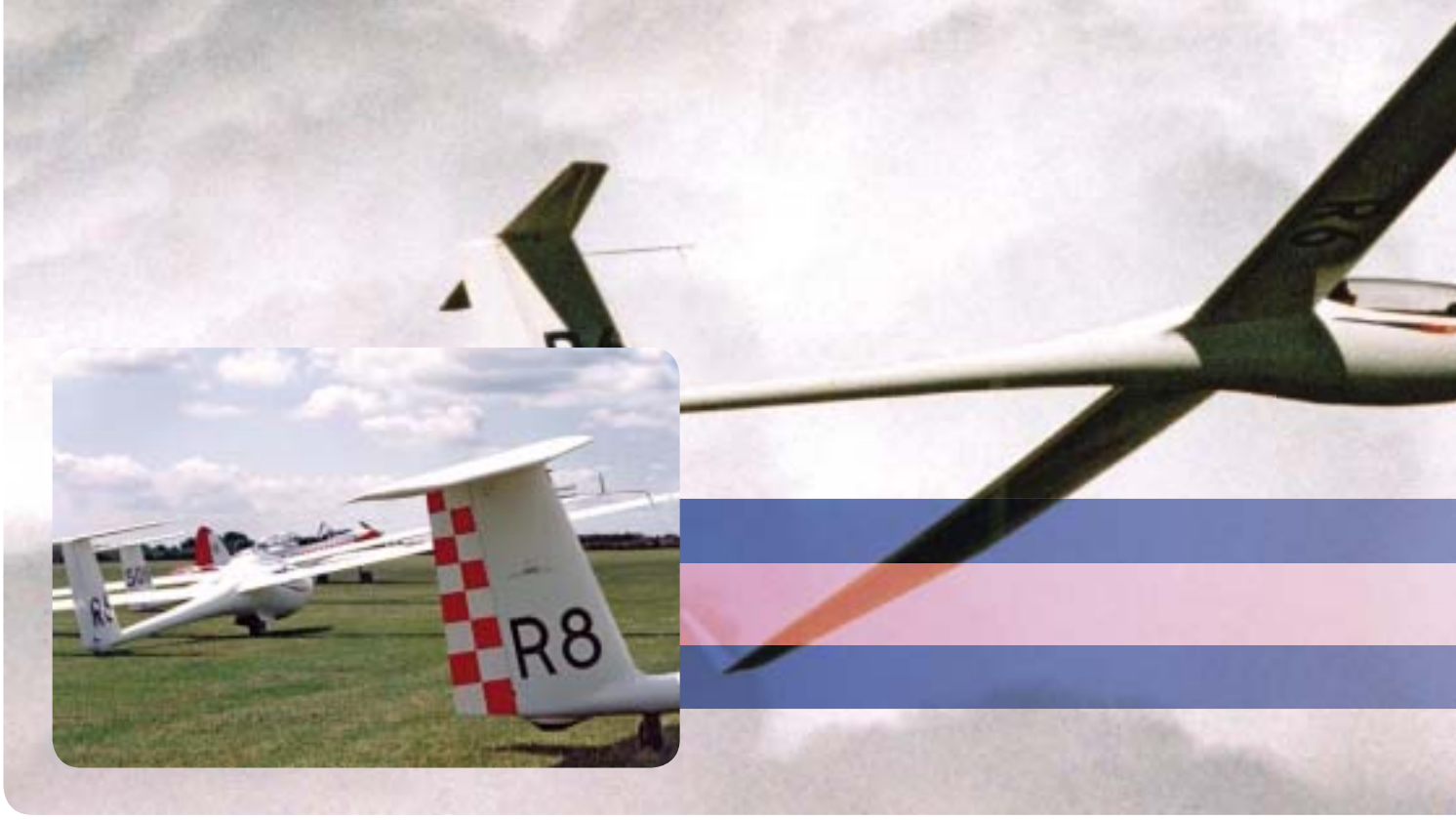
Meanwhile, minutes later, back over the rock-face, having gained a few thousand feet, Matt levels off above the snow-topped mountain peaks. Safely clear of the jagged rocks, he has a breathing space to absorb the awesome beauty of the landscape and to reflect on the top-class training that got him there.

Matt started flying with the RAF Gliding & Soaring Association (RAFGSA), the RAF's sport-gliding organisation, which owns 70 gliders distributed at 10 RAFGSA clubs located on military airfields throughout the UK. Six of those gliders are used for mid-week courses held at the Joint Services Adventure Training Gliding Centre at RAF Bicester, in Oxfordshire, where Matt had his first taste of soaring flight. Personnel of all ranks and all three Services can experience adventurous training through the medium of gliding on these courses; and a secondary aim is to train people for solo flight. A surprising number achieve that standard after just five days' training, without any previous gliding experience; and Matt was one of them. Very early in his Service career (incidentally, having already joined an RAFGSA club), Matt attended the Bicester course and was quickly bitten by the gliding 'bug'. Over the next 18 months he built on this basic training by working and flying at his local RAFGSA club during his off-duty time. In poor weather, his engineering and administrative skills were put to good use in helping with the smooth running of the club. When conditions were suitable for flying, he learned how to get airborne, to exploit different sources of rising air to stay aloft and to deal with all the challenges of flying an engineless aircraft out of gliding range of his home airfield.

The next step was to learn how to fly a glider across country at high speed, following a pre-planned route over a number of ground features. Whilst cross-country training is available in the UK, there are few better places to develop this skill than the enormous dry plains of Australia, where hours of sunshine and endless flat farmland produce rising currents of air - thermals - that can easily allow a glider pilot to climb at nearly 1,000 fpm towards the base of the neat cumulus clouds 10-15,000 feet above him. Top pilots can cover hundreds of kilometres across Australia at average speeds of 150 kmh or more.

Every year, the RAFGSA organises a number of adventurous training expeditions outside the UK - typically to the mountains of Europe during the spring, and to the southern hemisphere (usually Australia) during the UK winter. Any member of the RAF who belongs to the RAFGSA can apply to join one of these expeditions. So, having gained the prerequisite gliding experience during his first, full season of gliding at his local RAFGSA club, Matt lost no time in applying for a place on his first RAFGSA expedition - to Darling Downs, about 200 km west of Brisbane, Australia.

A typical day on the RAFGSA expedition to Darling Downs starts with a wake-up call by the local Kookaburras as the early morning sun starts to heat up the bustling bunkhouse accommodation. After breakfast, the whole team helps to prepare the gliders for flight, which includes filling up the water tanks in the glider's wings. A glider can nearly double its weight with this added water ballast and, given a weather forecast that suggests strong thermals, most glider pilots will load up their gliders with gallons and gallons of water, nearly 40 gallons in some cases, prior to getting airborne, thus allowing the highest-possible cruising speeds to be achieved between thermals. The best glide performance of any particular aircraft is fixed, say 1:50, which means that for every 50 metres the glider travels forward, it will descend




AS K21

one metre. The addition of extra weight, however, means that this best glide performance can be attained at higher speeds. This helps the glider pilot when he or she wants to cover long cross-country distances in the shortest possible time, or when flying through sinking air during the search for new thermals. But the disadvantage of additional weight means that stronger thermals are needed to keep the glider aloft, so, if the weather changes and the thermals become weak, the water ballast can be jettisoned to make the glider lighter and help it gain altitude more easily.

After all the aircraft are prepared, Matt, along with the other Servicemen and women on the expedition, then receives a comprehensive briefing, which includes a forecast of the day's weather, any airspace warnings and details of the cross-country routes to be flown. Although Matt is a relative beginner compared with some of the others, who have thousands of flying hours between them, he is tasked with flying a 300-km triangular route around two turning points: a grain silo and a railway junction, which are easy to spot from the air. The more experienced pilots plan to fly more than double that distance - a 750-km route using three turning points. Navigation over the near-featureless terrain is greatly assisted by on-board satellite navigation equipment but, despite the helpful technology, Matt is keen to pick up tips from his more experienced colleagues: how to spot the best sources of rising air, for example, or the best way to negotiate the thunderstorms that can develop in the afternoons. Foolhardy glider pilots in the past have deliberately flown into thunderstorms in attempts to gain record altitudes, but experience has taught the modern glider pilot to avoid thunderstorms at all costs. The risk of damage by a lightning strike is very real and there are associated dangers with strong winds and hail storms. Fortunately, thunderstorms do not just appear out of thin air! They develop over a period of time, although sometimes very quickly, and it is possible for meteorologists to forecast when and where they will appear and for glider pilots to see them coming.

Much later that same day, Matt is well into his cross-country route, but his altimeter is reading only 2,000 feet and his instruments tell him he is in sinking air. He tenses, realising that if only he could find another thermal to lift his glider to 9,000 feet he would be able to complete the 300-km route comfortably. At just 2,000 feet, though, he has to start planning for a landing away from his home airfield. If he does not find a source of lift, the ground is only minutes away. As he over-flies an outback settlement, assessing potential landing sites, he feels the glider surge upwards. His instruments indicate that he has flown into a thermal, so Matt carefully turns his aircraft to stay within the gently rising air. A couple of turns later, the altimeter shows steadily increasing height and Matt relaxes slightly. After about 20 minutes of circling, he checks his calculations and sets off on the straight, 80-km long glide across the flat terrain towards home, and a well-deserved cool beer! His first 300-km flight has taken only about four hours of flying: a good performance.

The next time Matt experiences this sense of personal achievement is on his second RAFGSA expedition, this time in the Southern European Alps. Thanks to that eagle, he has gained enough height to select a fast route home through the peaks and, from then on, the flight goes smoothly. There is nothing quite like the satisfaction he feels when he crosses the last ridge on his flight and the base airfield comes into view. His experiences at his home RAFGSA club and in Australia have given him the skills and judgement to tackle some of Europe's most formidable mountainous terrain - and to win. Like many RAF personnel before him, Matt has discovered that sport gliding can be incredibly rewarding, occasionally frustrating and always challenging.

It takes a significant amount of close teamwork to get a glider airborne, but it is nearly always down to the individual pilot to get the best out of the flight, and pilots literally have their life in their own hands. By promoting sport gliding for its people, the RAF benefits from the personal development aspects of a demanding recreational activity and is able to develop air-mindedness among the majority within its ranks who are not normally directly involved with flying in their working environment.

Silent flight entails challenges and excitement - but one of the biggest attractions for most people is that it is a huge amount of fun!

HEARTSTONE FESTIVAL

What links five front-line RAF squadrons, two reserve squadrons, one search and rescue unit, two air stations and an Indian dancer? The answer is a photographer and an organisation called Heartstone. Hopefully, the question will refer to even more RAF units, bases and personnel by the time a Festival of Flight is staged in north east England in July of this year.

Heartstone, whose director Sitakumari is well known on stage, which explains the first part of the question, is a national organisation dedicated to challenging racism, xenophobia, prejudice and intolerance. As part of this remit, it commissions documentary projects including photo-journalism. Almost all these projects are undertaken by top photographer Nick Sidle, whose work for Heartstone has seen him working in settings as diverse as the temples of Thailand, the cities of India and with wildlife projects ranging from elephants in Tanzania to great white sharks off the southern coast of Australia. Some stories, however, have explored the more tragic experiences of people in different parts of the world and Nick has spent time with the NATO-led forces in Kosovo (KFOR), the Stabilisation Force (SFOR) in Bosnia and the UN-mandated International Security and Assistance Force (ISAF) in Afghanistan. In all these regions, Nick has been covering the work of the military and civilian personnel on the ground, as well as the lives of the people they were trying to help. Saying that he was covering the work of the personnel on the ground shows, of course, that up to that point the documentary was, by definition, limited to only part of the operation, as the RAF had played a vital role in each case. It also seemed unfair not to include the RAF, as he had been flown into each location on RAF aircraft. The result was a request from Heartstone to be allowed to cover some of the RAF units that had been involved in the various campaigns.

The first assignment looked at the work of RAF Lossiemouth and the four Tornado squadrons based there. This was almost immediately extended to include D Flight of 202 Squadron and their Sea King HAR3 helicopters. Photography projects always start against the backdrop that almost everyone loves photographs, but almost everyone hates having their photograph taken. The easiest way around this problem is to create scenarios and to pose everything in them; you get most of what you want and the whole process is completed as quickly as possible. That is not, and never has been, the brief for a Heartstone documentary. Heartstone's idea is to show things that have really happened and gain an insight into other peoples' lives. In an age of spin and the modern media, it can certainly seem rather old fashioned but, when it works, the difference is clear and the results are worth the effort. With the help of the Corporate Communication Officer at RAF Lossiemouth, Flight Lieutenant Jim Anderson, Nick was able to cover as many of the sections and operations at RAF Lossiemouth as possible in the time available. When the photographs were circulated after the shoot, everyone agreed that the results were different and quite special and the project gained momentum.

Documentaries about the RAF often concentrate on the aircraft and their crews at the risk of ignoring the people in the support departments, without whose work and dedication the aircraft would never fly. The Heartstone documentary at RAF Lossiemouth almost completely reversed this process and the support personnel are an integral part of the end product. Having brought his usual skills to a story about people, Nick found himself at the side of the runway photographing the Tornado GR4 aircraft that the ground staff support. When the pictures were seen, the response of one pilot was typical, 'We should get you in the air.' Fortunately, the Station Commander, Group Captain Steve Hillier, agreed and authorised Nick to fly a sortie with 12 Squadron.

OF FLIGHT

Compiled by Sitakumari

The sortie was a resounding success and the photographs taken by Nick were very enthusiastically received.

It was at this point that the concept of an extended documentary looking at other RAF Stations and Squadrons was first discussed. Coverage was extended to RAF Leuchars and the Tornado F3 squadrons based there and an exhibition of the material obtained was staged as part of the RAF Leuchars Battle of Britain Airshow in 2003. For 2004, the possibility of making the documentary much more comprehensive is being studied. There is a lot of work involved for the RAF at Command, Station and Squadron level and for the Heartstone team, but the feeling both for Heartstone and the RAF is that this is an important initiative that justifies the effort being expended to make it a reality.

Simply getting the photographs and telling the story, however good the images, might not be enough to make all this effort worthwhile, but there is a genuine underlying aim for the documentary. Heartstone sees its role as challenging misconceptions and placing the issues in the news in the context that all sides of a question, or event, will always be ultimately about the people involved and that people the world over are never that different. Having seen the work the documentary was producing, the RAF saw it as an opportunity to increase its openness and its accessibility, and to improve the public's understanding of the work that it does. It also allows the RAF to reach an audience that it does not always have the opportunity to contact, or have an open dialogue with. The Heartstone documentary makes no demands that everyone should agree with its content, but asks that they look and consider before reaching a judgement and continue talking even if there are differing views. The armed forces of a democracy serve the government and the people of a country and are ultimately accountable to them. Contact and understanding are an essential foundation of that accountability.

Not only is there a documentary, but there is also an event - The Festival of Flight. This will run as a week-long event in July 2004, in Newcastle-upon-Tyne. The core of this event will be an exhibition featuring the RAF photo-documentary and other related Heartstone stories and around this core will be a selection of speakers, including some of the air crew featured in the pictures, to 'bring the story to life'. Added to the exhibition will be contributions from the major faiths and cultural communities for whom flight is an important part of their history, beliefs and mythology. Nearly 120 groups of young people in schools and youth groups from Northumberland and County Durham will also be involved in creating art-work expressing their thoughts and feelings on the issues being raised through the photo documentary, which they will have been discussing in the six months prior to the event. This project will include young people from socially excluded groups and disadvantaged areas. In addition, with the help of Afghan, Chinese, Indian and some African communities based in the north east, for whom kite making is an important cultural activity, they will be making an array of magnificent kites to be displayed and flown at the event. Finally, the event will conclude with a spectacular dance-drama on the theme of flight, involving many different ethnic communities resident in Britain.

The Heartstone Festival of Flight - a documentary coming to an RAF air station near you and an exhibition to look out for.

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