THE BUCCANEER IN RAF SERVICE

ROYAL AIR FORCE HISTORICAL SOCIETY

First published in the UK in 2022 by the Royal Air Force Historical Society

ISBN 0-9530345-8-5

Printed by Windrush Group
Windrush House
Avenue Two
Station Lane
Witney
OX28 4XW

ROYAL AIR FORCE HISTORICAL SOCIETY

President	Air Chief Marshal Sir Richard Johns GCB KCVO CBE

Committee

Chairman	Air Vice-Marshal N B Baldwin CB CBE
Vice-Chairman	Group Captain J D Heron OBE
Secretary	Group Captain K J Dearman FRAeS
Membership Secretary	Wing Commander C Cummings
Treasurer	J Boyes TD CA
Editor & Publications Manager	Wing Commander C G Jefford MBE BA
Members	Air Commodore G R Pitchfork MBE BA FRAeS
	Group Captain S Chappell MA MSc RAF
	Wing Commander S G Footer MBE
	Peter Elliott BSc MA
	*J S Cox Esq OBE BA MA
	*Maggie Appleton MBE
	*H A N Raffal PhD
	*Group Captain P Sanger-Davies MVO MPhil MA BA (Hons) MCIPD RAF
	*Gp Capt M Jeffries MA RAF

**Ex Officio*

CONTENTS

SELECTED GLOSSARY

AAA	Air-to-Air Refuelling
AAR	Air-to-Air Refuelling
ACM	Airspace Coordinating Measures/Means
ACO	Airspace Control Order
AHQ	Air Headquarters
ASMA	Air Staff Management Aid
ATCO	Air Traffic Control Officer
ATO	Air Tasking Order
AWACS	Airborne Warning and Control System
BDA	Battle Damage Assessment
BFME	British Forces Middle East
CAP	Combat Air Patrol
CRAF	Civil Reserve Air Fleet
CSAR	Combat Search and Rescue
CTTO	Central Trials and Tactics Organization
DDR	*Deutsche Demokratische Republik*
DMPI	Designated Mean Points of Impact
DNCO WX	Duty Not Carried Out – Weather
ELINT	Electronic intelligence
FAC	Forward Air Controller
'FRAG'	Historically 'Fragmentary Order', informally 'the Frag', but actually superseded by the ATO
FRG	Federal Republic of Germany
GAT	Guidance, Apportionment and Targeting
GCI	Ground-Controlled Interception
HAS	Hardened Aircraft Shelter
INS	Inertial Navigation System
IR	Infra-Red
JFACC	Joint force air component commander
JSDC	Joint Services Defence College
KKIA	King Khalid International Airport
LGB	Laser Guided Bomb
MFBF	Multi-Function Bomb Fuse
NAAS	Navigator and Airman Aircrew School
OCA	Offensive Counter Air
PBF	Pilot Briefing Facility

PMA	Personnel Management Agency
Phimat	A contraction of Philips/Matra
QCVSA	Queen's Commendation for Valuable Service in the Air
ROE	Rules of Engagement
SAG	Surface Action Group
SAM	Surface-to-Air Missile
Sel Rel	Selective Release (of a nuclear weapon)
SO	Staff Officer
SPINs	Special Instructions
SURPIC	Surface Picture
TAC	Tactical Air Command (USAF)
TIALD	Thermal Imaging Airborne Laser Designator
TLAM	Tomahawk Land Attack Missile
TPW	Target Planning Worksheets
UE	Unit Establishment, ie the number of aeroplanes
UNSCR	United Nations Security Council Resolution
USSOCCENT	US Special Operations Command
UXB	Unexploded Bomb
VASTAC	Vector Assisted Attack

THE BUCCANEER IN RAF SERVICE

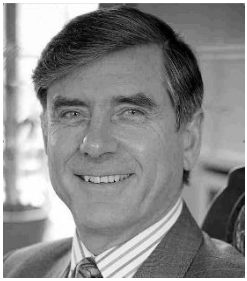
RAF MUSEUM, HENDON, 13 October 2021

WELCOME ADDRESS BY THE SOCIETY'S CHAIRMAN

Air Vice-Marshal Nigel Baldwin CB CBE

Ladies & Gentlemen – good morning and, a very special, welcome as we get the Society somewhere back to normal. My Committee and I are delighted to see so many of you here and, in particular, we welcome members of the Buccaneer Aircrew Association. Our Chairman for the day is the President of that Association, Air Marshal Sir Peter Norriss.

Sir Peter flew Hunters, Tornados and, of course, the Buccaneer, commanding both No 16 Sqn and RAF Marham, so he will be well placed to keep his young tigers under control today.



Sir Peter Norriss

From 1988, until he retired from the post of Deputy Chief of Defence Procurement (Operations) and Controller Aircraft in the Ministry of Defence, he was directly involved with the planning and procurement of defence equipment.

From 2001 he was a defence consultant, carried out major programme reviews for the Office of Government Commerce, and served as a non-executive director of Chemring and Turbomeca UK. He was President of the Royal Aeronautical Society in 2003-04.

Sir Peter, you have control

CHAIRMAN'S INTRODUCTION AND PERSONAL OBSERVATIONS

Air Mshl Sir Peter Norriss KBE CB AFC MA FRAeS

Thank you for the introduction. It's a great pleasure for me to be chairing this important conference. May I add my personal welcome to all those present: members of the RAF Historical Society and the many members of the Buccaneer fraternity with whom I have served over the years.

The Buccaneer has a special place in the hearts of all who flew it and engineered it, even though the decisions leading to its arrival in the RAF did not please all of the RAF's hierarchy at the time. Sometimes called a 'stop-gap' bomber following the cancellation of the TSR2 and the F-111, it soon became known as the 'banana jet', and I suspect that the love it engenders in those that flew it stems in part from those unappreciated beginnings and the close working together of Fleet Air Arm and RAF crews, though its ability to carry a lot a long way at high speed and low level, giving you the ride of your life, also has something to do with it. That bi-Service link remains strong through the Buccaneer Aircrew Association whose annual Blitz is the envy of many other forces, and The Buccaneer Aviation Group, now based at Kemble, helps to keep the aircraft in the public eye.

In the late 1950s and early 1960s my father was a production engineer with Blackburn Aircraft at Brough, and so I knew a bit about the Buccaneer while growing up. But my appreciation of the aircraft was sharpened in 1971 when I was displaying the Jet Provost and saw a 5-ship display by a Fleet Air Arm team at Biggin Hill, and a bit later when I had a memorable weekend at the Lossiemouth Air Day that year. Following the No 237 OCU course I joined No XV Squadron at Laarbruch with John Lillis in April 1972. The Buccaneer force was building up slowly, and the squadron was short of aircraft, largely because of the Spey engine problems, so the Boss said he'd accept the last four crews only if each one arrived with an aircraft. As a result, after a few theatre familiarisation sorties, John and I were dispatched to Holme-on-Spalding-Moor in May that year to pick up XW543, which was, I think, the first of the squadron's aircraft fitted with a bomb-door tank.

There then followed some of the most exhilarating flying that I have

enjoyed in my 35-year RAF career: 2ATAF Lo-Lo with SAPs (Simulated Attack Profiles) across the whole of what was then West Germany, a variety of weapon-delivery modes on different ranges, detachments to Decimomannu for concentrated weaponry, all mixed in with terrific camaraderie on the squadron and station which was home to another Buccaneer squadron and a Phantom squadron.

Somewhat unexpectedly, I was posted to No 237 OCU as Chief Flying Instructor in September 1974, where I experienced the challenges of sitting in the back without a stick while trainee pilots flew their first familiarisation sorties on the aircraft. Two particular 'Fam 1' trips spring to mind. One where the young pilot proved unable to line up with the runway, either from a GCA or from a circuit. We were below Diversion 2 fuel when he finally got close enough for me to tell him to land and just keep it straight! The second particular memory was when flying in the back with a trainee test-pilot doing a preview during his ETPS Course; almost straightaway he started experimenting with measuring stick-force per g and using other test-pilotry assessment techniques to explore the aircraft's operating envelope. I also learnt a bit about maritime ops there, though my flying with 12 Squadron on a detachment to Bodø was cut short when I was appointed as President of a Board of Inquiry after one of the squadron's aircraft was lost in the waters near Bardufoss on the first day.

With a mix of RAF, RN and USAF staff crews, the OCU operated twelve Buccaneers, three of which were provided by the RN and were engineered by Fleet Air Arm personnel operating to RN SOPs, as we were also providing refresher flying for Fleet Air Arm crews returning to 809 Squadron and putting RAF crews going on exchange to the Navy through the specialist training required. Being a believer in really understanding what your staff are doing, I took the opportunity to do that training also and went to the deck a few times, bouncing off the old *Ark Royal* in what was, I think, reasonably good order for 'a crab', though probably disappointing for the sailors manning 'goofers' who wanted to see some real drama.

Following staff college and a ground tour, my refresher flying on the Buccaneer was cut short by the RED FLAG accident in February 1980, so I took command of a grounded 16 squadron at Laarbruch. We kept flying skills alive by operating a small fleet of Hunters, 2-seat and

single-seat variants, until the structural causes of the accident had been identified and fixed. That took until late July 1980, after which the Buccaneer force found itself significantly reduced in numbers. In my particular case we never had more than nine aircraft on strength, and the demanding airframe-inspection regime required huge efforts from the groundcrew and greatly limited the amount of flying that crews could achieve. Despite that, 16 Squadron deployed in October 1981 to Nellis Air Force Base in Nevada to take part in RED FLAG, the transit being conducted without air-to-air refuelling and with 100 knots of headwind on every leg, irrespective of our heading.

I'll leave further talk of flying exploits to the speakers who will lead us through development of the aircraft, its history in the RAF, and its operations over land and sea, culminating in a session about its involvement in Operation GRANBY in 1991. I hope the audience will join in the Panel Discussions so that we can provide the Society with an accurate account of the Buccaneer in RAF service, as that is the purpose of this event. The programme has been developed by Graham Pitchfork, Tom Eeles, Chris Finn and Jeff Jefford, and I should like to congratulate them on setting a fine canvas for us.

To the speakers may I remind you that timing is tight and, if we are to benefit from useful discussions during the panel sessions, I'll ask you to stick to your allotted times. So without further ado, let me ask Tony Buttler to lead us off.

In its element – low and fast.

SPECIFICATION, DEVELOPMENT AND ADVANCED VERSIONS

by Tony Buttler

Tony Buttler spent 1974-94 working as a metallurgist, testing airframe and engine components. In the process, he developed an interest in the design and development of military aircraft. Having gained an MA from Loughborough in 1995, he became a freelance aviation historian and recently publishing his thirty-seventh book. He is a frequent contributor to historical aviation magazines, lectures to aeronautical and enthusiast groups and is a member of the RAeS's Aeronautical Heritage Group Committee.

I was delighted to be asked to present this paper to the RAF Historical Society and indeed to open this series of talks on the Blackburn Buccaneer. The objective today is, of course, to tell the RAF side of the Buccaneer story but, as the aircraft was first developed against a Naval specification, I must begin with events in Royal Navy 'waters'.

The Naval Requirement

In March 1954 Specification M.148T and Naval Requirement NA.39 were issued to cover a new two-seat, twin-engine naval strike aircraft. The need for this carrier-based aeroplane had been identified from the need to hit, not only Soviet Union shore-based installations, but also its growing fleet of major warships, such as the brand new *Sverdlov* class cruisers. The Soviet's plans to expand into a blue-water Navy under Admiral Gorshkov were causing alarm in the West.

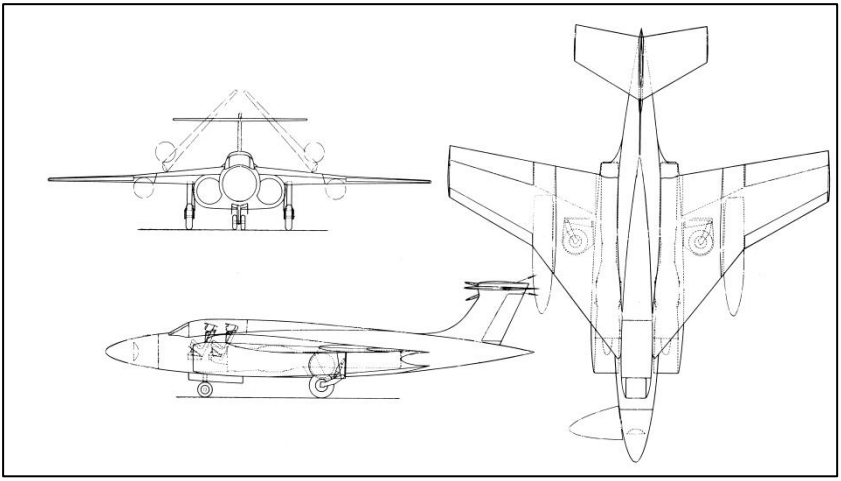
The new aircraft's all-up-weight and dimensions were set by the size of the lifts in current Royal Navy carriers (its folded length was to be 51 ft and span 20 ft). The impressive list of alternative weapon loads embraced: one target marker tactical nuclear bomb; one GREEN CHEESE anti-ship homing bomb (later cancelled); four RED ANGEL bombs; 24 air-to-surface rockets; four mines; two 2,000 lb armour-piercing or four 1,000 lb standard bombs, or a four-30mm gun pack. A high proportion of any strike operation was to be conducted at low-level and so the maximum sea level speed had to be at least 550 knots, and a

Model of the Armstrong Whitworth AW 168. (Ray Williams)

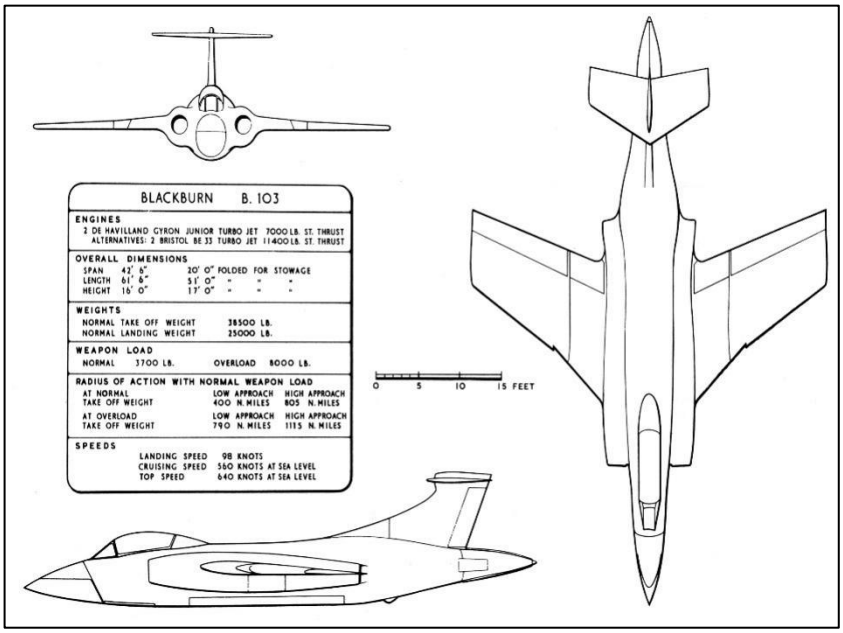
flight refuelling capability was also required.

Industry submitted six designs, some of which were quite advanced, others more conventional. The runner up was the relatively conservative AW 168 from Armstrong Whitworth. I have included it here because, had it been chosen as the winner, while it might have served the Fleet Air Arm well enough during the 1960s, by the time that the RAF wanted the Buccaneer, in the 1970s, the AW 168 would have been near obsolete. The RAF would, therefore, have had to fund an all-new design, or perhaps buy from abroad. The latter would, of course, have meant the USA, so potential candidates might have been the Grumman A-6 Intruder or the LTV A-7 Corsair II, the latter of which (like the Buccaneer) served both Air Force and Navy in its home country. A situation to consider perhaps!

In late 1954 the B.103 proposal from Blackburn Aircraft was declared the winner – indeed, from all operational considerations it was considered the best design. However, the Royal Aircraft Establishment (RAE) at Farnborough had preferred the simpler AW 168, which was also the only project likely to meet the required 1960 in-service date. However, the Naval Staff was now saying that it would prefer the B.103 a year later rather than the AW 168 in 1960.



While clearly an ancestor of the Buccaneer, the original B.103 layout of 1953 (above) was not area ruled. By the time it was submitted as a solution to M.148T (below), some refinement was still required to turn it into the definitive Buccaneer S.1. (BAe Brough Heritage)



The B.103 had several new features. First, area rule, which resulted in the Buccaneer's characteristic waisted bulges in the rear fuselage. Secondly, integral construction whereby many of the loads experienced in flight would be absorbed by the skinning and, to provide the necessary structural strength, the airframe would also use possibly the most massive steel forgings yet seen in an aircraft design. Third, with all of the specified weapon loads to be carried internally, there was a hydraulically-operated 180° rotating bomb bay door (although extra weapons could go under the wings inboard of the wingfold). A further aerodynamic feature was the large 'petal' dive brake produced by splitting the end of the fuselage. Blackburn had determined that an engine of around 7,000lb thrust was needed, so the de Havilland Gyron Junior was chosen for the Mk 1; the far more powerful Rolls-Royce Spey would follow for the Mk 2.

Finally, and perhaps the biggest innovation of all, was the use of Boundary Layer Control (BLC). Having 'increased airflow' over the wing control surfaces would provide more lift. The advantages of BLC for a naval aeroplane were clear – lower approach and take-off speeds, reduced wing area and span, and possibly smaller, lower thrust engines. The blow came from 'bleeding' air from the engine compressors and eventually BLC was used over the flaps and ailerons, the upper surfaces of the outer wing leading edges and the lower surfaces of the tailplane leading edge.

In fact BLC superseded all other potential high lift devices available at the time and the B.103 was, I believe, the first British aircraft design to incorporate it from the outset. Flight testing showed that BLC gave around a 25 knot reduction in stall speed when under take-off or catapult launch conditions, and a reduction in stalling speed on the approach of around 20 knots. In truth it would prove impracticable to launch a Buccaneer from a British-size aircraft carrier without employing BLC.

The BLC arrangement was redesigned for the Spey-powered Buccaneer Mk 2, which provided around double the thrust of the Mk 1's Gyron Junior. Here blowing was applied to the inner wing right into the wing-nacelle junction, which then made it possible to launch the heavier Mk 2 under the same conditions of carrier speed, wind speed and catapult steam pressure as for the Mk 1. Producing such an advanced design with all of these new features would, of course, require a very high quality design team, and that was what Blackburn had. The

The Blackburn design team was led by (left) Barry Laight, seen here in in 1974 (RAeS) and (right) Roy Boot, on his retirement in 1984. (BAe Brough Heritage Centre)

team was led by Chief Designer Barry Laight, while Roy Boot played a major role within the NA.39 Buccaneer development team before, in 1962, becoming the firm's Assistant Chief Designer.

A contract for 20 Development Batch (DB) aircraft was placed in August 1955. Airframes 1 to 3 (serials XK486-XK488) were to be used for development, manufacturer's and Ministry of Aviation flying and Gyron Junior development. A full sized mock-up was also built, but there were to be no 'prototypes' as such, although the first airframes would be 'flying shells'. Airframes 4 to 20 carried serials XK489-XK491 and XK523-XK536. It was intended that XK526-XK530 should be full Service aircraft for Controller Aircraft (CA) trials, and XK531-XK536 would undertake Service development and intensive flying.

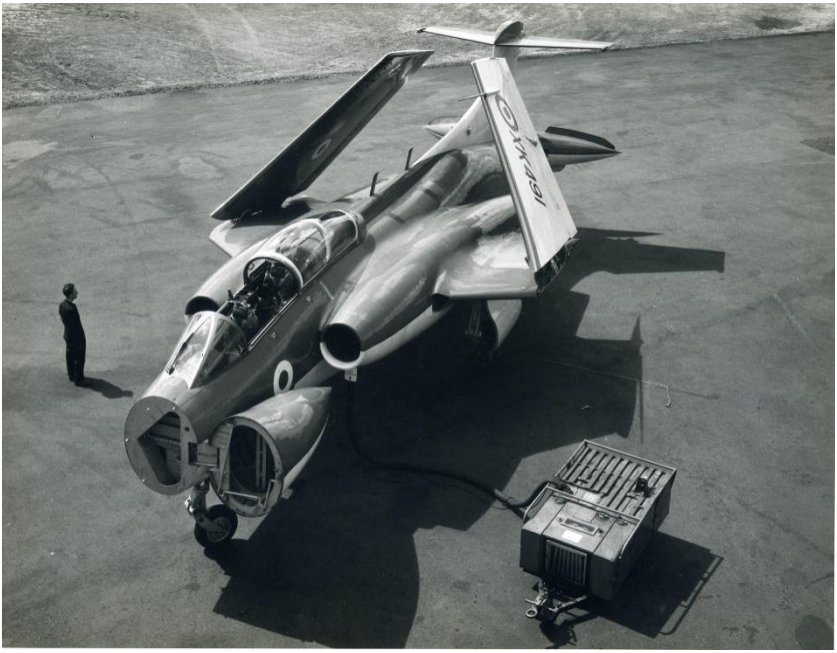
For the first two years of flight testing the aircraft was simply called the Blackburn NA.39, but in August 1960 it was officially named Buccaneer S Mk 1 with 'S' indicating a nuclear capability. Blackburn's own airfield at Brough was too small to operate NA.39-sized aircraft, so leasing arrangements were made to take over the nearby disused Holme-on-Spalding-Moor airfield which had a 6,000 ft runway and this became the base for Buccaneer flight testing. However, the very first flights were made from RAE Bedford.

In March 1958 XK486, lacking folding wings, completed its initial engine runs at Brough before being taken by road to Bedford. It made its maiden flight on 30 April 1958, crewed by Blackburn chief test pilot Derek Whitehead and observer Bernard Watson. This sortie was made without using BLC, but subsequent flights from Bedford looked into BLC operation and the system was soon proved successful. All subsequent DB aircraft would fly from Holme-on-Spalding-Moor,

XK486 gets airborne for the first time on 30 April 1958.
(BAe Brough)

XK487 flying first on 27 August 1958. The first two aircraft explored the flight envelope in full while XK488 joined de Havilland Engines at Hatfield for Gyron Junior development. One problem highlighted later by XK491 was severe tailplane vibration when flying at high speed. This was traced to shockwave-induced airflow separation at the fin/tailplane junction; the solution was the addition of a waisted 'bullet',

XK523 captured over HMS Victorious' *round down during deck trials in Lyme Bay on January 25, 1960.* (BAe Brough)



The Buccaneer's extraordinary ability to reduce its size for stowage aboard carriers is demonstrated by XK491 at Brough in May 1960. (BAe Brough)

a modification that was approved in early 1961.

Initial carrier trials began in January 1960 aboard HMS *Victorious*; these embraced a total of 31 take-offs and landings at increasing weights and were successful. XK524 was effectively the first aircraft completed to production standard and XK525 was the first to receive the full weapon system. XK526 to XK529 were assigned to the Royal Navy's Test Unit at Boscombe Down to begin full carrier trials. CA Service Release was granted in July 1961 and, despite losing three aircraft in crashes (XK486, XK490 and XK529), relatively few problems had been encountered during the development flying programme. Finally, the Navy's No 700Z Intensive Flying Trials Unit formed on type in August 1961.

The RAF Perspective

So the Buccaneer entered Royal Navy service in 1961. But what of

the RAF? Blackburn had offered versions of the B.103/NA.39/ Buccaneer to the Service on several occasions during the 1950s and '60s, either in official design competitions or as unsolicited proposals. In this second section I will review this effort, and consider some of the very advanced Buccaneer developments drawn up by Blackburn into the 1970s.

It appears that the first occasion when the NA.39 (not yet Buccaneer) was examined as an RAF tactical bomber was in September 1955, when it was rejected. The aircraft's performance in this role was considered insufficient to give it a reasonable chance of survival and the high altitude performance was handicapped by a lack of span. ACAS(OR), AVM H V Satterly, declared on 10 October, 'It is clear that to meet our requirements in full, a completely new design is necessary. I have decided to abandon the idea of the NA.39 as a Canberra successor.'[1]

Gp Capt H N G Wheeler had been even more critical on 30 September when he wrote,

> '. . . the NA.39 had received a lot of attention [*and*] we have come to the inevitable conclusion that the aircraft simply is not designed for the purpose and could not, without major redesign, be made a suitable replacement for the Canberra. Our main criticism is that the aircraft barely exceeds in speed and target height the Canberra PR.9, and it seems quite wrong to introduce in 1960 a subsonic aircraft that stands no hope of being supersonic.'[2]

In April 1957 a new RAF strike aircraft requirement, GOR.339, was in the pipeline and this would eventually produce the BAC TSR.2. With some knowledge of what elements the new requirement might cover, in 1957 several firms offered interim designs based on current service aircraft; for example de Havilland proposed a development of its DH 110 Sea Vixen. All of these were rejected, including the Blackburn B.103A, and it was now recommended to Controller Aircraft that there was no possibility of the RAF being satisfied with the NA.39 itself. The B.103A was basically the Navy aircraft but with the folding wing deleted and replaced by integral fuel tanks in the wings, a more powerful Gyron Junior engine and a fuselage extension behind the cockpit for more fuel.

A July 1957 Air Staff review stated,

'it would not be impossible to attempt to modify the Blackburn

> NA.39, but large-scale modifications would be required. Two year's study would be required followed by four year's development work. Thus, approximately the same time would be required to modify an existing type as to plan for a new aircraft.'[3]

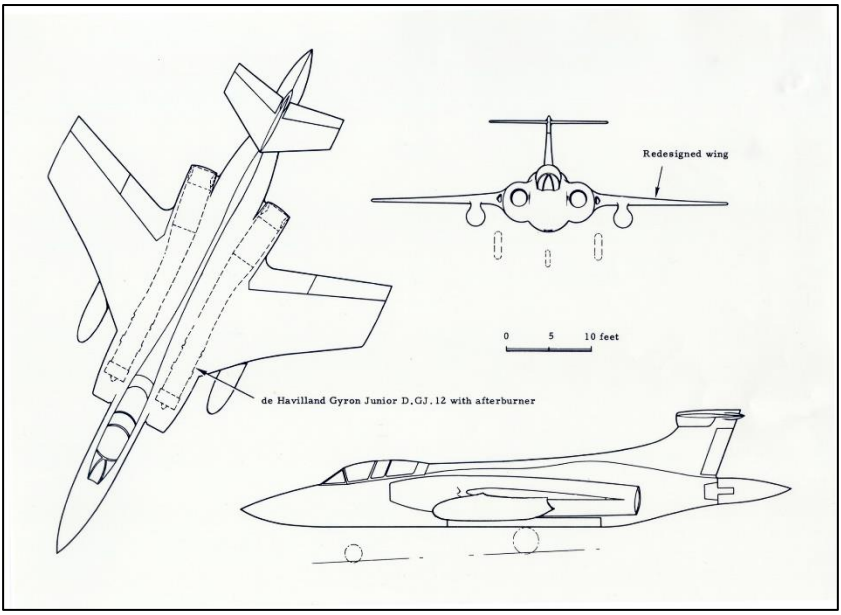
In July 1958 another review by the Ministry of Supply showed that converting the NA.39 to the tactical land role would cost 'approximately half the price of ten new GOR.339 aircraft.'

Blackburn's submission to the full GOR.339 requirement in early 1958 was the B.108, a more extensive development of, but not departing from, the B.103/NA.39's basic aerodynamics. The airframe was to be longer and heavier to accommodate a new cockpit, sideways-looking navigation radar and a forward-looking radar for terrain-following. It still had Gyron Junior engines which would give a top speed of Mach 0.95 at sea level, although Blackburn considered Mach 0.85 would be sufficient for the penetration of enemy territory when flying at low level.

Industry submitted numerous designs, all highly supersonic except for the B.108. In its review of the GOR.339 proposals the Air Staff said, 'The B.108 did not meet the requirement either in range, medium altitude, speed or airfield performance. The most important deficiency was its fundamental inability to achieve supersonic speed in level flight. In the RAF role the NA.39 [itself] did not represent a major advance over the Canberra.'[4]

By September 1960 the TSR.2 was in full development and some Ministry papers which discussed the new aircraft also referred to the NA.39 Buccaneer. One meeting report, dated 15 September, stated:

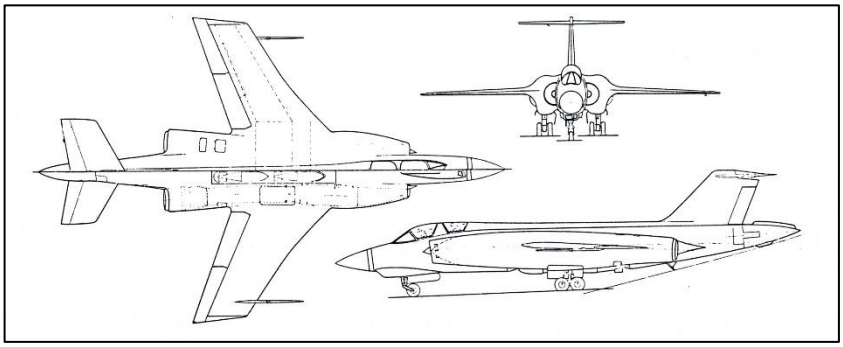
> '. . . the NA.39 could not possibly meet the operational requirement; indeed, except for a superiority in speed, it was inferior in all other respects even to the Canberra save, perhaps, at low altitudes where the wing strength of the Canberra was suspect. There was no possible compromise in this matter. The NA.39 could not be developed to approach the operational capabilities of the TSR.2 and any attempt so to develop it would result in spoiling the characteristics of the NA.39 and would produce a 'mongrel' which would satisfy nobody.'[5]
>
> Incidentally, the Blackburn NA.39 was also the TSR.1. Originally,



Blackburn's B.108 to GOR.339 in early 1958 was clearly a derivative of the B.103 and retained its basic aerodynamic form. It was longer and heavier, to accommodate a new cockpit, plus SLAR and TFR. It still had Gyron Junior engines for a top speed of Mach 0.95 at sea level. A B.108 Stage 2 (shown here) introduced a redesigned wing and reheated Gyron Juniors. (BAe Brough)

TSR.2 was to have been formally known as the GOR.339 or OR.339, but in 1958 a general comparison was made between the, as yet unnamed, Buccaneer, the GOR.339 studies and the embryonic Hawker P.1127 vertical take-off aircraft, for which purpose the three types were called TSR.1, TSR.2 and TSR.3. When the new RAF strike aircraft was first announced to the public, the Minister concerned called it the TSR.2, in error! The name stuck. Another proposed NA.39 Buccaneer derivative was the B.111 with reheated RB168 (ie Spey) engines which followed on from the B.109. This was reviewed by the RAF in 1960, while the B.112 design for the Navy would have been the same apart from having folding wings.

The TSR.2 was cancelled in early April 1965. A memorandum from the Chief of the Air Staff (Air Chf Mshl Sir Charles Elworthy), dated



The P.150 project of 1968. (BAe Brough)

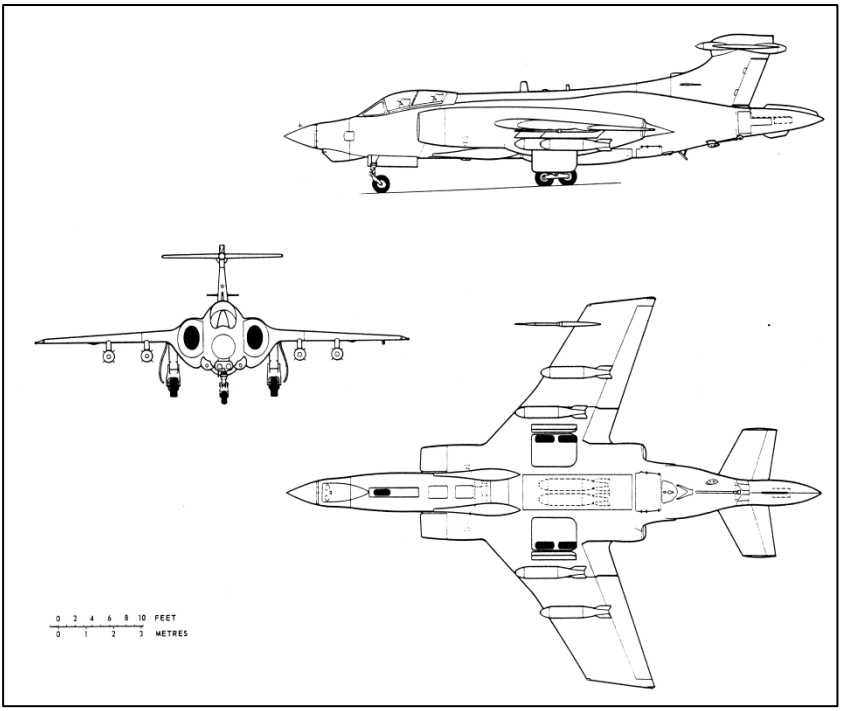
12 April 1965 and written just after the loss of TSR.2, and now discussing the American F-111 which at the time was to replace it, stated:

> 'The Buccaneer cannot reach all of the enemy bases we need to strike or threaten. With the Buccaneer we should be unable to take out the Indonesian Air Force even as it exists today.
>
> The delivery of a given weight of explosives needs two or more times as many aircraft on bombing grounds alone. It [*also*] needs long concrete runways, and its flexibility of deployment is therefore limited. It has not, and cannot be given, the equipment needed at night or in bad weather to find land targets other than 'sore thumb' ones. It cannot use supersonic speed to help it penetrate high-quality defences. None of these shortcomings can be removed by further development.'[6]

So even as late as 1965 the Buccaneer was still a no-go for the RAF.

Several supersonic developments culminated in the P.150 project of 1968. This aircraft was prepared in response to an Air Staff request for a version with reheated Spey 202s. It had: variable geometry intakes and reversible thrust; was 6 feet longer than the standard aircraft, which eliminated the area-rule bulge; non-folding wings; a new tail unit and bogie main wheels to handle the extra weight. Maximum speed was to be Mach 1·8 and basic weight was to be 7,000lb more than the standard S.2. A bit of a beast!

Moving into the 1970s, and with Blackburn's Brough facility now under the Hawker Siddeley banner, the next proposed version was the HS.1197 to Air Staff Target (AST) 396. AST.396, first issued in 1971,



With Brough now under the Hawker Siddeley banner, we reach the end of the line with the HS1197 to AST 396. (BAe Brough)

was a new requirement for a Harrier and Jaguar Replacement. It eventually resulted in all manner of new design proposals and revised older designs, both large and small, and was later split into AST.403, which led eventually to the Typhoon, and ASR.409 which covered the Harrier GR5. The requirement remained active for several years and in 1974 Brough assessed the S Mk 2B (RAF) Buccaneer against AST.396 Issue 2. The candidate aircraft was the HS.1197 and the dimensions were standard Buccaneer. With 11,560lb RB168-78 engines the quoted maximum speed was 670 mph at sea level.

Having introduced the Typhoon, I will end with a mention of the Fly-By-Wire Jaguar, a BAC Warton research aircraft which first flew in 1981. It was followed by the one-off Experimental Aircraft Project – the EAP – and ultimately the Typhoon. When proposals for fly-by-wire airframes were first requested in 1975/76, the Hawker Siddeley

contender against the Jaguar was, of course, the Buccaneer. Even at this very late stage the veteran was still in the running and, had things gone differently, we could have seen a fly-by-wire Buccaneer in the air.

This ends my review of the steps that were taken to produce the Buccaneer for the Royal Navy, the initial opposition to acquiring the aircraft for the RAF, and a selection of the proposed developments which never reached the hardware stage. If I may, I will end with a question and a declaration. Was the Buccaneer the first ever frontline combat aircraft designed specifically for the Royal Navy to be acquired by the RAF? I believe the answer is 'yes' (certainly, at least, since the mid-1930s) and, if you will excuse the pun, this step represented a sea-change in policy! The statements I have quoted illustrate the resistance to the design, and the resistance to acquiring a Royal Navy aircraft, prevalent within the Air Staff during the 1950s and 1960s. But such was the quality of the Buccaneer that it still battled through to win the day! Thank you.

Notes. This paper was prepared using documents, brochures and drawings held in The National Archives at Kew and by BAE Systems Heritage at Brough. In the former case:

1 AIR 2/11096. Requirement for a new light bomber to replace the Canberra bomber: policy, 1951-56. Letter C.45835/ACAS(OR) of 10 October 1955 from AVM H V Satterly to DCAS.

2 *Ibid.* Directorate of Operational Requirements, Gp Capt H N G Wheeler loose minute, 30 September 1955.

3 AIR 6/110. Air Council: Conclusions of meeting 18(57), 25 July 1957.

4 AVIA 65/1649. TSR.2: policy and finance, 1958. Draft report 'Latest position on OR.339', late July 1958.

5 DEFE 13/202. Evaluation of TSR.2, the Canberra replacement, 1958-61. Ministry of Defence meeting report 15 September 1960.

6 DEFE 13/285. Cancellation of TSR2 aircraft programme, 1964-69. Report CAS 2051 of 12 April 1965 from Air Chf Mshl Sir Charles Elworthy to Secretary of State through Minister (RAF).

THE BUCCANEER IN RAF SERVICE – AN OVERVIEW

by Air Cdre Graham Pitchfork

Following an initial Canberra tour in Germany, in 1965, Graham Pitchfork, a Cranwell-trained navigator, was seconded to the FAA to fly Buccaneers. Thereafter his career was inextricably linked with that aeroplane, culminating in command of No 208 Sqn. He later commanded RAF Finningley and was Commandant OASC before a final tour as Director of Operational Intelligence. He has written many aviation-related books and is an active member of this Society's Executive Committee.

This paper will provide a broad overview of the main events of the Buccaneer in RAF service with the aim of providing a backdrop to the more detailed presentations that follow, and to highlight one or two important developments that will not be referred to specifically in later papers.

It is very clear from the previous paper that the RAF never wanted the Buccaneer. From the earliest days, senior RAF officers dismissed the idea of the Buccaneer being a Canberra replacement. Over the following years, this view was perpetuated by the Air Staff, the Chief Scientist and Chiefs of Staff. The arguments put forward are, in some cases, simply wrong and lack analysis and detailed assessment. The chiefs had made up their minds, and the arguments in the written papers were tailored to support a conclusion that had already been decided.

We left the development of the Buccaneer at the stage where it passed to Boscombe Down for in-service trials. The Royal Navy then formed an Intensive Flying Trials Unit – No 700Z NAS at Lossiemouth. This unit developed the aircraft's nav/attack and weapon systems, toss bombing profiles and initial attack options. This led to the formation of 801 Squadron in 1961, which embarked in HMS *Victorious*, followed in 1964 by 800 Squadron in HMS *Eagle.* Both squadrons were equipped with the Mark 1 powered by the de Havilland Gyron Junior engine.

In 1965 the Mark 2 began trials with 700B Squadron. This aircraft, with its more powerful Rolls Royce Spey engines, increased the

A Buccaneer S1 of No 700Z NAS in the early all-white scheme long tossing a 1,000 pounder.

aircraft's performance significantly, not least its range.

The RAF's direct involvement in the Buccaneer began in the Spring of 1965 when an RAF crew arrived at Lossiemouth to commence a three-year exchange appointment with the Fleet Air Arm (FAA).

Coinciding with their arrival came the announcement that the Labour Government had cancelled the TSR2. Then, in January 1966, came a further announcement, the cancellation of the new Royal Navy aircraft carrier programme – CVA 01. This latter decision, in effect, heralded the demise of fixed-wing flying by the FAA and hence a steady reduction in the RN's fixed-wing aircrew training programme.

In January 1968, the US-built General Dynamics F-111K, destined to be the TSR2 replacement, was cancelled. This left the RAF still seeking an alternative strike/attack aircraft and, with the demise of the Fleet Air Arm squadrons, the RAF would have to assume the maritime strike/attack role.

Decisions followed quickly. The F-4M Phantom, powered by Rolls Royce Spey engines, was to be acquired for the attack role, and 26 new-build Buccaneer S2s for the strike role. In effect, these two aircraft became the Canberra replacement.

It was also decided that RN aircraft would be steadily transferred to

the RAF to meet the Tactical Support of Maritime Operations (TASMO) role and to provide the aircraft for two RAF squadrons to be assigned to SACLANT.

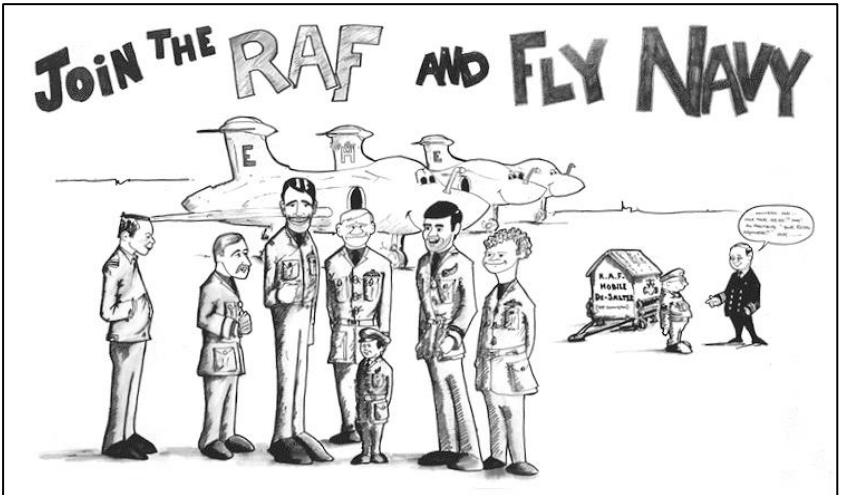
There were also significant manpower ramifications. Despite the steady run down of the FAA aircrew training programme there still remained the need to maintain sufficient crews for the three operational squadrons. This could only be met by RAF aircrew on loan to the FAA. The first of a steady stream of RAF aircrew began arriving in the autumn of 1966 and, over the following 12 years, until the final FAA squadron de-commissioned, FAA squadrons had an increasing number of RAF 'loan' officers rising to more than 50% by the time the last squadron – 809 Squadron – stood down in 1978.

With the requirement for the first SACLANT-assigned squadron to begin forming in late 1969, just twelve months after the decision that the RAF would 'inherit' Buccaneers, there was an urgent need to provide RAF crews. This could only be achieved by using the resources of the existing FAA operational training squadron – No 736 Sqn – at Lossiemouth. However, this unscheduled task could not be met by the squadron's current establishment.

To supplement 736 Squadron's resources, an RAF Element of 86 ground engineers, commanded by Flt Lt John Harvey, was formed to be embodied into 736, and a number of Buccaneer Mk 1s were taken from storage. RAF loan crews, who had returned from their time embarked with the front-line squadrons, were already instructors on 736 Squadron. The task was to train the first eight RAF courses providing sufficient crews to man the first two squadrons.

In October 1968 it was announced that the former V-Bomber base at Honington would be the UK Buccaneer base. The airfield had been on care and maintenance for three years and there was a heavy works programme required to prepare the base for Buccaneer operations, including re-surfacing the runway, building a new aircraft servicing platform (ASP) and new engineering and domestic facilities.

On 1 October 1969, 12 Squadron re-formed under the command of Wg Cdr G G Davies and he led the first four aircraft to arrive at Honington. Thereafter, there was a steady build-up of crews, some returning from RN loan service, before XV Squadron formed at Honington in September 1970. In the New Year it moved to its permanent base at Laarbruch in Germany.



The RAF personnel who were instructors on No 736 Sqn when the first RAF course started in June 1969. L-R Flt Lt John Harvey (Eng), Fg Off Mick Whybro (Nav), Fg Off Jerry Yates (Pilot), Flt Lt Tim Cockerell (Pilot), Flt Lt Barry Dove (Nav), Flt Lt Tom Eeles (Pilot) and, in front, Fg Off Dave Laskey (Nav).

With the steady run-down of the FAA Buccaneer training task, there was a need for an RAF Operational Conversion Unit (OCU) and, in March 1971, No 237 OCU formed at Honington to take on the task of both RAF and FAA Buccaneer conversion courses, post-graduate courses and groundcrew training courses.

Next to form was 16 Squadron, which joined XV Squadron at Laarbruch in June 1972 where they constituted the SACEUR-assigned Laarbruch Strike Wing, and completed the replacement of the Canberra force.

In June 1974 208 Squadron formed at Honington in the overland role. It was one of only two RAF squadrons permanently assigned to the AFNORTH region of NATO. Its main operating area was to be the Baltic coastal littoral and the north of Norway for attacks in the Kola Peninsula.

The squadron deployed to Norwegian airfields frequently and such exercises were a routine aspect of squadron training. The terrain presented a very different scenario to overland operations in the Central

Region and weather was a major influence. Distances from the UK were prodigious and staging through Norwegian airfields would have been necessary in order to reach targets in the far north. There were no plans to pre-stock these airfields with weapons, and the likely heavy demands on the RAF's air-to-air refuelling resources for UK air defence and other reinforcement options, it appeared to us, highly unlikely that the squadron would provide a significant contribution to operations in this remote area. To those serving on the squadron, it seemed more likely that they would be tasked to attack targets in the Baltic coastal regions or as reinforcements to the Central Region.

The 1970s saw some significant new operational capabilities. The first, in 1972, was the introduction of the bomb door fuel tank, which provided 3,000lbs of fuel. This virtually equated to the amount carried in the two wing tanks. These occupied two of the aircraft's four wing stations, which could now be made available for the increasing number of stores that had to be carried on the wings; eg Martel, ECM pods, Pavespike laser marker, etc.

Second was the long-awaited arrival of the Anglo-French Martel anti-shipping missile, which entered squadron service in 1974. The anti-radar version was developed by the French with the UK assuming responsibility for the TV version.

Another significant new capability was the introduction of a modern electronic warfare (EW) suite. Initially, a radar warning receiver (RWR) was mounted in the tailplane bullets giving a 360-degree coverage of threat radars, a significant improvement on the limited wide band homer inherited from Royal Navy days. This was followed by introduction of the Westinghouse ALQ-101-8, later 'dash 10', active ECM pod. This advanced EW capability, the first mounted on the new generation of RAF 'fast jets', was a considerable enhancement of the aircraft's survivability in the ever-increasing hostile EW environment.

The view – of Labrador – from the back.

By 1977, more realistic low-level training was introduced with the start of regular detachments to Goose Bay for training at 100 feet

One of No 208 Sqn's Buccaneers getting airborne from Nellis AFB on RED FLAG 77-9.

over Labrador. Special areas were also identified within the low-flying areas in northern Scotland. Together, these provided excellent opportunities for the work-up training prior to deploying to Nellis AFB for Exercise RED FLAG. In August 1977, ten Buccaneers of 208 Squadron and two Vulcans deployed to Nellis, the first non-US participants in this unique exercise. Pressure to perform well was intense and the first detachment was so successful that Exercise RED FLAG became, and remained, part of the RAF's routine training programme.

In July 1979, 216 Squadron formed at Honington to be the second squadron assigned to SACLANT. The squadron was to be equipped with the recently acquired Paveway/Pavespike Laser Guided Bomb (LGB). Together with 208 Squadron, 216 began Trial Tropical when bombing techniques were practised on the ranges at West Freugh and at Garvie Island. These trials were interrupted by events that occurred in the following year.

On 7 February 1980, a Buccaneer of XV Squadron crashed during a RED FLAG exercise with the loss of the crew. Initial reports suggested that the starboard wing had broken away causing the aircraft to crash.

The whole Buccaneer fleet was immediately grounded, although the RAF Germany squadrons continued to maintain two aircraft on QRA.

Investigations discovered that the crash had been caused by the failure of rib 80 in the inner wing structure. A fleet-wide inspection of this area revealed fatigue in virtually every airframe, even the latest build aircraft that had only been delivered in the late-1970s. Some aircraft were so badly damaged that they were immediately grounded, those on RED FLAG being eventually brought back to the UK by sea. Others were cleared for ferry flights with no in-flight stress. The Buccaneers that were assessed as being suitable for repair were taken to St Athan to await a modification programme. A scheme was devised whereby undamaged inner wings were transplanted between airframes, resulting in a significantly smaller airworthy fleet. Aircrew maintained flying skills using Hunter trainers, which were augmented by some single seat F6s recently retired from the Tactical Weapons Unit at Brawdy.

The Hunters proved to be a salvation. Each UK squadron acquired two F6s and four T7/8s and for the next five months both air and ground crew were able to maintain their skills. With four wing tanks fitted, Buccaneer profiles and tactics could be flown, and the single-seat aircraft provided a ‘bounce’.

This very challenging period came to an end when the aircraft was cleared to fly again on 28 July. Unfortunately, insufficient airframes could be recovered, resulting in a reduced UE on some squadrons and the disbandment of 216 Squadron.

Trial Tropical was resumed with a view to assessing the use of Paveway in operations over the Central Region. The culmination of the trial was the deployment of four Buccaneers of 208 Squadron to CFB Cold Lake in October 1991 with two specialist Pavespike marker crews from 16 Squadron. The successful trial, culminated in the destruction of the target by four 1,000lb LGBs tossed from two-and-half miles away.

In November 1981, 12 Squadron moved to Lossiemouth, with 208 Squadron following three years later, to form the Lossiemouth Strike Wing in No 18 (Maritime) Group.

In September 1983, six Buccaneers left Lossiemouth for Akrotiri for Operation PULSATOR. Druze militia in Lebanon posed a serious threat to British nationals and a British Army force in Beirut. Two

One of No 12 Sqn's Buccaneers with a full load of Sea Eagles.

fully-armed aircraft remained 'on state' and others trained with LGBs. Following a devastating attack against the US Marines' barracks, two Buccaneers flew over Beirut as a show of force, an event that attracted widespread media coverage. The detachment lasted until the following March.

Much of the final decade of the Buccaneer's service will be covered in later papers. The RAFG squadrons were re-equipped with Tornado in 1984. In 1986, the much-reduced ASR 1012 – the nav/attack and weapon systems update – began and the Sea Eagle anti-shipping missile was introduced into service. In February 1991, the aircraft flew on operations during the first Gulf War.

It was originally intended that the Buccaneer would remain in service until 1999. However, following Options for Change, the number of Tornado squadrons in RAF Germany was reduced, creating a surplus of Tornado GR1s. It was decided that they should replace the Buccaneer in the spring of 1994. To mark the aircraft's long period of service in the RAF, and its impending retirement, the Lossiemouth Wing was accorded the privilege of leading the 1993 Queen's Birthday Flypast over London. Led by Squadron Leaders Rick Phillips and Nigel Maddox, the 16 aircraft, in diamond formation, flew over Buckingham

The final formation, led by XX894 repainted in the colours of 809 NAS.

Palace, on time, at the head of the large RAF formation.

Over the weekend of 25/27 March 1994, hundreds of air and ground crew trekked to Lossiemouth for what became known as the 'Mother Of All Parties'; the final farewell of the aircraft. The CO of 208 Squadron, Wing Commander Nigel Huckins, decided that all RAF Buccaneer units would be represented on the aircraft's final flypast. He chose to fly an aircraft that had been re-painted to represent 809 Naval Air Squadron, a masterstroke appreciated by everyone present. The spectacular occasion resulted in the formation of the Buccaneer Aircrew Association, arguably the strongest such organisation of veterans.

And so, 'The Aircraft the RAF Never Wanted' flew into the history books on 31 March 1994 after 25 years of RAF service.

Note. All illustrations via the Buccaneer Aircrew Association and/or the author.

AIRCREW TRAINING AND NO 237 OCU'S WAR ROLE

by Gp Capt Tom Eeles

Tom Eeles joined the RAF via Cranwell in 1960. His post-graduate flying experience embraced the Canberra, Gnat, Hunter and, especially, the Buccaneer, culminating in a tour as OC 237 OCU in 1984-87. After two years with the CFS as OC Examining Wing, he did a stint at HQ Support Command before commanding RAF Linton-on-Ouse; his final appointment was with Defence Exports Services Organisation within MoD. On leaving the Service in 1997 he was commissioned into the RAF Reserve to serve, initially, with Cambridge UAS and latterly with No 5 AEF.

Setting The Scene

By March 1971 the first eight RAF long courses and many short acquaint courses carried out on 736 NAS at Lossiemouth were complete and the RAF element on 736 NAS was withdrawn. Some of 736's RAF instructors joined the RAF's Buccaneer OCU, No 237, which that same month formed at RAF Honington alongside 12 Squadron. But before I go into detail about how No 237 OCU carried out its training task, I will describe what the Buccaneer was like to fly, and where the challenges for the students and instructors were, as this will help in understanding how we trained the aircrew.

What Was It Like To Fly?

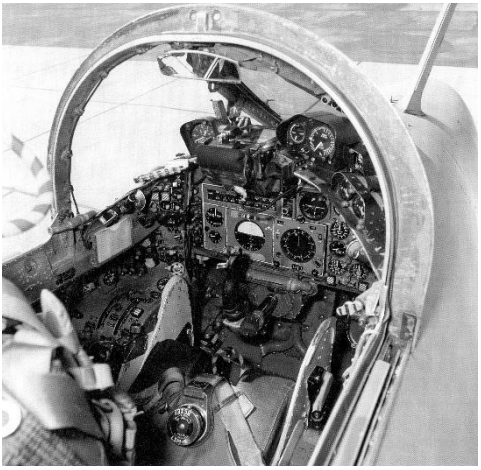
The Buccaneer S2 handled extremely well, was quite agile and posed no special challenge to its pilots when it was being flown at its normal operating speeds in its role as a low level attack, reconnaissance and strike aircraft. The view from both seats was very good, particularly for the navigator, especially if he had previously been confined to the dark recesses in the back of a V-bomber or a Canberra. The Buccaneer was prone to inertia coupling, because the need for it to fit in an aircraft carrier's hangar had dictated a smaller than ideal size of tail fin. Consequently, it needed 3 axis auto stabilisation, provided by the autopilot. The autopilot had originally incorporated a toss attack profile, but, after terrifying the pilots involved in trials flying, this function was soon deleted. The Buccaneer S2, with its large air intakes,

A Buccaneer S2B, XW538, of No 237 OCU letting everything hang out – undercarriage, arrestor hook and flaps down, ailerons drooped, air brake open, bomb bay rotated open – and a single SNEB pod on the port inner pylon. (MAP)

suffered from intake momentum drag at high speed. The early production run of aircraft for the RAF did not have wing vortex generators fitted, but this resulted in prolonged flight in buffet at medium and high level and at low speed. As prolonged flight in buffet was prohibited, they were soon refitted. It was a typical fast jet aircraft of its generation, challenging but exciting to fly.

By 1971 every fast jet introduced into the RAF had always had a dual control version, albeit not always at the beginning of the aircraft's arrival in service, apart from the Buccaneer. The Royal Navy felt it could never afford the luxury of a less operationally capable dual control version of its front line jet aircraft, hence the lack of dual versions of all British naval jet strike/attack and fighter aircraft. Thus the decision to bring the Buccaneer into the RAF would pose unique challenges to the instructors on the Operational Conversion Unit. In particular, the Buccaneer's low speed handling in the landing configuration would show some somewhat unusual characteristics. In order to enable the Buccaneer to launch and land on small Royal Navy aircraft carriers a number of innovative systems were provided which

were incorporated in all aircraft built. There was a gear change facility which gave greater aileron deflection for control column movement below 300 kts. It was operated by a pull up lever on the right hand cockpit console. The auto stabiliser selectors, also on the right hand side, had a low speed facility for use below 300 kts.



The cockpit. (BAe Systems)

The high lift devices were a combination of mainplane flaps and drooping ailerons. The drooped ailerons generated a strong nose down change of trim, so a tailplane flap that moved through the same amount in the opposite sense was used to compensate for this, a single selector being used for both droop and tailplane flap. The tailplane flap was electrically operated; if it failed to move or ran away, longitudinal control would be lost once the difference exceeded 10 degrees. High pressure boundary layer control (BLC) air was fed from the engine HP compressors over the wing leading edges, the mainplane flaps, the ailerons and the underside of the tailplane. Any extension of aileron droop and tailplane flap beyond 10 degrees required BLC air to maintain stable airflow over the wings and tail; this was selected by a switch in the cockpit. With this switch set to 'auto', the BLC air came on automatically as the ailerons extended beyond 12 degrees. So, not only was it vital for the pilot to ensure that the aileron droop and tailplane flap started and stopped moving together when selected to ensure longitudinal control was not lost, but he also needed to ensure that adequate BLC air pressures were maintained to avoid loss of lift from the wing.

The Buccaneer was fitted with an Airflow Direction Detector (ADD), a small rotating probe which measured the aircraft's angle of attack (AOA) and presented this in the form of an audio note, a gauge

A Buccaneer S2, XV336, of No 237 OCU.

measured in units of AOA and on a small visual display. An interrupted high note indicated that the aircraft was too fast, a steady note of 20 cycles/second indicated that it was at the optimum AOA/airspeed in the final approach configuration, and a loud interrupted low note indicated an excessive AOA/low airspeed. Finally, there was a large arrestor hook, most useful on airfields in the event of an aborted take-off, a landing on snow or icy surfaces and any hydraulic malfunction. Suffice to say, configuring the Buccaneer for landing was a very busy business involving much hand swapping in the cockpit and, until experience was gained, a demanding exercise requiring the learning of new handling techniques, all without the benefit of a dual-control version of the aircraft.

Training The Aircrew

Let me turn now to how the aircrew were trained to operate the mighty Buccaneer. First, where did they all come from? The pilots came from a variety of backgrounds, including Hunters, Canberras, the V-Force, creamed off and experienced QFIs, many first tourists straight out of flying training, exchange officers from the USAF, RN and RAAF and even the occasional Lightning pilot. Similarly the navigators came from Canberras, the V-Force, first tourists, one or two from a maritime patrol background, occasionally the Javelin or Phantom, and exchange

officers from the USAF, USN, RAAF and RN. I recall asking an ex-Vulcan navigator what he thought of the Buccaneer as we walked in after his first flight. He replied, 'Well, I suppose once I get used to climbing in through the roof, facing the wrong way and being able to see outside, I think I could get to enjoy it.' Overall, the student population was a very cosmopolitan mix.

In March 1971 No 237 OCU was established at RAF Honington, with a wing commander in command, two squadron leaders as Flight Commanders, two flight lieutenants (myself and a navigator), one Buccaneer, one Hunter, an engineer officer, a few ground crew and an empty hangar. Many more personnel soon arrived but provision of equipment for the flight line facilities proved to be difficult. I well recall being sent in the J2 minibus to raid the scrap dump at the recently closed RAF Stradishall to look for roller boards for our briefing rooms. By May we were just about ready and the first students arrived. Wing Commander Fraser, the boss, had even managed to get a proper squadron badge authorised by the College of Arms, with the motto 'Panache et Precision', translated as 'with style and accuracy'. The OCU remained at Honington until November 1984, reaching maximum size in the late '70s, when it was training aircrew for five RAF squadrons. It then moved north to RAF Lossiemouth and, remarkably, back into the building vacated by 736 NAS some 13 years previously. It remained there until 1990 when it disbanded as a stand-alone unit, any further operational conversion being undertaken by a flight on 208 squadron.

No 237 OCU's badge.

The course started with ten days in the Buccaneer Ground Servicing School, learning how the aircraft's systems worked and how to use them. This school also trained all the ground crew destined to serve in a wide variety of trades on the squadrons and in Engineering Wing. From Day One the need for good crew co-operation, inherited from the RN, was strongly emphasised, better known today as Crew Resource Management. All students then spent an intensive session in the flight simulator putting their knowledge into practice. The first flight simulator was originally set up at RNAS Lossiemouth but was

One of the OCU's Hunter T7s, WV372. (Shaun Connor)

dismantled and moved to Honington, where it was joined by a second one. Despite never being designed for mobility, both were taken back to RAF Lossiemouth in 1983/84. It was a piece of typical late-1960s technology, with motion supplied by hydraulic jacks and a visual system generated by a television camera moving over a superbly crafted Plaster of Paris large scale model of the airfield and a smaller scale landscape of a low flying area, complete with trees, buildings and pylons. The visual presentation was limited to a small screen directly in front of the pilot, with no peripheral display at all, a far cry from today's computer-generated realism. At first, most of the flight simulator instructors had no previous Buccaneer experience, but all had been through the ground training syllabus and in most cases were waiting posting to active flying on the Buccaneer. Despite their lack of experience on type, they did an excellent job. By the end of eight simulator sorties new crews would have a very good grasp of normal and emergency operating procedures, and the importance of good crew co-operation, but the flight simulator did not provide a realistic experience for the pilot of the real aircraft's handling characteristics.

Before arriving on No 237 OCU all of the pilots would have done a short tactical weapons course on the Hunter, so they arrived as qualified Hunter pilots. Their first live flying was in the OCU's Hunter T7As or T8Bs that were fitted with an Integrated Flight Instrument System (IFIS) identical to that in the Buccaneer. Whilst these stalwart trainers in no way replicated the Buccaneer's handling characteristics, they did at least give the OCU's QFIs the chance to assess their student's handling skills in a dual control aircraft. When the TWU Hunters were

taken out of service in 1980 and replaced by the Hawk, first tour pilots arrived with no Hunter experience, so a few conventional T7s were allotted to No 237 OCU to enable student pilots to gain a degree of Hunter flying proficiency before starting the Buccaneer-specific exercises.

One of the greatest challenges in teaching on the Buccaneer was, for the pilots, the lack of a dual control trainer version so the traditional QFI's technique of demonstrate, practice and correct, could not be used. Thus, after two or three Hunter sorties, it was time for the first Buccaneer sortie – the Fam 1. This was flown with a QFI in the navigator's seat, with no flight controls, minimal appropriate instrumentation and no ability to demonstrate technique or intervene in the event of trouble, just a very good line of instructional patter. But, with the rear seat offset and a bit higher than the pilot's, the instructor in the back had a fairly good view forwards, a good view of the all-important BLC gauges and, depending on the size of his student pilot, a glimpse of the engine instruments and standby flight instruments. He also had the ultimate sanction of a Martin Baker departure if things really went badly. As far as I am aware, this option was only ever exercised once – by me – following engine failure on overshoot in the circuit in a Mk 1 Buccaneer at Lossiemouth, swiftly followed by Ivor Evans, my student pilot. Not a bad record in 25 years of RAF Buccaneer conversion training, but these Fam 1 sorties were always tense. Let me quote verbatim one instructor's experience, that of a USAF exchange officer.

> 'I was doing a Fam1 with Keith Hildred. He was doing OK, but we were told to break off our first straight in approach, so we went to the overhead to join the visual circuit. About half way round the final turn, with full flaps, droop and blow, the Buccaneer got a little quieter. We had lost the right engine. I shouted the recovery procedures to Keith and he correctly applied them but it still looked like we were not going to make the go round. I informed Tower of our engine loss and the expected ejection. By the time everything was cleaned up we could just maintain altitude and airspeed and crossed the hangars at right angles to the runway with a few feet to spare. This poor student had not even performed a circuit or roller in the

> Buccaneer and now he had to land it from a single engine approach. I told him to just worry about getting it down in the first half of the runway and the hook plus the arresting gear would do the rest. We successfully made it and stopped without the aid of the cable but there was a funny smell out of the front cockpit when we opened the canopy!'

The second sortie was a repeat of the first, this time with an experienced staff navigator in the back seat. His work up training as an instructor would have included handling the Buccaneer simulator in the front seat, some live flying in the Hunter and a demonstration Fam 1 sortie profile with a QFI, and a comprehensive brief on how to fly the Buccaneer, with particular emphasis on the circuit. The third and fourth familiarisation sorties explored the Buccaneer's single engine flying characteristics and some of the less commonly practised events such as blown take offs and unblown landings; these were flown with either a QFI or staff navigator in the back seat, depending on how well the pilot was coping. The final familiarisation sortie was flown as a student crew for the first time. A similar but shorter series of familiarisation sorties were flown by the student navigators with staff pilot instructors. Subsequently, the first sortie of each new event was essentially dual, staff pilot with student navigator and vice versa, with student crews then completing the phase.

For the student navigators, there was little by way of lead-in training after graduating from Air Navigation School other than a short course of low level visual navigation in Jet Provosts, and an introduction to handling the Navigation and Bombing System radar used in V-bombers, with a modified display replicating the Buccaneer's BLUE PARROT radar, in a collection of venerable Hastings known as '1066 Flight'. There was no reproduction of the navigation displays in the front seat of the Buccaneer apart from the range and steering signals on the head up display in radar locked-on attacks, so help from the front seat in managing the navigation systems was not really possible. All pilot instructors carried a suitably marked map. However, despite these limitations, the staff instructors all coped well with the challenge. Nevertheless, No 237 OCU did earn a reputation for being a hard school, somewhat undeservedly in my opinion, but almost certainly because of the challenge of instructing in a unique environment that

could not include practical teaching demonstrations in the air for either student.

The flying syllabus was based very much on that used by the RN and followed logical lines, with the familiarisation, or type conversion phase followed in sequence by navigation, close and tactical formation, weapons system familiarisation and weapon delivery, which included toss and dive bombing, level retard bombing and 10° dive rocket firing on the local weapons ranges. All of these weapons events were flown as three or four aircraft tactical formations. Night flying included navigation, formation and weapons delivery. The final sorties included evasion tactics, often using the unit's Hunters as threat aircraft, and simulated attack profiles, with a fighter threat provided either 'in house' or by Lightnings and Phantoms from air defence squadrons. With crews going to either maritime or overland front line squadrons the syllabus did not specialise in either role until the Germany-based squadrons were disbanded and the OCU moved north to Lossiemouth where the remaining two squadrons were maritime assigned. The syllabus remained broadly the same apart from the deletion of overland attack profiles and the introduction of basic maritime simulated attack profiles. Specialist training in the use of Lepus, the AN/ALQ-101-10 ECM pod, Pavespike, Paveway, Martel, Sea Eagle and air-to-air refuelling was carried out by the appropriate front line squadrons.

It soon became apparent that meeting course graduation dates was going to be much more challenging at Honington than it had been in the early days up at Lossiemouth, where there were two dedicated weapons ranges within easy reach, an enormous low flying area, very few areas of restricted and controlled airspace and a good weather factor. East Anglia was crowded with other RAF and USAF outfits, all wanting access to the weapons ranges; the low flying system was much more complicated and even out over the North Sea the many rigs and their support helicopter activity restricted freedom of manoeuvre. The weather, especially in winter, was much more restrictive and it took some time before student pilots had amassed enough flying hours on type to qualify for an instrument rating. The winter months were particularly difficult and options to detach to better weather were distinctly limited. I recall one desperate attempt to catch up when four aircraft were detached to Machrihanish, the only airfield that would

accept us. Our gallant ground crew travelled up in a J2 minibus and a 3-ton truck which brought minimal ground support equipment, quite a journey in the late 1970s. Inevitably one aircraft suffered a hydraulic failure, was jacked up and fixed, but when the landing gear was being cycled the mini hydraulic rig failed, leaving the Buccaneer up on jacks with the wheels all up. There was no replacement rig anywhere closer than Leeming. I will not reveal how we got the wheels down. Eventually HQ 1 Gp realised that action had to be taken to improve the winter sortie rate, so it authorised detachments to Akrotiri, called Exercise WINTER WATCHER. These were extremely popular, and the close proximity of Episkopi Range allowed some weapons events to take place, along with general handling, formation and evasion sorties in good Cypriot weather. When the OCU moved from Honington to Lossiemouth in November 1984 the problem disappeared, and no course ever graduated late.

Let me turn now to some of the specialist post-graduate courses that were undertaken by No 237 OCU. In 1973 the RN's training squadron, 736 NAS, disbanded so the OCU picked up the task of training RAF crews destined for 809 NAS and refreshing RN Buccaneer aircrew returning from other appointments. This involved teaching the art of 'hands off' catapult launches, deck landings, tactical and photo reconnaissance, 'buddy' air-to-air refuelling and some other tasks, such as Forward Air Control, not undertaken by the RAF squadrons. Thus it was not unusual to see a Buccaneer in RAF camouflage parked on HMS *Ark Royal*. The static steam catapult at RAE Bedford was also used for initial experience of the 'hands off' catapult launch. A small flight, known as the RN Unit, was established at Honington to hold and maintain spare aircraft for 809 NAS whilst it was embarked. These aircraft were flown when required by OCU aircrew, not necessarily just the RN ones.

It was not long before the Buccaneer was perceived by some of the staff in Headquarters as being a mini V bomber, rather than a maxi Hunter, and to be operated accordingly. In order to quash this perception, at the instigation of Honington's Station Commander, Gp Capt Peter Bairsto, a Buccaneer Attack Instructor's course, modelled on the Hunter Pilot Attack Instructor course, was quickly established. This soon became renamed the Qualified Weapons Instructor course. It was an intense, high-pressure course aimed at producing weapons and

An AIM-9G Sidewinder firing in 1987. (BAe Systems)

tactics experts for the front line squadrons and it soon proved to be very successful. Some notable QWI course achievements included developing the low level bunt retard attack, evolving fighter evasion tactics, participation in the RAF's first visit to Exercise RED FLAG in 1977 and the first RAF Buccaneer Sidewinder firings in 1987. Nevertheless, questions about where to stow the sextant still came down occasionally from on high.

Somewhat more nerve racking was the occasional requirement to provide aircraft for the Preview Exercise carried out by Empire Test Pilot's School students as their final task on the course. This was undertaken by pilots who had never flown a Buccaneer before. The exercise only allowed them three sorties to complete their assessment of the aircraft's suitability for its role so, unsurprisingly, they wanted to explore the outer limits of the aircraft's cleared flight envelope – often making excursions beyond it! The staff instructors nominated to fly in the back seat were brave men.

Last, but not least, was the Instrument Rating Examiners course, which naturally used the OCU's hard working Hunters. Having a fleet of Hunters was a great bonus, as they were regularly used for all sorts of tasks that were inappropriate for a Buccaneer. I have a photograph of one emblazoned with the words 'Club Taxi'. The OCU was also the home of the Buccaneer CFS Agent, one of the QFIs, who was responsible for carrying out standardisation checks on pilot handling skills. The OCU was also routinely tasked by Group HQ with visiting the front line squadrons to carry out standardisation checks on general operating procedures.

During most of its time at Honington the OCU never had a clearly

defined war role until 1984. However, there was a requirement to keep some crews current in the strike role; they and other aircrew would have probably been moved to reinforce the front line squadrons in the event of an increase in alert posture. The OCU's Buccaneer S2As, which had small pylons and could not carry Martel, the ECM pod or Pavespike, would have been generated as AAR tankers, again to support the front line, whilst the more capable S2Bs would have also been sent to the squadrons. This all changed in 1984.

The War Role, 1984 -1990

The disbandment of XV/16 Buccaneer Squadron at Laarbruch in February 1984 left RAF Germany without an airborne laser designation capability for its Jaguar and Tornado squadrons assigned to Option Lima. This was 2 ATAF's attack plan to interdict specific high value targets on the Inner German Border, consisting mainly of communications choke points such as bridges and autobahn intersections. Option Lima might well have been initiated at the very early stages of a confrontation with the Warsaw Pact, before border crossing was authorised. With 12 and 208 Squadrons at Lossiemouth assigned exclusively to SACLANT in the maritime strike/attack role under the control of HQ 18 Group, and No 237 OCU having no specific war role, after some debate at high level the latter was assigned to the task of supporting the RAF Germany squadrons in the role of airborne laser designators. Fortunately there were aircrew on the OCU who had recent overland Pavespike experience in Germany.

The OCU had to provide four Pavespike-capable aircraft and six crews at C3 status, ie available within forty eight hours of being tasked. The detachment was given the use of two Hardened Aircraft Shelters and space in the Pilot Briefing Facility in 2 Squadron's sector at Laarbruch. By 1985 the Tornado GR1 had replaced the Jaguar in the strike/attack role and 20 Squadron, based at Laarbruch, assumed the task of covering Option Lima, followed eventually by 16 Squadron. Collocation of bombers and designators on the same base made great sense. The aircraft fit was similar to that previously used by the Germany based Buccaneer squadrons, consisting of a Sidewinder AAM, Pavespike, under wing tank and the ECM pod, with four retard 1,000lb bombs in the bomb door. Chaff was carried in the airbrake. Initially some doubt was expressed by 20 Squadron's aircrew as to

whether the Buccaneer would be able to keep up with the Tornado, particularly in the event of an emergency abort from low level but these doubts vanished after in-flight experience showed there was no problem. When the Tornado was armed with two Paveways we found ourselves well throttled back, apart from the final phase of an attack profile.

The concept of operations was virtually identical to that previously employed by the Germany-based Buccaneer squadrons. Two Buccaneers would accompany the four-aircraft attack package and transit in a loose arrow formation, one Buccaneer with each pair of Tornados. The attack aircraft would set up a profile to toss their LGBs from low level towards the target. Each Buccaneer crew would carry out its individual IP-to-target run, initial target acquisition being the pilot's responsibility. Once the navigator had been conned onto the target by the pilot, he would designate it with his laser at the calculated time after weapon release such that the LGB would impact the target. Fire the laser too soon and the LGB would fall short, too late, it would overshoot. This was a very tricky operation and demanded a high level of dexterity from the navigator, working head down under high g and keeping his Pavespike aiming mark tracking the target entirely manually as the pilot turned away from the target.

In order to maintain the necessary skills for this war role the OCU staff aircrew used their own Staff Continuation Training hours and practised as pairs, one aircraft simulating the 'bombers' the other the 'spiker', then exchanging roles for the next run. Luckily, with the large and adjacent low flying area of north Scotland this was fairly easy to do. The OCU also participated in MINEVAL and MAXEVAL exercises at Laarbruch, although this did not happen very often, as it was difficult to fit these in with the routine of normal training. Singleton aircraft used to visit Laarbruch to fly with the squadrons on an occasional basis. As a C3 outfit the OCU did not participate in RAF Germany TACEVAL exercises.

A very strong supporter of the Option Lima concept, and its support by No 237 OCU, was Gp Capt Nigel Walpole, who was a senior staff officer at HQ 2ATAF. He discovered that the Dutch air force had acquired a stock of LGBs from the USA but had no access to any designators. With his energetic assistance a NATO Squadron Exchange

A Buccaneer, with a Pavespike beneath its port wing, leading a pair of Paveway-armed Sea Harrier FA2s en route Garvie Island. (Eeles)

was organised in September 1985 between No 237 OCU and 322 Squadron RNelAF, whose home base was Leeuwarden. During the visit to Lossiemouth by 322 Squadron, the OCU's Buccaneers designated a number of LGB toss deliveries by 322 Squadron's F-16s at Garvie Island range. All of the LGBs guided successfully, and all hit the designated aiming point on the rock target. As a consequence of this very successful exercise, No 237 OCU was formally assigned to support 322 Squadron on Option Lima, a great example of NATO national interoperability. Having established the OCU as a provider of airborne laser designation we often found ourselves being asked to help other units, such as the Sea Harriers of 899 NAS from Yeovilton.

A further bonus of this war role was that a Buccaneer QWI course was tasked with undertaking trial firings of AIM-9G Sidewinders on Aberporth range in 1987, no Sidewinder firings having ever been done previously by RAF Buccaneers. Three Buccaneers were deployed to the Strike Command Air-to-Air Missile Establishment at Valley where two Sidewinders were fired, each from a different profile. Both missiles guided successfully and hit the towed target flare.

Needless to say, HQ 18 Group, responsible for all three Buccaneer squadrons at Lossiemouth, was not overly enthusiastic about this overland activity. It would have much preferred No 237 OCU's aircraft and crews to be assigned to 12 and 208 Squadrons in time of tension in

order to reinforce the somewhat meagre maritime attack and strike capability at Lossiemouth. The HQ staff believed that the overland training carried out by OCU staff crews was an unnecessary and costly diversion from the OCU's primary role of training crews for the maritime squadrons. However, thanks to the enthusiasm and dedication of both aircrew and ground crew no course was ever late in graduation or lacking the required skills when they arrived on 12 or 208 Squadrons, so HQ 18 Group reluctantly put up with it. The overland war role gave to the OCU great cohesiveness and team spirit; sadly, despite my best efforts, we never got a shadow squadron number plate, almost certainly because of lack of support from 18 Group. No 237 OCU retained this unique war role until the end of the Cold War in 1990, when it was disbanded and operational conversion was devolved to a specialist flight on 208 Squadron.

It could be said that the final justification of the OCU's war role came in Gulf War I, when Buccaneers supported Tornados in overland LGB attacks, albeit from high rather than low level. Some of the original OCU aircrew were still around so their expertise was much valued, not only within the Buccaneer detachment but also among the deployed Tornado crews.

In summary, after its formation in 1971 No 237 OCU quickly established itself as a busy and capable outfit, training crews for the front line squadrons, running various specialist post graduate courses and also providing short courses for staff officers and others associated with RAF Buccaneer operations. It survived the force reductions caused by the RED FLAG accident and moved from Honington to Lossiemouth, where it continued as an independent unit, with a unique war role, for another six years. Throughout its existence it never failed to live up to its motto of 'Panache et Precision'. I am proud to have commanded it.

THE BUCCANEER IN RAF GERMANY

by Sqn Ldr Vic Blackwood

Vic Blackwood joined the RAF in 1966 as a navigator. His Buccaneer experience included in initial tour with 809 NAS followed by successive stints with Nos XV Sqn, 237 OCU, 208 Sqn, XV Sqn and 237 OCU. Having converted to the Tornado GR1, he instructed on the TWCU and served with the TOEU at Boscombe Down and as a Flight Commander on No 14 Sqn at Brüggen; his final tour was in the Attack Office at HQAAFCE, Ramstein. After leaving the RAF in 1990, he joined BAe Systems as an instructor with the 7th Sqn RSAF at Dhahran, retiring as Chief Instructor in 1999.

Towards the end of the 1960s the Cold War was at its height. The Central Region comprised some of the most heavily-defended airspace in existence. A myriad of fixed missile sites, along with their associated search and fire control systems were deployed throughout East Germany and Poland. These installations were complemented by the numerous mobile systems integrated within the Soviet Guards Armies and the Motor Rifle Divisions (MRD) permanently based to the east of the Inner German Border (IGB). There was an urgent need to replace the ageing Canberra Force in Germany. These aircraft provided the only RAF offensive air assets and were declared in the strike role[1], with each squadron maintaining two aircraft on Quick Reaction Alert (QRA), able to launch within 15 minutes as part of NATO's 'tripwire' policy. The decision was made to equip the Brüggen Canberra Wing with three squadrons of Phantoms and replace the Canberra squadrons at Laarbruch with new-build Buccaneers. The first of these (No 15 Sqn) was formed at Honington in October 1970 and moved to Laarbruch in January 1971. They were joined by No 16 Sqn in October 1972, thus ending the Canberra era in RAF Germany (RAFG).

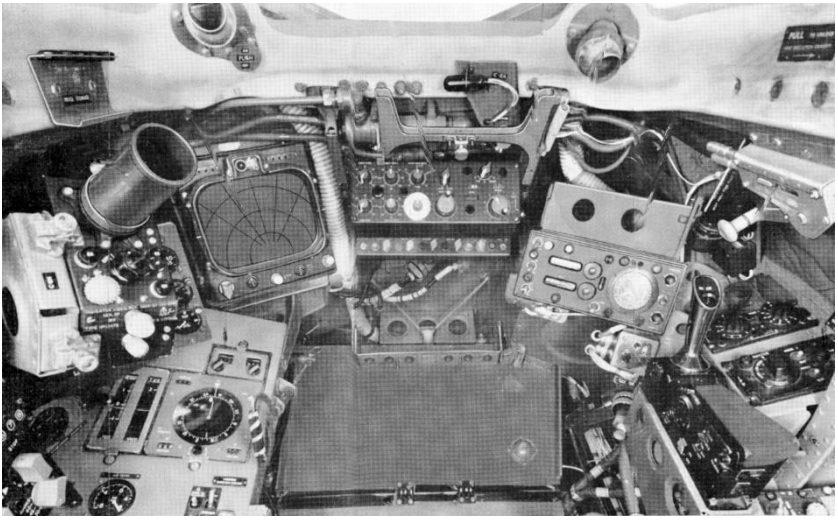
RAFG's strike capability would now rest with Brüggen's Phantoms and the Laarbruch Buccaneer Wing, providing greatly enhanced dual-capability to COMTWOATAF, as the new aircraft types would be declared in both the strike and attack roles, reflecting the 1967 change from 'tripwire' to 'flexible response'. Unlike their UK-based

No 15 Sqn's initial batch of factory fresh Buccaneers.

counterparts, there was no air-to-air refuelling requirement in the Central Region and probes were not fitted. From its home base near the Dutch/German border, the Buccaneer could carry a viable combat load (up to 8 × 1,000 lb), remain at low level and still reach targets near the East German/Polish border. More importantly, when employed in the strike role, it could reach well into Poland. The aircraft, as delivered, were effectively identical to the last of the new airframes delivered to the RN as regards equipment fit.

Despite the intense radar environment, the Buccaneer had no all-round radar warning equipment fitted, although its ARI 18216 Wide Band Homer (as used in the maritime role) could provide aural and limited directional indications of some air and ground threat radars. This shortcoming was eventually rectified when the ARI 18228 Radar Warning Receiver (RWR) was fitted in the bullet fairing on the fin. This new equipment covered all of the threat bands, including CW systems, and displayed the threat direction accurately. In 1973, the introduction of the bomb door tank provided another 3,200 lb of fuel and further extended the operational range. This modification incurred no real handling or drag penalty and did not affect the weapon load. In 1976, the Westinghouse 'Dash-10' jamming pod was fitted to the aircraft. This equipment had been used by the USAF in Vietnam and provided some degree of protection against the fire control systems deployed by the Warsaw Pact (WP) forces.

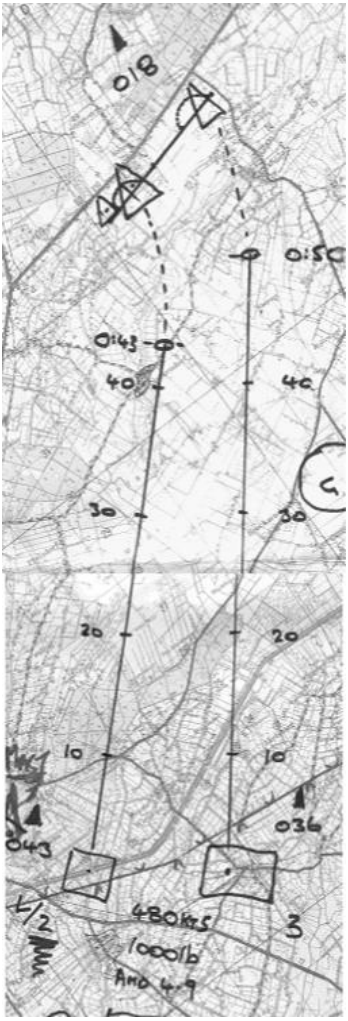
The layout of Laarbruch was straightforward. A single east/west runway, two parallel taxiways and an aircraft dispersal area at each



The rear cockpit. ARI 18216 Wide Band Homer and ARI 5930 BLUE PARROT radar on the left, ARI 5880 BLUE JACKET Doppler on the right.

corner. In addition, a separate compound on the north side housed the Weapons Storage Areas and the QRA Compound. Area defence was provided by the Bloodhounds of No 25 Sqn whilst the RAF Regiment deployed Bofors 40/70mm guns for short-range airfield protection. Each of the dispersals had a hangar/office complex and a decision was made to operate the aircraft from each of the revetments within the dispersal areas, rather than from the hangar. No 15 Sqn was initially located in the 'spare' NW dispersal before moving to a permanent home in the SW. Initially flying could be sporadic at times, because the Buccaneer was a new aircraft, for both aircrew and groundcrew. Operating from widely-dispersed individual revetments required a 'see-off team' for each aircraft and, if a problem occurred during start-up, there was a delay until a specialist could reach the pan. In due course, the NATO Hardening Programme provided each squadron dispersal with a number of Hardened Aircraft Shelters (HAS) as well as a Pilot Briefing Facility (PBF) to enhance the ability to operate under combat conditions, including nuclear, biological and chemical (NBC) attack.

In 2ATAF, the 'art' of day, low level navigation could be challenging at times. The Buccaneer had been designed to find 10,000



Steam-driven navigation – essentially map & stopwatch

tons of steel floating in the North Atlantic. There was no new equipment fitted to cater for operations over the North German Plain, where poor visibility from the Ruhr or low cloud could limit visual flying. Although the BLUE JACKET Doppler equipment could provide a reasonable output of groundspeed, the latent accuracy of the GPI could deteriorate so as to render its use marginal at times. TACAN was not useable at low level and the navigator either became adept at using a map and stopwatch or was 'lost'! In the FRG, low flying was normally permitted between 500' and 1,500' above ground level (agl). However, there were several areas where the minimum height was reduced to 250' and these areas were inter-connected by a system of link routes, also with a 250' limit. An Air Defence Identification Zone (ADIZ) ran the length of the IGB and was to be avoided at all costs. However, a 'Buffer Zone' was established along the western edge and aircraft could low-fly below this airspace if squawking correctly.

To the east of Laarbruch, the terrain was mainly flat, and rather featureless, open countryside, punctuated by the Osnabruck Ridge which extended NW from the Hartz Mountains (hills really) near the IGB. Once beyond the ridge, the terrain remained low-lying right up to the Polish border and beyond. In contrast, to the south of Laarbruch (towards the 4ATAF area), the terrain was marked by rolling hills and deep river valleys, until reaching the Czech border or the foothills of the Alps in southern Bavaria. Training sorties were

generally only flown to southern Germany when the weather in 2ATAF was unsuitable. When all of Germany was below limits, sorties were flown to the UK low-flying system and weapons ranges to ensure training continued.

The strike role entailed training for both Selective Release (Sel Rel) and as part of the Launch Sequence Plan (LSP), ie NATO's General Release of Nuclear Weapons – the Primary Strike Programme (PSP). Such missions would be flown entirely at low level, by singleton aircraft, to targets deep inside East Germany and Poland. The priority training task was for the Buccaneers to be declared 'Combat Ready – Strike', in order to replace the Canberras which were still maintaining QRA. Both the Canberra, and Brüggen's Phantoms, employed American nuclear weapons which required an input from a USAF Custodial Officers in the event of a scramble. In addition, the aircraft required USAF Security Police as aircraft guards. The Buccaneers would employ the WE177, a British weapon, and there would be no USAF input required during guarding or launch procedures.

The Buccaneer was equipped with two nuclear-certified weapon stations within the bomb bay. The wiring harness for the nuclear side of the armament system was totally independent of the conventional weapons stations. The Special Weapons Role Panel in the rear cockpit was used to provide electrical power to the weapon, to operate the Bomb Release Safety Locks and to control the necessary functions and release modes. Weapons release was controlled by the pilot's 'Accept' button, thus preserving the 2-man principle for the control and release of nuclear weapons. A Weapons Response Simulator (WRS) could be fitted to either (or both) of the special weapon stations in the bomb bay and the full checklist procedure was required in order to release a weapon. The WRS could carry 4 × 4 lb or 2 × 28 lb practice bombs so that laydown or toss attacks could be completed and the attack accuracy verified by the range score. Ground-based Nuclear Certification Procedures Training was overseen every year by the Wittering-based Weapons Standardisation Team (WST) and woe betide any crew who did not follow the correct procedures!

The 'white and shiny' WE177 was a multi-yield weapon which could be released at high speed (better than 540 kt) and low altitude in a laydown attack. Parachutes would deploy to slow the weapon prior to impact and a timer would run down to permit the aircraft to escape

The 'white and shiny' WE177.

the subsequent detonation and blast wave. To achieve an airburst, or provide a greater stand-off distance, the weapon could be tossed towards the target. Running-in at 540 kt, the aircraft would commence a 3G pull-up at about 4 miles from the target and the weapon was released after 9 seconds. A recovery manoeuvre would be flown to turn away from the target and return to low-level to escape the weapon effects.

The airspace restrictions in Germany limited the maximum speed and height above ground and thus did not permit practice toss attacks unless within a weapons range. Therefore, most simulated attacks involved a laydown delivery. Strike qualification required crews to complete (as I recall) twenty strike sorties. Each one required the crew to plan a low-level route which included a simulated laydown attack on a suitable target complex. They would then complete a timed first-run attack at a 2ATAF weapons range before recovering to Laarbruch. Each of the weapon deliveries had to meet the Allied Command Europe (ACE) standards for the mode of attack, (eg 300' for visual laydown, 3,000' for radar/toss delivery) to confirm crew qualification. There was a great emphasis on the crew concept and, where possible, first-tour pilots were paired with an experienced navigator or vice versa. Once strike qualified, crews were required to complete regular target-study

A pre-HAS Buccaneer on QRA.

sessions of their designated target. On 1 July 1972 No 15 Sqn was formally declared 'Strike Ready' and it began to stand QRA alongside the No 16 Sqn Canberra in the pen at Laarbruch.

QRA duty started at 1700 hrs when the on-going crew would finish their normal working day, suit-up (no squadron badges, etc) and be driven to the compound. The pilot would sign for the aircraft and weapon arming keys, the navigator would check the safe containing the Mission Bag and everyone would settle-in for a quiet but boring night – no Sky Sports TV in those days, only BFBS radio! There was accommodation for the aircrew (plus the USAF Custodial Officer for the Canberra) as well as the support groundcrews. The Airmens Mess provided a cook who prepared dinner and lunch. He also brought with him copious amounts of bacon and eggs so that no one went hungry. The RAF Police guards worked shifts and thus did not require feeding. Each morning, an aircraft inspection would be completed; power would be connected and a radio/telebrief check carried out with Base Ops. On completion, all would retire to the crew rooms once more. Crews could expect Q-duty two or three times each month and, on occasion, their reaction times would be tested by Station Ops in the form of a practice alert. These alerts could occur at any time, day or night and always if an officer of air rank from HQ RAFG was visiting! A welcome change of routine was implemented circa 1978 when dispensation was granted

to permit a Q-crew to leave the pen and complete a mission in the Buccaneer simulator. However, they were still at 15-minute readiness!

The QRA/strike task was a 24-hour/all-weather commitment and it was obvious that the performance of both the aircraft and crews would be severely impacted by weather and/or the dark! Visual attacks were clearly the preferred option as they minimised the deficiencies in the weapon system. However, for night or IMC attacks against a non-discrete radar target, the navigator had to use a Heath-Robinson lash-up to achieve weapons release. Night flying within the FRG was limited to pre-defined routes. These routes were flown at a specific altitude, 1,000' above the highest obstacle within 5 nm of track. The radar was initially of little use, as it lacked the resolution needed overland. In an effort to remedy this, the radar was modified to sharpen the beamwidth using Monopulse Resolution Enhancement (MRE), thus improving the definition.

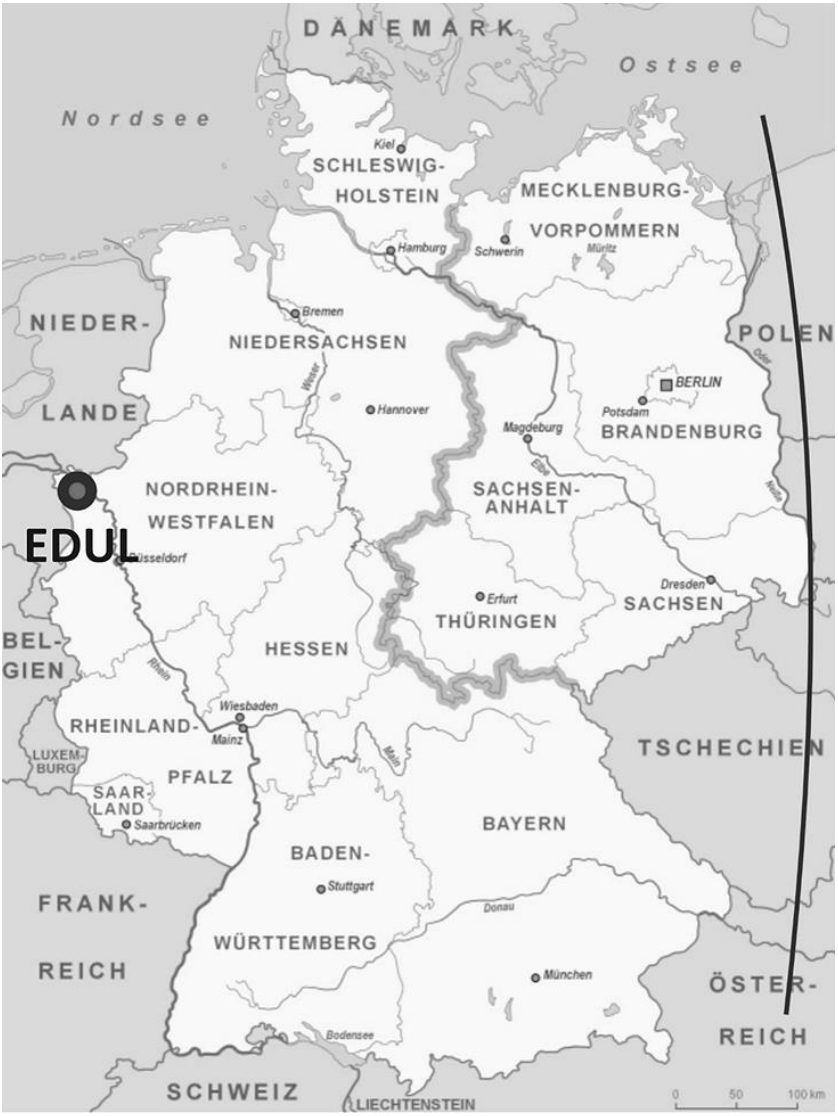
At the same time, the navigators began to use Continuous Mosaic Radar Prediction (CMRP) to assist in their interpretation of the radar display. The CMRP was essentially an attempt to show how the hill shadows cast by higher terrain might appear. The CMRP image could be compared with the actual radar picture permitting a target/fix position to be identified, although the general accuracy when using this was usually poor. Nevertheless, crews flew low altitude night routes within the FRG, the UK and even into France using this technique and it did work – kind of. They even practised scored attacks, using the Radar Bomb Score (RBS) facilities at Bergholtzhausen and Spadeadam, which were fortunately located in relatively hilly regions and thus provided some useable hill shadows! Operationally, the CMRP would have been produced for a leg altitude of 500' agl, rather than the peacetime limit. This may well have enhanced the effectiveness of the predictions. By the end of the decade, a GPI Correction Unit (GPIC) was fitted to the navigation system, permitting the navigator to position a radar marker over a radar discrete fix-point, on or off track, and then change to the target or waypoint. However, it was then necessary to re-mark the target with the GPIC selected ‘Out’ to provide the pilot with range to pull-up/release and thus any real benefit was minimal for night/IMC attacks.

All strike missions were prepared by the Mission Planners. The

mission bag contained two hard-backed booklets containing ½-mil mapping from Laarbruch to the target and back to a recovery base, as well as the 1:50k, IP-to-target attack run mapping. Each leg showed all relevant navigation, timing and fuel data as well as any significant INTEL and expected nuclear bursts near track. In addition, the Release Codes were 'Fablonned'[2] onto the back of the hard cover, as were the Vertical Dispersal/Recall codes. During the first half of the 1970s, the aircraft carried a single weapon. However, towards the end of the decade, the load was increased to two weapons and the targets were invariably located a bit further east, where the locals did not speak much Polish! By this time, Brüggen's Phantoms had been replaced by Jaguars in the strike/attack role and they used the British WE177s which were subsequently painted green, so as to blend in with aircraft camouflage.

For attack operations, the Buccaneers could expect tasking in three distinct roles, ie Offensive Counter Air (OCA), Air Interdiction/Battlefield Air Interdiction (AI/BAI) and Close Air Support (CAS). Against large static targets, such as airfields, the aim was to co-ordinate attacks from different directions before sticks of up to six 1,000 lb bombs were either tossed at the target or delivered from a lay-down pass. Interdiction targets included lines of communication, such as road/rail bridges, choke points, storage depots and convoys. CAS operations were not normally the preserve of the Buccaneer, but they offered a secondary role in the early days, when they were exercised with the FACs of 1(BR) Corps. The most likely targets would have been concentrations of armour and mobile air-defence systems, when the most effective weapons were rockets – the 2-inch RP or 68mm SNEB – delivered in a 10° dive, or BL755 cluster bombs delivered from a lay-down pass. However, the principal attack option was OCA. This task had a high priority in the war plan and, to reduce reaction times, a number of missions were pre-planned. The primary Laarbruch mission was known as Option Alpha which involved a six-ship, co-ordinated attack on one of the high-value Soviet airfields in East Germany.

The initial tactics and weapons delivery profiles employed owed much to the aircraft's naval origins and the aircraft were planned to transit in standard low-level battle formation to a split point. Each aircraft would then route via individual IPs for their synchronised attack runs. The aim was to saturate any target defences and, having cleared



The Buccaneer's likely battlefield.

the immediate area, the formation would re-form for the transit back to base. In the early 1970s, the threat posed by ground-based defences was formidable. Soviet airfields and other major target complexes were

protected by SA-3 sites, whilst medium to high-level cover relied on the SA-2. In addition, the East German SA-5 site was considered a priority target, as it could, in theory, threaten AWACs even when on station well back from the frontline. Moreover, every Soviet MRD was equipped with a range of surface-to-air weapons. Initially, the SA-4 provided the main short-range cover but, within a few years, this was superseded by the more capable SA-6 and eventually the SA-8. There were also large numbers of short-range, man-portable SA-7s to be expected. These missile defences were bolstered by the inclusion of self-propelled gun systems such as the ZSU-57-2, radar-guided ZSU-23-4 and similar towed systems. Finally, any overflight of troops would almost certainly encounter small arms fire.

The main fighter threat was provided by the East German and Russian regiments stationed in the DDR and their equivalents in Poland. Although available in large numbers, many of these fighters (MiG-15, -17 and -19) were of limited use at low altitude due to the performance of their radar/missile systems. The MiG-21 was the most capable at the time, but there was little scope for any GCI intercept of Buccaneers at low level under the normal closely-controlled GCI procedures employed by the Soviets. The probability was that any intercept would result from a chance visual pick-up, or from a fighter CAP. Fighters would have to close for a guns kill and the lack of any self-defence weapon (RAFG refused to allow Buccaneers to carry the AIM-9B) meant that the only defence was to remain at low level and run the fighter out of fuel or employ ‘retard defence’, ie releasing one bomb in the hope that the blast and/or fragmentation might damage the fighter.

It was most likely that any outbreak of hostilities in the Central Region would occur following a period of rising tension. The ‘game plan’ was that this period would enable NATO to bring to readiness those forces already stationed in Europe and, if time allowed, fly-in those out-of-theatre forces earmarked as reinforcements. If the political situation could not be resolved and hostilities commenced, the Warsaw Pact Forces would surge westwards due to their numerical advantage in armour and artillery. NATO would try to hold the line but would probably have to give ground and fight defensively until such time as SACEUR (and the political masters) decided that there was no other option but to go ‘all-in’ and execute the PSP. This scenario is what we trained for. The Laarbruch Wing would initially operate in the attack

role in support of the land battle and then re-role for strike as the ground situation became critical.

In peacetime, the success or failure in our task was measured during the annual Tactical Evaluation (TACEVAL). A NATO-led team of evaluators would arrive suddenly and assess the ability of the station to meet its war role over a 4-day period. Of course, the result of this evaluation was make-or-break for the station execs and so we needed to be ready by having a series of mini-evaluations (MINEVALs) during the year, culminating in a MAXEVAL just a few weeks prior to the anticipated, but unscheduled, NATO visit. They all followed the same pattern:

Day 1

Alert Called – Station personnel report
Aircraft/weapon loads generation (70% UE within 12 hrs)
Mission Tasking for Sqns ('practice plan' on *real* targets east of IGB)
Aircraft reloaded with practice bombs and attack missions flown within the FRG system

Day 2

More 'practice plans' and FRG sorties (4ATAF/UK is weather alternate)
Possible night missions – singleton 'Night Charlie'[3] to Nordhorn or Hi-Lo UK

Day 3

Attack tasking continues as Days 1 & 2
First instance of Sel Rel – experienced crews
2 aircraft strike-prepped and loaded
2 crews – primary & secondary
When both 'on state', WE177s off-loaded and replaced by practice bombs
'Execute' received – primary launches; back-up stands down
Late pm, attack tasking halted; all aircraft generated in strike role
WE177 live/training rounds prepped and loaded
Weapons accepted by crews and declared 'On State'
Weapons downloaded; re-armed with practice bombs. Crews still 'On State'

Once the nuclear hurly-burly of a TACEVAL was nearly done, the end result could be the delivery of a 28 lb practice bomb.

Day 4

Crews at 15 minutes readiness (initially in Sqn until HAS programme complete)

Simulated 'Contamination Black' conditions – gas masks and tin hats!

'Execute' signal received – General Release – crews to cockpits, power on

Crews launch if correct code, otherwise 'Withheld'

Released aircraft airborne within 15 minutes

'White Light'[4] applicable on ground, otherwise no possible recall (this applied in the first few years, but the system was ultimately modified to include an airborne recall option)

If not released, nuclear-loaded aircraft expect target change or launch to vertical dispersal

Released missions to Nordhorn Range via a field target

Recover to Laarbruch for mission debrief

ENDEX – Hooray!!!

There were other annual exercises where we tested the ability of the UK, French and Danish air defence systems, eg Ex HAMMER/MALLET BLOW, Ex DATEX and Ex BLUE MOON. In addition, an annual deployment to Decimomannu (Sardinia) to complete an armament practice camp provided a welcome Mediterranean break and a period of concentrated weapons practice.

To be more appropriate for the high desert terrain of Nevada, for RED FLAG 77-9 the Buccaneers were given an Alkali Removable Temporary Finish in Dark Earth and Light Stone.

However, in 1977, the RAF was invited to participate in the RED FLAG training programme in Nevada.

US combat losses during the Vietnam War led Tactical Air Command (TAC) to set up a training scenario, designed to replicate the conditions and stress which all crews experienced during their first few combat sorties. Located in Nevada, the sheer size of the exercise area was impressive and full-size outlines of typical targets had been bulldozed into the desert. Airfields, industrial complexes, missile sites and convoys were scattered throughout the western portion. These targets could be attacked using live or practice ordnance. A series of manned sites used Soviet weapon systems employing authentic radar/visual tracking and fire control procedures to provide crews with the ultimate in realism. Preparation for the exercise was intense. The selected RED FLAG crews were cleared to fly to 100'. This could not be practised in Germany, so a series of work-up sorties were flown in Scotland, with over-night stops at Machrihanish. The Scottish 'moon country' proved an excellent environment for crews to get used to being lower and faster. Spadeadam replicated the hostile EW environment and Phantoms from Leuchars provided the fighter frolics! In Nevada, the RAF contingent was split, with the aircraft being deployed by No 208 Sqn, using tanker support. They then participated in the exercise for the first two weeks before the RAFG crews replaced them.

The RED FLAG environment could not have been more different

The Pavespike pod.

from Germany, as the terrain included dry salt-lake beds, interspersed by mountainous ridge-lines and plateaus. Crews felt exposed in the bright sunlight and clear desert air and realised that flying too low kicked-up a 'rooster tail' which could be seen at long range. Initial sorties were planned to avoid known defences. However, we soon realised that we could get more out of the sortie by deliberately flying through the active ground defence sites to practise terrain masking, rather than clearing the target area. In addition, most of the US attack assets normally exited the range to the west and recovered to Nellis due to their low fuel reserves. The Buccaneer was able to reach the target area, play for a while and then route back as it would have to do for real. We even had enough fuel for the odd 'canyon tour' before landing at Nellis.

I think it is safe to say that the Americans were ill-prepared for the 'Bananajet'! Their Vietnam nightmare had driven them away from very low-level ops and those aircraft, such as the B-52s, F-111s and RF-4s which did still operate at low altitude, all crossed ridgelines wings level and thus ballooned until back to low-level. Aggressor pilots were un-nerved by the Buccaneer tactic of over-banking to 130° and pulling the nose below the horizon before rolling-out and continuing in the weeds! They were unable to achieve the requisite 'blue sky + tone' kill criteria, for a simulated AIM-9L launch. The exercise was so well-received that participation on an annual basis was established until the unfortunate fatal accident in February 1980 which resulted in the fleet being grounded.

Recovery from the grounding was slow, although both squadrons continued to maintain QRA until normal service was resumed, when the surviving airframes were cleared to fly once more. New equipment was tested to provide the aircraft with the ability to designate targets by fitting the Pavespike pod. Adapter kits were supplied to convert 1,000 lb 'dumb' bombs into 'smart' weapons. Yet again, the lack of an

inertial platform in the aircraft required another Heath-Robinson fudge! Target acquisition required the pilot to point the bore-sighted laser at the target. The navigator, having identified the aiming point, could then start to track as the aircraft turned away, so as to clear any target defensive fire. 'Simple!' . . . Not really! The 'spike' display was on the cockpit floor, between the nav's legs. With no stabilisation, the nav's internal gyros could topple as the tracking inputs altered with the aircraft's change of direction. But it could work, and the sheer skill of the crews made it work, at least by day and in reasonable visibility. Operationally, attacks in poor visibility or at night were not viable but, in good weather, co-ordinated 'spike' attacks involving both Jaguars and Dutch F-16s were practised and achieved some good results.

In September 1983, Laarbruch welcomed the arrival of the long overdue Tornado GR1 and No 15 Sqn's Buccaneers officially handed the baton over to No 15 Sqn's Tornados on 31 October, leaving No 16 Sqn to soldier on for another few months until they too were replaced by Tornados in March 1984, thus ending the Buccaneer era in RAF Germany.

Notes:

[1] It should be understood that the term 'strike' implied the use of nuclear weapons, as distinct from a conventional 'attack', a convention that was strictly adhered to. **Ed**

[2] *Fablon* was the trade name for a range of rolls of sticky-back plastic sheeting, in this case transparent and ideal for covering maps to prolong their life and/or make them chinagraph-reusable. At the time it was produced by H-A Interiors Ltd, but they have long since gone into liquidation. **Ed**

[3] Night flying in the FRG was confined to standard routes, annotated A, B, C, etc. The normal option flown from Laarbruch was Route C, hence 'Night Charlie'.

[4] A crew on QRA could receive a release message relayed via radio, telebrief or even face-to-face, although a mission could be cancelled while the wheels were still on the ground. It is understood that, at USAF-operated airfields, as an additional means of communicating a cancellation, the control tower's flashing green identification beacon could be changed to white – hence the colloquial 'White Light cancellation'.

Q&A and Discussion 1

Paul Smiddy. I have two questions. First, we have seen several pictures of the aircraft parked with their wings folded and fewer of them with wings unfolded. What was the standard practice when parking aeroplanes – when not in a HAS? And my second question. How did the chop rate compare with other OCUs at the time?

Air Mshl Sir Peter Norris. It tended to vary, depending upon where you were – and circumstances. For example, if you were putting two aircraft in a HAS, you would have to fold the wings. I recall that, on 15 Sqn we developed a technique – as a counter to the TACEVAL team who would block a hangar door – that involved partially clearing the blockage and taxing the aircraft out through the gap with their wings folded.

Gp Capt Tom Eeles. Before the RED FLAG accident, we used to fold the wings and spread the wings at any time, while taxying in, taxying out and so on. But after the accident, to minimise unnecessary fatigue we were stopped from moving the wings while the aircraft was moving. Still OK at a standstill, but not while taxying.

Having folding wings in the RAF was inherently a bit of a flight safety hazard. There was an incident – I think at Laarbruch? – that involved someone taxying out for a night sorties with is wings folded. Luckily, when he got on the runway, the alert chap in the control caravan noticed that the upper anti-collision light was reflecting off the inverted top surface of the folded wings. (*nervous laughter*)

An S2B, XZ431 of No 12 Sqn folding its wings while taxying. This practice ceased following the RED FLAG accident. (Alec Blyth)

The chop rate? I can't really be sure, but I fancy that it may have been a bit higher than the other fast jet OCUs, simply because of the lack of a dual control facility. We had the simulator, of course, and the Hunter and those sufficed. up to a point, but if someone just wasn't 'getting it', we had to work within our available budget which meant, in real terms, fuel and flight time. So if someone failed a trip, we would probably re-fly it, maybe even twice, but after that there really wasn't much point in persevering and, since there wasn't much more that we could do he would be let go to a less challenging role. So, I think a higher chop rate than the Harrier, Jaguar and Phantom – but not excessively so.

Philip Ratcliffe. Would I be right in saying that the US Navy equivalent was the A-6 Intruder and, if so, how did it compare with the Buccaneer?

Air Cdre Graham Pitchfork. We had a Buccaneer/A-6 exchange programme. The big difference was side-by-side seating, which had some advantages – and one or two disadvantages. The crews liked it. The A-6 wasn't as fast as the Buccaneer, or as manoeuvrable but it did carry a pretty heavy weapon load. The crews that went across certainly enjoyed flying it but, on balance, I think they preferred the Buccaneer.

Paul Burton (of the AWE). The strike role. Vic spoke about the WE177 – I think just the 177A. Was the Buccaneer cleared for the 950lb 177B and C, and did you have an interim period with RED BEARD?

Sqn Ldr Vic Blackwood. Not RED BEARD, that had been withdrawn from service by then. We initially used the 600lb weapon, as it was called, and later the B and C as well, so we were cleared to carry all three.

Norris. I am conscious that we don't have an engineer on today's programme – and there were a lot of engineering issues. Do we have someone in the audience might be able to fill that gap?

Sqn Ldr Bert Neo. I was lucky enough to have done two engineering tours on the Buccaneer. In 1972, I was with 12 Squadron in the maritime role. Then on No 16 Sqn in Germany, in 1980, in its overland role, in fact serving under Sir Peter. As on all front-line squadrons we

did encounter numerous problems – hydraulic leaks, fuel leaks, electrical and avionics system malfunctions and engine problems as well. But the squadrons usually got by. However, there were two major and significant engineering problems which were outside the norm and beyond the squadron's resources to fix. By coincidence, there was one during each of my tours.

In 1972, at Honington, we had excessive problems with the Spey engines, and it transpired that the main cause was cracking of the blades on the first stage of the low-pressure compressor. Consequently, after each flight we had to inspect for blades damage, and that could take up to five hours. Inspection from blade to blade, often resulted in engine changes and there were many of them. The workload on the engine fitters was enormous. We did repair some blades as an interim but eventually the modification came out – Rolls-Royce came up with a permanent fix and we got a modified redesigned blade.

I moved on to Laarbruch in 1980 – the major defect this time was cracking of the wing spar. This has already been covered this morning. This resulted in the fatal incident during RED FLAG in Nevada where we lost an aircraft and, tragically, its crew. The Buccaneer fleet was grounded for six months from the February. We spent these six months flying Hunters instead. During this uncertain period, the ground crew were working pretty hard, doing inspections, polishing, grinding and implementing the modifications for the aircraft assessed as 'salvageable'. Morale was helped by our shift system which guaranteed that every shift got a long weekend off every fortnight – finishing on Friday at 4.30pm and going back to work on Monday night. We also had some relief during the Hunter flying period, when we had a squadron exchange. We went down to Spangdahlem in southern Germany where the Americans were amazed to see the Hunters coming in, instead of the Buccaneers. We were obviously very pleased when we got back to operating Buccaneers again in August. In October of the following year we went to RED FLAG again, led by Sir Peter Norriss – and we enjoyed that.

An aside. My memory was prompted by a photo printed in the *Daily Telegraph* a couple of months ago. There it was, an F-35, the RAF's latest, with a pilot sitting under its wing, taking shelter from the sun. Nothing unusual, except that the aircraft was in Ibiza. It was only there because it had diverted due to a problem. That brought a smile to my

face. *Déjà vu* indeed – we'd been there and done that, some 40 years ago.

Every now and then, we sent pair of Buccaneers away from Laarbruch for a weekend Ranger, usually somewhere in the Med. The idea was for them to sharpen their navigational skills. There was also the chance to top-up the wine cellars. After all, there was always plenty of space in the Buccaneer bomb bay. On one occasion, on their return to base, one of the pair encountered a problem and they decided to divert. Of the many airfields they could have landed at, they somehow had to choose Ibiza. What a surprise! The groundcrew team had a week in the sun recovering the aircraft back to base. Happy bunnies they were.

So, while these incidents may have been 40 years apart, involving a different generation and a different aircraft, they just go to show that the mentality and behaviour of the men remains the same. The aircrew just had to divert to a 'hot spot' – and the engineers were just as happy to help out – wherever.

Other than that, I think the engineers could be very proud of what they did. If you ask an engineer what he thought of his time on Buccaneers, most of them will say that they were very proud and have fond memories of working on a great aircraft.

Sqn Ldr Bob Tuxford. I'm a slightly odd fish in this audience as I'm 'tanker trash'. I have a question possibly for Gp Capt Eeles? A lot has been said about the low-level handling qualities of the Buccaneer, and I don't think that anyone would dispute those, but would you care to comment on its handling at higher levels and, in particular, the closed loop task of air-to-air refuelling?

Eeles. Yes, happy to do that. Obviously, handling did deteriorate with altitude, but, so long as you kept the speed up – a reasonably high Mach number, 0·8 - ·85 – there was no real problem. In the Gulf, for instance, the guys found that when they were doing their 'spiking' from FL200 and above they were far more manoeuvrable than the Tornados. But if you reduced the speed, things did begin to get a bit more difficult. AAR was generally carried out at an IAS of between 250 and 280 kt and the aeroplane was not quite so straightforward to fly at that speed. It didn't really like flying slowly, so you were always having to decide how to deal with it. Should you select the aileron gear change to 'low speed',

which meant changing hands on the control column? And if you put the auto-stabs to 'low speed' – that was another hand change – did you then forget that you had done it, so that when you accelerated to a more comfortable 300+ kts after tanking, you would be exceeding the speed limits for flap, droop, low speed gear change and low speed auto stabs?!

But, with careful briefing, low-speed flying, below 300 kt, wasn't too challenging. For example, although we were within the 300 kt limit for putting flaps and droop down, we didn't do it when we were tanking, because there wasn't really any advantage. But it was clear that the Buccaneer had not been designed as a low-speed handling aeroplane and flying it did require careful briefing – and teaching. For example, in the circuit, at low speed, and with all that droop down, if you rolled the aeroplane one way, the downgoing drooped aileron created a huge amount of adverse yaw. So, when you rolled on the bank, the aeroplane's nose yawed off in the opposite direction! Most fast jet pilots use the rudder bar as a foot rest most of the time, but you couldn't do that in the Buccaneer – you had to lead with rudder when you turned onto finals . . .

So, to answer your question, the Buccaneer wasn't an easy aeroplane to tank, but we could cope. I'm guessing that you had in mind the collision that occurred.[1] If you allowed your aircraft to rise up into the downwash coming off the tanker's wing, you were definitely going to be in trouble.

Gp Capt Jock Heron. Could I ask about accident rates? We had a pretty high rate in the Harrier world in those days, the 1970s-80s, and the Jaguar was even worse, I believe. But the Buccaneer lost the Boss of 15 Squadron early on, and there were two wing failures, and the Buccaneer colliding with a Victor, but beyond that, I don't recall any headlines saying that the Buccaneer was particularly accident prone. Would anyone care to comment?

Pitchfork. We did loose rather more than that. Some due to handling issues – the sort of thing that Tom spoke about. There were the tragic

[1] During an AAR exercise on 24 March 1975, a Buccaneer, XV415, collided with Victor K1A, XH618, of No 57 Sqn resulting in structural damage and immediate loss of control. The captain was able to eject but the other four crew members died. The Buccaneer was able to return to base. **Ed**

loss at RED FLAG, and we had a rogue pilot who flew into pylons in Norway. But I would agree that we weren't headline grabbers in the context of accident rates and we certainly weren't in the Harrier/Lightning league.

Gp Capt Chris Finn. I can answer that one specifically. In twenty-four years we lost twenty-three aeroplanes and nineteen crew, and something similar in ground incidents so, overall, not a high rate.

Chris Pocock. Apart from WE177 – and bottles of wine – we haven't heard much about what else could be carried in the Buccaneer's bomb bay. And I think there may have been a passing reference to tactical reconnaissance? If so could that be expanded upon?

Pitchfork. We did have reconnaissance pack that went in the bomb bay. Half of it carried flares – we never used them – and it had six F95 cameras in the rear half, which we did use, but not often. The recce pack was used much more by the FAA.

As to weapons in the bomb bay, they included 1,000 pounders, slick or retarded, BL755, the WE177 – and our luggage!

Eeles. Could I just add a footnote to what Bert Neo was saying about engine problems in the early '70s? One Buccaneer had a major engine failure taking off from Lossiemouth. It was uncontained; the aircraft caught fire and came to a halt. It had been carrying Lepus flares, so it burned very well. The crew ran away bravely, and the end result was a Buccaneer-shaped hole burnt into the runway. As a result, 12 Squadron was detached to its forward operating base at Stornoway for the autumn NATO exercise – but that is a story that could take all day to tell . . .

INTRODUCTION TO THE MARITIME ROLE

Air Mshl Sir Peter Norriss

This afternoon we concentrate on the maritime scene and the aircraft's part in the Gulf War.

When the Buccaneer entered service in the RAF, it was in the maritime role. For the next 25 years of its RAF service, it was a crucial force in SACLANT's Order of Battle and was one of his most potent land-based strike/attack assets.

Graham Pitchfork was involved from Day 1, and he is going to tell us about the early days of Buccaneer maritime operations. He will be followed by Chris Finn who played a leading role in the Lossiemouth Maritime Wing. They are going to tell us about this specialised role and how the Buccaneer force developed into such a formidable force.

I'll leave it to the speakers to tell you more about these activities. First up is Graham Pitchfork.

One of No 208 Sqn's Buccaneers keeping an eye on a Sovremenny *class destroyer.*

MARITIME OPERATIONS – THE EARLY YEARS

by Air Cdre Graham Pitchfork

In late 1968, Honington was identified as the future home of the RAF's Buccaneer Maritime Wing and the first squadron, No 12, was re-formed on 1 October 1969. It was tasked with providing TASMO – Tactical Support of Maritime Operations – in particular the attack of Soviet Navy Surface Action Groups (SAGs). The area of operations assigned to the squadron was the Eastern Atlantic, from Gibraltar to the North Norwegian Sea. To cover this vast area, the squadron regularly deployed to Forward Operating Bases (FOB) at Lossiemouth and St Mawgan, and on one famous occasion to Stornoway, which, in conjunction with air-to-air refuelling, extended the already long range beyond a 1,000-mile radius of action, allowing the force to cover the whole of its assigned area of operations.

When 12 Squadron re-formed in late 1969, the RAF had not been involved in the attack of surface warships since the Second World War days of the Coastal Command Beaufighter and Mosquito Strike Wings. The initial tactics devised for the maritime Buccaneer squadrons followed closely the principles of the tactics employed by the Strike Wings at the end of the war. Put simply, a defence suppression element went in first to be followed by the precision attack sections. Surprisingly, we did not inherit any attack tactics from the Fleet Air Arm since, at that time, the Navy's Buccaneers were basically a carrier-borne ground attack force operating in much the same way that they had during the Korean War and the Suez campaign. Hence, we were basically starting from scratch.

So, when we started to devise tactics on the basis that there would eventually be two squadrons assigned to SACLANT, we photo-copied the tactics of the Strike Wings and simply scored out the words Beaufighter and Mosquito and replaced them with Buccaneer. This simple expedient allowed us to get started and we modified the tactics as we gained experience. The problem we had in the beginning was the lack of a precision weapon.

The wartime Strike Wings had been part of Coastal Command, so it was surprising that Honington became a 1 (Bomber) Group station rather than one in 18 (Maritime) Group. This anomaly caused considerable difficulty in the early days and the Buccaneer, its role and

its people did not fit easily into the long-established bomber mentality ever present at Bawtry, a Group steeped in Bomber Command tradition and *modus operendi.* Not one single officer had experience in the maritime role, let alone any knowledge of the Buccaneer and its tactics. For the first few years, until Buccaneer experienced aircrew became available to join the Group staff, it was an uncomfortable relationship. It was a steep learning curve for everyone and the aircrew often felt that the 'bomber' syndrome of the air staffs stifled their initiative. I well remember being with my Station Commander when he was briefing some very senior officers at Strike Command and reminding them – almost three years after the aircraft entered RAF service – that the Buccaneer was 'not a mini-Vulcan, but a maxi-Hunter.' He was right. Fortunately, as experience was gained, the full capability of the Buccaneer became better understood and accepted by the hierarchy, and the support of higher formations improved greatly and within a few years we were well supported.

Running parallel with the RAF's new role to provide TASMO, a very important organisation was established as the focal point for training, doctrine and the development of maritime air procedures. I refer to the Joint Maritime Operational Training Staff, or 'J-MOTS', as it became widely known. By 1970 it was established at RAF Turnhouse where a series of courses – known as JMCs (Joint Maritime Courses) were run each year, and they carried on for the next 24 years.

JMOTS was such a fundamental aspect of the RAF's maritime warfare capability, it is worth dwelling for a few moments to expand on its role. Although the JMC was a national course, participation by invited NATO ships and aircraft allowed joint procedural training, in addition to providing the Buccaneer squadrons with different and realistic targets. Each JMC started with a series of discussion periods and briefings at Turnhouse, before ships sailed from the Firth of Forth when they immediately came under simulated air attack as basic tactics and procedures were practised as the ships headed to the main exercise area. Buccaneers were in constant demand as 'targets', providing ship's operations staff, and missile and gun crews with a very potent and realistic target. Once the naval force was in position north of Scotland, the exercise moved into a five-day operational phase representing the transit of an Anti-Submarine or Amphibious Task Group through the United Kingdom Air Defence Region (UKADR) towards the Shetland

The UK's JMCs provided excellent training for both air and naval elements and included NATO participation.

Isles and Scandinavia. The ships moved along a predetermined track designed to ensure maximum interaction with submarines, maritime patrol aircraft, air defence fighters, airborne early warning aircraft and attack aircraft.

The early JMC exercises in the 1970s provided an ideal scenario for 12 Squadron to develop tactics and procedures. The exercises became more sophisticated and responded quickly to developments and the changing capabilities and tactics of the Soviet Navy. In later years, JMCs took place off the South-West Approaches and others off Gibraltar. Much larger, NATO-wide exercises – involving a lot of free play – were an annual occurrence.

However, before we get ahead of ourselves, let us return to the early days and consider the problems we in the Buccaneer force were confronted with. By the late 1960s the increasingly sophisticated anti-aircraft defences of Soviet warships dictated that a stand-off weapon was needed for defence suppression and for precision attacks but, in 1969, the chosen weapon – the Martel missile – was still a few years from entering service so the tactics employed in the early days were

Buccaneers and Phantoms at Luqa for Exercise LIME JUG

based on the use of the unguided conventional bombs and rockets – some would say this was less effective than the World War Two Strike Wings with their torpedoes and heavy cannon.

The major problem to an attacking force operating at long range was locating the target. The world's oceans cover vast areas and ships can easily 'disappear' so our first task was to set about devising tactics to locate surface ships. Here, the newly formed Central Trials and Tactics Organisation (CTTO) played an important role – its first major study was one addressing this very problem. Their recommendations were trialled in the Mediterranean during the largest RAF maritime exercise ever held at that time. In November 1970, eight Buccaneers deployed to Luqa in Malta for Exercise LIME JUG. Amongst others participating in the exercise were the Victor radar reconnaissance aircraft of No 543 Sqn, and the two squadrons devised a system to identify target shipping based on the continuous plotting of radar contacts. With their long endurance, the Victors maintained a continuous patrol of the exercise area plotting all ship contacts. After a few hours a picture emerged that identified shipping on routine passage, and others that were manoeuvring or operating as groups when the latter were then singled out. Their positions were passed by secure code to a Buccaneer flying a low probe (LOPRO) to identify potential targets. Once identified, the Victor flying at 40,000 feet shadowed the force and broadcast the coded position at regular and frequent intervals. The Soviet Navy obliged by monitoring this large exercise and numerous 'interceptions' were made against Soviet warships, providing invaluable experience for the crews new to maritime operations.

The method of ‘shadow support’, devised during LIME JUG, formed the basis of more refined procedures over the next 25 years. With the demise of 543 Squadron and its Victors, Vulcans of No 27 Sqn were tasked exclusively with maritime radar reconnaissance. Their crews became expert at identifying targets in a cluttered sea area and new methods of passing coded dispositions were developed. Canberras and Buccaneers flying LOPRO sorties were often launched to identify the targets selected as possibles by the Vulcans. Shackleton AEW aircraft were sometimes used to provide Tactical Direction (TACDI), although this was a secondary role for them. With the demise of the Vulcans in 1982, the Nimrod, equipped with the Searchwater radar, assumed the task and, with its other sophisticated aids, it was able to provide a surface picture (SURPIC) and give accurate range and bearing information of the target. This will be discussed in a later paper.

With large areas of ocean devoid of enemy activity, the standard profile adopted by a Buccaneer maritime attack formation was a Hi-Lo-Hi. This had the added advantage of extending the range to as much as 600 miles radius without refuelling, although this range was regularly extended by the use of air-to-air refuelling from Victors. Whenever possible, formations were made up of six or eight aircraft and during the transit to the target area, all the crews listened out on the radios for the latest information on target locations broadcast by the shadowing aircraft. Radio and radar silence was maintained to avoid giving away their approach to a target. At a range of 180 miles from the target the Buccaneer formation started an ‘under the radar lobe’ descent to sea level in order to stay outside the enemy’s radar cover. By monitoring the passive radar warning receiver during the descent, the formation was able to remain undetected by the target – see Figure 1. At 30 miles the leader ‘popped up’ and the navigator switched on his BLUE PARROT air-to-surface radar for two or three sweeps during which time he identified and ‘marked’ the target before descending back to 100 feet. The lead navigator then had to inform the rest of the formation and this created problems.

During the attack, only the lead aircraft transmitted on radar. The navigator selected the most likely radar return as the target and the aircraft was turned to place this radar return dead ahead. To identify the target to the rest of the formation all that was needed was a pre-

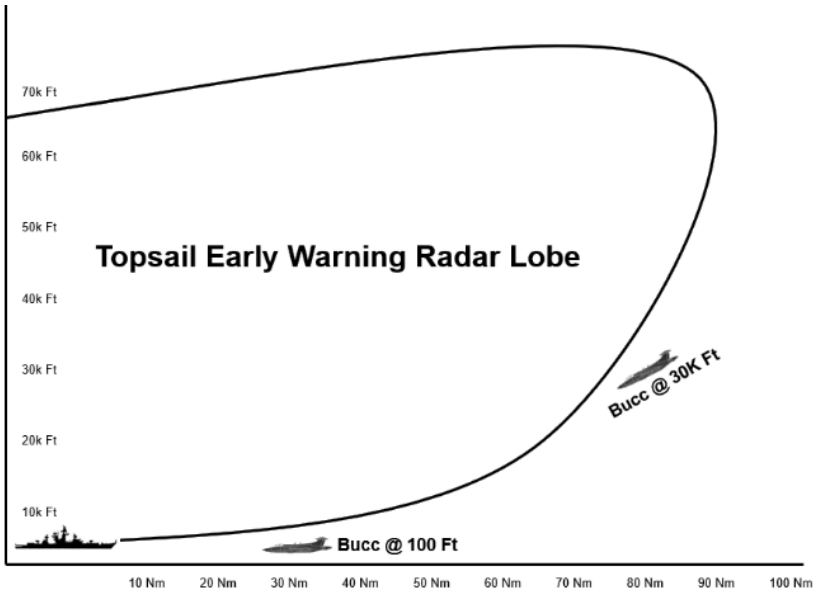


Fig 1. Under the lobe descent.

briefed range – normally 20 miles – and a simple codeword to tell them when to switch on their radars. The codeword? 'Bananas!' It was never changed, and it became the trademark attack call of the Buccaneer force.

At the pre-sortie briefing one of a number of attack profiles designed to provide a co-ordinated attack was selected as the primary option based on the defences of the planned target. We called them 'Alpha' attacks. The leader could change the option at short notice if weather or enemy ship dispositions dictated different tactics, and the new 'Alpha' attack was broadcast with the 'Bananas' call. However, they all employed the same basic principles – suppress the enemy defences before hitting the target with the lethal weapon – see Figure2.

The aim of the Alpha attacks was to maintain the element of surprise by remaining undetected for as long as possible followed by a series of pre-planned splits to confuse the target defences and delay the lock-on solutions for their radar-laid anti-aircraft defences. Once we had penetrated the target ship's weapons engagement zones, we used the exceptional low-flying performance of the Buccaneer to fly at high speed and ultra-low level while sustaining high-g manoeuvres to

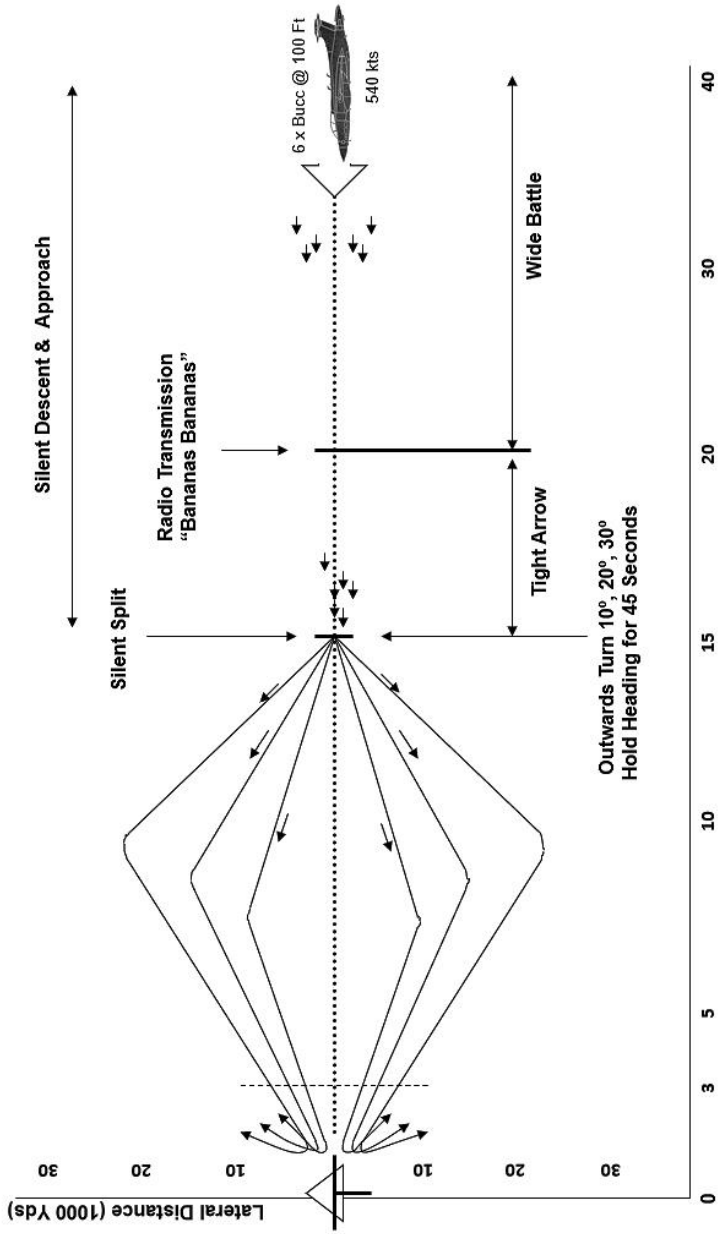


Fig 2. Typical Maritime Attack Profile.

A Kresta II *cruiser*

increase the tracking problems of the enemy radars. The first attacks were delivered from a toss delivery at three miles on converging headings. Each 1,000lb bomb was fused to explode at a height of 60 feet above the target, the aim being to destroy the fire-control radars and incapacitate the missile and gun crews. In the meantime, the attack force had turned starboard through 60 degrees before rolling in to release four to six 1,000lb bombs independently from a low-level dive or laydown attack to provide the killing blow. Timing was critical if aircraft were to avoid the debris from the preceding attack. The obvious weakness of this attack was the vulnerability of the aircraft – particularly those that carried out the precision attack.

Co-ordinated attacks were also practised at night, but with formations of four aircraft operating at a minimum height of 200 feet, which required considerable concentration at 500 knots plus and careful monitoring of the aircraft's excellent radio altimeter. The principle was similar to the day profiles, but the precision low-level bombing under Lepus flares made the attacking aircraft very vulnerable and was avoided, so the preferred delivery mode was a toss attack, giving a degree of 'stand-off.' The 4g recovery from the toss delivery, which required 120-degree angle of bank, followed by the re-join with the rest of the formation, in the very dark conditions, was very exciting, demanding and disorientating.

Less well-defended targets, such as Fast Patrol Boats (FPBs), were attacked using Lepus illumination flares thrown by the lead aircraft of a pair. As they approached the target, the number two aircraft dropped astern. The leader tossed the flares to place them ahead of, and beyond, the target and the second aircraft attacked with SNEB rockets or, occasionally, bombs, with the target silhouetted in the light lane created by the flares.

The improved Soviet naval defence systems of the new class of


Left, the ALG-101 ECM pod and, right, a TV Martel.

surface ships such as the *Kresta II*, the *Krivak* and the *Kara* posed a greater threat to attacking aircraft. The introduction of the SA-N-4 point defence surface-to-air missile, capable of engaging aircraft at close range and flying as low as 50 feet, effectively rendered laydown and dive-bombing attacks as obsolete. Equipping the Buccaneer with a new radar-warning receiver, a major improvement over the Wide Band Homer, and the Westinghouse AN/ALQ-101-8 active ECM pod gave some protection. As the capabilities of the likely targets increased, it became clear that the only viable conventional attack was a co-ordinated attack by up to six aircraft tossing 1,000 lb bombs from a range of some 2 to 3 miles.

The answer was to equip the Buccaneer with a stand-off weapon and so Martel (Maritime Anti-Radar and TELevision) was developed. As the 1974 CTTO report on Buccaneer maritime tactics made clear, 'The introduction of TV and AR Martel missiles radically affects the whole maritime attack concept.'

Martel was available with either a passive radar homing seeker or a TV seeker coupled to radio command guidance. Martel was one of the first Anglo/French military collaborative projects, with the French primarily responsible for the development and evaluation of the Anti-Radiation (AR) version and the UK having similar responsibilities for the TV missile system. The TV-guided missile became the primary attack weapon for the maritime Buccaneer force. It had a 350 lb semi-armour piercing warhead to penetrate a ship's hull.

The missile was launched from the delivery aircraft at 100 feet and 500 knots at 15 miles range from the target. After release, the weapon climbed to its mid-course phase at about 2,000 feet – this was necessary for target acquisition and to maintain the data link with the launch aircraft. TV imagery from the missile's camera was relayed back to the navigator by the data link, which then transmitted control inputs made

by the navigator using his joystick. He maintained the cross wires over the aiming point by giving up/down and right/left commands with his control stick until impact. It required a lot of practice and we spent many hours on a simulator. Martel was a very effective weapon in its day and the radar version remained in service as a defence suppression weapon until the aircraft went out of service.

Soon after Martel entered service, another stand-off option became available when the Buccaneer force received the Paveway laser guided bomb (LGB), making the Buccaneer the first RAF aircraft to be armed with an LGB. An MoD underspend in 1978 provided an opportunity to buy, off-the-shelf, first generation Paveway seeker heads and Pavespike laser designator pods, the latter carried on a wing pylon to provide the laser marking. The pilot pointed the aircraft at the target allowing the navigator to acquire it on his TV screen. The pilot was then free to manoeuvre the aircraft. At three miles the accompanying bombers tossed their LGBs as the 'spike' navigator tracked the target. As the bombs reached their apogee, he fired the laser and the bombs homed on to the target. This was very effective during the First Gulf War when Buccaneers marked targets for Tornados, in addition to marking for their own bombs.

Virtually all of the attack modes discussed thus far required some form of visual acquisition by the crew, be it dive bombing, TV Martel or Pavespike operations. For night and poor weather attacks, we were limited to medium toss attacks and the use of AR Martel where the latter provided defence suppression by degrading the target ship's radar systems only – it could not disable the target.

One further weapon that I have not discussed is the nuclear option. The Buccaneer could carry one or two WE177 weapons in the bomb bay and the force was part of the UK National Plan but in the maritime field it provided a 'Selective Release' option. Given the poor survivability of a single aircraft attempting to 'Long Toss' a weapon at a capital ship, such as the *Kresta II* or *Kara*, the strike aircraft was screened by other attacking aircraft. This was called SNOCAT – the support of nuclear operations with conventional air tasking. An Alpha-type attack (known as a SIERRA) was planned with four aircraft attacking with conventional weapons with a fifth aircraft in two-miles trail tossing a 10-kiloton nuclear weapon.

In 1980 it was decided to move the UK-based Buccaneer force to its

A pair of No 12 Sqn's Buccaneers inspecting a Soviet Kotlin class destroyer.

spiritual home at Lossiemouth, which had itself been transferred to the RAF in September 1972. This was much nearer the likely action and the squadrons came into regular contact with the Soviet Navy. Lossiemouth was an ideal location for the maritime squadrons, being close to the likely wartime operational area and to the excellent local air-to-ground weapons range at Tain. First to move was 12 Squadron in November 1980 when it transferred to No 18 (Maritime) Group, and 208 Squadron made the move in July 1983. Although small – some 40 aircraft – the Wing provided SACLANT with his only dedicated land-based maritime strike/attack squadron, and it became the major anti-shipping force in the North-East Atlantic region.

RAF LOSSIEMOUTH AND THE MARITIME BUCCANEER WING

by Gp Capt Christopher Finn

Gp Capt Chris Finn joined the RAF in 1972 as a navigator. His subsequent career was closely linked with the Buccaneer and included tours with No 809 NAS, Nos 15 and 208 Sqns, No 237 OCU, CTTO and HQ 18 Gp. Twice awarded a QCVSA, he was the UK's laser-guided weapons specialist at AHQ Riyadh 1991. Having commanded the NAAS at Cranwell, his final appointment was as Director Defence Studies (RAF). After leaving the service in 2005 he spent ten years lecturing at the RAFC Cranwell in association with King's College London and Portsmouth University and became, and still is, a member of the International Guild of Battlefield Guides.

The move to RAF Lossiemouth, between 1980 and 1983, marks the penultimate chapter in the RAF Buccaneer story and one in which the aircraft was, arguably, at its operational peak. Lossiemouth was the ideal location for the Maritime Buccaneer Wing (MBW). The scope of maritime Buccaneer operations and training at RAF Honington have been covered in Air Cdre Pitchfork's paper, and that changed little with the move north, apart from the benefit of being on the edge of our main operational area. What did change though was: coming under HQ 18 Gp; significant improvements in Soviet capabilities; concomitant improvement in the Buccaneer's weapons; and, eventually, an improvement in its navigational and defensive suites.

Being in 18 Gp, working with the 'Kipper Fleet' and the RN on a daily basis, and being tasked by the EASTLANT HQ for maritime exercises, was ideal for the MBW. However, it could get confusing (often to our advantage) because we were usually used as Red Forces, particularly against the US Carrier Groups on their way East. It was worse for the Nimrods who could occasionally be playing Blue ASW and supporting Red ASUW on the same sortie.

But what of the Soviet Navy? The first of the modern naval point-defence SAMs, SA-N-4 *Gecko* was first seen on the new *Kara* class

cruiser in 1972. Then the *Udaloy* class anti-submarine destroyer and the *Sovremenny* class anti-ship and anti-aircraft destroyer entered service in 1980. The first of a class of four nuclear-powered guided missile cruisers, *Kirov* entered service in 1981 – we will come back to her. Lastly, the *Ivan Rogov* was the first landing ship to have a point-defence SAM system fitted. For us, it was their new defensive armament that mattered more than the desired weapon effect on the target when selecting which attack option to use. SA-N-4 (*Kara*, *Kirov* and *Ivan Rogov*) and SA-N-9 (*Udaloy*) both operated between 1 and 8 nm range, and down to a supposed minimum of 50ft. SA-N-7 (*Sovremenny*) was much the same but had a greater maximum range of 23 nm. All had the ability to track and engage multiple targets. The release point for the conventional toss attacks was at about 2½ nm to the target, at 2,500ft in a 4g manoeuvre; the nuclear release point was slightly higher and closer at 3,500ft and 2 nm. So, the toss attacks with guided or un-guided 1000 lb bombs, or the WE177, were now less survivable against these new classes of ships. However, TV Martel attacks were still viable against all bar the *Sovremenny*. It was against this background that No 208 Sqn had to develop the Pavespike/Paveway tactics.

Until some crews were posted in from No 12 Sqn, whilst No 208 Sqn had some crews with maritime experience this was to some degree out-of-date. So, Sqn Ldr Brian Mahaffey, who was the Central Tactics and Trials Organisation (CTTO) Buccaneer desk officer, worked with the squadron to develop the new tactics. Pavespike was a day, visual conditions only, electro-optical system and survivability dictated that the bombs it was to designate for had to be delivered in a toss mode. Consequently, the DELTA tactics were direct developments of the 'dumb bomb' ALPHA tactics. The Pavespike was always carried on the port-inner (No 1) wing station, and the aircraft carrying it were referred to as 'spikers'. As can be seen from the 'DELTA 2 tactic' at Figure 1, a spiker turning left away from the target whilst designating had to be in a constant 2G turn to stop the fuselage and bomb-door tank obscuring the pod. A spiker turning right could run straight and level, angling away from the target.

The heart of the Pavespike system was a laser and TV camera collimated through a gimballed mirror. The system limits were +15º to

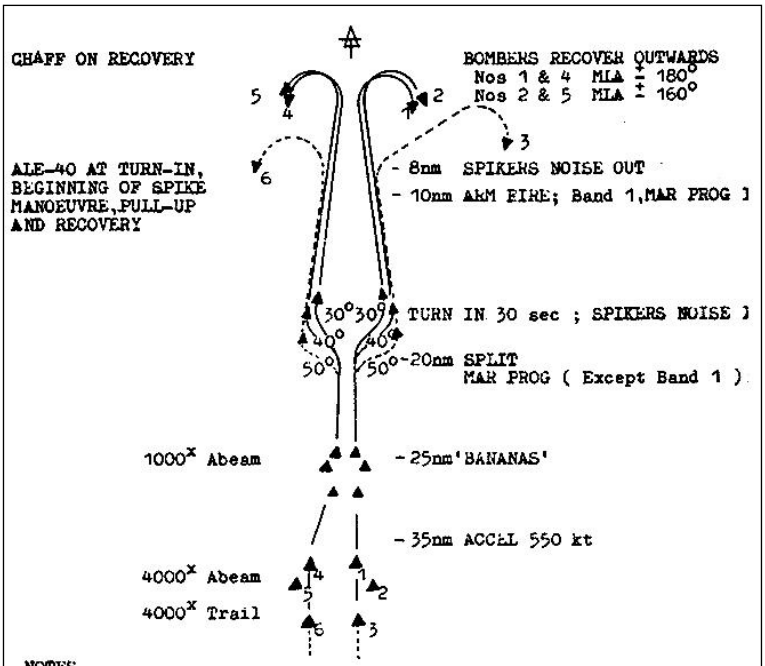


Fig 1. Delta 2 Tactic.

-160º in pitch, and +160º (clockwise) to -110º in roll. The picture was transmitted to a TV screen between the navigator's knees and to a video recorder. There was no INS to slave the head to, as in the US system on the F-4. So, the aiming reticle was positioned and retained on the target manually by the nav using a thumb operated 'eyeball' which was under his left hand, and was rate-assisted to help maintain tracking in a turn. The reticle was boresighted to the pilot's Strike Sight on the


Left, the Pavespike pod and, right, the Paveway display located between the nav's knees.

runway before take-off, and the target acquired by the pilot putting his sight over the target when acquired visually. The nav acquired the target in the wide field of view, then went to narrow field of view, and when tracking the target called 'happy'. This was dependent not only on the visibility but also on angle and elevation of the sun as the TV camera was highly sensitive to glare.

The lead bombers pulled up at 3.5 nm to the target which started a 1kHz tone on the radio which ceased at weapon release, 4.5 secs later. At the same time the spiker pilots started their stopwatches and initiated their outward turns (at 6nm to the target). Keeping the reticle on the target until weapon impact was essential, so both crew members had indicators of the position of the 'head' with respect to the gimbal limits and obscuration from the airframe or store on the port outer weapon station. These were incorporated in the video display for the nav and on the starboard coaming for the pilot. At 17 secs the pilot called 'lase' and the nav pulled the laser trigger. The delay was to allow the LGB to be over the apogee of its trajectory and so prevent it undershooting the target. At about 24 secs the LGB(s) would impact the target. The LGB needed a minimum of around 3 secs of received laser energy to guide onto the target, so the minimum cloudbase was around 1,500ft. The minimum visibility was theoretically 6 nm but the spikers could push in a bit if necessary. This, however, would lead to a higher 'G' turn-out. Unfortunately, under high G the head tended to 'nod' violently, forcing the pilot to reduce the rate of turn away from the target. With a

Kirov.

1,000 lb medium charge bomb (500 lb of explosives) as the warhead, a Paveway LGB had a high impact angle and velocity. With a 40ms post-impact-delay on the fuze it would penetrate the target to the level of the magazines or ops room before detonating. In a frigate-sized target it would penetrate to explode on the keel. It was a very effective 'ship sinker'.

Between September 1983 and March 1984, Nos 12 and 208 Sqns had to send experienced crews to RAF Akrotiri for Operation PULSATOR in support of British forces in Lebanon. This slowed No 208 Sqn's maritime work-up but they were still able to declare six pilots and four navs Combat Ready in the maritime role by the end of October 1983. That month also saw AR Martel and Paveway/Pavespike formation tactics introduced and crews also carried out their first live Paveway/Pavespike attacks on the range at Garvie Island, near Cape Wrath. By 1 January 1984 the squadron had seven fully operational crews and on 1 July it was declared to SACLANT in the maritime strike/attack role.

Returning now to the *Kirov*. In addition to the point-defence SA-N-4 system it was also equipped with the SA-N-6, the navalised version of the SA-10 *Grumble*. With a range of 5 to 50 nm and a minimum altitude of 82ft, the maximum was 82,000ft, this negated TV Martel attacks.

The answer to this was a sea-skimming missile, known initially as P3T, later Sea Eagle. The details of the development and functioning of Sea Eagle were covered in Journal No 62, so a brief description will suffice. Developed by BAe Systems from Martel it was 13ft, 7in long, weighed a substantial 1,320 lb (plus an additional pylon adapter taking it to about 1,500 lb) and had a 505 lb semi-armour-piercing warhead. Powered by a Microturbo TRI-60 turbojet it had, initially, a nominal range of 55 nm. It had a very sophisticated homing head, including ECCM and a home-on-jam facility that would over-ride any other targeting selections if the 'right' form of jamming was identified. Its

flight profile was adaptive, varying with the launch distance, targeting selection and, in the terminal phase, the sea state. In reversionary mode the missile assumed that, at launch, the target was at 40 nm on the nose.

In September 1984 Wg Cdr Keith Robertshaw, who commanded the Sea Eagle Joint Service Trials Unit (JSTU) at Boscombe Down, briefed 208 Squadron on progress to date, the first missile having been fired in 1991. This marked the start of the development of the Sea Eagle tactics which was led by the author, who was the Weapons Leader on the squadron from August 1984 to December 1987. This was a very collaborative affair. CTTO (Sqn Ldr Mahaffey was soon to be replaced by Sqn Ldr Caz Capewell) was overseeing modelling of the various potential attack profiles at BAe Stevenage. The squadron was supporting the JSTU with two crews using the Pavespike system to film the trial shots of the missile from release to target impact – which involved some very exciting, very fast and very low flying during the sea-skimming phase of the missile's flight! The benefit, for the squadron, was being directly involved in the development trials and finding out more about the missile's capabilities than they otherwise would have done. One interesting fact that came to light was that the missile, which came as a sealed round, was not filled-to-full – there being some expansion space in the neck of the fuel tank. BAe were asked, through MoD, to investigate this. As a result, the fuel load was increased to maximum, giving a potential increase in range of about 7nm.

What emerged was the need when attacking a major surface combatant such as *Kirov,* which would have a large defensive screen, to target the major combatant with 24 Sea Eagles fired from six Buccaneers on two different axes, 90º apart. This led to the first ECHO tactics which were based on 2 × 3-ships, but could be used by pairs. ECHO 1 had the two elements splitting at 60nm to firing points at 45nm and 90º apart. ECHO 2 kept the elements together and firing on a single axis – this was in case there was no third-party target information. And ECHO 3, which was the night tactic, was 2 pairs or 3-ships in 10-mile TACAN trail. This was a war only, last ditch tactic. However, the squadron did start working-up night pairs and 3-ships to provide a limited night Sea Eagle capability. The principal limitation was, of course, that the aircraft still had the BLUE JACKET Doppler navigation

Success in maritime ops was often dependent upon the synergy between the Buccaneers and a Nimrod.

system which could not be relied upon for accurate navigation over the sea. So, for any major attacks we had to rely on support from an MPA, usually the Nimrods from RAF Kinloss, for the target position and some form of attack direction: these were known as SURPIC (surface picture) and VASTAC (Vector Assisted Attack).

SURPIC involved the shadowing MPA observing the target group on radar from well outside its defences. With its profiling radar the Mk 2 Nimrod was able to classify each contact by type, and broadcast this in a type/range/bearing format from the centre of the target Surface Action Group (SAG) on HF. This position was known as the ZZ and was usually the major combatant, at the centre of the SAG. The latitude and longitude of the ZZ, the time of the plot and the Mean Line of Advance (MLA) of the ZZ preceded the target layout. VASTAC involved the attack formation passing through a nominated Gate, about 60 nm from the ZZ, at a set time. The Leader and No 3 would 'squawk' and the Nimrod pass a coded range and bearing from the formation to the ZZ on UHF, all parties having to be in radar line-of-sight of each other. This was fine for all the toss and Martel tactics, which were always conducted using active radar in the final stages, and against earlier Soviet warships. But it wasn't so good for Sea Eagle. However,

with the BLUE JACKET we had to continue to use range and bearing VASTAC, with the Gate being at about 100 nm from the target. So, the early ECHO tactics and the slightly revised VASTAC were just interim procedures to get No 208 Sqn declared as operational with Sea Eagle, both day and night, at the end of December 1986.

A lot of the early ECHO tactics development and training was done on a solitary gas rig in the middle of the North Sea. This was a known position, clear of the helicopter lanes and zones, and simulated the ZZ. Before the attack all the formation would fix off Fife Ness, simulating VASTAC. The attack would then be carried out radar and radio silent until the firing point. The formations would then accelerate to 540 kt, at 100ft, and at 12 nm to the assumed target position switch on their radars and, if necessary, climb a bit. In its optimum operating mode the Sea Eagle had three search 'ambits'. It searched the smallest one first, and if it found a target in it went for that one. If not, it would go to the middle and then the outer ambit. All the navs carried a piece of plastic with the ambits marked on them at quarter mil scale – that of the radar in 15 nm range. At radar switch-on they would place the plastic over the radar screen, note the position of the target with respect to where the radar markers were, and then turn away well outside the rig's protected zone.

When exercising against warships, and especially when we had Nimrod support, such as on JMCs, the process was different. After the firing point the Buccaneers would carry out an Anti-Ship Missile Defence (ASMD) profile for the warships' training. At the 12 nm point we would switch on the radar, identify the selected target, and head for it at 50ft above the sea. This gave us confidence in the SURPIC/VASTAC procedures referred to above. Naturally, the ships would claim 'all Buccaneers shot down' until they were reminded, usually by the JMOTS staff, that they had never even seen or heard the Buccaneers, which had fired and would have then turned away whilst still below the ships' radar horizons, but instead had just been subjected to a sea-skimming missile attack from 4-times the number of aircraft they had claimed !

Being a sea-skimmer, with a level attack profile (unlike Harpoon), Sea Eagle was designed to hit the target in the centre of its mass, and low enough to hit magazines, fuel tanks and ops rooms. The main

damage mechanism was fire. During the Falklands Conflict the Atlantic Conveyer was destroyed by a single Exocet missile. With a similar sized warhead to Sea Eagle, but travelling at 700 kt, the missile penetrated the gap between the rear ramp and the ship's side. When the warhead exploded it caused a fireball, from its residual fuel, to blast forward through the cargo space, and the ship subsequently burned out. For this reason, when Sea Eagle was filled-to-full we did not extend the firing range but left it to have more residual fuel at impact, to increase the fire effect.

Although the primary tactics were designed around deep-water attacks on major surface combatants the missile could be fired, if necessary, at closer ranges, using a mix of visual identification and active radar. This would have been very effective against smaller, but well-defended, targets with far fewer missiles expended. It was also the only way we could have operated in confined sea-spaces such as the Baltic Approaches, or the Minches for that matter.

In May and June 1986, Nos 12 and 208 Sqns moved from their 'soft' hangar and flight-line accommodation into hardened sites, 12 Squadron north of the main runway and 208 Squadron to the south. Each site comprised nine of the large Third Generation Hardened Aircraft Shelters (Gen 3 HASs), a (misnamed) Pilots Briefing Facility (PBF) and a similar above ground 'bunker' for the engineers. These were NATO funded and on new sites. Each site should have had twelve Gen 3 HAS but the additional three, which were to be nationally funded, were never built). There was also a relatively small soft annex to the PBF for offices and a crew-room. These were NATO funded (the nationally funded additional 3 HAS were never built by the UK) and on new sites. Consequently, unlike the RAFG squadrons, there was no soft hangar on-site and everything had to be done in the HASs. We were able to learn a lot from the RAF Marham Tornado squadrons who were already operating out of identical hardened facilities. Inside the PBFs the main ops area was divided with wooden partitions. So, we were able to reduce the large planning space, which was not needed for maritime operations, increase the briefing room to take the full complement of squadron aircrew and create a secure planning area for Selective Release (nuclear) planning. Each PBF also had a very good HF radio with a decent aerial on the outside. This enabled us to monitor SURPIC broadcasts, particularly on JMCs, and for the crews to have


Left and right sides of the nav's station post-ASR 1012.

the most up-to-date target information before they briefed and as they 'walked'. Shortly after Wg Cdr Brian Mahaffey took over as OC 208 Sqn we spent a most uncomfortable 48 hrs with all the aircrew and supporting personnel living in the PBF over an exercise. The multiple-deck bunks were only 2ft 6in wide and just 6ft long, which, with formation snoring and farting going on, made getting a reasonable night's sleep impossible. We self-catered out of war reserve Compo rations, with a couple of microwave stoves for over 30 people. To cap it all, the WRAF Admin Clerk ensconced herself in the communal showers for 20 mins every morning!

Whilst routine training sorties usually involved some bombing on Tain or Rosehearty ranges, as well as maritime tactics practice, exercises did not. Consequently, planning was very quick, usually involving no more than a top-of-drop and a Gate position, and sometimes a tanker RV on the way out. Navigation was done on a Fablon-covered 2 mil en-route chart, and we had a one-page tactical fuel planner in our pocket-books. The MBW had a standard, 2-page, kneepad format which was completed by the lead pilot, copied and handed out at the briefing. This meant that we could respond very quickly to exercise tasking, especially on TACEVAL, and could re-task in the HAS. This was very simple. After landing the crews were given new knee-pads, a photo-copied map, up-date IFF codes, the latest SURPIC and, if they were very lucky, an aged 'egg banjo' and a mug of tea. A quick check-in on telebrief and an update from Ops and you were off again.

With Sea Eagle coming into service it was finally accepted that the Buccaneer desperately needed an update to its 1960s avionics and 1970s EW equipment. Air Staff Requirement (ASR) 1012 was

supposed to deliver this. It was to include all sorts of goodies such as a new radar display, with a single-sweep freeze-frame facility, and a tie-in between the Pavespike Pod and the Inertial Navigation System (INS) that was at the heart of the update. In December 1984 it was cancelled to save £150M. Both Wg Cdr Graham Pitchfork (Air Plans Strike/Attack) and Sqn Ldr Geoff Thompson (OR51a(Air)) lobbied AVM Andy Roberts (D Air Plans) on the grounds that it was pointless spending £350M on Sea Eagle to fire it based on the antiquated Buccaneer navigation system. The result was that £50M was allocated, although this was later eroded by the £10M 'Woodford Premium' BAe claimed it needed as they were having to bus the workforce daily from Brough to Woodford where the work was to be carried out.[1] In the end what the Buccaneer got was: the Ferranti FIN 1063 INS; an update to the Westinghouse ALQ-101-10 ECM Pod (in particular its counters to modern Soviet fighters); and the digital Sky Guardian RWR. It also received, at the same time, a new radio, with a complete controller in the rear cockpit and a give/take switch in both cockpits which enabled the nav to do all the channel and frequency switching if the pilot was focused, for example, on an IMC approach. The AN/ALE-40 chaff and flare system was also fitted. And, later, a small artificial horizon was finally provided in the rear cockpit. The first aircraft went off to Woodford in July 1986 and the first updated aircraft started appearing back at Lossiemouth in September 1987.

Initially, there were problems with the INS overheating during alignment on the ground. Strangely, the training rig in the ground school didn't have the same problem – but it did have a Bedford 4-tonner electric fan providing cooing air. The problem was that, despite BAe's protest to the contrary, the mass flow of cooling air into the radio bay, where the INS was situated, was totally inadequate. The quick-fix was an in-line fan, later replaced by a properly integrated INS cooling system. In the maritime role the INS could not be fixed as Jaguar and Tornado ones were. Consequently, due to the Schuler Loop phenomenon it was always about 4nm out 40 mins after alignment and returned to accuracy another 40 mins later.[2] When compared to the Doppler-based BLUE JACKET this was sheer luxury and was perfectly adequate for maritime use.

With SA-N-6 and an increasing Soviet fighter threat, assuming the northern Norwegian air bases were in Soviet hands, the Nimrod needed

to be more covert, and generally to the west of the target SAG. So, it would pop up, create a plot and then descend below the SAG's radar horizon and transmit the SURPIC. It also couldn't risk getting in close enough to do a range and bearing VASTAC, particularly if there was a *Sovremenny* playing 'up-threat air defence picket-ship' with a *Udaloy* in company for close-in protection.[3] VASTAC was therefore changed. Now the Nimrod moved towards the Gate, at 100 to 120 nm from the ZZ, and when the formation's IFF was observed passed a coded message giving the formation's distance, in northings and eastings, from the Gate. This was, quite simply, a Plot-lock and enabled all the Buccaneer navs to correct their SURPIC ZZ position. The attack was then carried out using this updated position. This was surprisingly accurate and, given the capabilities of the missile, should have been successful. This development was a joint effort between No 208 Sqn's QWIs and selected Nimrod crews at Kinloss; and was practised in the Nimrod mission crew simulator before airborne trials. Experience soon produced empirical evidence that VASTAC might not be needed at all for Sea Eagle attacks, and that SURPIC alone would suffice. The post-ASR1012 ECHO 1 (Figure 2) shows how simple these tactics were when compared to the earlier ALPHAS and DELTAS. It also shows that we were trying to achieve near-simultaneous pop-up from both waves of missiles. They were flown at 480 kt instead of 540 kt. This gave us a good 'fighting speed' in a fighter threat environment for only 18% increase in fuel used per air nautical mile and the Spey engines did not push out tons of black smoke at this speed. However, we still had the strike role to consider and a new SNOCAT tactic, the SIERRA 1 was designed to screen the bomber with a Sea Eagle attack at the critical moment.

In 1988 CTTO[4] had another round of attack-profile modelling completed at BAe Stevenage. This, in conjunction with some studies with the Maritime Tactics School at HMS *Dryad*, showed that getting exact angles and timings in the ECHO attacks was not necessary. Indeed, it could be more confusing for the target SAG if the two waves of missiles arrived at different times; but achieving that added an unnecessary complication to the crews' tasks. The squadron then further simplified the tactic to turning outwards by 70º at the split and turning in to the firing point at a fixed 'time-to-go' to the target

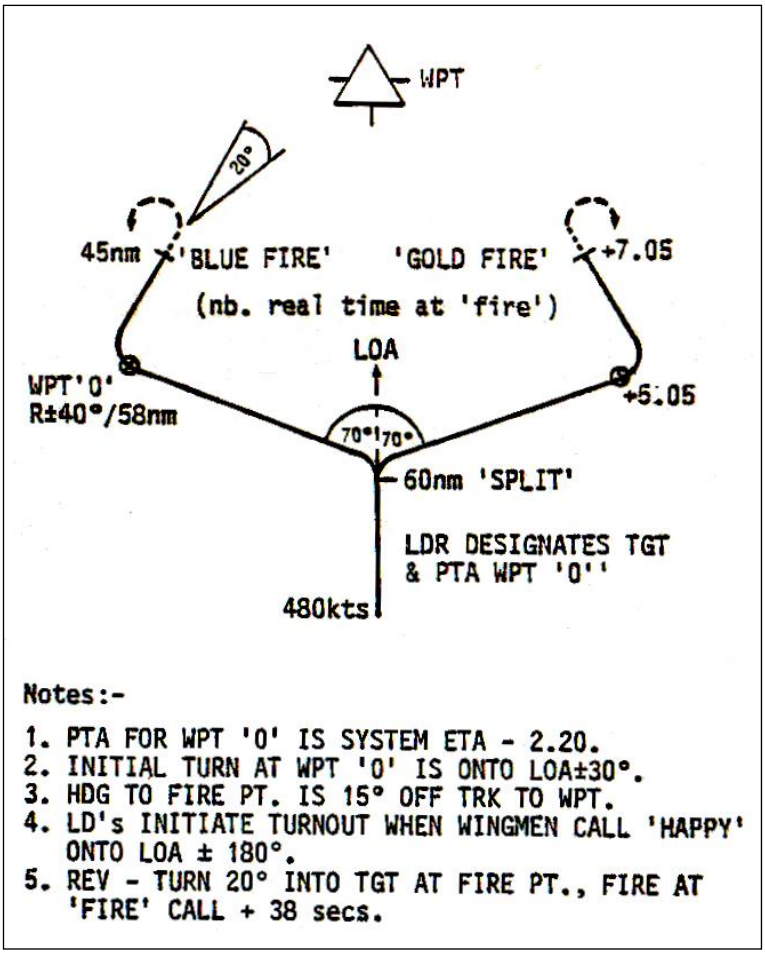


Fig 2. Post-ASR1012 Echo 1 Tactic.

waypoint in the INS. The first in-service firing, of a telemetered Sea Eagle, took place on the Royal Artillery Range Hebrides on 14 October 1988. The image below shows the missile passing above the centre target trawler's well-deck, about 12ft above the sea. At the same time a trial was carried out to assess the accuracy of Nimrod SURPIC with respect to the navigational accuracy of the INS-equipped Buccaneer. This confirmed earlier suspicions and, taking into account the Sea

The first Sea Eagle in-service firing off St Kilda – 14 October 1988. (Finn)

Eagle's inherent target-finding capabilities, the use of VASTAC for Sea Eagle attacks was discontinued. This gave the Nimrod much more tactical freedom, and thus survivability. A subsequent in-service firing of a live 'war shot' Sea Eagle was also a complete success.

Much delayed by the lack of Sea Eagle engineering support equipment, and aircraft at Woodford for the ASR1012 update programme, No 12 Sqn finally began their Sea Eagle work-up in earnest in the autumn of 1989. An interesting comment from OC 12 Sqn (Wg Cdr Nigel Yeldham) was that, 'the Sea Eagle tactics were simpler than the Martel ones, but required more thinking ahead by the crews.' However, the squadron had to persevere with the increasingly unreliable TV Martel until 1990 when they worked-up for Pavespike/Paveway operations at which point TV Martel was finally retired from service. This was aided by the squadron having, due to normal postings, a core of ex-208 Sqn crews who were already Sea Eagle and Pavespike trained. Thus, by the end of 1990 the whole MBW was Pavespike/Paveway qualified, which was to pay enormous dividends just a month later when the force deployed at short notice on Operation GRANBY.

On its return from Operation GRANBY in March 1991, back in the role it was originally designed for, the Buccaneer was planned to stay in-service until the late-90s. But events were already underway which would curtail its service. The fall of the Berlin Wall in November 1989, and the subsequent dissolution of the Soviet Union and the Warsaw Pact led to two things.

The first was the Iraqi invasion of Kuwait in 1990. The second was the demand, in the western democracies, for a 'Peace Dividend' on the fallacious grounds that the world was now a safer place, and that defence spending could therefore be cut. In the UK this manifested itself in the 1990 'Options for Change' Defence Review. This, ironically, was being staffed that autumn at HQ Strike Command

predominantly by the Plans Branch, as the rest of the Air Staff were involved in the deployment of aircraft on Operation GRANBY. The decision to withdraw the Buccaneer from service early led to detailed planning taking place at HQ 18 Gp in early 1991, in particular the aircrew drawdown and postings plot.[5]

No 237 OCU disbanded first, on 1 October 1991, with an element of it becoming the Buccaneer Training Flight (BTF) within 208 Squadron. Then, in January 1992 No 208 Sqn took over the Operation YARRA[6] commitment from the TIALD-equipped No 617 Sqn (Tornado GR1). Six aircraft were modified to integrate the Pavespike pod and the FIN 1063 INS, and were fitted with the Phimat chaff dispenser. The commitment was passed to No 12 Sqn a few months later. Sea Eagle development work also continued with CTTO-led trials to develop the homing head further, for Tornado use. The last BTF student, Fg Off 'Ned' Cullen, a pilot, completed his conversion course in March 1993 and the BTF was then disbanded. No 12 Sqn disbanded as a Buccaneer squadron on 30 September 1993, reforming the next day as a Tornado GR1B squadron in the maritime role. Finally, 208 Squadron disbanded on 31 March 1994, to be replaced by No 617 Sqn (also Tornado GR1Bs) in the maritime role in the April.

Thus ended the Buccaneer's 24 years of operational service with the RAF. At its, albeit brief, peak it operated three squadrons and a large OCU in UK, and two squadrons in Germany. One hundred and seven of the 211 Buccaneers built served on RAF squadrons, of which 23 were lost in flying accidents. Nineteen aircrew were lost including one FAA pilot and one USAF exchange pilot.

Notes:

1 From Wg Cdr G Thompson in the *Buccaneer Aircrew Association Newsletter*, Volume 43, autumn 2017.

2 The exact Schuler Loop period is 84.4 mins.

3 This was exactly what the RN did in the Falklands Conflict with the Type 42s and Type 22s.

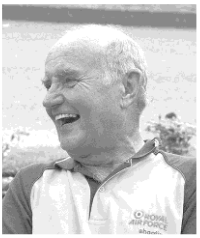
4 The author was CTTO Strike/Attack Buccaneer from February 1988 to September 1989.

5 The author was Wg Cdr Recce/Strike/Attack at HQ 18 Gp at this time.

6 This was a contingency operation in support of the No Fly Zone operations over Iraq, possibly from Bahrain. Source – AHB.

THE BUCCANEER'S SHORT NOTICE INVOLVEMENT IN OPERATION GRANBY

by Air Cdre Jon Ford



Having previously gained a PPL on a Tiger Moth via a Flying Scholarship, Jon Ford joined the RAF via Cranwell in 1962. After a tour on Canberra B(I)8s, he flew four Buccaneer tours, the last as OC 208 Sqn. Following a stint as a PSO and staff tours at HQ 1 Gp and Ramstein, he commanded Lossiemouth 1990-93. More senior appointments included posts at the MOD, SHAPE and as Commandant of the ATC. Subsequent to retirement in 1998, he flew AEF Bulldogs and Tutors while maintaining his association with the ATC as Regional Commandant of Central and East Region until 2008.

In August 1990, as the Station Commander Designate of RAF Lossiemouth, I was in deepest Cornwall attending a Sea King acquaint course at RNAS Culdrose so that, when in post, I would be able to fly as a qualified co-pilot with D Flight No 202 Squadron. On 2 August I woke early ready for another stirring day of ground school and switched on my radio to learn that Iraq had just invaded Kuwait. Little did I know what lay ahead! Within a few hours my course had been cancelled and I was wending my way north via my house in Suffolk ready to tackle a short course on the Jaguar OCU (the joys of being a Station Commander on a multi-aircraft base in the good old days!)

It was originally planned that I should take command of the station in early December but, once back at Lossiemouth and settled into another ground school, I learned that my predecessor had been earmarked to be the Chief of Staff to the Commander of British Forces in the Gulf and was thus likely to be pulled early. On Friday 21 September, I flew my Jaguar IRT and conveniently landed at RAF Honington ready for a weekend at home. This was fortuitous as the following morning I received a call to tell me that my father had collapsed and was being taken to hospital in Cambridge. I rushed across to Addenbrookes and found him in A&AE on a trolley wrapped in a space blanket. He was admitted, but the diagnosis was not good and sadly he died, with his family at his bedside, the following day. I only

mention this as it added an extra dimension to an already rather busy time. I had an extra week at home to deal with the usual post-death matters and to try to get my mother settled, but I was back at Lossiemouth on 1 October to learn that I was to take command of the Station on the 12th. No rest for the wicked! My predecessor's family were still in the Station Commander's residence (*The Captain's House* later to become *The Old Manse*) so I was living in the Mess and able to enjoy the odd beer or two). Meanwhile at HQ Strike Command detailed planning was going on ready for a combined operation to liberate Kuwait – the UK contribution was called Operation GRANBY.

At station level it seemed that there was no appetite at HQSTC for the Buccaneer to be involved. However, I have since learned from your President that there was an early thought of deploying the old lady, but the Coalition HQ had indicated there was insufficient in-theatre ramp space available and that the US marines would be able to provide any laser support needed. Meanwhile, unaware of this, at Lossiemouth I called a meeting of the Squadron Commanders, plus Sqn Ldr Norman Browne, to look at how we might develop tactics to use the Pavespike laser designation pod at medium/high level. (At that stage it had only ever been used at low level). I have read in some reports that this initiative came from 18 Group. That is not my recollection, as we went through the process of, 'if you don't want the wrong answer, don't ask the question'! A spiking procedure was soon developed which we then declared to HQ 18 Gp and we started to let crews on both squadrons have a look at it.

Over the next two months, because the Buccaneer was definitely *not* going to be involved, 10% of the station's manpower (should that be peoplepower in these woke times?) was detached to various locations. My wife, Brenda, through the Wives' Club was busy trying to keep wives (and parents) informed as to what was going on – a task made more difficult at Lossiemouth with no on-base housing and people living in several scattered locations. Also, unbeknown to most people, the bomb dump was slowly being emptied of its stock of 1,000lb bombs. Sadly, my mother was admitted to hospital in November suffering from pneumonia, but improved slightly and I was then able to get her into a RAFA care home for rest and recuperation, for a maximum of two weeks – more pressure!

Soon after Christmas No 12 Sqn was deployed to Gibraltar and No 208 Sqn to St Mawgan to provide targets for the Royal Navy who were busy working-up and deploying to the Gulf area. I also managed to get RAFA to agree, exceptionally, to allow my mother to stay for another week of recuperation. She then returned home, but as she had gone direct from hospital to the RAFA home she would need to go back to the hospital at some stage to be formally discharged.

On 22 January 1991 the AOC 18 Gp, Air Mshl Sir Michael Steer (RIP), visited Lossiemouth and then wanted to go down to St Mawgan to visit 208 Squadron. I flew him from Lossiemouth to St Mawgan that evening in a Hunter T7 – there is nothing like having your AOC in your sole presence for an hour! After an enjoyable sortie (flown entirely by the AOC) we were met by the Station Commander, Gp Capt Ben Laite, and the last words Sir Mike spoke to me on the pan were, 'I am sorry, Jon, I have tried to convince HQSTC that the Buccaneer should be involved in the Gulf War, but they have told me this definitely won't happen'!

I was accompanied on the return flight by Wg Cdr Bill Cope, OC 208 Sqn, as he was returning to depart the following day on a family skiing holiday in Austria! …. Ho Ho! When we arrived back at Lossiemouth – I forget the time, but I think it was 9.30ish pm I was met by the Orderly Officer who informed me that I needed to go to the bunker to make a secure phone call (the only secure phone on the base) to Air Cdre Natrass at HQSTC. (Was I about to be bo…cked for working a 14 hour day?)! … (My choice)!

Well I rushed to the WOC and managed to get through to the Air Cdre on the secure phone which, in those days, was hopeless and a bit like talking to a strangled parrot. He directed me not to disclose this call to anyone and then asked me how long it would take to get six aircraft modified for Gulf War operations (*The offer of US laser designation had not materialised – funny old thing!*). I asked him what modifications would be required and he told me the fitting of: Havequick radio; IFF Mode 4; the fitting of bomb bay tanks, chaff and flare dispensers; and repainting them desert pink. I explained to him that both squadrons were deployed and that, if he could ensure that we would be allocated Air Transport to recover them, I thought we would have them ready within three days of their return to Lossiemouth. An

author (I know not whom) has said this was a wild guess, but having then been involved with the Buccaneer for 21 years and knowing the quality of our groundcrew and bearing in mind the time of day and the fact that I had just landed, I consider it was a well-educated estimate!

At 07:00 the following morning the phone rang in the Captain's House and it was a fairly frosty AOC telling me that we were going, but that I already knew (not true!) and why the bloody hell hadn't I told him.

Early on 23 January, I called a meeting of my Execs to brief them and get the various balls rolling. I followed this with a meeting of OC Ops, the Squadron Commanders and OC 237 OCU to choose the best possible 12 crews for deployment (later increased to 18). Some armchair critic on PPRuNe in the past has criticised the fact that we chose crews from the three units and said that we should have sent a formed unit. I disagree – we would not have got 18 crews from one unit and there was good experience on the OCU which needed to be used. The selected crews and groundcrew were given various inoculations including one for anthrax (No thought in those days given to after effects)!

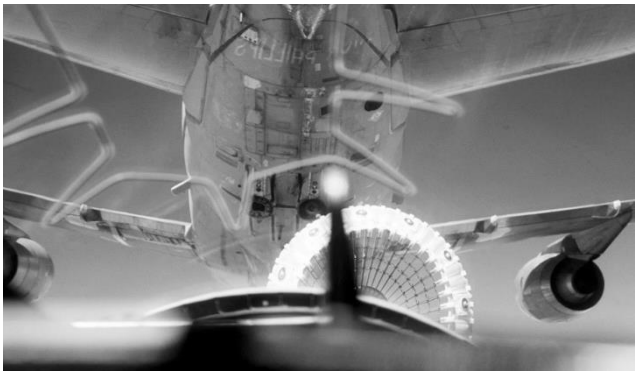
Air transport was provided for the recovery of the two squadrons and we quickly set about the task of modifying the first six aircraft. MoD (PE) was still looking for value for money as we were given twelve IFF Mode 4 kits which we were told were 'the last available'. We spent 24 hours trying to get these to work, with no success and then informed HQSTC. We got the following response, 'Oh, we had the same problem in trying to fit those to the Victors. We will send you twelve of a different make' – so they were ***not*** the last available, and it had cost us 24 hours! These replacement IFF versions cured the problem and the modification of the aircraft went well with the first two aircraft ready to go late on the 25th – two days after we got the 'Go', so my 'wild guess' (sic) was entirely correct! I must pay tribute to the fantastic work done by the engineers over those two days. Some had to return from St Mawgan and Gibraltar, then work on the modifications, be injected and leave by Hercules for Bahrain in very short order! Also on the Hercules was Sqn Ldr Norman Browne, our Pavespike expert, going out early to brief the various staffs on the Buccaneer's laser designation capabilities, and 20 other aircrew.

Gp Capt Ford bidding bon voyage *to Wg Cdr Bill Cope and Flt Lt Carl Wilson on 26 January 1991.*

At 0400 hours on 26 January I was at the HAS to say farewell to Wg Cdr Bill Cope, the Detachment Commander, and Flt Lt Carl Wilson and to wish them the very best of luck. In the accompanying photo we were all looking a bit glum, but they were about to set off on a 9-hour direct flight to Muharraq Air Base in Bahrain – and bear in mind that six Tornados had already been lost in action. The first two aircraft, XX899 and XX892, took off on time, beating the three-day 'wild estimate'. The following day the next two aircraft were seen off by myself; the third pair departed a day later with me again wishing them *bon voyage*.

Chris Finn will cover the subsequent operations. However, I do have a couple of tales to tell. First, at a gathering of wives, one asked if I could keep them better informed, as she had received a phone call from her husband from his room in the hotel (pre-mobile phones!) telling her that he was flying his first mission the following day. When he landed safely, he had a few beers to celebrate and forgot to tell her he was OK! Secondly, on 6 February I was in my office waiting for word as to how the Buccaneer's mission had gone when I received a phone call telling me that my mother, in preparing to go to hospital to be signed off, had fallen over and been found by the taxi driver who had come to collect her. I was told she was fine, but was being taken to hospital. I said that I would fly down by Hunter that evening to Honington to go to see her. Mid-way through the afternoon I was advised that I needed to hurry as her condition was deteriorating, I therefore made arrangements with the OCU for a Hunter to take me to Honington. We landed in the middle of a snow storm, and I was met by the Station Commander, Gp Capt Jo

Whitfield, who took me aside to tell me that, sadly, my mother had died – so I was too late. I then headed off to formally identify my mother in the hospital in Cambridge and deal with those various wretched post-death matters.



It was a 9-hour non-stop flight to the Gulf tanked, in this case, by a TriStar.

The next three aircraft set off from Lossiemouth to the Gulf on 7 February, followed three days later by the last three, so I missed the opportunity to wish these six crews good luck. Mean-while, having sorted out my mother's initial post-death formalities, I set about trying to get back to the Moray Firth. East Anglia was covered with snow and no airfields were open so, with a kit bag full of flying kit, I decided to go by train. I caught a local train from Thetford to Peterborough which, amazingly, ran on time. But when I arrived at Peterborough, and asked when the next train to Scotland was due, I was told, 'There are no trains today mate, because it is the wrong kind of snow and our engines are breaking down'! However, at this stage a train reversed in from the North and, when I asked what it was doing, I was told that it had come back to have a broken window boarded up.

I walked the length of the train and there was no standing room anywhere and, when I got to the last carriage next to the engine and opened the door, a passenger nearly fell out. Someone called out, 'There's no room in here mate,' so I replied, 'Well I'm coming in.' I then lobbed in my kit bag of flying kit, which created a small gap in the crowd, so I climbed in and closed the door. I then stood cheek-to-jowl with 15 or so very unimpressed fellow passengers all the way to Newcastle where one or two got off, so we were able to ease out a little. The loo door was open and two people were in there, sitting on their suitcases, which was OK until a lady from the depths of the carriage

decided she needed to go. So then it was one in and two out, with already no space! My ticket was to Inverness, but this train, the only one running, was going to Aberdeen so, somehow, I needed to rearrange my pick-up (pre-mobile phones)! Fortunately, the guard/ ticket collector allowed me to use his 'brick' so I finally got home, shattered, very late at night. It was a journey I shall never forget! I then learned that Brenda had been very busy writing to the parents of all the detached single people – not only those at Muharraq, but also those sent to other locations because, 'the Buccaneer was definitely not going to be involved'!

17 March 1991 – Gp Capt Ford welcoming home Sqn Ldr Rick Phillips. The atmosphere is clearly a marked contrast with the picture taken on 26 January . . .

Well the Buccaneer most certainly was involved and the aircrew and ground-crew did a brilliant job and made sure it made its mark. The last operational miss-ions were flown on 27 February 1991 and we then started to think how we might best welcome the detachment back to Lossiemouth. The feedback I received from the Gulf is that they did not want a big fuss. However, I was mindful that the local population had shown a great interest in the Buccaneer's achievements and I felt it was appropriate to open the base up to selected visitors. The crews flew back on 17 March, and they arrived to a special welcome, not only from their families, but also from a large crowd from the Moray Firth.

I was concerned as to how the crews would settle back into the hum drum routine of squadron life, but I need not have been as they all slotted back in very quickly. Bill Cope and a small team attended a post-Gulf War Reception at Bentley Priory at which General de la Billière very specially mentioned that the Buccaneer had 'saved the Tornado's Bacon' – fine words, which summed up well our contribution. I am also reminded of Bill Cope's words on arrival at

XV332 was one of the aeroplanes hastily given a coat of desert pink ARTF. Seen here after its return to the UK, now named 'Dirty Harriet'. (Erik Frikke)

Muharraq – 'My old grandmother is getting on a bit, but you wouldn't want to mess with her!'

One strange knock-on effect we later faced was disrupting the town's sewage farm. Apparently washing the desert pink (Alkali Removable Temporary Finish – ARTF) off the aircraft prior to second line servicing killed off the microbes in the sewage farm. We thus had to fund and build a dedicated aircraft wash pan with all water being collected and disposed of safely.

The following year, on 4 April, the station received the Freedom of Moray with a prestigious parade being held in Lossiemouth town. Three years later the Buccaneer was formally retired from service, but the BAA bought XX901, which is proudly displayed at the Yorkshire Air Museum, and two aircraft (XX894, a Gulf War veteran, and XW544) are now taxying at Kemble (having been moved by road from Bruntingthorpe) where they are being maintained by The Buccaneer Aviation Group (TBAG).

Well there we have it. The Buccaneer went to war with three days' notice in its nadir years. Twelve aircraft, 18 crews and 230 groundcrew did an incredible job. Armchair critics may suggest we should have done it differently, but the proof is in the pudding! I make no apology for mentioning the passing of my parents as it added an extra dimension to what was already a busy and challenging time.

PERSONAL RECOLLECTIONS OF BUCCANEER INVOLVEMENT IN OPERATION GRANBY – FROM THE HEADQUARTERS' PERSPECTIVES.

by Gp Capt Christopher Finn

Following the Iraqi invasion of Kuwait on 2 August 1990, UNSCR 661, which confirmed Kuwait's right to individual or collective right to self-defence under Art 51 of the UN Charter, was issued on the 6th. The first Operation DESERT SHIELD[1] began on 7 August with the deployment of USAF F-15Cs to Dahran in Saudi Arabia. Twenty-four RAF Tornado F3s and Jaguars deployed two days later.

The Build-Up

After attending JSDC 10 at Greenwich, I had joined the Plans Branch at HQ STC in the preceding April as Plans 3C. On (about) 4 August, I was summoned to see Air Cdre Plans (Nigel Baldwin) who told me that, as I had just completed JSDC I was obviously well versed with Joint Theatre Plans (JTPs) and therefore the ideal person to cover the night Contingency Plans shift for the next few nights. The next four nights, in the new bunker, were to give me an insight into how the RAF configured itself for its first major conflict since WW2. The first thing that became apparent to most was that this was a US-led operation and they called all the shots. The critical path at this time was ramp-space, there just wasn't enough of it in-theatre for all the aircraft the Coalition air forces wanted to deploy, and the USAF had the prior claim. So, it was the case (notwithstanding the lobbying by certain 'Forces' to be included) that the aircraft the RAF deployed were those the USAF wanted. But, once the bed-down plan was settled, the Royal Engineers began pouring concrete in industrial quantities at the RAF bases such as Muharraq, in Bahrain. This then enabled the deployment of the Tornado GR1 in strength, for the OCA role.

There is a lot of controversy, at least in Buccaneer circles, as to why the RAF's only aircraft with an operational Laser Designation capability was not deployed in August 1990 at the start of Operation DESERT SHIELD, or once the build-up for Operation GRANBY started in earnest. There can be no doubt that there were those in authority, and in industry, who didn't want the GR1 Tornado[2] to be upstaged by an ex-naval aeroplane nearing the end of its service life.

However, there were also many practical reasons – although some might call them excuses. The Buccaneer Force was part of 18 Group and now solely maritime in role. There was, however, still a cadre in No 237 OCU who were practiced in overland laser-designation, at low-level, in support of 2ATAF.[3] The Tornado was the RAF's primary bomber for attacking airfields (with JP233, which could only be delivered from 200 ft, straight and level), and for air interdiction. The Tornado's weapon system was extremely accurate, even with 'dumb' bombs, provided the target and the radar fix points used to update the nav-attack system prior to attacking were mensurated beforehand to a high degree of accuracy. So, there was no perceived requirement for the RAF to deploy a laser-designation capable aircraft. And the build-up, and mission planning for the first 48 hours of the Air Campaign, proceeded on this premise. There was a tacit agreement with the USAF that should there be a need to support the Tornado with laser-designation then they would be able to meet it.

After four nights of coalition attacks on airfields, the Iraqi Air force had been effectively neutralised; four Tornados were lost in action during these attacks. As a result, it was decided to operate the Tornados thereafter from medium altitude, around 20,000 ft, where the rest of the Coalition air forces were operating. This enabled the Tornados to operate within fighter cover and with US defence suppression support. However, all the US laser-designation capable aircraft, potentially available to support the Tornados, were now dedicated to the '*Scud* Hunt' – an unforeseen but essential task to keep Israel from intervening, and thus breaking up the (nominally) Saudi-led Coalition as Saddam intended. But it had never been envisaged that, in the Central Region of NATO, the Tornado would drop unguided bombs from medium level, and the radar and main computer were optimised, and harmonised, for low level attacks.[4] The Tornados were able to attack area targets, such as oil refineries, and continued to do so, by day and night, throughout the conflict. So, the immediate need for the RAF was to restore a meaningful capability to the deployed GR1 sqns. Furthermore, the Coalition need was for precise attacks on specific Designated Mean Points of Impact (DMPIs) – and each target; airfield, bridge, air-defence site, etc was considered in that way by the Coalition planners. So, the RAF had to deploy a laser-designation capability – and that capability could only be provided in the quantity required by

the Buccaneer. Thus, the statement by the Secretary of State that the Buccaneer had been deployed 'to improve the bombing accuracy' was true, but was by no means the full story.

In Theatre

On 14 December 1990 I was posted, on promotion, to HQ 18 Gp as Wing Commander Recce/Strike Attack. I was the lead staff officer in the HQ for Lossiemouth and Wyton. With the tasking cell for No 51 Sqn (Nimrod R1s) at Wyton, only two officers at HQ 18 Gp had the relevant security clearances to be fully aware of No 51 Sqn's operations; these were the AOC and myself.

After the discussions and decision-making described in Air Cdre Ford's paper the AOC decided that I should go out to AHQ Riyadh as the Buccaneer staff officer and UK LGB specialist. I went to Innsworth the following day to be issued with some tropical combat kit (there was no desert kit at that time) and be re-qualified on and issued with a 9mm Browning pistol. Then, on the 26th, I headed off to Brize Norton to pick up my pistol, be 'jabbed' and get on the daily TriStar to Riyadh, arriving just as the first Buccaneers were landing in Bahrain. The next day I went over to Bahrain on the daily in-theatre round-robin C-130. This enabled me to see Bill Cope[5] and the Muharraq Execs, and get a feel for how they were going to work. Also at Muharraq was Sqn Ldr Terry Yarrow, who had succeeded me as the Buccaneer desk officer at CTTO, and was my forward liaison officer with the Buccaneer Detachment on all tactical issues.

While above ground in AHQ I worked for the UK Air Commander (AVM Wratten) as SO Bucc Ops. Details of my security clearances had been sent to the USAF on the 24th and I had immediate, unescorted, access to the 'Black Hole' and the SCIF (Secure Compartmentalised Intelligence Facility), and was one of just two RAF wing commanders who were cleared to work below ground in the Black Hole. Here, in the strategic targeting organization, I worked, in practice, for Brig Gen 'Buster' Glosson, USAF, the head of the Guidance, Apportionment and Targeting (GAT) cell, as the UK's LGB targetter.

By now, the Coalition Air HQ was in a well-established 'battle rhythm'. Although seen by many as inflexible, the 72 hour Air Tasking Order (ATO) cycle was, in fact, a very effective and flexible tool for generating and managing over 2,400 sorties per day, including over

1,000 attack sorties, from multiple bases and nations. Figure 1 shows its key elements and decision points (local times):

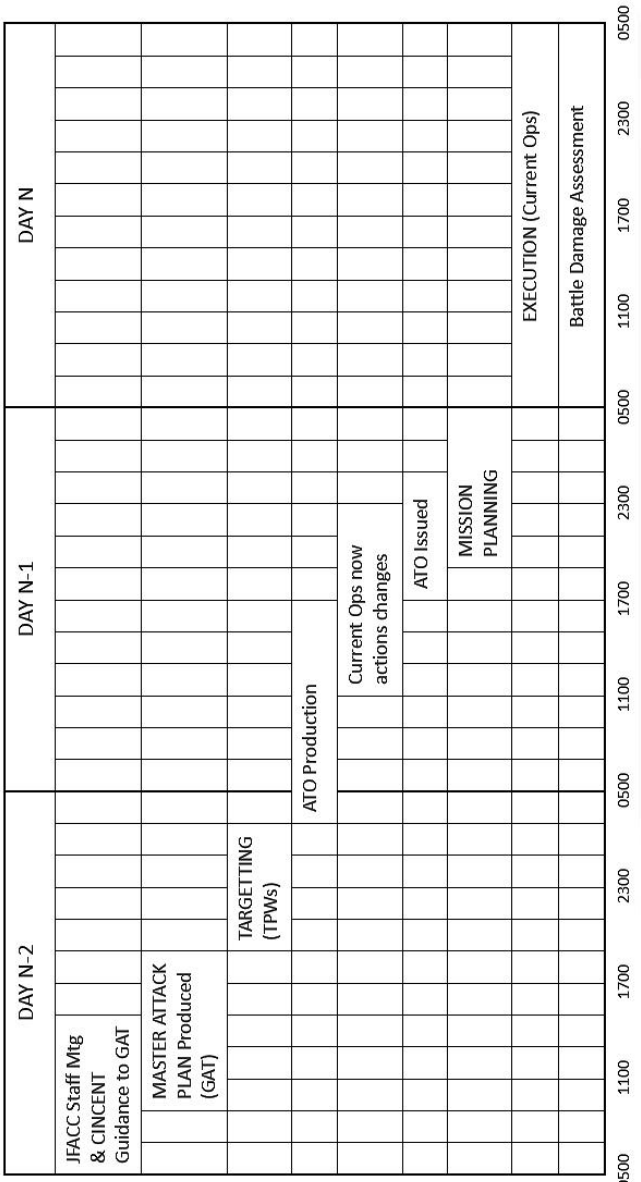


Fig 1. Preparing the ATO, ran on a three-day cycle. A new cycle started every day, so the single diagonal pattern shown here was repeated, with identical entries, starting on the previous and subsequent days.

RAF AHQ Riyadh outside, and in.

Each night the intelligence and ops staffs collated the crews' Mission Reports (MISREPS) and conducted Battle Damage Assessment (BDA) to inform Gen Horner and his key planning staffs' morning meeting. This produced direction to GAT which led to the production of the Master Attack Plan (MAP) and the Target Planning

Worksheets (TPWs). These were then handed off to the ATO production team. At around mid-day the ATO was frozen and Current Ops then took responsibility for any changes, which were handled separately from the ATO. This was issued at 1700 hrs to enable mission planning to begin at 1800 hrs. Execution was then the responsibility of Current Ops. So, the three days of the cycle boiled down to planning, tasking and execution, and at any one time all three were happening concurrently for different days; plus the subsequent BDA activities.

Because the ATO was issued only 12 hours before the start of the Execution day, the USAF adopted the policy of using Planning Crews. These were the most experienced formation leaders and Fighter Weapon School graduates (QWIs). The 'deal' was very simple – get on with being a planner and you can fly on ops every third day; complain and you don't fly! The RAF stuck with lead crews planning the missions which meant that Tornado lead crew planned the mission, sometimes with little or no reference to the Buccaneer crews, particularly if they were operating from Dhahran. But the Buccaneer crews, who may have flown that day, often had to wait around until evening when the mission planning was completed before flying it the next morning. Where possible, we did give the Buccaneer crews advanced warning of the likely DMPIs after the TPWs were produced.

My routine interactions with the ATO cycle were:

a. Mid-morning, agree the UK LGB targets with the relevant GAT staff. Each Target Set (airfields, bridges etc) had a dedicated lead staff officer with a night shift deputy. So all the many thousands of individual DMPIs had their individual 'owners' who knew the intent for the next few days;

b. Any time from mid-morning on deal with urgent changes to the following day's ATO;

c. Late-afternoon and evening, answer any weapons questions from the targeteers;

d. From 2100, if I was lucky, receive the day's Pavespike video tapes from Riyadh airport and set about analysing and reporting on them.

ATO changes were implemented by using a simple, single page, form. You identified all the relevant role desks in Current Ops, eg AAR, CSAR, etc, and got a signature from them agreeing the change. When completed you took it to the duty colonel who would approve it,

and then passed it on for action.

Then I had my 'above ground' role within the AHQ which comprised: keeping the UK Air Commander and his deputy (Gp Capt J B Hill) in the picture on past, present and future LGB ops; liaising with Bill Cope and Terry Yarrow on the same issues; working with the two Wg Cdr Ops[6] (the only post which had full 24 hr cover); and with the Tornado and AAR staffs. In addition to this there was a constant dialogue with HQ STC and, to a lesser degree, MoD, mostly on weapon issues, but also fielding their constant questions. This was all fitted in around my GAT role and, once the Buccaneers were operating, could take 20 hours a day, and on one occasion took 22 hours. This was not sustainable. The immediate solution was to agree with the Dep Air Cdr that I could not work a normal day shift, but would come in between 1000 and 1100 hrs depending on when I had finished the previous night (or early morning). The longer-term solution was a deputy and, after much debate with HQ BFME and JHQ (HQ STC), Sqn Ldr Pete Binham (another Buccaneer navigator) joined AHQ on 13 February.[7] This took the more routine staff work off me, and also gave me the time to deal with integrating the TIALD-equipped Tornados into the UK LGB effort.

The overall conduct of the Operation GRANBY Air Campaign has been previously covered by this Society, so I will just highlight a few pertinent aspects. Within a week of arrival the Buccaneers and Tornados had worked-up their tactics and had a few practice LGB drops on ranges in Saudi Arabia. The attacks were in three phases. First, against fixed major river bridges and then some pontoon ones; then against Hardened Aircraft Shelters (HAS); and lastly, against airfield surfaces and facilities, including a couple of aircraft.

The first combined Tornado and Buccaneer attack was on the morning of 2 February, on the Samawah Highway Bridge, and was a complete success. I showed the video tapes to Gen Glosson the next day. He was an ex-Vietnam F-4 pilot and on seeing the first clip said 'Hell – these guys are doing this in rev (ie not inertially stabilised) mode!' I pointed out that the Buccaneer did not have an IN tie-in and everything was 'thumb stabilised'. He was mightily impressed and a great fan of the Buccaneer crews for the rest of the war.

The video tapes had their pros and cons. Once I received them I

Combat Camera.

took them to the USAF 'Combat Camera' organisation who proved to be invaluable and incredibly helpful. Whilst I used their very high-quality playback equipment to compare the recordings with the MISREPS they would make copies onto fewer cassettes. This was to meet HQ STC's demand for copies for media use whilst retaining the originals for BDA. Slow-speed and freeze-frame replays were vital to confirming, or correcting, MISREPs and getting this information to the BDA analysts was always the first task. With twelve Buccaneer, and at least two TIALD, missions per day, from 15 February, this was a time-consuming process. The last step was to go back to AHQ and write a detailed report for the Air Commander and general staff use.

The first targets to be attacked were large highway and rail bridges within, or on the edges of towns. This raised the new issue of 'Collateral Damage', the un-intended consequence of attacking a 'civilian' target that had military significance. I was instructed by the UK Air Cdr to direct the crews to only attack bridges along the line of the river – the majority of un-guided LGBs falling in the 12 o'clock/6 o'clock line – to select DMPIs away from the river banks and to seek his approval if these criteria could not be met. When we started

bombing pontoon bridges, on the 10th, I was advised by our resident Royal Engineer that the thing to target was the anchor pontoons that connected the bridge to the beach. There were lots of bridge units, so a broken bridge could be easily repaired, but relatively few anchor ones which couldn't, if hit by a 1,000 lb LGB. I put this 'military necessity' case to the UK Air Commander, and he immediately approved the attacks.

On 9 and 10 February, four out of the eight sorties each day aborted their attacks due to weather. This gave me a couple of very welcome early nights. I was accommodated in a house in a compound in central Riyadh and had my own room. But, the poor weather also allowed the *Scud* launchers to deploy unmolested. At about 0300 on the first 'night off'. I was sound asleep when a loud explosion shook the building – it was the first *Scud* to land in Riyadh, about half a mile from our compound. The drill was to put on a respirator and go and sit under the dining-room table: so, I sniffed the air, decided I was still alive, and rolled over and went back to sleep!

A couple of nights later I was in Combat Camera when a *Scud* alert sounded. I duly went down into the shelter with the USAF personnel, but there were no RAF personnel present. The next night I was in AHQ when the alarm sounded. We had an RAF Regiment Cell which was linked into the USAF missile warning system – a Cold War IR Satellite network which had been re-focused on Iraq. So, we knew which '*Scud* Basket' the missiles were coming from and, quickly, their track and intended target. On a nod from J B Hill we all went to the loading ramp for the RSAF kitchens, which had a quick route down to the cellars if needed. To the north was a large apartment block beyond which was the Patriot Battery protecting Riyad (KKIA) airport. We watched the *Scuds* coming in at about 60º elevation, solid yellow/red dots in the sky, staying on a steady bearing and growing larger. Then the Patriots would fire and streak up towards the incoming *Scuds* – there would be a flash and the *Scud* debris would land, often in the suburbs, but outside the 'protected footprint' of the battery. On one occasion, a Patriot exploded as it left the launch tube, directly over a condominium site where some of us were billeted. Apparently, after the explosion all that could be heard was shrapnel raining down on the roofs, or the hiss if it landed in the swimming pools. On 25 February, a *Scud* hit a US barracks in

Dhahran killing 28 and injuring 110 more soldiers. The '*Scud* - watchers' Club' was immediately disbanded.

It became quickly apparent that more information could be gained with the Pavespike recorder. Crews were therefore instructed that after they had finished recording their own attack the navs were to go back to 'wide field of view' and sweep the general target area. Apart from confirmatory evidence of other attacks this proved particularly useful on 13 February when a single LGB landed in the town of Fallujah. This was seized on by some of the Press as evidence that we were now deliberately bombing civilians. The pilot of the Buccaneer (Sqn Ldr Dave Bolsover) saw that one of the bombs had hit in the town, the target was the highway bridge, and his nav (Flt Lt Steve Gregory) was able to record this. Analysis of their target designation showed that the other LGBs had all impacted around the DMPI enabling us to conclude that a single LGB had suffered a failure, most probably of one of the four fins to deploy, and rebut suggestions of crew error from the UK.

There was another period of bad weather between 18 and 21 February, all 10 missions on the 20th being 'DNCO WX'. This affected the Tornados as well and became known as the 'Iraqi Weather Checks' by the crews. The reason for continuing to fly in the known poor weather, and this applied across the Coalition, was that Gen Horner did not want to give the slightest impression that either bad weather, or more importantly, the poor visibility created by the burning of the oil wells, were going to impact on the sortie generation rate and our dominance of Iraqi skies. However, continually flying the same Paveway seeker heads in the contaminated atmosphere, and not dropping them, led to the optical properties of the heads becoming degraded which contributed to later weapon failures and difficulties in target acquisition.

Contrary to some misinformed comment afterwards, only two TIALD pods[8] were deployed, to Tabuk, where they were used for Tornado night LGB attacks. Thus, the Buccaneer provided laser-designation for the Tornado until the end of the Conflict. However, at the start of the attacks on pontoon bridges (on 10 February), it was accepted, at all HQ levels, that the Buccaneer could provide an additional attack capability using its own LGBs and clearance to do this was pursued as an urgent operational requirement. With its considerable endurance at high-level the Buccaneer was able to support

a Tornado formation and then remain in the target area once the Tornados had departed to attack further specific DMPIs or targets of opportunity. This started on 21 February and continued until the 27th, during which time 52 LGBs were dropped on airfield surfaces (taxiway and runway intersections) and two on aircraft in the open at Shayka Mazhar airfield. The first of these failed to explode but broke the back of a captured Kuwaiti C-130 Hercules, and the second destroyed an Antonov An-12 *Cub*. Unfortunately, I was unable to convince the UK Air Commander to let me task some pairs of Buccaneers in the 'armed recce' role hunting the camouflaged tug boats that were critical to the Iraqis deploying pontoon bridges on the Tigris and Euphrates rivers !

By the end of the conflict the Buccaneers had been tasked with 224 operational sorties of which:

Eight were cancelled due to weather and two due to lack of a mission plan from Dahran.

Eight were technical aborts, radio and Pavespike failures, and two aborted due to no AAR.

Buccaneers designated for 746 LGBs (including the 54 self-designated ones) on 107 different targets comprising 290 individual DMPIs, to the following effect:

127 DMPIs were Damaged, Severely Damaged or Destroyed.

95 DMPIs were missed, mostly due to Out-of-Basket releases, and cloud or smoke obscuration.

54 attacks were aborted due to weather.

There were 14 last-minute no-drops, due to cloud or smoke obscuration, or Pavespike problems.[9]

The overall weapon effectiveness of the LGBs dropped by the Tornados and Buccaneers, and designated by the Buccaneers, was that 45% of weapons carried to the release point hit the DMPI.[10] This was due to a number of factors: weapons being released outside the laser energy 'basket', technical failure, crew error and weather, but a lot were due to obscuration of the target to the second and/or third bomb in a 'stick' by smoke or dust from the first bombs. On 12 February (Day 11 of the LGB campaign), the number of LGBs in a stick was reduced from three to two because of an emerging shortage of fuzes and Paveway heads. There was also a significant number of UXBs (about 10%)

caused by having to use the older No 947 fuzes and, sometimes, even WW II-era No 79 Pistols. This was due to a large number of the new No 960 MFBF being used during the Tornado ballistic bombing phase. Central control of the loading of the No 960 fuze, and a rush build by Hunting Engineering eventually resolved the issue. This level of success might not seem high by today's standards but the USAF F-111 LGB success rate was about 55%, the F-117's 75-80% and it was vastly better than the Tornado's accuracy from medium-level with unguided bombs.[11]

On a lighter note, one of the AAR staff was Flt Lt David Barradell, who had been one of my air navigation instructors seventeen years before. One morning he received a message from HQ STC and, the AAR Sqn Ldr being out, asked me to look at the message on his ASMA Terminal. In it AHQ Riyadh was asked to provide a summary of all fuel given to Coalition aircraft, by nation and service, over the duration of the conflict. The three AAR staff were working flat-out and Dave was not happy about the request, to put it mildly. I suggested he ask them if this was for billing the recipients after the conflict was over? He did; the reply came back swiftly – YES! I then suggested that he point out to them that the Saudis were providing all the fuel for the war for free. He did – but this time there was no reply!

In the end 12 Buccaneers, and 18 crews from No 12 Sqn[12], No 208 Sqn and No 237 OCU were deployed to Muharraq. By 15 February the Detachment was generating their maximum of twelve sorties per day.

So, how was it possible to run an air war over 350,000 square miles of airspace, with over 4,000 fixed-wing aircraft from 16 air forces/services[13] generating an average of 2,400 sorties per day?[14] One answer is Exercise RED FLAG and the USAF's willingness, from August 1977, to allow Allied air forces to participate.

At a simplistic level the idea was that we all learned to speak 'American', or at least to understand their tactical doctrine and procedures. The key to this was the daily flying programme, or 'Frag', which was the direct forerunner of the ATO. As each RED FLAG progressed offensive, and then mixed offensive and defensive, 'packages' grew in size and complexity, always seeking to defeat the 'Aggressors' and the realistic ground defences. In DESERT STORM the USAF provided secure telephones and faxs at all coalition bases which enabled package and element leaders to plan together quickly.

Approaching 'Students Gap' in the RED FLAG Area.

Thus, Tornado/Buccaneer formations were supported by F-4G Wild Weasels and EF-111 Ravens for defence suppression. One has to add to that the provision of dedicated AAR and, on an area (indirect support) basis AEW, fighter cover and ELINT-based threat warning. As soon as I walked into the Black Hole it was obvious that this was RED FLAG 'writ large' and, having participated in two RED FLAGs myself, it was incredibly easy to fit into the whole process. But, I would argue that is not the whole story.

By 1977, when the Honington and Laarbruch Buccaneer Wings were the first foreign participants in RED FLAG, the exercise had become wholly focused on training TAC aircrew for their war role reinforcing the Central Region of NATO. The targets were predominantly direct replicas of Soviet airfields in East Germany, with some interdiction targets, the defences were actual, or simulated, versions of the latest Soviet SAM and AAA systems, and the F-5 Aggressors replicated Soviet fighters and tactics. So, the underlying purpose of RED FLAG was to train TAC for NATO operations, and not the other way round.

The initial air campaign, INSTANT THUNDER, was created by Col John Warden, USAF, and his 'Checkmate' team[15]. This was a 6-day campaign against 84 strategic targets designed to coerce the Iraqis into

compliance. That Warden spectacularly failed to sell this to the CENTCOM Air Commander, Gen 'Chuck' Horner USAF is well known. However, what Gen Horner did was to retain Warden's key deputies (including, then Lt Col, David Deptula) and produce a much-expanded plan comprising:

A Strategic Component (INSTANT THUNDER plus),

Suppression of Enemy Air Defences in Kuwait,

Preparing the Battlefield,

And Air Support to the eventual Ground Campaign.

The first part of the Strategic Component was using, initially, stealth and stand-off systems (F-117 and TLAM) to knock out the Integrated Air Defence System and allow conventional aircraft (F-111, Tornado, etc) to attack the Iraqi Air Force on its bases. Whilst, in part, technologically new this was pure NATO Offensive Counter Air doctrine; ie Option ALPHA – which is what RED FLAG was designed to replicate. Preparing the Battlefield and the subsequent Air Support to the land battle were, in NATO doctrinal terms, Air Interdiction, Battlefield Air Interdiction and Close Air Support. Of the 33,706 weapons dropped in the campaign[16] just 7% were PGMs. 12% were dropped on 'strategic' targets such as NBC and Republican Guard; 15% on Counter-Air targets; and 73% (including 3·5% on interdiction targets) in direct or indirect support of the land campaign.

In addition to the ATO the Airspace Control Order (ACO), plus the generic Special Instructions (SPINs), was fundamental to the successful management of the air campaign. Our two Air Space Management (ASM) staff officers were Sqn Ldrs Peter Quaintmere and David Lainchbury, both ATCOs. Peter was responsible for devising the Airspace Control Measures which would form the basis of the ACO. This he did by shamelessly plagiarising the NATO ACMs in 'SUPPLAN MIKE',[17] just deleting the NATO security caveats. Interestingly, late most afternoons a French Air Force (FAF) officer would come over to AHQ, chat with the ASM staff officer over a coffee and a *Gauloises*, and hand him the FAF tanker track bid (for their KC-135s) for the evening's allocation meeting – this was quietly slipped in with our own bid, and no questions ever asked.

In conclusion, some elements were technologically new. The move

(return?) to medium level operations was enabled by having air superiority, which was not the case in the Central Region. And nuclear options were replaced by a return to conventional, strategic, coercive options which would not have seemed out of place in discussions at Maxwell AFB in the 1930s. But nearly 90% of the doctrine, equipment and aircrews were either from, or earmarked and trained for, the Central Region of NATO. This is the other reason, I would argue, why this multinational campaign was so successful.

Note. All illustrations © the author.

Notes:

[1] The second was in 2006.

[2] Throughout this chapter Tornado should be taken to refer to the GR1 strike/attack variant, and not include the F3 fighter variant which was also deployed on Op GRANBY.

[3] See Gp Capt Eeles' paper regarding No 237 OCU's war role.

[4] Operation GRANBY – A Personal Perspective by Air Cdre Alistair Byford, *Air Power Review*, Vol 21, No 2, Summer 2018.

[5] Wg Cdr Bill Cope, OC Bucc Det and OC 208 Sqn.

[6] One was Wg Cdr Nigel Huckins, the last Buccaneer Squadron Commander, and the other Wg Cdr Al Winkles whom I had known on HMS *Ark Royal* in 1975-6.

[7] Wg Cdr Iain McNichol (an ex-Buccaneer pilot) was very helpful in giving this request a 'fair wind' at HQ STC.

[8] The Americans couldn't work out why they were called *Sharon* & *Tracey* until they were introduced to '*Viz*'!

[9] These statistics have been taken from the 208 Squadron F540 for Operation GRANBY, augmented by some Tornado MISREPS and the author's contemporaneous notes. They are the most authoritative statistical summary of the Buccaneer/Tornado LGB operations until the RAF AHQ Riyadh files are released.

[10] Whilst No 208 Sqn's F540 shows this to be 53%, the 45% figure was taken from the author's contemporaneous notes and reflects the more detailed analysis of each attack conducted in Combat Camera.

[11] Authors contemporaneous notes (Buccaneer 'Ops' diary).

[12] Including Flt Lt Mike Wood from HQ 18 Gp.

[13] The US Air Services were: USAF, USMC, USSOCCENT, USN, USA and CRAF.

[14] This average ignores the very low sortie rates on 16 Jan and 28 Feb 91.

[15] This included Lt Col Mike Nelson who had been one of the UASF exchange WSOs on 237 OCU in the early 1980s.

[16] *Gulf War Air Power Survey*, Vol 5 A Statistical Compendium and Chronology (United States Dept of the Air Force, Washington DC, 1993.)

[17] A NATO manual that laid down control procedures within SACEUR's airspace. **Ed**

Q&A and Discussion 2

Peter Almond. Considering its low-level operating environment, why didn't the Buccaneer have a gun?

Air Mshl Sir Peter Norriss. The only reason I can think of is that the original – naval - concept was limited to lofting a nuclear weapon at a cruiser, and the weapon fit followed from that. I suppose that a gun could have been added later, but we more in the business of counter-air operations – putting heavy weapons onto ground targets – and close air support was very much a tertiary role.

Sqn Ldr Vic Blackwood. The South Africans fitted gun packs in the forward part of the bomb bay and used them in Angola. So it could have been done, had we felt the need.

Gp Capt Tom Eeles. The Navy had found that the Sea Hawk and Sea Venom, which were armed with 20mm cannon, had a tendency to loose-off the occasional stray round during arrested landings so they decided not to use guns in their next generation of aircraft. The Sea Vixen never had guns, just missiles and RPs, and the early Buccaneer would have been subject to that policy. That said, I know that Blackburns, or maybe Hawker Siddeley, did propose to the air force a gun installation in the forward part of the bomb bay, but the Air Staff were simply not interested.

Gp Capt Andrew Pennington. Smoke? It was mentioned that reducing speed could reduce the amount of smoke coming out the back. Was smoke production, and the associated give-away visibility, considered as a planning factor?

Gp Capt Christopher Finn. The short answer is –No. You had to achieve a certain speed to carry out a toss attack, and smoke was a consequence of that. We were aware of it, of course, and we had a 'limited buster' procedure to cope with it. If you were travelling at 420 kt and you got a whiff of a fighter, you called 'Limited Buster – Go' and everyone accelerated to 480 kt, and you might also spread the formation out, so you now had a bit of energy, and you hadn't been pushing out smoke until you knew you had been spotted.

Air Cdre Graham Pitchfork. In addition to smoke, there was another factor. We took pride in just how low we could fly and flying *too* low

over the sea could actually be a giveaway. I recall flying bounce in a Hunter, looking for four Buccaneers over the North Sea, and we picked them up from the wake that they were leaving on the surface. That was a potential issue in the maritime world, although we didn't expect to have to deal with many fighters. Oh – and dust on RED FLAG. Don't get *too* low over the desert or you will throw up a cloud of sand . . .

Seb Cox. A question for Graham – on strike wing tactics as adapted for Buccaneers. To what extent were you able to use tactics employed by Beaufighters and Mosquitos using, for instance 60 lb rockets? There is a notable photograph of a strike wing attack on a German convoy which contains, I think, eighteen aircraft. I'm not sure that would read across directly to the Buccaneer, but could you say something about how you did it?

Pitchfork. Initially, we expected two squadrons assigned to SACLANT, ie 24 aircraft. However, that took much longer than expected so, there wasn't a direct read across because we simply didn't have the numbers in the early years. In essence, tactics were based on defence suppression followed by an attack with something more substantial, more accurate. We probably felt a bit more like a Beaufighter than a Mosquito, because the Beaufighter had a torpedo and we were getting the MARTEL as our precision weapon. At one stage my wing commander actually sent me to AHB to see what the strike wings used to do.

Sqn Ldr Bob Tuxford. For Air Cdre Ford, perhaps? Reflecting on your ability to despatch the Buccaneer force to the Gulf with just three days' notice, had you been sitting in your office in 1982 when the CAS asked whether you could get a Buccaneer down to the Falklands, what would your response have been?

Air Cdre Jon Ford. 'With great difficulty', but the option was certainly considered at the time when we were deciding on which aeroplane to use for what became the BLACK BUCK mission. One counter argument, that would seem to have been a stopper at the time, was that the aeroplane simply didn't have enough oil capacity to get it there and back. That said, they flew nine hours non-stop to get to the Gulf without any problems of that nature.

Pitchfork. There was another potential problem – LOX – and that would have been a problem in getting there, and back. That said, in March 1983 a pair of Buccaneers did fly down to the Falklands and operated from there for several weeks, just to demonstrate our ability to reinforce, as distinct from to attack – and that certainly worked. They were taken down by the Victor but on the way back their first top-up was from a Hercules.

Ford. I can offer a bit of a personal 'war story' here. I was at HQ 1 Gp at the time, as Wg Cdr Air 2, responsible for the Buccaneer. 'The Bear'[1] was DCinC at Strike Command at the time and he didn't like my plan which, inevitably, relied on air-to-air TACAN – which didn't always work. But there was another issue. The crews had decided to make the return transit without wearing immersion suits. They had worn them on the way down, flying into the sun, and had found then uncomfortably oppressive. The Station Commander had noticed, however, and insisted that they wear them. That meant recovering them from the bomb bays which meant that they were twenty minutes late getting off, which was critical in terms of the RV with the Victor. The Bear told me that if the RV didn't work, I would be out of a job. But it did . . . (*laughter*)

Rob Day. I have question on Martel. I know that you had a simulator which was, I believe, reasonably realistic, but how often did you actually got to fire a live missile?

Finn. I never did TV myself, but you got a deep-sea firing perhaps once a tour. But it was mostly the trainer. There was a trainer on *Ark Royal* but the Navy wouldn't train the RAF navs on it, so it was the preserve of the FAA observers. There was, of course, the final fire off which was underpinned by financial considerations. It was going to cost a lot of money to decommission these missiles so it was more cost effective simply to fire them off**.**

Pitchfork. In the early days there were trial firings, done by specially selected crews, of both AR and TV missiles. But with the datalink for the TV missile we had video recordings, of course, which meant that we could analyse the conduct of dummy attacks. But there was never

[1] Air Mshl **Sir Peter Bairsto.**

a formal allocation of ‘firings per crew’ as was the case with, for instance, so many 1,000 pounders per tour. There simply weren’t enough to do that, so we had to rely on the simulator and the datalink.

Gp Capt Tom Eeles. I simply have to claim the last word on this one, which you might find amusing. During Trial MYSTICO, when I was on 12 Squadron in the early 1970s, firing Martels at a raft target in Aberporth Bay, our FAA exchange observer was selected as one of the participating navigators. CTTO had decided to run, in parallel, a similar trial that involved a Phantom, stepped up well above the Buccaneer, but heading towards it, to see whether its pulse Doppler radar could pick up a cruise missile-sized target. So you have a Buccaneer running-in in one direction and firing its missile, with a Phantom going the other way about 4,000 ft higher with the pilot probably reading *The Investors Chronicle* while the Nav was trying desperately to spot the target. The Buccaneer fires its missile and off it goes in its cruise mode. The Phantom nav thinks he’s got it. Meanwhile our naval observer decides that he has got the ship target, so he selects ‘Terminal Phase’ – and his TV screen promptly goes blank. Turning the pages of *The Investors Chronicle* in the front seat of the Phantom, the pilot glances out to see a 12 foot long telegraph pole shooting vertically upwards out of the cloud. It stops about 500 ft above him and turns over to have another go . . . *(laughter)* The trial was cancelled.

CLOSING REMARKS

by Air Mshl Sir Peter Norriss

Ladies and Gentlemen, that brings us to the end of this symposium on the Buccaneer.

We have heard that it surprised many by its versatility and capabilities in both the Fleet Air Arm and the Royal Air Force, going on to serve this country operationally for over 32 years. We have heard how in the RAF it transformed the nation's ability to attack surface maritime targets with conventional weapons, a capability largely lost after World War 2 until its arrival in RAF service; how an aircraft conceived for one specific role was developed by both the RN and the RAF for different attack roles; how it coped with having new weapons and systems integrated onto it, even though the end-result of the many extras added to the cockpits was accurately described as creating an ergonomic slum; how it delivered the goods as a laser-designator during Operation GRANBY; and how it inspired a level of affection in those associated with it far exceeding expectations.

During its final years in service it was also used as a test vehicle for many of the new systems under development for the Multi-Role Combat Aircraft, that became known as Tornado, and eventually replaced it. Indeed there were many who felt that, if these systems had been incorporated into the Buccaneer, alongside the thinking for a Buccaneer 2-star that would have drawn on systems developed for the cancelled TSR-2, what might that have become! However, such a beast could have undermined support for the Tornado, and so such thinking was not pursued. Despite being a huge supporter of the Buccaneer, and having flown the Tornado GR1, I think that decision was right.

Perhaps I can finish by thanking the organisers of this symposium, especially Graham Pitchfork and Jeff Jefford, together with the speakers and the Museum staff, for enabling us to hold such an informative event in this wonderful location. Perhaps you would join me in giving them all a round of applause.

SUPPLEMENTARY PAPERS

The following paper was among those presented at a seminar, devoted to Operation GRANBY, *held at the RAF Museum on 13 March 2013. Since, as a 'hands-on' impression, it provides a contrasting perspective to some of the above, it is appropriate to recycle it here.* **Ed**

BUCCANEER OFFENSIVE OPERATIONS

Wg Cdr Ewan Fraser

Having read Electronic and Electrical Engineering at Glasgow, Wg Cdr Fraser joined the RAF in 1986. Trained as a navigator, he flew Buccaneers with No 12 Sqn and Tornados with Nos 14 and 15 Sqns, which included operational experience over Iraq and the Balkans, as a QWI and Flight Commander. Ground appointments have included a stint in the CAOC at Al Kharj and tours with the PMA, on the staffs of HQ 1 Gp and the UK's JFACHQ in Afghanistan. He is currently serving at High Wycombe as the Air Platform Protection (EW) desk officer.

You have heard (*from Air Cdre Witts*) about the concerns he felt while leading a stream of aircraft over well-defended Iraqi targets, and about the specific incident involving the last Tornado lost to enemy fire. Well, I shared Air Cdre Witts' concern at that time, albeit from perhaps the opposite end of the responsibility spectrum, that of a fresh-faced newly combat-ready junior navigator, and 14 February 1991 is firmly implanted in my mind, as that was the date of my first operational sortie. What is more, I was actually informed of that Tornado's loss during the outbrief for my first mission which was, in effect, the follow-on task to the very same target, the heavily defended Al Taqaddum airfield, just west of Baghdad. I had actually planned my sortie alongside the crew who were now missing in action. I still recall my dryness of mouth – as we walked to our aircraft I could not speak. Two things were in my mind: success and survival.

I am going to talk about Buccaneer operations. I shall make no attempt to address the high level strategy and politics surrounding the aircraft's deployment, or to discuss the complexities of operational

The Buccaneer in its natural environment, at low level over the sea toting, in later life, as in this case, Sea Eagle missiles.

command – these issues having already been admirably covered by previous speakers. My intention is to present a view through the tactical lens or, more specifically, through the eyes (as constrained by the extremely limited field of view provided by the optics of a Pavespike pod) of a junior Buccaneer nav. However, I should provide a health warning. My efforts to keep my head above water at the time – simply trying to understand what was expected of me, never mind recording anything for potential future presentations to distinguished historical societies – meant that I kept no journal nor do I have any notebooks for reference. Thus, what I present here is a personal recollection, perhaps enthusiastically tainted or embellished through time.

I remember clearly when Iraqi forces invaded Kuwait in August 1990 and the Gulf crisis began. At the time only three Buccaneer units remained operational – Nos 12 and 208 Sqns and No 237 OCU, all based at RAF Lossiemouth. They all flew the Mk S2B version of the Buccaneer in the maritime strike/attack role assigned to SACLANT, with the OCU also responsible for a low-level land attack commitment to SACEUR. At the personal level I was participating in an RAF sailing expedition to the west coast of Scotland, a week of leisure as a reward for an intensive year, involving six month's OCU conversion flying followed by a six month work-up to combat ready (CR) status. Looking back, I still recall thinking a year or so later that the misery of the OCU and the torment of my CR training was worse than the ordeal I faced going to war!

My sailing expedition continued uninterrupted and when I

eventually returned to the squadron I found that the invasion of Kuwait had changed little, aside perhaps from a sudden appreciation of where Kuwait was situated geographically, and the emergence of a plethora of instant experts on Middle East politics, each with their own view of how to resolve the crisis – specifically through employment of the Buccaneer of course. However, closer to my near-term junior officer heart, was that a squadron exercise to Turkey had been cancelled for lack of available air transport (AT). Of course I now realise, with the benefit of a further twenty-one years' experience, that while a lack of AT was undoubtedly a factor, the rationale was more likely to have been linked to the strategic implications of deploying a squadron of attack aircraft to one of Iraq's immediate neighbours.

What immediately followed for the Buccaneer force was, well, not much really. For the rest of 1990 the Cold War influence continued – long range maritime strike/attack missions with low-level anti-shipping laser guided bomb attacks being very much the norm. The wing carried on with absolutely no inkling of what was to come – deployment simply was not in the frame. Nonetheless, foreseeing a possible requirement and with potential deployment in mind, the Force commenced some low level overland tactical and target designation training, very aware that, aside from a few laser designation targeting pods in development for the Tornado, the Buccaneer with its Pavespike pod provided the only national airborne laser designation option for the UK. Shortly afterwards, however, I recall my Flight Commander telling me that Lossiemouth had received quite a stern directive from 18 Group to the effect that we were *not* going to deploy to the Gulf and that we should therefore desist from war-mongering and return to working purely on our maritime tactics. Whether this statement was true, or whether it was simply a way of managing our expectations, I guess I will never truly know but I do know the disappointment that it brought. We were also advised that the US military air planners had undertaken to provide any necessary airborne target designation for RAF aircraft.

Christmas 1990 came and went. Our forces continued to build up in the Gulf. We could only observe these developments from afar, with keen interest and more than a little envy.

In January 1991, when news broke that the air war was actually underway, I was at home at Lossiemouth. Listening to the radio at 6am

in the morning after the first night of operations I remember being somewhat taken aback, and more than a little relieved, to hear that we had lost only one aircraft – my Cold War training, whether by design or individual misconception, having led to me to expect far worse. The Met briefing on that cold dark Scottish morning was a sombre affair. All of our minds were elsewhere and youthful concerns were being voiced regarding the futility of training for our maritime role when clearly there was real work to be done elsewhere. But the Flight Commanders pulled us together and we were soon airborne over the sea practising the multi-aircraft attacks that were designed to take out the worst that our potential adversaries' navies could offer. As I recollect it, a few days later, at 'happy hour' in the Mess, AOC 18 Gp, Air Marshal Sir Michael Steer, who had been pushing for a Buccaneer involvement, confirmed that we were unlikely to be required. It still seemed that a Buccaneer deployment was simply not on the cards, especially as the force was currently engaged in exercises with No 12 Sqn down in Gibraltar and No 208 Sqn at St Mawgan. If anyone had told me then, that within two weeks we would be fighting in the war, I simply would not have believed them.

Warfare has but one certainty – it is unpredictable. With the Tornados soon operating at medium level (*for reasons already covered by Air Cdre Witts*) with their weapons system optimised for low-level it soon became evident that a laser designation capability was required. I believe that, towards the end of the first week of hostilities, Lossiemouth's Station Commander was asked how quickly he could get a squadron of Buccaneers to the Gulf. His response was – six aircraft ready to deploy in three days, once they had been recovered to Lossiemouth. Not long afterwards a Warning Order was issued which directed the Buccaneer Force to prepare for a deployment to the Gulf where it was to provide co-operative, daylight laser designation support for the Tornados. The station became a hive of activity.

The first major task was to modify the aircraft. Immediately apparent was the application of the, by now familiar, Jaguar/Tornado-style 'desert pink' paint scheme – the joke being that if you stood still in General Engineering Flight you would find yourself coated head to toe within seconds. To cater for the unfamiliar electromagnetic environment, both the hardware and software of the radar warning receiver had to be upgraded. *Have Quick II* encrypted frequency-

A Buccaneer in hastily-applied, but immaculate, 'desert pink'.

hopping radios and Mode 4 IFF were fitted, both of which would be essential for in-theatre operations. For self-defence, our ageing AIM-9G Sidewinders were replaced by AIM-9Ls. That all of this was done, tested and declared operational in a matter of days was clear evidence of the effort, resourcefulness and single-mindedness-of-purpose demonstrated by personnel across the board, not just at Lossiemouth, where these traits were readily apparent, but across the whole of the Defence establishment. With hindsight, I was probably naïve not to have to concluded that someone, somewhere had not already given some thought to what might be required but, even so, it was a remarkable performance.

Modification of the aircrew was the second major task. Those selected to deploy – I was not among them, as the initial selection was confined to experienced operators – had to be equipped with what they needed from NBC suits to an assortment of injections and medical preparation. Perhaps more importantly, procedures for laser target designation from medium level had to be developed. Although laser designation was part of the regular Buccaneer training programme, it was always done at low level and, aside from the OCU crews who had their overland role, it was practised exclusively against maritime targets. Therefore, in order to develop and validate the tactics, techniques and procedures that the deployment would subsequently use, the squadron's Qualified Weapon Instructors and other senior operators took to the air whenever they could in whatever suitable aircraft were available – remembering, of course, that the majority of the aircraft

Air-to-air refuelling was an un familiar technique for ex-RAFG crews but would be essential both for deployment and in-theatre operations.

fitted for, and equipped with, the Pavespike laser pod were undergoing modification or in the paintshop. In addition, some of the OCU crews required a rapid familiarisation with air-to-air refuelling, a discipline of which they had no previous experience through having spent their earlier front line tours in Germany, where there was no AAR requirement.

In very short order, six Buccaneers were flown out to Muharraq via a non-stop nine-hour transit. They were launched as three pairs on consecutive days starting on 26 January, with six more crews, along with more than 200 groundcrew, having already left by Hercules.

Following a couple of in-theatre training flights with the Tornados, the first Operation GRANBY Buccaneer mission was flown on 2 February. It was a successful interdiction of the As Samawah highway bridge, in a co-operative laser designation support role and the format of this first mission was to become the baseline. I will come back to this format shortly. Within a week of commencing ops, nine crews were operational with their success leading to increased tasking, the only constraints being the numbers of aircraft, of crews, and of daylight hours, the Pavespike pod having no night capability.

Meanwhile, on Friday, 1 February, I had been informed that I was to be one of six crews standing by to deploy with six further aircraft. My pilot was to be Fg Off John Sullivan, a great friend and pilot, both of us having recently graduated from the OCU and newly rated as combat-ready. I felt very proud to be one of only a handful of first-tourists selected; indeed we were the only first-tourists to be paired as a crew. For me, this meant a weekend of concentrated flying with one of the

squadron's Qualified Weapon Instructors who introduced me to the new discipline of medium-level co-operative target designation. We also completed some self-designation high-angle dive attack training. Whether I impressed or not I cannot recall, but I was satisfied to note that a 'DCO' – duty-carried-out – was entered in the Authorisation Sheet. This, and visits to Stores and the medics completed my preparation.

Orders to deploy the remaining six Buccaneers followed very quickly on the heels of the success of the 2 February mission and another on the 3rd. This would place a total of twelve aircraft and eighteen crews in-theatre. For a first-tourist, the transit flight was quite an adventure. It was a cold, wet, pitch black Scottish morning as we took off as Number Three of a three-ship at about 0600 hours. About 90 minutes later I distinctly recall the beautiful sight of the sun rising over the English Channel as we approached the first tanker bracket with a Victor. A direct sortie, we reached Muharraq, once again in the dark, after a total flight of some nine hours. Our arrival remains clear in my mind.

Having departed from the last tanker, the plan was to arrive as single aircraft in trail from the south east. The Buccaneer's navigation kit was not the best and, suffice to say that, after nine hours at medium level above cloud it really did not resemble the real world. Nevertheless I was confident that Muharraq, at the northern end of Bahrain island, would show on the radar, and, so far as we were aware, there was only one major airfield. But confusion reigned during the approach when we saw a clearly lit up runway of significant size to the left of the aircraft's nose. My pilot rationalised – logically, of course – that without the benefit of accurate navigation information or radar displays, this must actually be our destination. But I could clearly see that this was not the case, as my radar showed this runway to be in the middle of the main island. Thankfully, my argument prevailed and we ignored this airfield – which turned out to have been the recently constructed Sheikh Isa Air Base, so recently constructed that it did not yet feature on aeronautical maps – and pressed on until Muharraq came into view. We landed a few minutes later, absolutely exhausted, but exhilarated.

My initial impression was of organised chaos – aircraft, personnel, weapons and vehicles charging purposefully in every direction. While

The usual procedure was for a strike to be carried out by six aircraft, operating as two elements, each comprising a pair of Tornados and a Buccaneer 'spiker'.

climbing down the aircraft steps I heard a loud bang, and on looking over my shoulder I saw that a fuel bowser had reversed into an RAF Regiment Land Rover. The resolution of this incident, which would have required at least a Unit Inquiry back in the UK, simply involved the hefty application of a right boot to disengage the interlocked vehicles.

But, getting to the Gulf was only the first of many challenges.

Co-operative bombing was not the simplest of tasks. It was a complicated business that required extremely close co-ordination which, in an ideal world, would be predicated on familiarity with the procedures, underpinned by a regular training regime. But in Op GRANBY, the technique was very new, to both the Buccaneer and the Tornado crews, and there was no time to spare for practice. So we were, in effect, thrown in at the deep end – but we coped.

The standard procedure was for a pair of Buccaneers to accompany four Tornados, the first Buccaneer designating a target, or targets, for the laser guided bombs (LGB) dropped by the first two Tornados and the second for the second pair. The over target time between Tornado pairs was normally separated by two minutes, reducing to one minute if each Tornado had a different target. With a bomb's time of flight being around 40-45 seconds, this spacing allowed each Buccaneer to laser designate, or 'spike', up to two separate targets for each Tornado pair; and also ensured that, should only one Buccaneer be available for whatever reason – perhaps an in-flight unserviceability or the other

Left, an LGB strike on a bridge as seen on the Navigator's TV display and, right, on a different bridge as seen with a camera.

crew having difficulty identifying a target – that it theoretically had time to identify and 'spike' all four targets.

Other factors ate into the limited time that was available, such as the distance between targets and the need to allow time for dust and debris to settle, and to allow the Buccaneer navigators to 'map read' or 'walk' their targeting pods over features on the ground from one target to the next.

Furthermore, positive identification of the target, or the target area, which would permit the actual target to be positively identified while the weapon was in flight, was essential before the Tornado could release its bombs.

For the Buccaneer navs, locating and identifying the targets on the designation pods could be very difficult. First, the Pavespike pod was not linked to the aircraft's nav/attack system so there was no computerised or inertially aided means of slewing the pod onto the target. The work around for this was that, shortly after getting airborne, the aircraft would be accelerated to attack speed and, from a line astern position, the crew would boresight the pod against one of their accompanying aircraft, the pilot making a mark on his sight with a chinagraph pen to align with the navigator's Pavespike pod sight – I will come back to this shortly. Secondly, the limitations imposed by the Buccaneer's navigation kit meant that simply finding a target in barren, often featureless terrain, was an issue in itself. Indeed, prior to the target run we dared not lose visual contact with our Tornados, as finding the formation again was not easy and clearly the integrity of the formation was vital to the whole process. This often meant flying in close

formation, in cloud, as a four- or six-aircraft package for two hours or more.

At around 10 to 15 minutes from the target the four Tornados would split into pairs in order to provide the required over target spacing, individual Buccaneers remaining with their respective Tornados, flying a wide visual 'battle formation' at heights between 22,000 and 27,000ft, always flying slightly above the Tornados – it had not escaped our notice that putting the Tornados between ourselves and the ground-to-air threats increased our chances of survival, the Tornados effectively acting as active decoys! About 20 miles short of the target the leader of each Tornado pair transmitted a codeword, which was the cue for its accompanying Buccaneer to split and accelerate ahead in order to acquire the target. The Buccaneer pilot then had 45 to 60 seconds to acquire the target visually, place his boresighted chinagraph mark over it – which meant entering a dive of around 5º, depending on distance from target, and hold the mark on it until the navigator had identified the target or target area and had started tracking it on his screen. Coping with the obscurity caused by desert haze and dust, coupled with slant angle, was a constant problem.

Once satisfied that he had the target, a codeword was broadcast from the Buccaneer's back cockpit to let the Tornados know that they were clear to release their 1,000lb Paveway II LGBs, usually in sticks or salvoes of either two or three. Once the navigator was tracking the target, the Buccaneer pilot was free to manoeuvre the aircraft but only within clearly defined parameters, because the pod, which was carried on the left hand inner wing pylon, suffered from both airframe masking (getting a part of the aeroplane between the target and the Pavespike's sighting head) and gimbal limits. Although you could certainly pull out of the initial dive and ease away from threats in the target area and from other aircraft in the formation, if the Pavespike's gimble-mounted electro-optical sighting head hit its stops, it would automatically 'cage', which is to say that it would boresight back to dead ahead.

With bombs already in the air, the only way to re-acquire the target and resume laser designation would be to go through the whole process again but, now being much closer to the target, this would involve a much steeper dive – and it was most unlikely that this could be achieved in the time that remained before the bombs impacted. I should perhaps stress, incidentally, that the optical magnification of the pod inevitably

Hardened aircraft shelters, each one individually targeted and surgically destroyed by an LGB

resulted in a very narrow field of view, so the navigator was effectively 'looking through a drinking straw' while trying to identify the target which he then had to track continuously using a thumbwheel with his left hand. It was a delicate task, not eased by the fact that there was a slight lag between operating the thumb-wheel and the pod's response. All this while having to contend with the aircraft manoeuvring, and reacting to ground-to-air threats. Since the only RWR display, and the majority of the controls for the AN/ALE-40 chaff and flare dispensers, were in the rear cockpit, this served only to increase the load being carried by the already stretched navigator.

These attacks were real team efforts – a lot had to happen both in and out of the cockpit and it could be a tense time.

Our early sorties were flown, in the main, against interdiction targets, broadly intended to disrupt the movement of Iraqi forces – bridges, and petrol, oil and lubricant production and storage facilities. However, from 12 February the mission largely changed from interdiction to offensive counter-air, primarily aircraft in hardened aircraft shelters, expanding from around 15 February, to embrace

From 21 February the standard load for a Buccaneer was, from left to right, an ALQ-101 ECM pod, an LGB, the Pavespike pod and a second LGB.

airfield targets in general, such as runways, taxiways, PBFs (Pilot Briefing Facilities) and hardened bunkers.

Until 20 February the Buccaneers were flown only on co-operative designation missions. For these sorties the aircraft carried a Pavespike pod on the left inner wing pylon, an AN/ALQ-101 ECM pod on the right inner pylon and an AIM-9L Sidewinder on the left-hand outer. Chaff and flares were also carried as a standard fit and an internal fuel tank was fitted in the bomb-bay. However, from 21 February the opportunity was taken to arm the Buccaneers with Paveway II LGBs on the right-hand inner and left-hand outboard pylons, the Sidewinder having now been removed as, by that stage, the Iraqi Air Force was no longer considered to represent a credible threat.

A quick change to tactics and procedures followed and the Buccaneers, having first designated for the Tornados as before, would now remain over the target area as a pair and execute high-angle self-designation dive attacks, tipping in from around 27-29,000 ft to drop their own LGBs – a high-angle, ie 45º-55º, dive being the only way to get the Pavespike sight on the target while at the same time being close enough to the target to ensure that the release point would be within the weapon seeker's field-of-view, bearing in mind the Buccaneer's lack of accurate navigation capability which, in turn, precluded any form of level weapons delivery, the intricacies of which are beyond the scope of this paper.

It did not escape our attention that these self-designation attacks meant that the RAF's Buccaneers had, in their final years of service, actually delivered live munitions in anger – albeit perhaps not in the way its designers at Brough had envisaged, but a success, nonetheless.

It would, however, be quite wrong to suggest that it was easy, or that we had had it all our own way. We were lucky in many respects; there were undoubtedly flaws in our tactics and it could be argued that we also became complacent. As I have already mentioned, my first combat mission was against Al Taqaddum airfield where we had lost an aircraft earlier that day. The loss of that Tornado was a harsh reminder that operating at medium-level was not a panacea and that, although very much on the back foot by this stage, the enemy always has a vote. That Tornado had been the eighth aircraft in an eight-ship formation and one did wonder whether there might not have been a cleverer way of going back in to hit that same target again. That thought was in the back of my mind as we were about to repeat exactly the same tactic – and we were going to be the last aircraft through from our formation. Sure enough, as we attacked, from the same direction and using the same profile, we were engaged by SA-3 and SA-6 surface-to-air systems. Furthermore, later in the campaign we were routinely loitering above our targets, executing our self-designation attacks for up to six minutes from first co-operative weapon impact to last self-designation impact. I vividly recall, as Number Six in a formation, pulling out of more than one such high-angle delivery through a hail of well-aimed AAA. For us to have assumed that the enemy would not have been able to visually acquire us and optimise their weapon solutions within six minutes was somewhat reckless.

By the end of the campaign, our twelve Buccaneers and eighteen crews had flown some 226 missions. Thankfully there had been no losses, and on 17 March all twelve aircraft took off from Muharraq for the nine-hour non-stop return flight home, accompanied by Victor tankers. So ended the Buccaneer's first and only war during its years of RAF service. Ironically, it had not been flying in the low level maritime strike role for which the aircraft had been designed, nor on low level overland strike/attack missions into Eastern Europe for which it had been adapted, but at medium level in the Middle East.

The Buccaneer's performance on Op GRANBY is a reminder that,

The Buccaneer had proved itself in 1991 but within three years the last of them had been withdrawn from service.

regardless of its age, it is the quality and flexibility of an aircraft and its equipment, and of the people who fly and maintain them, that determines a weapon system's capability and thus its effect, whether at the tactical, operational or strategic level. Participation in Operation GRANBY was a challenge for the Buccaneer but it must be acknowledged that, while it was an old platform, it was its unique ability to deliver smart precision weapons that determined its utility. This was a game-changer and in many ways is the wider point.

For the aircraft itself, when called it stood up to the plate, eloquently captured by Wg Cdr Bill Cope, the Commander of the Buccaneer Detachment at Muharraq, who, when asked by the media to comment on the effectiveness of an aircraft that had already seen some three decades of service and was fast approaching retirement, said, 'My old grandmother is getting on a bit, but you wouldn't want to mess with her.'

As for me, I had succeeded and survived – I wanted no more.

Sources:

a. Stringer, Gareth, Military Aviation History (Global Aviation Resource, http://www.globalaviationresource.com/reports/2011/gulfwar20thbuccaneer.php)
b. White, Andy, 'Operation Granby' Iraq 1991 Buccaneer - 'Gulf War' Missions History (Putting the Records Straight), http://www.blackburn-buccaneer.co.uk/0_Gulf-missions.html
c. Cope, Bill, Gp Capt, Gulf War Buccaneer Operations, http://www.raf.mod.uk/history/GulfWarBuccaneerOperations.cfm

The following paper was among those presented at a seminar, devoted to the RAF in the Mediterranean theatre post-WW II, held at the RAF Museum on 12 April 2006. Since it reflects a notable incident in the Buccaneer's long career, it warrants recycling in this edition of the Journal. **Ed**

BUCCANEERS OVER BEIRUT

Air Cdre Ben Laite

Commissioned in 1963, Ben Laite trained as a navigator and completed flying tours on the Vulcan (Blue Steel), Phantom and Buccaneer. Most of his staff work was in the fields of tactical and maritime reconnaissance and strike/attack operations. He was Director of Cranwell's Department of Air Warfare and later Assistant Commandant of the RAF College. His final appointment was as a Director at the Personnel Management Agency. In 1983 he was OC 208 Sqn and thus commanded the Buccaneers assigned to Op PULSATOR.

In September 1983, elements of the British Army stationed in Beirut were perceived to be at risk. Operation PULSATOR was mounted to cover the detachment of six Buccaneers, from Lossiemouth's Nos 12 and 208 Sqns, to Akrotiri whence they were to provide air support for British Forces deployed in the Lebanon (BRITFORLEB).

Operating alongside their American, French and Italian counterparts, the 102 officers and men of the UK contingent of the multi-national peacekeeping force in Beirut, had been occupying a block of flats in the Hadath area of the city since the previous February. Their primary role was to prevent the many local factions (which included Druze militia, Shi'ites, Sunnis and the Lebanese Army) from destroying the city as they fought each other. Unfortunately, by September the situation was getting worse, not better, and it seemed that the peacekeepers were likely to become targets themselves. The morale of the American element (Marines deployed ashore) was maintained by the close proximity of the US 6th Fleet, also known as Carrier Task Force 60 (CTF60), which could field well over 100 fixed-wing combat

aircraft. Similarly, the French forces ashore were reassured by the presence of the aircraft carrier FS *Foch*[1] and its air wing of Etendards. These shipborne aircraft could, in theory at least, retaliate in response to any direct or indirect threat to the ground forces. This was not the case for BRITFORLEB and their morale was deemed to be suffering because they felt extremely vulnerable and isolated in their part of the city where they lacked any means of support, ground or air. Hence MOD's decision to deploy attack aircraft to Cyprus.

The types considered were the Tornado, the Jaguar and the Buccaneer. The prime requirement was the ability to deliver an extremely accurate attack, the aim being to achieve maximum effect whilst minimising the risk of collateral damage or injury to friendly forces. The threat to BRITFORLEB was assessed to be from either long-range artillery or an assault from within the city itself. While the Tornado's on board nav/attack system could certainly provide much of the required degree of accuracy, it was ruled out because of its poor radius of action, its inability (at the time) to deliver Laser Guided Bombs (LGB) and a still untried deployment capability. The Jaguar had an accurate navigation system and it could deliver a precision attack using LGBs, but it lacked the ability to laser designate the target. The third option, the Buccaneer, had an extremely basic navigation and attack system but it was the best option in terms of LGB capability in that it could both designate the target and deliver the weapons. The Buccaneer was chosen.

The Warning Order, which was issued on 8 September, specified operations in support of the British peacekeeping force in Beirut and stressed the need for accurate weapon delivery. This drove the selection of crews towards those with overland laser designation (ie Pavespike) experience. Unfortunately, while No 12 Sqn was familiar with Pavespike procedures, it was all in the anti-shipping role and thus largely inapplicable. By contrast, there was some overland Pavespike experience embedded within No 208 Sqn but this was at least two years old as the unit was currently engaged in converting to maritime operations. Nevertheless, six crews were drawn from across the two squadrons, although it was evident that the necessary degree of expertise was concentrated at the squadron leader/Flight Commander level.

With OC 208 Sqn appointed as Detachment Commander (Det Cdr),

Lossiemouth's personnel began to prepare the aircraft, plan the deployment route, organise Intelligence briefings, issue small arms and attend to personal administrative details. On 9 September several Hercules flew into Lossiemouth where they were rapidly loaded with stores before departing for Cyprus with a contingent of Buccaneer ground crew on board. The Buccaneers took off the same day, in three pairs, each of which linked up with a Victor tanker which accompanied them, non-stop, to Akrotiri. All aircraft were on the ground in Cyprus within 24 hours of receipt of the Warning Order.

At Akrotiri, the first tasks were to find our domestic accommodation, open up the facilities allocated to the detachment and prepare the aircraft for their intended sorties. On the following morning, the Air Commander (Air Cdr) Cyprus gave a briefing to all deployed aircrew at AHQ Episkopi. While he clearly had a firm grasp on the overall picture, the aircrew were somewhat confused by the various permutations on just who might be shooting at whom, from where and why. Worse still, details of the air scenario, and in particular the air threat, were very sparse. One issue which was very clear, however, and one which would dominate both the planning and the conduct of any operations was Rules of Engagement (ROE). There were four of them, although they would have been better described as 'Possible Scenarios for Action.' They were:

ROE 1*	Show of Strength.
ROE 2*	Reaction to Attack (Bombardment).
ROE 3	Immediate Defence.
ROE 4*	Reaction to Attack on Multinational Force.

*****Required Ministerial Approval

After the briefing, and in discussion with the Air Cdr, it became obvious that there was little or no Buccaneer experience at Episkopi which meant that the AHQ lacked the necessary expertise to raise tasks or to direct operations. Indeed, the Air Cdr had requested that an Air Support Operations Centre (ASOC) should accompany the deployment but for some reason none had been forthcoming. Another issue that required urgent attention was the relationship with CTF60, sitting just off Beirut, with the USSs *Dwight D Eisenhower*, *Iwo Jima* and *Austen* along with many other ships. There was also the Marine Amphibious

The Buccaneer dispersal at Akrotiri.

Unit (MAU) that had been put ashore at the International Airport. Effective tasking of the Buccaneers would require close co-ordination with CTF60 so deconfliction of routes and the associated air traffic procedures were high priority issues for resolution by the air staff.

For the Buccaneer Detachment itself, the order of business was:

- Establish an ASOC, of sorts – even a one-man operation (probably all we could afford) would be better than nothing.
- Decide on comms requirements and draw up a Communications Plan.
- Identify a suitably experienced Air Liaison Officer (ALO) to be with CTF60 aboard either the *Eisenhower* or the *Iwo Jima*.
- Begin planning 'showing the flag' sorties under ROE 1.
- Brief the Forward Air Controller (FAC) who was about to join BRITFORLEB in the block of flats in Beirut, on standard operating procedures for ground laser designation for Buccaneer air attacks.
- Develop a Concept of Operations for all sorties under each of the ROEs.

The Buccaneer Detachment Commander (Det Cdr) decided to establish an ASOC within the AHQ at Episkopi and man it himself. This would leave the senior detachment Flight Commander, in charge

of the flying crews and aircraft at Akrotiri, responsible for the effective leadership of that part of the operation. The ASOC was established within the Episkopi Air Operations Centre by commandeering two of the desks and designating them 'Buccaneer Operations.' The Buccaneer Det Cdr obtained a dusty copy of ATP27 (Manual of Tactical Air Ops) from the publications library and added it to the equipment on the desks. The communicators quickly installed an HF radio facility within the console and two separate networks were established, one embracing the more important units of CTF60 and the other a direct link to COMBRITFORLEB. In concert with the staff at Episkopi, the fighter controllers at Troodos devised a Communications Plan that would deal with all phases of any sortie likely to be flown by the Buccaneers, that is to say: departing Cyprus, transiting through CTF60's airspace, overflying the FAC in Beirut and re-entering the fleet's air cover before recovering to Akrotiri.

One of the detachment's Flight Commanders possessed the requisite experience and skill to be the Air Liaison Officer so he was initially despatched to the *Iwo Jima*, although he was soon transferred to the *Eisenhower* where he could exercise more influence. To take his place at Akrotiri, a Buccaneer navigator, an overland Pavespike designation expert, was urgently flown in from RAF Germany. By now, the detachment was confident that it could mount ROE 1-style 'show the flag' sorties, the aim being to demonstrate to BRITFORLEB that air power had arrived and was on hand to help if required. The crews had planned a scenic route across the city including at least two passes across the block of flats housing the British contingent. The stationing of an ALO with CTF60 had proved to be extremely effective in terms of deconfliction, not only with the US Navy's fixed wing aircraft, but also, and even more crucially, with its intensive helicopter traffic. The Buccaneer crews were all cleared to fly at 100 feet Minimum Separation Distance, which, in terms of avoiding other aeroplanes, was deemed to be the safest height to fly over the water – no other aircraft, fixed- or rotary-wing, operated at that height. The available intelligence suggested that there was no co-ordinated air defence network within the city whereby one group might alert another of an impending attack. If there were to be any reaction, therefore, it was likely to be sporadic and late.

With a slack Union Flag in the foreground, one of the Op PULSATOR Buccaneers overflies the block of flats occupied by BRITFORLEB on 11 September 1983. (via Peter March)

The major problem with the showing-the-flag sorties turned out to be a conflict of aims. COMBRITFORLEB was delighted that his troops would see some friendly air power but, although he applauded the raising of the morale of his own troops, he thought that the sorties should also make a show of solidarity with the Lebanese Army. To the south of Beirut there is a high ridge which overlooked the block of flats. On top of the ridge stands the village of Soukh Al Garb, which, because of frequent militia activity there, obliged the Lebanese Army to maintain an almost permanent presence in the area which, in turn, meant that they were at risk. COMBRITFORLEB felt that the planned overflights of his block of flats could easily be diverted to encompass a flypast of the Lebanese Army in the Soukh Al Garb area. The Commander British Forces Cyprus (CBFC) and the Air Cdr jointly vetoed this suggestion, directing that the sorties should be restricted to the 'British' block of flats followed by a run across the city.

Accordingly, on 11 September, a pair of Buccaneers took off from Akrotiri and headed for the Lebanon, via CTF60's airspace, to coast-in

at the International Airport. Having overflown the flats in Hadath they flew on across the northern part of the city before turning to fly back to Hadath on their way back to Cyprus, again via CTF60, the whole sortie taking just 40 minutes.

During the sortie, the crews established radio contact with the FAC at Hadath, but a new voice come on the air identifying himself as COMBRITFORLEB and ordering the Buccaneers to change their route and to fly to a grid reference. Fortunately, the Air Cdr and Det Cdr were monitoring radio traffic in the AHQ at Episkopi and it was quickly established that the co-ordinates were those of Soukh Al Garb. Apart from increasing the risk to the Buccaneers, in issuing such an instruction COMBRITFORLEB was clearly exceeding his authority, not least because his order contravened the current ROE. The Air Cdr was immediately on the radio to order the crews to stick to their briefed plan, ie to overfly *only* the flats and the centre of the city, and to ignore orders from any other source. Communications were less than perfect and there was some lingering doubt as to whether the crews had heard the countermanding instructions; this was dispelled at the subsequent debrief when it became clear that the crews had flown the prearranged profile. A second pair flew the same profile some two hours later also with strict instructions to fly only the pre-briefed route.

With all four aircraft safely back at Akrotiri, there followed a lengthy dialogue between CBFC and COMBRITFORLEB but the latter stuck firmly to his view that the Buccaneers should have threatened Soukh Al Garb to show solidarity with the Lebanese Army. Despite a degree of lack of confidence in the reliability of the radio link between Episkopi and Beirut, it was considered that the situation warranted a repeat performance and another pair flew the same profile on 13 September. Again, all went well – the US Navy was very co-operative and COMBRITFORLEB agreed, albeit reluctantly, not to attempt to retask the Buccaneers. The comms problems had not been solved but had improved somewhat.

While these showing-the-flag sorties were being flown, work was progressing on a concept of operations for ROEs 2, 3 and 4. The aircraft fit was relatively straightforward with LGBs, Pavespike pods, ALQ-101 ECM pods and AIM-9 air-to-air missiles under the wings and, to provide a back up option, 4 × 1,000lb retarded bombs in the bomb bay.

We were also pressing for as many aircraft as possible to be fitted with ALE-40 chaff/flare dispensers.

The requirement under ROE 2 was to retaliate if the flats came under fire – Cyprus was most likely to learn of this via a call from the FAC on the HF net, or a FLASH signal from COMBRITFORLEB himself, telling the ASOC what had happened, what damage had been sustained and what response was required. The ASOC would relay all of that information to the Buccaneer detachment at Akrotiri while ordering the aircraft to scramble. All that the crews had to do was go and do it.

While this sounded fine in theory, there were two significant problems. First, reaction times, which, in reality, were governed by the available secure communications links between Episkopi and Akrotiri. These were appalling, relying upon an intermittent DSSS[2] system or a FLASH signal. What was needed was a dedicated secure voice connection between the Buccaneer Detachment Ops Room and the AHQ. Within a couple of weeks it had been provided and it had been extremely reassuring to observe the RAF's machinery lumbering into action to sort things out.

The second problem was rather less straightforward. Once the Buccaneers had been ordered off, the crews needed to know exactly what it was that they were supposed to hit, and how they were supposed to hit it.

Dealing with the second, 'how?', question first, the most important factor was the need to minimise collateral damage. This clearly required a precision attack which, in turn, meant Laser Guided Bombs – the reason why the Buccaneer had been chosen in the first place. It was reasoned that the most likely targets would be artillery positions which would almost certainly not be visible to the FAC in his block of flats, which ruled out ground-based laser target marking. This drove us towards airborne laser designation but the difficulties inherent in acquiring and designating small land targets from low level were well understood and this rendered the Buccaneer's standard toss tactic unattractive, if not unusable.

I should perhaps explain that 'tossing' a bomb involved a minimum of two aircraft, a 'bomber' and a 'designator' both of which approached the target at low level. The designator would stay low and, having identified the target, direct a beam of high-intensity light (laser) at it from a pod carried under its wing. Meanwhile the bomber would have

Wg Cdr Laite explains the workings of the Paveway LGB's guidance system to FOSNI (Flag Officer Scotland and Northern Ireland).

pulled up into a steep climb, releasing the bomb to fly on upwards before arcing over to fall back down into the 'basket' of reflected laser energy. As soon as the bomb's guidance system was able to detect that it was 'in' the basket, its integral controls adjusted its flight path so that it homed onto the source of the reflected illumination – the target. While that was a reasonably viable option against something as large and distinctive as a capital ship at sea, it was far less practical against a small, and quite possibly camouflaged, land target that would be very difficult to identify.

To improve the chances of target acquisition it would be necessary to fly higher, but accurate illumination required the designator to be close to the target. These requirements could be combined by approaching at a relatively high altitude, to afford the designator more time to search for and locate the target, and then diving steeply while marking it. To work, this would require an absence of cloud, to permit visual target acquisition, and a benign air defence environment. The seasonal weather could be expected to provide a better than even chance of clear skies and the MOD assessment was that the defences were likely to be confined to SAM-7 and small arms fire.

The upshot of all this was a sortie profile that involved a pair of aircraft departing Akrotiri at 100 feet and staying at that height until they had coasted-in, at which point they would climb, in close formation, aiming to be at 11,000 feet, and offset laterally from the target, to permit it to be acquired. Once identified, both aircraft would roll into a 40^{o} dive with the pilot of the designator putting his weapon aiming boresight on the target. His navigator would then place the crosswires on his TV display over the aiming point, proclaim that he was 'Happy!' and switch on the laser. The pilot of the other aircraft,

who had also been boresighting the target visually, would release the bomb at 7,000 feet allowing both aircraft to turn away while continuing to descend to low level for the recovery to Cyprus. The designator would continue to illuminate the target, enabling the LGB to home onto the reflected energy, until the bomb impacted. The only snag with this plan was that the Buccaneer was not actually cleared to release an LGB in a 40^{o} dive.

Before this locally-conceived profile could be formally adopted, therefore, it would be necessary to validate the overall concept and to confirm that no problems would be encountered in dropping the bomb. The Det Cdr requested the assistance of a weapons specialist from the Central Trials and Tactics Organisation (CTTO) who was to supervise a small trial to be conducted on Episkopi Range, expending, ideally, six LGBs (one for each crew). The CTTO specialist arrived from the UK and the trial was carried out, although only three bombs were actually allocated. All three attacks, against a hessian-covered frame target, were completely successful and thus confirmed that it would be possible to acquire a small target and that a 40^{o} dive release was a practical proposition.

Its feasibility having been confirmed, the planned profile became the preferred option, provided that the weather held and that the Syrians, with their more capable air defence systems, did not encroach too far into Lebanon. In the meantime, CTF60 had published a concept of Combined Air Operations which afforded Buccaneers participating in attack operations over the Lebanon priority over all other air traffic. All of which had answered the second question – '*How* were the Buccaneers going to hit their target?'

Still unresolved, however, was the first question – 'What was the target to be?' If COMBRITFORLEB reported that he was under fire, would he actually know where from? The various factions operating in and around Beirut fielded a wide variety of artillery pieces, which meant that, within a radius of about 20 miles, there were large numbers of guns, of many different calibres, any or all of which could threaten the British flats. Current Intelligence briefings indicated that the preferred operating pattern for the gunners was to fire off a few rounds in quick succession and then move. Since the response time for an air strike would be of the order of 45 minutes, it was clear that, even if it had been possible to identify which gun had been fired, it would

probably be long gone before the Buccaneers arrived on the scene.

It was rumoured that the US forces were able to detect an incoming artillery round, track its trajectory and calculate the position from which it had been fired. We were never able to establish whether there was any truth in this tale but the RAF never benefited from such a capability – perhaps because it did not exist or, if it did, because it would have been too difficult to disseminate the time-sensitive information to the relatively remote Buccaneer Detachment.

On the other hand, it became apparent that CTF60's routine intelligence output noted the co-ordinates of some of the larger, permanently manned, artillery sites, sometimes supplemented by photographic imagery. In consultation with the Air Cdr, it was agreed that it would be worth pre-planning attacks against these permanent sites on a contingency basis, regardless of whether they had fired the offending rounds or not. The flaw in this approach was that these permanent, big-gun emplacements were all Syrian backed and there was no hard evidence to indicate that the Syrians were actually shelling the city and to have delivered a 'counter' strike against non-participating Syrian forces could well have provoked an even worse response. Nevertheless, after referring the question to London, the MOD approved the pre-planning of such sorties with the specific proviso that Ministerial approval would be needed prior to execution.

When the Buccaneers first arrived at Akrotiri they had found a Phantom squadron already in residence on an Armament Practice Camp and these had been included in the forces assigned to Op PULSATOR, their function being to provide Air Defence (AD) for the attack aircraft. The most obvious ways of employing the fighters would be to fly them as close escorts or to provide sweep sorties ahead of the strike to ensure air superiority. This was not as easy as it seemed, however. Apart from having to dovetail the activities of the Phantoms with those of the Buccaneers, there was the more critical problem of co-ordinating the type of no-notice sorties that we envisaged with CTF60's air controllers and, quite possibly trigger-happy, self-defence systems. The necessary procedures would inevitably have demanded extensive use of the radio and the Buccaneer crews preferred to stay as silent as possible. CTTO's recommendation was that the Phantoms should mount Combat Air Patrols (CAP) no closer than 10 miles from the Lebanese coast and even

One of the Op PULSATOR Buccaneers at readiness with an LGB and an ALQ-101 ECM pod visible under the starboard wing. (G Pitchfork)

this would have put them sufficiently close to CTF60's airspace to make co-ordination a constant concern. Since there was very little likelihood of any of the in-country factions being able to mount an airborne defence, however, the escort option was not pursued and the AD commitment was confined to a pair of F-4s on standby to fly CAP sorties near the coast if/as required.

Having sorted out the concept of operations, the comms plan and the targeting, the Buccaneer crews settled down to a standby routine punctuated by practice alerts. The normal state involved two crews at 30 minutes readiness, two more at an hour and the third pair on call but, because Pavespike designation was only possible in daylight, readiness was only maintained between sunrise and sunset. Practice alerts were entitled Exercise KELLY; initiated by BRITFORLEB, they were transmitted to the ASOC at Episkopi thence up to the Air Cdr for Command Post procedures before being relayed to Akrotiri where the crews would hastily plan the specific task before boarding their aircraft and taxiing to the marshalling point. Generally speaking, reaction times were pretty good. In order to rehearse short notice co-ordination with CTF60 we eventually introduced Exercise TEPHRITE. In essence this was a KELLY followed by getting airborne and flying to a point just short of the coast near Beirut but sensitivities were such that we were not authorised to practice TEPHRITE procedures until the later stages of the operation.

In the meantime, and predictably, it had soon become apparent that

it was impractical to expect one individual to cope with manning the ASOC and two Operations Officers were flown out from Lossiemouth to join the detachment. One of them was assigned to the Buccaneer Ops desk at Akrotiri while the other went to Episkopi to work shifts in the ASOC with the Flight Commander who had been deployed aboard the *Dwight D Eisenhower* but who had since returned to Cyprus. This was the final link in the chain and this state of orderly preparedness was maintained for some time while a watchful eye was kept on the visibility and cloud base which were critical to our 11,000 ft concept. By January 1984 seasonal deterioration meant that favourable weather conditions could not be guaranteed and it was increasingly likely that the attack profile would have had to revert to a shallow dive or a lay down delivery from low level, accepting the inevitable degradation in accuracy.

In the event, of course, neither option was ever exercised in anger, although the French did mount an air strike. On 22 September, at least two waves of Etendards were launched from the FS *Foch* to attack an artillery site outside Beirut. While the French claimed that this operation had been successful, the Buccaneer Det Cdr was able to make his own assessment while aboard the *Foch* a few days later for a 'co-ordination meeting' (aka lunch); in reality, the attack appeared to have achieved very little, probably the result of inadequate intelligence on the target.

On 30 September, an official cease-fire was declared in the Lebanon. Nevertheless, the detachment continued to mount the standby for some considerable time, although the readiness state was relaxed to two crews at two hours and two at four hours. The reduction in tension provided the opportunity to relieve some of the original personnel and this eventually settled down to a two-monthly rotation which was sustained until the detachment was finally withdrawn.

During this cease-fire period, there were several significant events. One was the replacement of COMBRITFORLEB, the original incumbent being relieved due to exhaustion. Another was the provision of ASMA[3] which transformed the business of communicating securely with MOD, HQ STC and HQ 18 Gp. There is always a downside, of course, and in this case ASMA also meant a proliferation of reports and statistics that had to be compiled and submitted 'up the chain'.

Of far greater consequence was the use of a truck loaded with

explosives to carry out a suicide attack on the US Marine HQ at Beirut Airport on 23 October. This cost 241 American lives while a simultaneous attack on the French barracks killed fifty-eight paratroops. RAF Chinook and Wessex helicopters, which were also assigned to Op PULSATOR, played a crucial role in ferrying some of the more seriously wounded from Beirut to the Military Hospital at Akrotiri. A few weeks later, in December, Druze militia used state-of-the-art SAMs to shoot down two US Navy aircraft over the Chouf Mountains. The Americans responded by launching a large package, containing defensive aircraft and twenty-six bombers, sixteen from the USS *Independence* and ten from the *John F Kennedy*, against ground targets in the Lebanon. The attack aircraft delivered unguided Rockeye cluster bombs from 40º dive attacks at 520 knots.

The results of those attacks are not known but the choice of weapons and the attack profiles flown were clearly of interest to the Buccaneer Detachment whose standby requirements had, by this time, been further relaxed to just two crews at four hour's readiness. Had any attack sorties been required at this stage it was clear that, the deteriorating weather aside, the recently demonstrated presence of more sophisticated SAMs in the area meant they would have had to be flown entirely at low level. The readiness state was increased temporarily on 11 January when BRITFORLEB's block of flats was hit by tank fire. However, the tension was greatly eased when the local Druze Militia Commander immediately apologised in person to COMBRITFORLEB for the 'stray' shell!

After the cease-fire had been sustained for several days, the Rules of Engagement were amended as follows:

ROE 1*	Show of Strength.	Remains in Force but no longer deemed likely.
ROE 2*	Reaction to Attack (Bombardment).	Not in force – inappropriate during cease-fire.
ROE 3	Immediate Defence.	In force but needs Ministerial approval.
ROE 4*	Reaction to Attack on Multinational Force.	Not in force – inappropriate during cease-fire.

The new rules, along with the reduced standby commitment, meant that the detachment now had sufficient spare capacity to be able to

introduce a local flying programme and, since they were in the Mediterranean, the opportunity was taken to mount several training missions employing maritime attack procedures against the large numbers of naval vessels that were concentrated in the vicinity. A number of real reconnaissance sorties were also flown against the *Kirov*, a relatively recent addition to the Soviet fleet. The detachment was also able to carry out airfield attacks against Akrotiri, practice-bombing at Episkopi and fighter affiliation exercises with the Phantoms.

By late January/early February, the British peacekeeping forces were being helicoptered from Beirut to the Royal Fleet Auxiliary *Reliant* for a night's sleep twice a week. On 8 February, the entire force was redeployed, first to *Reliant* and then to Akrotiri. By the beginning of March, the flats in Hadath had been completely evacuated. The Buccaneer Detachment began planning its return to Lossiemouth, all six aircraft eventually flying home on 26 March, staging through Sigonella and Nice. In all, the deployment had lasted 6½ months during which the Buccaneers had flown 733 hours 55 minutes on PULSATOR-related sorties.

On their departure from Akrotiri, the GOC Cyprus, Maj Gen Sir Desmond Langley, said: 'The Buccaneers provided a vital part of the force required for peacekeeping operations in the Lebanon and the detachment from Lossiemouth has been most professional.'

Notes:

[1] The French Navy does not apply a prefix to its ships, in the style of HMS or USS, but it is common international practice, including within NATO, to identify them as 'FS' – for French Ship – hence the FS *Foch*.

[2] DSSS (Direct Sequence Spread Spectrum) was a secure voice facility but, being operator-dependent, rather than automatically switched, its capacity was limited, which meant that it could not be relied upon to be immediately available when required.

[3] ASMA (literally, the HQ STC-sponsored Air Space Management Aid) was a computerised electronic information storage system which provided secure communications links between VDU terminals which could be deployed globally, including aboard HM ships. To the operator, it was very much like sending an email, although ASMA began to be deployed as early as the mid-1970s – long before the availability of the Internet. It was eventually superseded by a more up-to-date network after more than thirty years of invaluable service.

ERRATUM

On page 83 of Journal 79, CinC Coastal is named as Air Marshal Sir Frederick Bowhill. That was his substrative rank but, at the time, he actually held the temporary rank of Air Chief Marshal, as is correctly reflected on page 87.

ROYAL AIR FORCE HISTORICAL SOCIETY

The Royal Air Force has been in existence for more than one hundred years; the study of its history is deepening, and continues to be the subject of published works of consequence. Fresh attention is being given to the strategic assumptions under which military air power was first created and which largely determined policy and operations in both World Wars, the interwar period, and in the era of Cold War tension. Material dealing with post-war history is now becoming available under the 20-year rule. These studies are important to academic historians and to the present and future members of the RAF.

The RAF Historical Society was formed in 1986 to provide a focus for interest in the history of the RAF. It does so by providing a setting for lectures and seminars in which those interested in the history of the Service have the opportunity to meet those who participated in the evolution and implementation of policy. The Society believes that these events make an important contribution to the permanent record.

The Society normally holds three lectures or seminars a year in London, with occasional events in other parts of the country. Transcripts of lectures and seminars are published in the Journal of the RAF Historical Society, which is distributed free of charge to members. Individual membership is open to all with an interest in RAF history, whether or not they were in the Service. Although the Society has the approval of the Air Force Board, it is entirely self-financing.

Membership of the Society costs £18 per annum and further details may be obtained from the Membership Secretary, Wg Cdr Colin Cummings, October House, Yelvertoft, NN6 6LF. Tel: 01788 822124.

THE TWO AIR FORCES AWARD

In 1996 the Royal Air Force Historical Society established, in collaboration with its American sister organisation, the Air Force Historical Foundation, the *Two Air Forces Award*, which was to be presented annually on each side of the Atlantic in recognition of outstanding academic work by a serving officer or airman. The British winners have been:

1996	Sqn Ldr P C Emmett PhD MSc BSc CEng MIEE
1997	Wg Cdr M P Brzezicki MPhil MIL
1998	Wg Cdr P J Daybell MBE MA BA
1999	Sqn Ldr S P Harpum MSc BSc MILT
2000	Sqn Ldr A W Riches MA
2001	Sqn Ldr C H Goss MA
2002	Sqn Ldr S I Richards BSc
2003	Wg Cdr T M Webster MB BS MRCGP MRAeS
2004	Sqn Ldr S Gardner MA MPhil
2005	Wg Cdr S D Ellard MSc BSc CEng MRAeS MBCS
2007	Wg Cdr H Smyth DFC
2008	Wg Cdr B J Hunt MSc MBIFM MinstAM
2009	Gp Capt A J Byford MA MA
2010	Lt Col A M Roe YORKS
2011	Wg Cdr S J Chappell BSc
2012	Wg Cdr N A Tucker-Lowe DSO MA MCMI
2013	Sqn Ldr J S Doyle MA BA
2014	Gp Capt M R Johnson BSc MA MBA
2015	Wg Cdr P M Rait
2016	Rev (Sqn Ldr) D Richardson BTh MA PhD
2017	Wg Cdr D Smathers
2018	Dr Sebastian Ritchie
2019	Wg Cdr B J Hunt BSc MSc MPhil
2020	Gp Capt J Alexander BA MBA MA MSt MSc RAuxAF
2021	Wg Cdr P Withers BSc(Hons) MA MSc CEng

THE AIR LEAGUE GOLD MEDAL

On 11 February 1998 the Air League presented the Royal Air Force Historical Society with a Gold Medal in recognition of the Society's achievements in recording aspects of the evolution of British air power and thus realising one of the aims of the League. The Executive Committee decided that the medal should be awarded periodically to a nominal holder (it actually resides at the Royal Air Force Club, where it is on display) who was to be an individual who had made a particularly significant contribution to the conduct of the Society's affairs. Holders to date have been:

Air Marshal Sir Frederick Sowrey KCB CBE AFC
Air Commodore H A Probert MBE MA
Wing Commander C G Jefford MBE BA
Air Vice-Marshal N Baldwin CB CBE

SECRETARY
Gp Capt K J Dearman
1 Park Close
Middleton Stoney
Oxon
OX25 4AS
Tel: 01869 343327

MEMBERSHIP SECRETARY
(who also deals with sales of publications)
Wg Cdr Colin Cummings
October House
Yelvertoft
Northants
NN6 6LF
Tel: 01788 822124

TREASURER
John Boyes TD CA
70 Copse Avenue
West Wickham
Kent
BR4 9NR
Tel: 0208 776 1751

EDITOR and PUBLICATIONS MANAGER
Wg Cdr C G Jefford MBE BA
Walnuts
Lower Road
Postcombe
Thame
OX9 7DU
Tel: 01844 281449