

# Visiting RAF Lossiemouth: The RAF Shapes a Way Ahead



11/21/16

## Shaping a Transition

The Royal Air Force is in transition as the Tornado is retired, the Typhoon is modernized and the P-8 and F-35 are introduced. Infrastructure of key bases is being modernized as well. This transition as seen by officers involved in the operation and support of combat aircraft at RAF Lossiemouth is presented in this report.

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## SHAPING A TRANSITION

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## INTRODUCTION

In April and June 2016, there was a chance to visit RAF Lossiemouth in Scotland and to talk with the base commander, and several officers involved with the combat operations and logistical support for the aircraft operating from the base.

As such, the interviews provide a slice of current activities and preparation for the transition associated with the evolution of the RAF combat aircraft, including the coming of the P-8.

According to the [RAF Lossiemouth website](#):

*RAF Lossiemouth has entered another significant period of its history. The Station remains an important fast jet main operating base within the Royal Air Force, with both Tornado and Typhoon squadrons based here.*

*RAF Lossiemouth remains the home to the Tornado GR4 Operational Conversion Unit, XV (Reserve) Squadron, who train all Pilots and Weapons Systems Operators to operate the Tornado GR4.*

*During the summer of 2014 two Typhoon squadrons, 6 Squadron and 1 (Fighter) Squadron, relocated to RAF Lossiemouth. The Station's third Typhoon squadron, II (Army Co-operation) Squadron relocated from RAF Marham in early 2015.*

*As part of the changes, the Station assumed Quick Reaction Alert (Interceptor) North (QRA(I)N) duties from September 2014. RAF Lossiemouth is now primarily responsible for maintaining QRA(I)N – providing crews and aircraft at high states of readiness 24 hours a day, 365 days a year, to police UK airspace and to intercept unidentified aircraft.*

*Additional units at RAF Lossiemouth include No 5 Force Protection Wing of the RAF Regiment. 5 Force Protection Wing includes a regular field squadron, 51 Squadron RAF Regiment, and a reserve squadron, 2622 Squadron of the Royal Auxiliary Air Force Regiment.*



**FIGURE 1 RAF LOSSIEMOUTH IS LOCATED IN SCOTLAND DIRECTLY FACING THE NORTH SEA**

[RAF Lossiemouth](#) currently is a Typhoon and Tornado base, but with the Tornados to be phased out within the next few years, the Typhoons will be joined by the P-8, which will operate as well from Lossie.

Second Line of Defense

This provides the opportunity to integrate the Typhoons with P-8s with the F-35s, which will initially operate off shore from the new carriers or, in other words, shaping an offensive and defensive enterprise to protect the homeland and to anchor the defense of the Northern NATO countries.

In effect, Lossie will train to support the formation and evolution of a 21st century combat force in which a multi-mission combat fleet of Typhoons will work with the maritime-focused but land-based capable maritime combat system which is the P-8 (which will be based at RAF Lossiemouth), and which, in turn, will work with the multi-tasking flying combat system which is the F-35 which will be based at RAF Marham.

It is clear that the base is well positioned to support the evolving dynamics of defense, not only for the UK homeland, but to provide a solid anchor within the defense system for the North Atlantic.

We start with the first interview with Group Captain Paul Godfrey, the base commander with regard to his perspective concerning the evolution of the base in preparing for the RAF airpower transition.

We will then present interviews, which look at the coming retirement of the Tornado, its legacy and its contribution to the transition as well.

We will then look at the Typhoon and its key role for the RAF, in Quick Reaction Alerts, Operation Shader and in the Baltic Air Patrol.

Insights are provided by interviews with the 1 (F) Squadron, 2 (AC) Squadron, and those charged with the responsibility of maintaining and supporting the Typhoon fleet at Lossie and in its expeditionary operations, which include deployments to the Falklands as well.

Next is an interview with an officer involved in keeping the skill sets alive while waiting for the P-8, which highlights how the RAF is handling a very difficult transition, namely, the retirement of the Nimrod PRIOR to receiving a replacement aircraft,.

The final RAF Lossiemouth interview is one a second interview with Group Captain Paul Godfrey, who highlighted the challenges and opportunities of shaping RAF transformation as seen from a key operating base for the RAF.

## THE EVOLUTION OF A 21ST CENTURY AIRBASE IN THE UNITED KINGDOM: THE PERSPECTIVE OF GROUP CAPTAIN PAUL GODFREY, RAF LOSSIEMOUTH

Earlier this year, RAF Lossiemouth provided the air engagement piece for the major NATO Exercise Joint Warrior 2016.

Ben Hendry in story published in *The Press and Journal* on April 23, 2016 noted the following:

*A major military training exercise hosted by RAF Lossiemouth has drawn to a close, with fleets of international aircraft jetting off from the base throughout yesterday.*

*Operation Joint Warrior brought some of the world's most advanced fighter jets into the skies above Moray, where they staged a series of spectacular aerial training sessions.*

*More than 3,400 Nato troops took part in the land, sea and air war games event – including 22 ships, four submarines and more than 40 aircraft from a dozen Nato nations and three partner countries.*

*For the past two weeks the region has been buzzing with excitement about the event, with enthusiasts flocking from far and wide to glimpse the awe-inspiring machines in person.*

*But by yesterday afternoon, a hush had descended on the base as normality began to reassert itself.*

*One onlooker, who made several trips to the viewing area at the northern edge of the RAF Lossiemouth runway, hailed the success of the event.*

*The former RAF serviceman said that a fleet of Turkish F-16 jets had been the main attraction for a lot of the aviation enthusiasts who visited the area for the event.*

*He added: "The Turkish jets flew on missions twice almost every day, and were involved with some important training sessions."*

*A German crew which had been participating in the war games exercise was unexpectedly called away shortly after it began, and many experts believe they were summoned to assist with international operations.*

*A fleet of Poseidon aircraft attached to Patrol Squadron 10 at the "Red Lancers" Naval Air Station in Jacksonville, Florida, proved of special interest to observers and Lossiemouth personnel – as the airfield will secure its own brand new deployment of the craft in the coming years.*

*The hulking spy planes were stationed at the northern end of the runway throughout the exercise, and it is understood that RAF chiefs plan to keep the station's new fleet in that area.*

*RAF experts who have maintained their surveillance skills since the UK's fleet of maritime patrol aircraft was decommissioned in 2010 spent time conferring with the American pilots and learning more about the machines.*

*It is believed that they will train the crews who will work with the machines when they take up a permanent residence at RAF Lossiemouth.*

<https://www.pressandjournal.co.uk/fp/news/897689/joint-warrior-concludes/>

When you put this exercise together with the recent Cold Response 2016 exercise in Norway, one definitely gets the point that NATO is treating Russian activity in the North of Europe very seriously.

During a visit to Lossie in April 2016, there was a chance to talk with Group Captain Godfrey. As a combat aviator who has flown a wide variety of aircraft, and working air power integration, he is well positioned to discuss the way ahead for the base at a crucial geopolitical location.

Group Captain Paul Godfrey, OBE has extensive experience of a range of combat aircraft through Harrier, F-16 and Typhoon. As a Harrier weapons instructor, he was the first non-US national to fly the F-16 CJ operationally in the SEAD (Suppression of Enemy Air Defense) role while on exchange with the USAF and has spent the last 10 years in the Typhoon program with two flying tours including 4th/5th generation fighter training with the F-22.

He also has around 100 flight hours in the Spitfire and 80 hours in the Hurricane.

We started by "Godders" providing an overview on the base and its history.

"The base has been through some significant transformations over the years.

It started off as a bomber-training unit in World War II, became a bomber base, and then at the end of war there was no requirement in the area for the RAF.

It was passed to the Royal Navy and every single type of aircraft they had through the 50's and 60's was deployed up here as HMS Fulmar.

Second Line of Defense

Then a transformation began again when the base went from the Royal Navy back to the Royal Air Force in 1972, and then it hasn't stopped. We were stable for the last few years with the Tornado fleet that replaced the Buccaneers, as there were four squadrons of Tornado's between 1992-2015.

We've just come through another period of transformation on the base as I arrived in November last year, with three operational Typhoon Squadrons standing up.

The RAF is drawing down the Tornado fleet so we lose the operational conversion unit that we have up here next year.

One of my priorities for the two years that I'm here is to ensure that 'future Lossie' is planned and executed properly.

With P8 on its way, either in the short term with USN participating in Exercises or the longer term aspiration to base the RAF fleet here, there's a huge opportunity in terms of cross-fertilization of ideas and TTP's with the resident Typhoon force.

In terms of bringing F35 into the UK fleet and how we operate, whether it's NATO, whether it's other European nations, we will be working this opportunity as well within the Scottish region as the Queen Elizabeth carrier arrives for operations and allows flexible basing.

I think the possibilities are huge with where we're going, not only in the Royal Air Force, but with working with the joint and allied forces in the region and beyond."

**Question: The recently concluded Joint Warrior 2016 is clearly a harbinger of some of these changes.**

**How do you see the exercise in light of your transformation opportunity and challenge?**

Answer: We had P3's, P8's and Turkish F16's here. There's an opportunity right there just to look at how other nations do it. There were Canadians, Norwegians, French, Germans, Americans, all operating here.

And, I had a chance to see the P-8 and to get briefed by the crew. It is clearly not just a maritime patrol aircraft. In terms of the software upgradeability of the platform itself, in terms of what it brings straight out of the shop in terms of weapons loads, etc. it is very impressive.

I think that we will widen the P-8 rapidly from an MPA role out to a multi mission aircraft within seconds of getting our hands on it, because of the sensors and its electronic combat capabilities. It's a 737 with weapon's hard points; which provides a huge range of possibilities. The fusion of data in the airplane is another key piece for us.

Having a single fused maritime picture in P-8 connected with the F-35 capabilities with what you bring from Typhoon and suddenly you have that single unified picture amongst a huge range of platforms. We are getting P8 at the same the Queen Elizabeth class carriers with their F-35s become operational for the Royal Navy and Air Force

Within 24 hours of the December vote in Parliament, our first Typhoons were dropping weapons in Syria.

Clearly the Tornado's have been doing just as much as well. the mix of forces have performed magnificently, as we all knew they would.





FIGURE 2 TYPHOON INVOLVED IN JOINT WARRIOR 2016 EXERCISE. CREDIT PHOTO: RAF

**Question: Reliability rates for the Typhoon in Operation Shader have been good?**

Answer: Other than weather factors, we did not miss a single combat trip.

**Question: You are here off the North Sea, so how is the cooperation with the other North Sea states in providing for air combat capabilities?**

Answer: There's a normal working relationship among the coalition forces.

The quick reaction task requires a close working relationship.

For example, when the Russians flew their Blackjack bombers through our area of operations heading to Syria to deliver their cruise missiles, those bombers were first intercepted by Norwegians and then handed off to us. Those bombers were obviously armed and headed for Syria and then returned on their multiple hour mission and then went back through the Black Sea.

We obviously are preparing the ground for more effective and integrated operations with our allies with dealing with this kind of operational challenge.

**Question: Obviously, this is a challenging transition as well.**

**How is the RAF preparing for this transition?**

Answer: It is.

The RAF has started a program, which we call Thinking to Win.

It is about getting people to think differently to deal with new technologies and the new challenge.

I think over the last few years we've had to innovate because of budgets. The lack of budgets means that we couldn't throw money at problems therefore we've had to think carefully about certain problems that we have and how would you solve them?

What we want to try and do now is just bring that into our normal approach.

Second Line of Defense



Whether you've got the money or haven't got the money you just always want to question why we doing it like that.

Can I do it differently?

Can I do it better?

I am trying to inculcate that here at the base and with whom we work in a joint or coalition environment.

We are clearly working to link the platforms we have and are getting differently or more effectively.

We will have a P8 simulator up here and a mixed synthetic domain. We're enhancing the Typhoon synthetics in this area, and link them together every day of the week.

One can link them into the Coningsby wing in terms of Typhoons, Waddington in terms of the rest of the ISTAR force, we will be able to link them into Marham in terms of F35. At that point we can then really go to town in terms of developing the next generation of combat leaders and how we actually need fight in a 21<sup>st</sup> century environment.

It is not simply about preparing for the way we used to do it; it is thinking through how we need to do it in the coming years.

**Question: Obviously the training side of the preparation for operations.**

**How does the synthetic training work to prepare the force?**

Answer: We have the opportunity now to work the Tornados with Typhoons through live and virtual training and this gives us an advantage when we deploy.

We also have 5 Force Protection Wing here. That constitutes an HQ, an RAF Regiment Field Squadron and a reservist, Royal Auxiliary Air Force Regiment Field Squadron.

Just by getting guys talking together we've had the RAF regiment JTACS in the simulators with the Tornado and the Typhoon crews so that they get the benefit of the real JTACs talking to them on the radio, during a simulated mission.

The JTAC gets controls that you wouldn't necessarily get out in the real world because he doesn't have the live assets available to him the whole time.

For our guys working up to the operations in Syria and Iraq, we've got scripts and events that have actually happened combined with the data base in the simulator, so that when they walk out the door here and land in Cyprus for the first time, they are ready.

It may be only the first time that landed at Cyprus in the real world, it's only the first time they been into Syria and Iraq in the real world, but they've done it 10's of times prior to that.

They've spoken to real guys on the ground, that ground just happened to be three feet away from him in the simulator up here at Lossiemouth, but that is huge in terms of preparing our people for what they going to do.

And that lays the foundation for shaping the way ahead as new aircraft, and new capabilities enter the fleet and the force.

**Question: In short, Lossie is a great place to be for you?**

Answer: As you can see out the window, the beautiful sunshine, the beaches and the warm welcome of the Scottish people, there's no other place I would rather be.

## THE PERSPECTIVE FROM II (AC) SQUADRON: MEETING THE CHALLENGES

During a visit to RAF Lossiemouth in April 2016, there was a chance to talk with OC II(AC) Sqn, the commander of one of world's oldest and most famous squadrons.

He was the squadron commander who led the transition from RAF Marham to Lossie in 2014.

As the Wing Commander described the situation at Lossie:

"This was a Tornado squadron. Typhoons first arrived at Lossiemouth in 2014, with their arrival from Royal Air Force Leuchars in Fife.

When that air base closed, number one and six squadrons moved up from Leuchars, and then in January 2015, we re-rolled from Tornado to Typhoon and moved to Lossiemouth from Marham in Norfolk."

**Lossie is becoming a key Typhoon hub from which the jet is deployed worldwide.**

This is placing a significant stress on the hub to support several concurrent forward deployments, a subject discussed with the Wing Commander as well as the Chief Logistics and Engineering Officer at the base in a later interview as well.

**Question: How would you describe your mission?**

OC II(AC) Sqn: We are a Quick Reaction unit at RAF Lossiemouth .

When conducting Baltic air policing, the key is to learn the [template](#) or approach to air policing and to work that with our NATO partners so we can seamlessly pass that mission back and forth to the NATO nations who perform the mission on a rotating basis.

It is a NATO mission and the NATO procedures have to be followed, learned and refined in executing the mission.

**This is the third time that the Typhoon UK force has done the mission and is basically a quick reaction mission but in a NATO context.**

It's a very focused, dedicated NATO mission.

It is a great learning experience for everyone in how NATO works and how NATO operates.

**Quick reaction alerts are a zero to hero mission in a period of minutes.**

You can be asleep, completely asleep, dressed up, ready to go; and the engineers will be asleep; and yet, a number of minutes later, you are mandated to be airborne and facing a potential threat, facing a potential escalating situation, and you just don't know.

**You need to have everyone trained, and everyone in the mindset that they have to be ready to go all the time.**

You need to do your job as professionally as you can when you get there.

Second Line of Defense

You need to make sure that you're following all the protocols that we have.

It is challenging.

**Question: One challenge you face is that when you go on a mission, bombing in Libya or air policing in the Baltics, your pilots are honing their skills in one area.**

**How do you deal with the challenge of training with other proficiencies?**

OC II(AC) Sqn: That is a problem.

When you're out on operations, you're just doing that single thing. You're not practicing all the other skill sets; and it's not like riding a bike.

It is like playing a musical instrument.

**Getting people to keep current on lots of different mission sets whilst being deployed is a challenge.**

And we are expanding our training systems with regard to synthetics as a key way to try to enhance our multi-mission proficiencies.

**Question: This is also significant as you end the Tornado era and operate Typhoon as a multi-mission asset.**

**How do you see this challenge?**

OC II(AC) Sqn: It is a challenge.

There are two different roles for a pilot, control the air and attack; but anyone should be doing both at the same time.

**But with the Typhoon doing a multi-role mission we are now taking the two people in the cockpit in the Tornado and relying on only one in the cockpit now to transition among the mission sets.**

When we're teaching swing role, and taking people through swing role mindset, I often see people writing, "Get the bombs on target, and then deal with the rest of the mission."

Actually, that is not the philosophy at all.

**The philosophy is that we are an air system, an integrated air system.**

You need to control that air space before you can do anything, be that take photos or get bombs on target

Our entire mission, our raison d'être, is to control the airspace that we want to operate in, before we even do anything else.

It's not a mindset change, really, but it's more of a discipline change, in that "I want to prioritize different things at different times."

Doctrinally there is a distinction between Control of the Air and Attack, but Control of the Air is the First Among Equals.

No one conducts surveillance, no one delivers airborne troops and no-one responds to a TIC until we have established the necessary Control of the Air.

We instill in the guys that we train to always think about Control of the Air.



FIGURE 3 A TYPHOON INTERCEPTING A RUSSIAN AIRCRAFT. CREDIT: RAF

**Question: I would like to turn to your experience with Typhoon.**

**The recent trilateral exercise at Langley brought together two airplanes which now have 10 years of operations under their belt along with Rafale which is a bit older, but the point is that it takes time to get the full combat capability out of a combat jet.**

**How do you view Typhoon at 10?**

IIOC (AC) Sqn: I've been lucky to fly the airplane for all 10 of those years.

It is fantastically rewarding and satisfying but it has taken those 10 years to get there!

It will take another 10 years to bring in all of the other new equipment that we're looking forward to incorporating into the jet.

I do think that the British are driving the equipment program because the British have the greatest political imperative to make it work of any nation in the consortium.

We like to think we bring performance in terms of fighter-to-fighter against a Russian threat.

We bring performance and we bring deterrence.

**Those are the two things that we bring.**

It's a large aircraft in the F-15 class so we have endurance and a large payload.

Combine that with our performance and we bring a lot to the fight.

**What we also bring is that we are different to the F-series fighters.**

Having a fourth-fifth gen force mix allows plenty of scope for innovation and great tactical benefit.

We have different sensors and capabilities to the F-jets, as does Rafale, so any potential adversary would have to defeat a number of networked sensors.

Second Line of Defense

**We are however looking at new generations of Russian aircraft.**

We are looking at upgrades of Russian aircraft we've been looking at evolving Russian SAM systems for years.

**But it is not just about showing up.**

What are they doing with that Russian aircraft?

How many have they got?

**I do think that Typhoon brings to the modern combat air party a very capable, large weapons platform with plenty of room for expansion.**

What I particularly like in terms of comparing it against Russian aircraft is that I bring performance, and I bring size and scale.

That's what I really like about it.

**Question: The squadrons at Lossie are operating worldwide, what strain does that put on the hub at Lossie?**

OC II(AC) Sqn: One great advantage about being deployed is that you get full support in the field, often better than we would get at home.

**Therefore every deployment puts greater pressure on 'the hub' to provide forward sustainment.**

The challenge of delivering training and delivering serviceability to the variety of micro Typhoon fleets is a significant one.

**Editor's Note: A brief history of No. II (AC) Squadron with AC standing for Army Cooperation, hence the knot in its squadron emblem, is provided on the RAF website.**

*II(Army Cooperation) Squadron was formed at Farnborough on 13 May 1912 as one of the original Squadrons of the Royal Flying Corps (RFC). It quickly gained a pioneering reputation as it set the British altitude record of 16,000ft in August 1913 and, in August 1914, deployed the first British fixed-wing aircraft to fight in a war as the Squadron deployed to France.*

*World War I*

*The Squadron deployed to France with the R.E.1 and was later equipped with the B.E.2, Vickers FB5 and Bristol Scout. It initially performed reconnaissance duties but as technical innovations rapidly advanced, II(AC) Squadron increasingly acted in an air-to-surface attack role.*

*On 26 April 1915, whilst conducting a raid on Courtrai, 2nd Lt Rhodes-Moorhouse became the first airborne recipient of the Victoria Cross (VC), which was awarded posthumously.*

*A second VC was awarded to 2nd Lt Mcleod in April 1918 after he shot down 3 Fokker Triplanes and crash landed his damaged aircraft between lines before dragging his observer to safety from the wreckage.*

*It was in 1916 that the Squadron began painting black triangles on the fuselage, which were later painted white, as a means of friendly identification to ground troops. To this day, the white triangles remain as the Squadron symbol.*

### Inter-War Years

On its return to the UK, II(AC) Squadron was soon conducting Army Cooperation activities in Ireland and in 1927 it deployed to China where it operated the Bristol F2.B fighter from Shanghai racecourse. In 1931, the Hereward knot was approved for use on the Squadron crest symbolising its close relationship to the Army.

### World War II

At the outbreak of World War II, II(AC) Squadron was operating the Lysander aircraft in a reconnaissance role as well as performing supply drops and inserting Special Operations Executive (SOE) Agents into occupied France. In August 1941 it was equipped with the Tomahawk as the Lysander had become inadequate in the reconnaissance role and the Squadron proved the utility of fighter aircraft as a photo-reconnaissance platform.

In 1942 II(AC) Squadron was re-equipped with the P-51 Mustang which it operated in tactical reconnaissance sorties in the D-Day landings in 1944. The Squadron flew 36 sorties on D-Day and it was a II(AC) Squadron aircraft that brought back the first aerial photographic images of the landings.

II(AC) Squadron supported the Canadian Army as they advanced through Europe and saw out the war with later marks of the Spitfire.

### Cold War Years

After World War II, the Squadron moved to Germany where it spent 47 years before moving to RAF Marham with the Tornado GR1A. The years in Germany saw II(AC) Squadron operate Swifts, Hunters, Phantoms and Jaguars in a number of large NATO exercises as well as deploying on exercise to El Adem in Libya in 1963.

### Post-Cold War Years

In 1991, II(AC) Squadron conducted sorties in support of Operation DESERT SHIELD over Iraq and in 1999 it policed the No-Fly Zones of Northern and Southern Iraq. It then deployed twice more to Iraq in 2003 and 2005 as part of Operation TELIC flying the Tornado GR4.

Following the retirement from service of the Harrier GR9, the Tornado GR4 began to operate in Operation HERRICK from Kandahar airfield in Afghanistan.

II(AC) Squadron performed several tours of Operation HERRICK until British forces withdrew at the end of 2014. The Squadron also sent aircraft to Operation ELLAMY in Libya, performing long-range sorties from their base in RAF Marham.

### Present Day

On 9 January 2015, II(AC) Squadron became the fifth front-line Typhoon squadron and is now based at RAF Lossiemouth. It contributes to the Quick Reaction Alert (QRA) mission of the Station, which maintains a high state of readiness 24 hours a day, 365 days a year in the defence of UK airspace. The Typhoon is a multi-role capable combat aircraft and the Squadron prepares to deploy on contingency operations around the globe as well as participating in large international exercises such as Red Flag.

<http://www.raf.mod.uk/organisation/2squadron.cfm>

### Second Line of Defense

## THE PERSPECTIVE ON TYPHOON FROM THE RAF'S 1(F) SQUADRON

During a visit to RAF Lossiemouth in June 2016, there was a chance to discuss with an experienced Typhoon pilot now in 1 (F) Squadron, the evolution of Typhoon and its performance in recent Middle Eastern operations.

This pilot's background was initially with the Army and then he became a Typhoon pilot and this is his fourth tour with Typhoon.

Given his background, his judgment about the migration of the Typhoon in its ground attack role is quite significant.

He has flown the Typhoon for a number of years, and was one of the first to fly with the USAF F-22s and been part of shaping interactive con-ops with the USAF's initial fifth generation aircraft as well.

According to this pilot, the Tranche 1 Block 1 was really a developmental aircraft; and evolved into a pure air-to-air platform.

"When we flew the Typhoon in Libya, we performed our first real ground attack role, but we added the Enhanced Paveway in a relatively basic fashion.

It performed pretty well in 2011; but it was challenging to operate."

When Tranche 2 entered the force, there was a solid foundation laid for shaping the way ahead for the evolution to the ground attack capabilities of the aircraft.

"The real upgrade to Tranche 2 was the Phase 1 enhancement.

It integrated Paveway IV into the aircraft; the integration provided a focused capability for the ground strike role.

The software completely changed with an enhanced capability to perform the ground attack role.

We now could direct the weapon to a variety of targets with the onboard control systems and software.

In the early Tranche 2 experience, the weapon was not integrated with the aircraft; with the evolution of Tranche 2 and the phase 1 enhancements, Paveway IV is completely integrated into the aircraft's combat system."

As he described Tranche 1 was far more challenging than Tranche 2 in order to target a ground attack weapon for the targeting pod could find a target, but the pilot would have to handle the weapons use manually.

The pilot was the sensor.

Now with Tranche 2, you can type in the targeting information and the plane will then provide the data to execute the strike mission.

"This capability has been demonstrated in Operation SHADER.

And the targeting capability was so effective that JTACS actually were calling for the Typhoon/Paveway IV capability on a regular basis.



We had combat mass and significant strike capability which could be delivered rapidly and coalition partners quickly began to pick up on this capability.”

As he described the performance, “we could operate a four ship formation and strike 16 targets in one pass.

We never could do that with Tranche 1.



**FIGURE 4 TYPHOON AIRCRAFT WHICH RELOCATED TO RAF LOSSIEMOUTH NUMBER 1 FIGHTER SQUADRON WITH A SPECIAL 8-SHIP FORMATION IN THE SHAPE OF A NUMBER 1. THEY RELOCATED FROM RAF LEUCHARS IN SEPTEMBER 2014. CREDIT: RAF**

And we provided close air support to our ground forces, and provide information to the ground forces to support their operations, with targeting information provided from the ground maneuver forces, or from our onboard sensors.”

The way ahead in his view is the integration of new weapons, such as the evolving Brimstone series, to expand the capabilities, which the Typhoon can deliver in the battlespace.

He argued that if the weapons envelope was expanded then the speed of the Typhoon could be leveraged to expand the attack profile of the aircraft.

In short, for this Typhoon pilot, the recent Operation SHADER experience highlights the new capabilities of Typhoon, and shapes in his mind a key way ahead.

“We can fly high and fast but we are limited by current generation weapons in terms of how we can use them.”

The evolution of Typhoon highlights the need for evolving the weapons capability of the aircraft to take advantage of the platform’s performance capabilities.

For an overview on 1 (F) Squadron, see the following:

<http://www.raf.mod.uk/organisation/1squadron.cfm>

## OPERATION SHADER AS A DRIVER FOR CHANGE IN THE RAF TYPHOON FLEET: THE PERSPECTIVE OF WING COMMANDER PETERS, OC ENGINEERING AND LOGISTICS WING

During the visit to RAF Lossiemouth in April 2016, there was a chance to talk with the Officer Commanding Engineering and Logistics Wing at RAF Lossiemouth.

Second Line of Defense

Obviously, the operation of the Typhoon fleet is dependent upon the engineers and logisticians to forge an effective hub for operations, as well as to support deployments abroad.

In this case, Wing Commander Peters, OC Engineering and Logistics Wing not only knows a great deal about this subject, but has been involved in the evolution of Typhoon from his time at MoD Abbey Wood, where one finds the [Defence Equipment and Support](#) procurement organization.

It is clear from the discussion with the Wing Commander, that operation SHADER is driving change in the Typhoon fleet and highlighting the challenges of managing the various configurations within that fleet.

*Operation SHADER is the operational code name given to the British participation in the ongoing military intervention against the Islamic State of Iraq and the Levant (ISIL), otherwise known as Da'esh.*

*The operation began in Iraq on 26 September 2014, following a formal request for assistance by the Iraqi government.*

*Prior to this, the Royal Air Force had been engaged in a humanitarian relief effort over Mount Sinjar, which involved multiple aid airdrops by transport aircraft and the airlifting of displaced refugees.*

*By 21 October 2014, the intervention had extended onto Syria with the Royal Air Force only mandated to conduct surveillance flights over the country.*

*On 2 December 2015, the House of Commons approved British airstrikes against ISIL in Syria.*

*In March 2016, the Ministry of Defence announced that over 1,000 personnel were engaged in theater and that the Royal Air Force had conducted a total of 640 airstrikes, flying over 2,200 sorties, killing almost 1,000 ISIL fighters.*

From the engineering and logistics side of the RAF what this has meant is that the right configuration of Typhoons need to be prepared in the UK, sent to the Middle East and supported during operations.

This means Typhoons prepared for air-ground operations and coalition configurable.

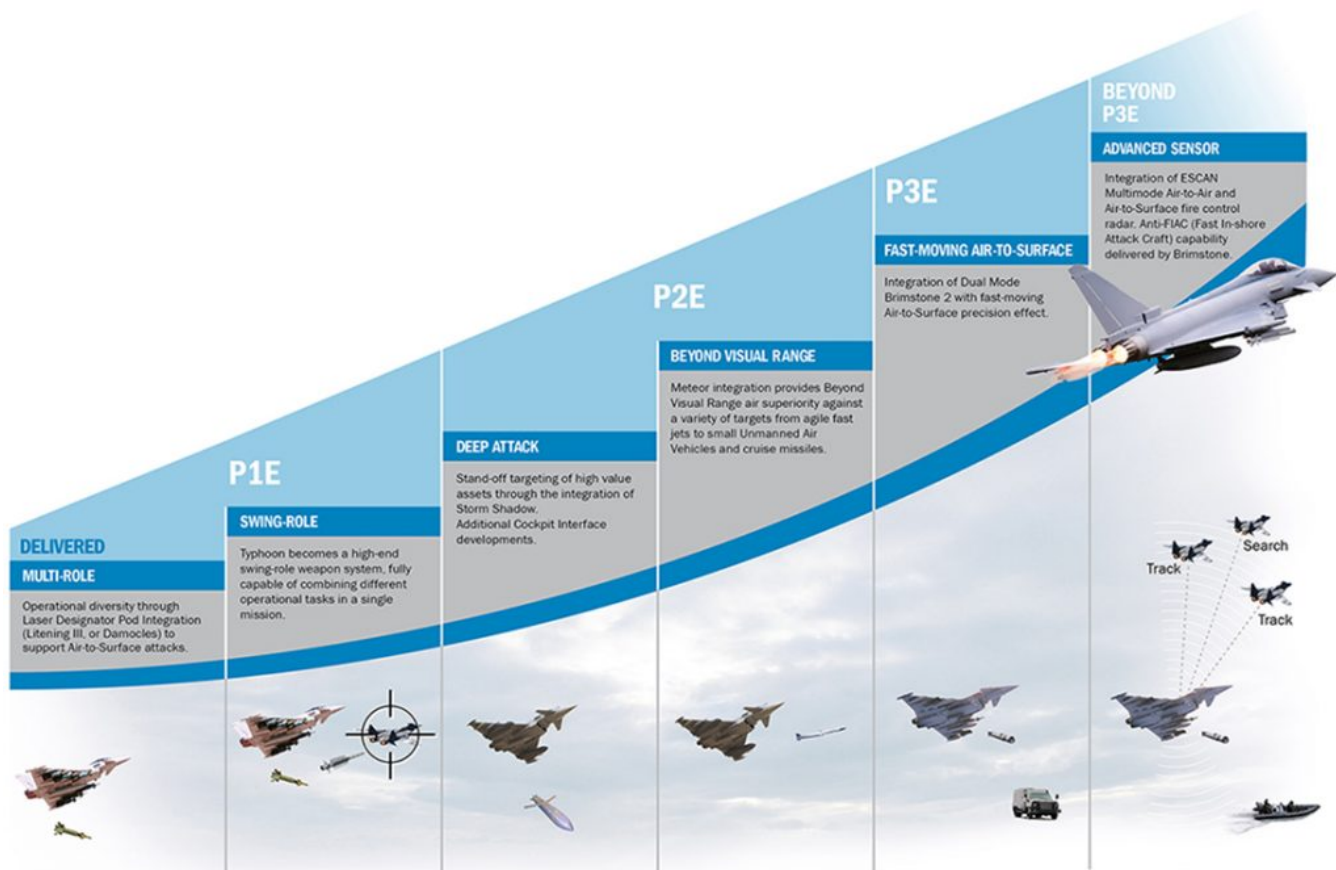
With the Typhoon fleet in transition from its classic air superiority role to a multi-mission role, not all Typhoons are prepared to operate in Operation SHADER.

This means that the RAF is working the necessary upgrades and driving change in the fleet to meet combat requirements in the Middle East.

The different configurations of Typhoon have been identified and explained in the graphic below provided by BAE Systems.

Here it is clear that the P1E aircraft is the baseline which is needed with the planned evolution to adding a new radar, an upgraded cockpit and other modernizations on the way.

# TYPHOON A PHASED APPROACH TO DEVELOPMENT



In terms of delivering military capability in the near term, it is about delivering the right configuration to the right place at the right time.

This is the challenge being faced by the Typhoon Force Headquarters (the main operating bases such as Lossiemouth effectively react to the tasking of the FHQ).

Wing Commander Peters highlighted that during his time at Abbey Wood, the structure was put in place to make the requisite changes.

Here the Requirements Management staff and the engineering specialists of the RAF and MoD Civil Service operated in close proximity to identify necessary changes and to find ways to get those changes implemented.

“The requirements manager would walk 100 yards across the hall and say: “The Air Command customer wants me to achieve this effect.

“Engineers, what can you do to deliver it?”

“During my time at Abbey Wood, we were driving the P1EB modifications on the aircraft for UK needs for the RAF.

Second Line of Defense

“We service modified the aircraft to be able to operate Paveway IVs and we have modified the aircraft to operate Paveway IVs, sometime ahead of the four nation program.”

The variant the Wing Commander discussed is the air-to-ground modified Typhoon, the aircraft they send to Red Flag and send to Operation SHADER.

“P1 EB is a software upgrade, with minor hardware changes.”

According to November 27, 2014 article published on the [RAF website](#):

*P1Eb is predominantly an air to ground capability upgrade; it provides enhancements to the Litening III Laser Designator Pod (LDP) and Helmet Equipment Assembly (HEA) (helmet mounted sight) integration, as well as with Paveway IV.*

*The LDP can now also be used seamlessly with the HEA to visually identify air tracks at long range, as well as identifying, tracking and targeting points on the ground.*

According to the Wing Commander:

“P1Eb sets us on the path to getting to the point where Tornado can be retired.

“The Tornado was designed for a 4000 flying hour, life.

We now have aircraft in excess of 6 1/2 thousand flying hours.

“I think the intent is to take some airframes up to 7 1/2, maybe even more, thousand flying hours.

We are wearing them out.”

**Question: What is the biggest challenge to shaping the hub to support Typhoon?**

“Having the right numbers of people in the right place at the right time.

“Deployments pressure the workforce and it is about not burning those people with the qualification experience necessary to operate the fleet.

“Unless we do things differently, we risk our sustainability of the fleet by not having enough qualified people in the right place at the right time.

“We would then risk not only successful operations but growth into the future.

We want to ensure that we’re in a sustainable medium-long term future for the fleet.”

**Question: What is the big fleet management challenge for you?**

“We have fleets within fleets.

“We have Typhoons with different Tranches, and different software configurations or PSCs (Production Software Configurations).

“A different PSC can do different things.

“It has a different level of capability.

“We need to deliver a SHADER standard Typhoon to the Middle East operation and that drives a lot of intra-fleet movement.

“It is things like moving Laser Designator pods around within the fleet, to make sure that we have the right configuration at the right place at the right time.

“The key disconnect which we have to manage is between the need to deliver the SHADER standard aircraft, and the presence of variable configuration Typhoons in the overall fleet.

“A lot of our support challenges are driven by not having enough aircraft at the same standard.

“If all of our fleet was to the same standard, the challenge would be much easier.

“There is steady progress towards increasing numbers of key variants (specifically the P1E aircraft and standards beyond) but this takes time.

“Of course, this is somewhat of a historic challenge that has always affected armed forces across the world, which have strived to deliver the best military capability within the resource available.”

## TYPHOON GROUND SUPPORT SYSTEM: A PERSPECTIVE FROM RAF LOSSIEMOUTH

During a June 2016 visit to RAF Lossiemouth, there was a chance to discuss the GSS or Ground Support System approach for the Typhoon with an RAF officer involved with GSS.

This digital system is a key part of both maintaining the Typhoon and enhancing its performance going forward.

According to a publication by Eurofighter Typhoon, the system is described as follows:

“The implementation into the aircraft of advanced Built-In Test and diagnostic features has substantially reduced the number of Ground Support Equipment (GSE) compared to previous aircraft.

The remaining suite of state-of-the-art GSE was developed according to the same stringent standards as the aircraft, thus ensuring performance and reliability.....

The Ground Support System (GSS) gives all operators a leading edge mission and engineering data management.

This provides rapid seamless bi-directional data flow from the operational and maintenance centres to the aircraft and back. The GSS is linked to the National Support Centre and Industry, thus facilitating continuous on-line data and intelligence transfer.”

The RAF added this insight with regard to GSS:

“Information Communication Technology (ICT) Technicians play a pivotal role supporting, operating, and maintaining vital ICT subsystems essential to the support of Typhoon.

This is achieved by empowering Mechanical, Avionic and Weapons trades with the ICT capability to diagnose the critical engineering data produced by the aircrafts advanced computer systems.

Additional ICT expertise is also utilised by supporting aircrew and operations staff through the management of Mission Support Systems that are vital to the operational functionality of the aircraft.

Second Line of Defense

In summary, we deploy and provide 24/7 support to all the stations day to day operations worldwide.”

The onboard computers on the Typhoon provide a steady stream of data into the brick carried within the aircraft.

That brick is removed after flight and the data downloaded to the ground IT system for diagnosis.

The data becomes part of the operational data base for the aircraft, and provides regular inputs to the ongoing assessment of the parts and components onboard the aircraft.

The data is used to provide the information necessary for servicing the aircraft and readying it for the next flight.

The data is also part of the lessons learned mission debrief performed by returning pilots from a mission.

It is a deployable system and part of the capability of Typhoon to deploy to areas of interest like the Baltics or the Middle East.

The GSS is a fundamental element in making the Typhoon an expeditionary aircraft.

The GSS officer highlighted that improvements were under way in ways to manage the data and display the results.

“We are getting better displays to show the findings which will, in turn, enhance our ability to service the aircraft.”

And serviceability is crucial to generate increases in the sortie generation of the aircraft as well.

The officer highlighted that the Typhoon experience is a key input to the RAF learning how manage data-generated by aircraft to be able to make steps forward into the age of ‘big data’ management.

These challenges will only increase as the P-8 and the F-35 come to the RAF, but the Typhoon experience is an important part of the RAF learning curve.

## LEVERAGING THE LEGACY OF THE TORNADO: THE PERSPECTIVE OF WING COMMANDER PAUL FROOME

During a visit to RAF Lossiemouth in late April 2016, there was a chance to meet with the Officer Commanding and members of the Tornado Operational Conversion Unit, XV(R) Squadron.

When one looks at the end of an era, in this case the sun setting on the Tornado in the RAF, one can look backwards or forwards.

Looking backwards, there is the legacy and history of the squadrons and of a core-fighting platform in the history of the RAF. Here the plane and the crews have a distinguished record in all of the RAF operations since the plane became operational in the early 1980s. The Tornado GR1 and subsequently the GR4 has been deployed successfully in operations since 1990 and has seen action in various operations in Iraq, Kosovo, Afghanistan and Operation ELLAMY over the skies of Libya in support of the UN Security Resolution 1970 and is currently in operations in the conflict against D’aesh.

According to the RAF website:

*Still one of the very few aircraft in the world that is able to operate at low level, day or night and in poor weather, the Tornado is now equipped with a modern precision-guided weapons suite and world-class reconnaissance sensors such as the Reconnaissance Airborne Pod for Tornado (RAPTOR). The aircraft also carries the Litening III Advanced Targeting Pod, which is used in both attack and reconnaissance roles.*

<http://www.raf.mod.uk/equipment/tornado.cfm>

Looking forward is really about the fusion of technology with crew competencies carrying forward to the Typhoon and F-35 fleets of the decade ahead.

The GR4 is a two-seat, all-weather, day/night attack and reconnaissance aircraft, and its pilots and weapons systems officers have pioneered a unique contribution of the RAF in terms of introducing Brimstone and Storm Shadow to the fight and evolving those systems over time into the newly emergent Spear 3.

A walk around the hanger with some of the members of the Squadron highlighted their accomplishments. The planes have been pushed hard beyond any realistic expectation of their service life. Yet upgrades have kept the plane relevant to evolving combat needs, but the age of the aircraft and its complexity has been a maintenance challenge.

As one member of the Squadron noted, “We sent 10 Typhoons and 10 Tornados to the Libyan operation. We had to swap out 18 engines during our time operating the Tornado, but only one Typhoon engine, and that was simply for precautionary measures, but turned out that it did not need to have been replaced.”

The complexity of the aircraft is a significant challenge for maintainability.

It is the very opposite of the digital aircraft, and they noted that the Typhoon maintainers live really in a different world from the wrench turners of the Tornado era!

But the crews have been able to maintain an effective ops tempo for Tornado, which attests to their skills and to the effectiveness of the sustainment approach which the RAF has with industry. Tornado is maintained through the ATTAC contract with BAE Systems.

According to BAE Systems:

*We provide the Royal Air Force with a guarantee that their Tornado aircraft's availability, capability and effectiveness will be maintained throughout its service life. This enables the RAF to perform their duties. We have a commitment to supporting and maintaining the fleet; with a responsibility of ensuring that enough aircraft are available for the squadrons to fly, making them easily deployable on operations.*

According to David Ward, head of UK Fleet Operations, Tornado:

*We have a 250 strong team that works alongside the customer in order to deliver this service mainly from RAF Marham in Norfolk. To cut out any delays in the decision-making process there are communications links to the supply chain and project management teams at our Warton and Samlesbury sites also.*

*It is incredibly important that we perform for the RAF for the security of the nation, but it's also important from a business point of view because around the world we have to deliver on our commitments here in the UK.*

*The benefits of the contract are as follows:*

*Guaranteed availability of the aircraft – UK Tornado fleet is able to rapidly deploy on operations. Recent deployments include Libya, Iraq and Afghanistan.*

Second Line of Defense



*Capability upgrades and maintenance – capability upgrades are scheduled around servicing to cut down on lost time and increase aircraft availability.*

*Prompt joint decisions – through working side-by-side with the customer and using camera links to team members at other locations.*

*The contract delivers significant savings by combining the skills and expertise of our employees and the RAF. RAF officers and BAE Systems personnel stand shoulder to shoulder each day to enable the Tornado fleet at RAF Marham to complete successful operations. It's a partnership that has been so successful it has led to similar contracts most notably on the RAF Typhoon and Hawk fleets.*

<http://www.baesystems.com/en/product/tornado-attac>

In a discussion with Wing Commander Paul Froome OC XV(R) Squadron we discussed the way ahead. The Wing Commander has been operating Tornados since the late 1990s and has worked with the aircraft and the squadrons in virtually every capacity and in multiple operations.

He noted that with the decision by the government to stand down the Tornado by 2019, they had the twin challenge of maintaining the operational readiness of an aircraft still in high demand for operations while preparing to stand down the aircraft and its crews.

“The SDSR15 just confirmed that the Tornado will go out of service in March 2019. You work back from that date. Once your kids are at what we call secondary education, high school, then you don't need a kindergarten. The kindergarten is going to close, the force will then be set for its last few years.

But the Squadron's output over the next year is critical to that force being capable to reach 2019. If I don't get all of my students out — the basic students who've never flown the Tornado before, or those who have been away and come back to refresh on the Tornado- then we quite simply won't have enough people to operate the aircraft, which remains a high demand combat asset.”

We discussed Brimstone and its evolution into Dual Mode Seeker Brimstone and the key role of the Tornado fleet in operating the weapon and shaping its concepts of operations.

The Brimstone program has delivered a unique and very effective close proximity weapon which is the weapon of choice by ground commanders in the kind of operations characterized by operating forces against combatants mixed with civilians. Although it started out to replace cluster bombs and to destroy tanks, it has become a very effective anti-personnel, anti-boat, and anti-vehicle weapon.

The crews evolved the tactics of the missile and its evolution and working closely with the weapon's designers, MBDA, shaped further capabilities with the weapon as it evolved as well.

The basic approach is for the weapon systems officer to laser designate the key moving target, and then the weapon using its on-board radar to refine the aim point with significant precision on the desired target.

And this is a uniquely UK experience.

“With Paveway IV for example we can talk to other national users. With Brimstone we can talk to our industry and ourselves. It was so successful in Afghanistan and was the weapon of choice for a ground commander. He knew that it was so low collateral damage, very accurate and very, very quick.”

The weapon has been used in trials against fast attack craft with Royal Navy assets as well. It can provide for a capability to destroy fast attack boats coming against the Navy and obviously a useful weapon in many parts of the world.

The OC discussed as well the importance of the working relationship among the Tornado pilots, weapons systems officers and MBDA in shaping the evolving Brimstone weapons portfolio.

“We had MBDA up recently, and they came up to chat to my weapons instructors course about Brimstone 2, and how it’s developing and they are receiving feedback from operational experiences as well.”

The weapons aboard Tornado are transitioning to Typhoon and to the F-35, but the operational envelope of the Tornado is different and it is a two seat aircraft with a weapons systems officer in the second seat.



FIGURE 5 HERE THE TORNADO FLEET MARKS ITS 1,000,000 FLIGHT HOUR IN 2011. CREDIT PHOTO: RAF

Here the CO saw the importance of the enhanced cockpits on the Typhoons and F-35s as crucial to enable the pilots to operate weapons while flying the aircraft. “It is not just about adding technology; it is about how to operate it from the cockpit.”

One challenge is that the Tornado crews have combined a wide range of operational experience, ground attack, day-night operations, electronic warfare, and reconnaissance and the question is where those skill sets will migrate within the RAF.

With regard to EW, Wing Commander Froome argued that there has been an atrophy of the Wild Weasel like skill sets in favor of what became a more pressing need, namely to combat manpads.

“Earlier, we had two squadrons of Tornados that were effectively Wild Weasel squadrons with our ALARM or air-launched anti-radiation missile, similar to HARM. As we fought in Iraq and Afghanistan, some skill sets began to fade, and this was one of them. The threats there were MANPADS, so our EW system developed a very capable counter-MANPAD capabilities.”

What will happen to the Electronic Warfare competence as the Tornados are retired?

“Good question. They can provide support for a number of the new platforms like F-35 and P-8. The RAF tends to be good at carrying forward core capabilities and sorting out how best to evolve them with new platforms coming in. I think we’re very good, historically, on recognizing people with those competencies, and their skill-set, and using them in the best place.”

He did issue a caution with regard to the coming of the P-8 and the need to evolve the skill sets.

Second Line of Defense

“The P-8 is clearly not Nimrod. If we think that we’re going to take an old-fashioned air electronics operator, and use him in the same way on the P8, we’re missing a trick.

We need to be developing the crews now to be maritime warfare operators, not electronic operators, and radar, and wet and dry, we need to be thinking bigger than that. If we don’t, then you end up making problems for your F-35, your Typhoon, your P8, your Reaper, your Son of Reaper.”

In short, sun setting one platform requires a shift to shape an effective sunrise of the next. It is about the challenge of managing an innovative transition.

For the military, which is often accused of not being innovative, it is clear that at XV Squadron that is not the case.

History of XV Squadron:

Key Dates:

1915 – Formed at Farnborough.

1938 – One of the first squadrons to receive the Fairey Battle.

1955 – Took part in the Suez crisis.

1983 – First RAF Germany squadron to receive the Tornado GR-1.

Current Aircraft and Location:

Current Aircraft: [Tornado GR4](#)

Current Location: RAF Lossiemouth

Battle Honours:

Western Front 1915-1918\*,

Somme 1916\*,

Arras, Cambrai 1917\*,

Some 1918, Hindenburg Line\*,

France and Low Countries 1939-1940, Meuse Bridges\*,

Dunkirk, Invasion Ports 1940, Fortress Europe 1941-1944,

Ruhr 1941-1945\*,

Berlin 1941-1945\*,

Biscay Ports 1941-1945,

France and Germany 1944-1945,

Normandy 1944\*,

Gulf 1991\*.

(Honors marked with an asterisk, may be emblazoned on the Squadron Standard.)

### **The History of XV Squadron:**

Formed as a training unit at Farnborough on 1 March 1915, No. 15 Squadron crossed to France in December of that year equipped with BE2Cs for corps-reconnaissance duties.

One unusual task the unit undertook was the dropping of ammunition by parachute to troops on the front line during 1918. After the War, the squadron succumbed to the inevitable disbandment.

The Squadron reformed at Martlesham Heath in March 1924, but it was little more than in name, as their aircraft were part of the A&AEE trial fleet.

This arrangement continued until 1934 when the squadron was reformed at Abingdon with Hawker Harts. It was shortly after this, that on the insistence of its Commanding Officer, Squadron Leader TW Elmhirst DFC, that the Squadron became known as XV Squadron.

During 1938, the Squadron was one of the first to receive Battles, and it was with these that XV Squadron flew to France in September 1939. In early 1940, the Squadron returned to the UK and re-equipped with Blenheims flown in the ground attack role. By the turn of the year, these had been traded in for Wellingtons, and shortly after that XV Squadron became one of the first Stirling heavy-bomber units.

One famous aircraft flown by XV Squadron was named 'MacRobert's Reply', an aircraft donated by Lady MacRobert in memory of her three sons killed in RAF service. Lancasters arrived during 1943, and the Squadron remained part of No. 1 Group's main force for the remainder of the war.

Other heavy bombers were flown in the shape of Lincolns and Washingtons, but in 1953, XV Squadron moved into the jet age with Canberras. During the Suez crisis, the Squadron dropped more bombs than any other Canberra unit, but was disbanded in 1957. In September 1958, the Squadron reformed at Cottesmore as the second Victor squadron, but six years later was again disbanded.

On 01 October 1970, the Sqn was reformed at Honington, before moving to Laarbruch in January 1971. After the Gulf War, three Tornado Squadrons at Laarbruch were disbanded, XV Squadron being one of these, at the end of 1991. On 1 April 1992, the XV (Reserve) number plate was given to the Tornado Weapons Conversion Unit at Honington. XV(R) Squadron remained at Honington training Tornado aircrew until November 1993, when it moved to Lossiemouth, its present home.

XV Squadron has approximately 175 permanent personnel, and up to 20 aircrew students at any one time. As the Tornado GR4 Operational Conversion Unit its main commitment is to the training of Pilots and Weapon Systems Operators before sending them onto front-line squadrons.

The Tornado GR4 is a multi role ground attack and reconnaissance platform. It is capable of performing a variety of day and night, all-weather operations.

These include: Airborne Interdiction using precision ground attack munitions;; Close Air Support for coalition troops; Air-to-Air refuelling and Intelligence, Surveillance and Reconnaissance. The Tornado GR4 is currently deployed on operations over Iraq in support of Operation SHADER.

XV Squadron teaches ab-initio aircrew straight from their advanced flying training at RAF Valley, as well as conducting Refresher Courses for experienced operators returning back to the Tornado GR4 following other tours of duty; additionally, XV Squadron trains aircrew officers from other nations Air Forces who are posted to the UK on an overseas 2-3 year 'exchange tour' flying the Tornado GR4 with the Royal Air Force.

Second Line of Defense

XV Squadron also conducts post-graduate courses. The Squadron is the home to the Qualified Weapons Instructor Course, the Electronic Warfare Instructor Course and the Instrument Rating Examiner Course; each of these courses provides advanced qualifications to front line aircrew. Additionally, XV Squadron provides both aircrew and ground crew support to RAF operations around the globe when required.

<http://www.raf.mod.uk/raflossiemouth/aboutus/xvrsqn.cfm>

## “MACROBERT’S REPLY” AND TORNADO THUNDER

The last of the Tornado squadrons is found at RAF Lossiemouth.

During a visit to Lossie in April 2016, the Squadron Commander of XV(R) Squadron as well as members of the squadron were interviewed about the transition role and the legacy of Tornado.

The operational experience of Tornado as well as the weapons which it pioneered – notably Brimstone and its variants as well as Storm Shadow – and the con-ops associated with those weapons can clearly be found in the next evolution of the RAF.

Namely, it is the blending of weapons with air crews and support crews in the Tornado legacy can be found in the new capabilities being shaped with Typhoon and the missiles pioneered by Tornado in operations and reflected in the new what MBDA calls “fifth generation” weapons.

Tornado “thunder” is being passed on to the Typhoon and to those who use the weapons which it pioneered in combat.

But there is another heritage which can be found when you enter the hanger and see the Squadron’s famous ‘MacRobert’s Reply’ aircraft.

The photo below was shot last year at the time of the 100<sup>th</sup> anniversary of the squadron.



FIGURE 6 100TH ANNIVERSARY OF THE SQUADRON 2015. CREDIT PHOTO: RAF

The Squadron had a Tornado GR4 especially painted for their centenary in the Squadron’s famous blue and red colors.

In a special training sortie, this unique jet flew alongside the Squadron's famous 'MacRobert's Reply' aircraft.

*The MacRobert's Reply story has its roots with the MacRobert family and World War II.*

*The three sons of Lady Rachel MacRobert and her husband Sir Alexander MacRobert were all killed within 3 years of each other in separate flying incidents; the eldest of the three was killed in action whilst on missions during World War II.*

*Lady MacRobert's response to her sons' deaths was to donate £25,000 to purchase a bomber for the RAF and asked that it be named "MacRobert's Reply".*

*This was the start of a tradition that the RAF has kept alive. A succession of RAF aircraft has since carried the name. The current "MacRobert's Reply" is a Tornado GR4 from XV (Reserve) Squadron, still identified by the cherished tail letter 'F'.*

<http://www.raf.mod.uk/news/archive/xv-reserve-sqn-100th-anniversary-tail-takes-off-from-raf-lossiemouth-04032015>

The story is especially interesting for Americans as well because Lady Rachel born in the United States in 1884.

A fuller explanation of her life and the gift to the RAF is provided by this source found on the Free Library.

*If the MacRobert story wasn't true, someone in Hollywood would have to invent it.*

*The saga begins in 1854 when Alexander MacRobert was born in Aberdeen.*

*Fascinated by education, he was determined to improve his intellect but, coming from a humble family, university was out of the question. Instead, when his family emigrated to Canada, Alexander chose to stay in Scotland and take night classes at Robert Gordon's College and the Aberdeen Mechanics Institute while still working full-time at a paper mill.*

*Incredibly, despite his job and his studies, he still had time to meet and fall in love with Georgina Porter, who worked in another office at the mill.*

*When he was offered the job of managing a woollen mill, he jumped at the chance. All he had to do was tell Georgina that the mill was in ... Cawnpore, India.*

*Alexander and Georgina married on Hogmanay 1883 and moved to Cawnpore. By 1888, MacRobert was wealthy enough to buy a small estate at Burnside, now Douneside in Aberdeenshire and, before long, turned it into a splendid country house.*

*But MacRobert's visit to the house in 1905 was to be like no other. The heavy-hearted Scot had brought his wife home to die of cancer.*

*MacRobert honoured her memory with a pounds 25,000 donation to Aberdeen University for cancer research to be named "The Georgina MacRobert Fellowship". And after his lonely return to India, he established the "Georgina MacRobert Hospital" in Cawnpore.*

*It was in 1909, four years after Georgina's death, that MacRobert met Rachel Workman while sailing home to Scotland.*

Second Line of Defense

## Visiting RAF Lossiemouth: The RAF Shapes a Way Ahead

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*The feisty young 25 year old was charming and intelligent – she had a BSc in Geology from London University – and her free thinking spurred her to join the suffragette movement.*

*MacRobert was smitten by her and their courtship was, according one historian, “discreet and almost secretive”.*

*Alexander eventually proposed, but agnostic Rachel refused to get married in a church, so they were wed in a Quaker Meeting House in York on July 7, 1911.*



*At the stroke of a fountain pen, American heiress Rachel Workman became Lady MacRobert.*

*During their courtship, the former paper mill manual worker had been knighted for his public services both at home and in India.*

*Lady Rachel brought colour and energy into the marriage. But she also brought something Sir Alexander must have thought had passed him by – children. The couple doted on sons Alasdair, Roderic and Iain. And blessed with joy at home, Sir Alexander saw his businesses enjoy equal good fortune.*

*A director of six companies, he merged them to form the British India Corporation, the highlight of his career in commerce. Back in Scotland, he bought the 9000-acre Cromar estate, which bordered on Douneside, from Lord Aberdeen.*

*In 1922, when he was created a Baronet, he was proud to take the title of Sir Alexander MacRobert of Cawnpore and Cromar.*

*Sadly, just when he was enjoying the fruits – and accolades – of years of hard work, Sir Alexander fell ill and died ... fittingly, at Douneside.*

*It says much about Lady MacRobert that she agreed he should be buried in Aberdeen beside Georgina, his first love and wife for more than two decades.*

*Overnight, the Scottish estates, vast investments all over the world and not least, three sons aged 10, seven and five became Lady MacRobert’s responsibility.*

*The boys were educated in English public schools and went on to study at Cambridge.*

*In 1933, 500 guests arrived at Douneside for the coming of age of Alasdair – now Sir Alasdair as the eldest son.*



As if to give her growing sons “space” Rachel decided they could have the House of Cromar to entertain the friends they brought to Scotland.

Aviation pioneers including Charles Lindbergh and Amy Johnson were the stars of the day and Sir Alasdair was greatly interested in their field. He had taken flying lessons in India and founded his own aviation business.

Then tragedy struck. His promising young life was wiped out when an aircraft he was piloting crashed near Luton.

Lady MacRobert mourned her husband’s heir but didn’t argue when Sir Roderic joined the RAF in 1938.

On May 22, 1941, he led an attack on a petrol convoy in Iraq, but perished during the raid. He was buried in a Commonwealth grave in Mosul.

The baronetcy fell to Sir Iain, just 24, who had joined the RAF straight from Cambridge as a pilot officer.

A few weeks after taking leave to mourn his brother, Sir Iain returned to duty. His aircraft disappeared while searching for a bomber crew at sea. His body was never recovered.

In 1953, his name appeared on the Runnymede War Memorial, unveiled by The Queen, in memory of the 20,000 airmen who have no known grave.



The death of Iain was a final, devastating blow for Lady MacRobert who, as well as losing all three of her sons, would now see her husband’s title extinguished without an heir.

But instead of crumbling under the strain of the tragedy, she decided it only fitting that someone else should fight on in her sons’ names in an aircraft donated by her.

In one of the most powerful and poignant letters ever penned by a grieving mother, Lady MacRobert wrote to Secretary of State for Air, Sir Archibald Sinclair: “It is my wish to make a mother’s immediate reply in a way that I know would also be my boys’ reply – attacking, striking sharply, straight to the mark.

“The gift of pounds 25,000, to buy a bomber to carry on their work, expresses my reaction on receiving the news about my sons. They would be glad that their mother replied for them and helped to strike a blow at the enemy.

Second Line of Defense

*“So I feel that a suitable name for the bomber would be “MACROBERT’S REPLY”. Might it carry the MacRobert Crest, or simply our badge – a frond of bracken and an Indian Rose crossed?”*

*“I have no more sons to wear the badge, or carry it into the fight. If I had 10 sons, I know they would all have followed that line of duty.”*

*The chosen bomber was a Stirling of XV Squadron and in command was Flying Officer Peter Boggis who flew it bravely through many missions, including an attack on the German Navy at Brest for which he received the Distinguished Flying Cross.*

*And when it crashed in 1942 at Peterhead, its replacement also bore the “MacRobert’s Reply” name. And so, a great tradition was born.*

*Fifteen Squadron may have changed, but its “Foxtrot” aircraft has always been a “MacRobert’s Reply” – a Lincoln in 1947, a Washington in 1949, a Canberra in 1953, a Victor in 1958, a Buccaneer in 1970, and a Tornado from 1983 onwards.*

*In 1993, when XV(R) Squadron moved to Lossiemouth, “MacRobert’s Reply” was back home in Scotland.*

*But Lady MacRobert wasn’t finished after one bomber. She donated four Hurricane fighters, three named after her sons and one called “MacRobert’s Salute to Russia – The Lady”. Lady MacRobert also established the MacRobert Foundation and several trusts. And the House at Cromar, where her sons entertained their friends, became a leave centre for airmen.*

*In 1954, Lady MacRobert passed away of heart failure, at Douneside, aged 70.*

The photos of the MacRoberts are credited to the MacRobert Trust.

<http://www.themacroberttrust.org.uk/about-the-trust/gallery/>

## TRAINING THE FINAL TORNADO WEAPONS INSTRUCTORS: SHAPING A WAY AHEAD

When one looks at the end of an era, in this case the sun setting on the Tornado in the RAF, one can look backwards or forwards.

Looking backwards, there is the legacy and history of the squadrons and of a core-fighting platform in the history of the RAF.

Here the plane and the crews have a distinguished record in all of the RAF operations since the plane became operational in the early 1980s.

Looking forward, the question is how the skill sets developed with the Tornado squadron’s transition forward?

In April 2016, during my visit to RAF Lossiemouth, I had a chance to talk with Wing Commander Paul Froome OC XV(R) Squadron and discussed the transition challenge with regard to the Electronic Warfare officers involved with Tornado.

**Question: What will happen to the Electronic Warfare competence as the Tornados are retired?**

Answer: “Good question.

“They can provide support for a number of the new platforms like F-35 and P-8.

“The RAF tends to be good at carrying forward core capabilities and sorting out how best to evolve them with new platforms coming in.

“I think we’re very good, historically, on recognizing people with those competencies, and their skill-set, and using them in the best place.”

<http://www.sldinfo.com/visiting-the-tornado-transition-squadron-at-raf-lossiemouth-leveraging-the-past-and-preparing-the-future-for-the-raf/>

And then during a visit to RAF Lossiemouth in June 2016, there was a chance to talk with a senior RAF officer who has been involved with the Tornado for many years, and in the training of weapons officers for this venerable and very successful weapons platform.

Currently, he is involved in training the last weapons instructors for the Tornado, which raises some key questions about what they need to learn for the projected operations, and what do they need to take away for the future as they move to other platforms and other responsibilities.

A key question facing the sunset of any platform is the legacy going forward as those who are operating the platform towards the end move on.

What is the operational “technology transfer” as weapons officers move to other combat platforms, or senior staff positions?

The final group of weapons officers will finish in November 2016 and then be with the program until it is ended in 2 ½ years.

“What do I train these guys to do in light of that?”

On the one hand, clearly the core skill sets of a Tornado weapons officer need to be maintained for the most likely operational scenario, namely, to provide support to the ground forces in uncontested airspace.

“We need to train to the basic skill sets one sees necessary in something like Operation Shader.”

Skill sets to deliver weapons on target in a permissive environment but where low collateral damage is expected has become the core skill set, which needs to be delivered.

Yet is clear that the airpower equation is changing and the anticipation is that both the F-35 and the Typhoon will be operating in more contested environments and yet providing support to the ground forces or to the ground maneuver element.

Training of the final Tornado weapons officer’s needs to take this transition into account as well.

“I would expect several of our weapons officers to transition to Typhoon or F-35 as well.

So it is about performing in anticipated Tornado missions but shaping a mentality that is very much about transition as well.”

Put in other terms, it is not about dumbing down the skill set, but opening a broader aperture to the higher end skill sets.

“It is not just about preparing the guys for what they are most likely to see in the next couple of years, but thinking about the higher end challenges as well.

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We can focus on some skill sets we shaped earlier in a more contested environment, and bring those back in the training process going forward as well.”

He also argued that the shift in the Typhoon community towards a ground support role is seeing that community informed by the RAF experience in the Harrier and Tornado communities.

The culture and training focus for close air support or support to a ground maneuver force is different from the classic Typhoon training, and bringing forward some of the training skill set in the Tornado community is part of the Typhoon transition itself.

In short, as the Tornado era closes, a number of the skill sets will be carried forward into the fighter transitions involving Typhoon and F-35 and with the P-8 into the maritime domain awareness strike community.

## KEEPING SKILL SETS ALIVE WHILE WAITING FOR A REPLACEMENT AIRCRAFT: FROM NIMROD TO P-8

On a recent visit to Norway, the UK Minister of Defence signed a new agreement with Norway to shape [enhanced cooperation](#) on maritime patrol operations. This was done in part due to the coming of the P-8 to the United Kingdom.

In the story on the UK MoD website it was noted:

*Work on the UK’s MPA programme is progressing well, including the investment on infrastructure in Lossiemouth in Scotland, where the planes will be based.*

*Former armed forces personnel who previously served on UK Nimrod are also re-joining the RAF to help operate the future P-8s.*

*12 have recently re-joined and more will re-join in the future*

The UK MoD retired the Nimrod in 2011; recently, the UK government announced that the P-8 was coming into the force in 2019.

The Nimrod MK2 MPA was taken out of service in 2010 with the UK accepting the capability gap until the MRA4 came into service.

<https://www.gov.uk/government/news/nimrod-r1-retires-from-service>

How do you maintain the skills necessary to stay in the maritime domain awareness game when your aircraft goes away?

According to the MoD, a “seed-corn” program was put in place to provide for a transition.

*With the first aircraft due to arrive in the UK in 2019/2020, the RAF has been committed to maintaining the skills needed to operate these MPAs through the ‘seed-corn’ programme, which has embedded former RAF MPA operators within the MPA squadrons of Australia, Canada, New Zealand and the USA.*

*Air Vice-Marshal Gerry Mayhew, who is responsible for the RAF’s fast jets and Intelligence, Surveillance and Reconnaissance assets, said:*

*The seed-corn initiative has been vital in ensuring that our future MPA aircrew are prepared to regenerate the UK's MPA capability. By retaining those essential skills, our aircrew are already on the front foot when it comes to operating these new aircraft.*

<https://www.gov.uk/government/news/mod-seals-the-deal-on-nine-new-maritime-patrol-aircraft-to-keep-uk-safe>

But doing so is not easy, and notably because the P-8 is not really a Nimrod replacement.

As Wing Commander Paul Froome put it during my April visit to RAF Lossiemouth:

“The P-8 is clearly not Nimrod.

“If we think that we’re going to take an old-fashioned air electronics operator, and use him in the same way on the P8, we’re missing a trick.

“We need to be developing the crews now to be maritime warfare operators, not electronic operators, and radar, and wet and dry, we need to be thinking bigger than that.

“The training that was already in place for the MRA4 saw more use of Link 11 and 16 and ensuring that the information flow between assets was as slick as possible. The Nimrod was used as more than an MPA spending more time supporting overland operations in the Middle East than over the sea.

“If we don’t, then you end up making problems for your F-35, your Typhoon, your P8, your Reaper, your Son of Reaper.”



**FIGURE 7 THE BRITISH MINISTER OF DEFENCE DURING A VISIT TO JAX NAVY LAST YEAR. CREDIT PHOTO: US NAVY**

During a June visit to RAF Lossiemouth, there was a chance to meet with a former Nimrod commander who is part of the seed corn effort, and it was clear that getting the P-8 into the force was an important step to allow the challenge of skill transition to be met successfully.

My discussion with this RAF officer from No. 602 Squadron, which is a Royal Auxiliary Air Force squadron, highlighted the transition effort.

“We are predominantly former Nimrod personnel and I spent 32 years flying in the MPA role.”

He highlighted how important NATO exercises have been to shape a transition.

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Joint Warrior which this year brought various NATO aircraft to RAF Lossiemouth, including the P-8, has provided a crucial opportunity for former Nimrod operators to go onboard US and allied Maritime Patrol Aircraft to keep skill sets current.

Lossiemouth is a fast jet base; it is not yet fully set up to support larger MPA aircraft. There is a clear challenge with the decision to standup the P-8s at RAF Lossiemouth. One should note that the Nimrod base, which was located close to Lossie, was closed down and is now an Army base.

Currently, Lossie supports two large Joint Warrior exercises a year, which includes MPA aircraft at Lossie as well. The location of Lossie is important in terms of the area of interests for the UK and its allies as well.

The base is manned 24/7 for the Quick Reaction Alert capability. This provides a foundation for thinking forward towards the future MPA as well. The personnel is used to expeditionary operations as well.

The decision-making facility for MPA and the Royal Navy, more generally, is located at Northwood; and with the deployment of P-8s at Lossie will shape a new decision-making dynamic between the two centers as well.

The MPA community is very international in character; with the Joint Warrior exercises, the RAF has had an opportunity to keep skill sets current; but is not the same as flying your own aircraft.

But what this means as the P-8 comes into the RAF inventory, the broader multinational orientation built into the exercises, and the Nimrod/P-3 working relationships can be carried forward.

“We have continuously sent officers to work with our allies abroad to keep their skills current as well.

“We are well replaced to the new challenges.

“The training we have given our ex-MPA guys in flying and operations with our allies is crucial.

“This will allow us to slot in people very quickly as the P-8 becomes operational.”

“But it is a clear challenge.

As the USN’s 6<sup>th</sup> Fleet Commander put it recently, we are seeing the fourth Battle of the Atlantic take shape as the Russians take to sea once again.

For the British, making a key contribution to this effort is crucial and will be provided a new aircraft is married to the transitional “seed corn” approach.

<http://www.usni.org/magazines/proceedings/2016-06/fourth-battle-atlantic#footnotes>

## GROUP CAPTAIN PAUL GODFREY LOOKS AT THE WAY AHEAD FOR RAF LOSSIEMOUTH

We will conclude with the interview conducted with Group Captain Paul Godfrey conducted on the June visit to RAF Lossiemouth. He had just returned from Estonia where he was able to look at the performance of RAF Lossiemouth Typhoons on deployment to the Baltic Air Policing effort.

**Question: You recently returned from Estonia.**

**How is the effort going?**

Group Captain Godfrey: It is very similar in mission to QRA in the UK; as you know we have QRA NORTH which is here at Lossie, and QRA SOUTH at RAF Coningsby.

The facilities in Estonia are of the same level and quality we have here in the UK.

You will have seen in the media, that our aircraft are busy intercepting Russian aircraft, including those launched from Kaliningrad although I do think the dynamic has changed slightly since we've been operating in the same AOR as the Russians in Syria.

We know more about each other given the deconfliction that we're going through in Syria and Iraq AORs.

**Question: Are there differences between QRA in the UK and in the Baltics?**

Group Captain Godfrey: The template is the same but the mission is slightly different.

From the UK, we are largely dealing with Russian Long-Range Aviation with crews that are 'used' to being intercepted by European Fighters

In the Baltics, we are often intercepting Russian fighters, and there the adherence to a common template is a work in progress. For several Russian pilots, this may be the first time they seen or dealt with a Typhoon and they are learning the process of how to work safely in such situations.

We are dealing with a different generation of pilots.



FIGURE 8 GROUP CAPTAIN PAUL GODFREY ADDRESSING THE COPENHAGEN AIRPOWER SYMPOSIUM, APRIL 17, 2015. CREDIT: SLD

**Question: How is Typhoon doing in performing the mission?**

Group Captain Godfrey: We are building on the experience of the other Typhoon nations, earlier German and Spanish deployments as well as our own, in creating a solid understanding of the infrastructure support.

It is great to have an aircraft able to deal with any of our likely eventualities in performing the mission.

Question: The P-8 is coming to the RAF and during a recent visit to Jax Navy we were able to see some of the capabilities, which you mentioned last time, certainly in terms of its ability to do more than simply do classic maritime patrol.

What is your sense of its potential impact?

Second Line of Defense



Group Captain Godfrey: If we open our intellectual aperture, and do not stymie it by doctrine, the P-8 becomes a key part of overall evolving combat force, and not simply as you say a classic maritime patrol aircraft, doing a specialized mission.

It's all about on board sensor fusion.

With F-35 and P-8 out in the battlespace, we have the potential to shape collective sensor fusion to give absolutely everybody, either airborne, on the sea, on the land the same situation awareness to allow for enhanced timely decision-making.

And that will affect how we operate Typhoon here as well, as we work greater integration across the combat fleet.

P-8 can be the wingman for F-35; F-35 can be the wingman for P-8; and Typhoon can operate as the weapons force multiplier of the evolving force, and a key force protection element as well.

It will be important for our air doctrine to be reworked as our force finds ways to cross-transform rather than trying to fit these multi-mission and multi-tasking assets into classic doctrinal boxes such as strike, mobility, lift, etc.

We are at the beginning of a long road.

I am not sure of the direction in which the road is going which is probably a good thing for if we set the direction to narrowly we will limit the innovation, which is possible.