



This one-off statistical release provides information on the use of RAF fixed-wing armed aircraft (Harrier and Tornado), armed Remotely Piloted Aircraft Systems (Reaper), and Unmanned Aircraft Systems operated by the British Army (Desert Hawk, T-Hawk, Hermes, and Watchkeeper) in Afghanistan on Operation HERRICK. It does not include any information on the use of aircraft such as helicopters or transport aircraft.

It gives information on flying hours, missions and sorties flown, and weapons expended, by year and aircraft type, from the beginning of Op HERRICK in 2002, to the end of combat operations in 2014.

Key Points and Trends

Flying Hours

- Harriers were used in Afghanistan from 2004 to 2009, when they were withdrawn from service and replaced by Tornados, which were used up to the end of Op HERRICK. Harrier and Tornado flew more than **56,000 hours** in total, averaging about 500 hours per month between 2007 and 2013.
- Reaper was introduced in Afghanistan in 2007. Unlike Harrier and Tornado, Reaper is remotely piloted and is primarily tasked in an Intelligence, Surveillance and Reconnaissance role, but also has an armed capability. Reaper's annual flying hours steadily increased between its introduction in 2007 and 2011, due to a staged increase in Reaper platforms arriving in Theatre and the subsequent increase in missions flown. Reaper flew more than **71,000 hours** in total, averaging just over 1,000 hours per month in 2011 and 2012. This increased in 2013 and 2014.
- All the Unmanned Aircraft Systems operated by the British Army are unarmed. Hermes aircraft flew over **85,000 hours** in Afghanistan in total, and the Desert Hawks more than **18,000 hours**.

Weapons Expended

- To obtain a fair measure of weapon usage frequency, which accounts for the different types of weapon available to each aircraft, each mission report received from Theatre is retrospectively examined to determine the number of Weapon Release Events (WREs) during that mission. The number and frequency of WREs peaked in 2006. After 2006, there were downward trends in the numbers and frequencies, which were not significantly altered by the switch from Harrier to Tornado, or the introduction of Reaper. The overall WRE rate was highest for Harrier, followed by Reaper, then Tornado.
- Comparing only precision-guided munitions (PGM), and ignoring all the use of unguided weapons by Harrier and Tornado, **the total number PGM used by RAF fixed-wing aircraft each year did not substantially change with the introduction of Reaper**: Harrier was the only RAF fixed-wing aircraft which expended PGM until 2007, and in 2007 it expended 119. From 2008, PGM were also expended by Tornado and Reaper, and the average from 2008 to 2013 was 121 per year.
- The overall rate of PGM expended was highest for Harrier, followed by Reaper, then Tornado.

Responsible Statistician: WDS Head of Branch Tel: 020 7807 8792 Email: DefStrat-Stat-WDS-Hd@mod.uk

Further information/mailling list: DefStrat-Stat-WDS-pubs@mod.uk

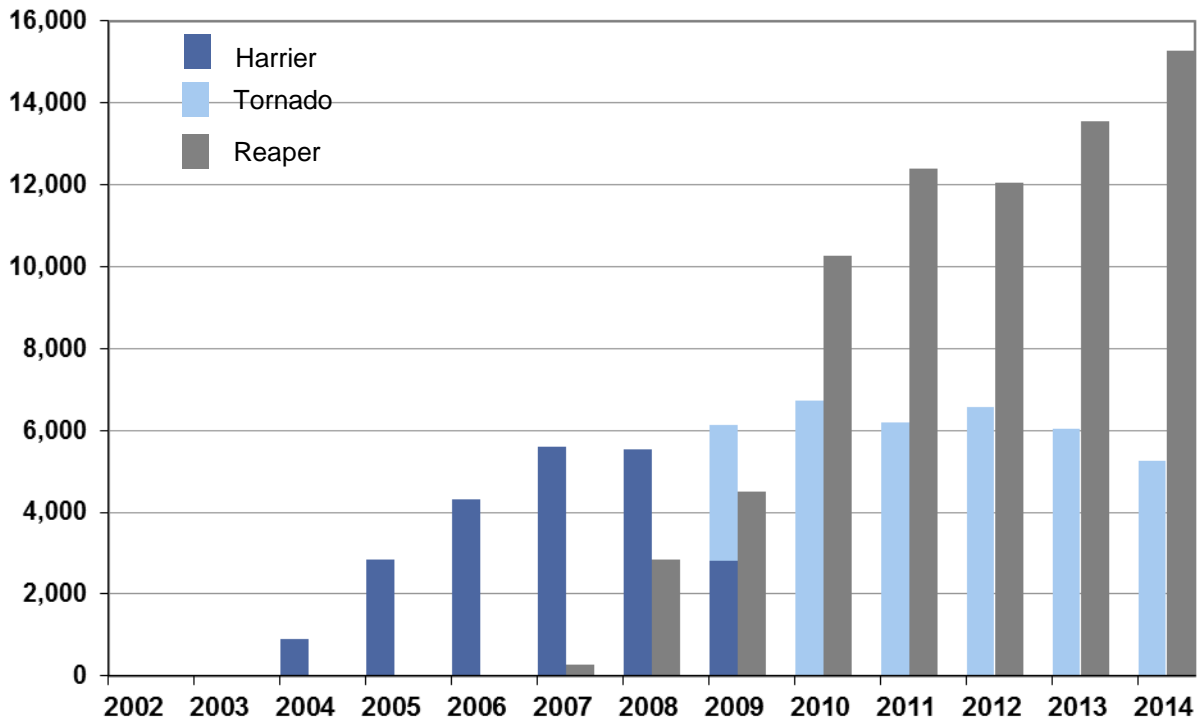
Background quality report: www.gov.uk/government/organisations/ministry-of-defence/about/statistics

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Key Findings

1. Fixed-wing armed RAF aircraft

Flying hours



- Harriers were used in Afghanistan from 2004 to 2009, when they were withdrawn from service and replaced by Tornados. Harrier increased its annual flying hours more than 6-fold between 2004 and 2007. Between 2007 and 2013 Harrier and Tornado averaged about 6,000 flying hours per year, or 500 per month. In 2014, this dropped to 440 per month. Harrier and Tornado flew more than 56,000 hours in total.

- Reaper was introduced in Afghanistan in 2007. Unlike Harrier and Tornado, Reaper is remotely-piloted and is primarily tasked in an Intelligence, Surveillance and Reconnaissance role, but also has an armed capability. Reaper’s annual flying hours steadily increased between its introduction in 2007 and 2011, due to a staged increase in Reaper platforms arriving in Theatre and the subsequent increase in missions flown. In 2011 and 2012 it averaged just over 1,000 flying hours per month. This increased in 2013 and 2014. Reaper flew more than 71,000 hours in total.

Detailed **flying hours** figures can be found in [Table 1](#).

Missions and sorties

A sortie is an operational flight by one aircraft, and a mission is a particular task which one or more aircraft are ordered to accomplish. Fast jet aircraft such as Harrier and Tornado generally fly as a pair, hence one mission comprises two sorties. Reapers fly singly, so sortie count is approximately equal to mission count.

- Between 2006 and 2010, Harrier and Tornado flew about 80 missions and 160 sorties per month. After 2010, these decreased every year. In total, Harrier and Tornado flew just over 9,200 missions, and just over 18,400 sorties.

- Reaper's sorties and missions steadily increased between its introduction in 2007 and 2011, as the number of platforms in Theatre increased. From 2011 to 2013 it averaged about 75 per month, and this increased to 87 per month in 2014. In total, Reaper flew just under 5,300 missions, and just over 5,300 sorties.

Detailed figures on **missions** can be found in [Table 2](#), and numbers of **sorties** in [Table 3](#).

Weapons expended

It is difficult to make genuine like-for-like comparisons between the numbers or rates of weapons expended by Reaper, Harrier and Tornado. This is for a number of reasons (see Background Information, p.16), including the fact that the types of weapon available to each aircraft are different: Reaper uses precision-guided unitary¹ warhead weapons only, whereas Harrier and Tornado use precision-guided unitary warhead weapons, unguided unitary warhead weapons, and unguided multiple-round weapons (e.g. cannon rounds and unguided rockets).

Simply comparing the total number of rounds used would result in misleadingly high totals for those aircraft that use multiple-round weapons, whereas excluding multiple-round weapons altogether would also be misleading. To obtain a better measure of weapon usage frequency, the Air Warfare Centre retrospectively examines each mission report received from Theatre to determine the number of Weapon Release Events (WREs) during that mission. A WRE is defined as: (a) each unitary warhead weapon release, or (b) for multi-round weapons, one or more rounds fired at the same target in a single attack run. Measuring weapon use in WRE terms produces a figure that is more representative of usage frequency than the absolute number of rounds expended.

Note: the following does not include any weapons expended by Apache (see Background Information, p.15). Note also that Reaper is not an autonomous system, and all weapons employment depends upon commands from the flight crew. The weapons are only released under the command of a pilot in line with Rules of Engagement that are no different to those used for manned UK combat aircraft.

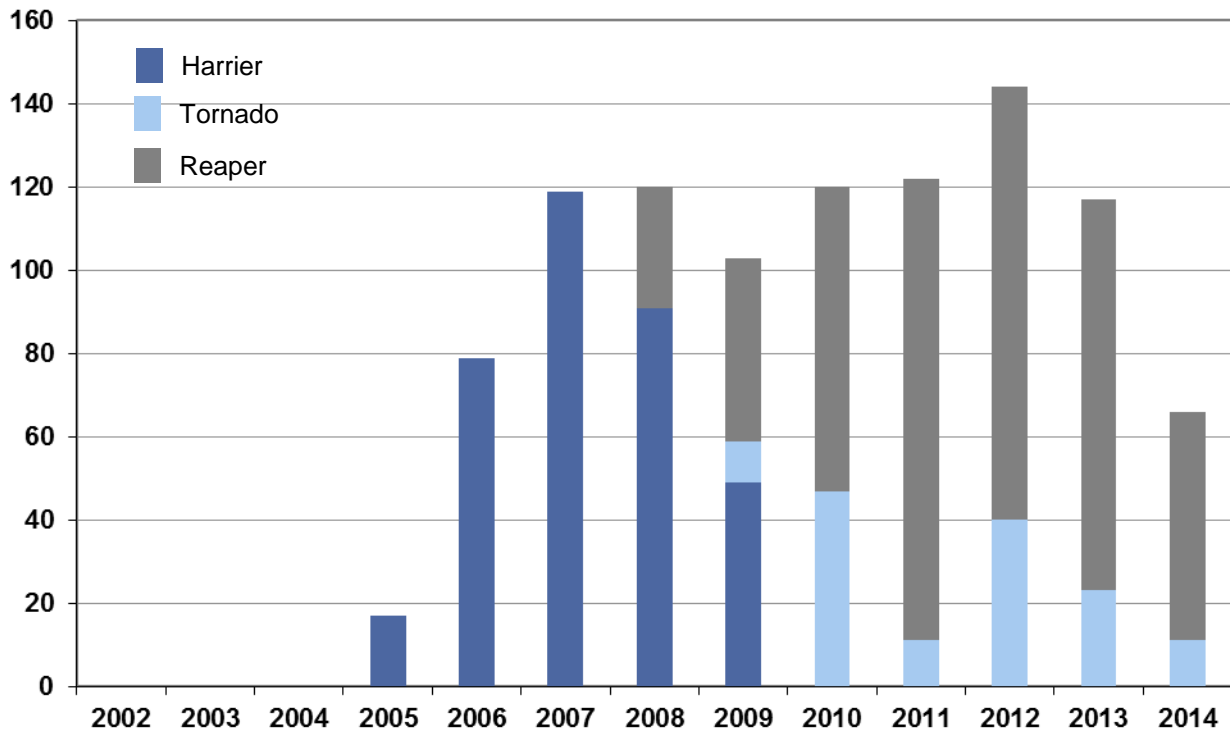
- The number and frequency of WREs peaked in 2006, when Harrier had 326 in total, at 1 every 13 flying hours. After 2006, there were downward trends in the numbers and frequencies, which were not significantly altered by the switch from Harrier to Tornado, or the introduction of Reaper.
- The overall use of WREs was highest for Harrier, followed by Reaper, then Tornado:
 - Harrier had most WREs (953), followed by Reaper (510), then Tornado (213).
 - Harrier had the highest overall rate of WREs compared to flying hours (1 every 23 flying hours), followed by Reaper (1 every 140 flying hours), then Tornado (1 every 160 flying hours).
 - Harrier had the highest rate of WREs compared to missions (9% of missions had a WRE), followed by Reaper (7%), then Tornado (3%).

Detailed figures on the **numbers of WREs and flying hours per WRE** can be found in [Table 1](#). Detailed figures on the **numbers and percentages of missions with WREs** can be found in [Table 2](#).

As all Reaper's weapons are precision-guided munitions (PGM), a comparison can be made with the PGM used by Harrier and Tornado, ignoring all the use of unguided weapons by Harrier and Tornado.

¹ i.e. Single round (as opposed to multi-round weapons such as Tornado 27mm cannon).

Precision-guided munitions



- The total number of PGM used by RAF fixed-wing aircraft each year did not substantially change with the introduction of Reaper: Harrier was the only RAF fixed-wing aircraft which released PGM until 2007, and in 2007 it expended 119. From 2008, PGM were also expended by Tornado and Reaper, and the average from 2008 to 2013 was 121 per year. With the reduction in operational tempo in 2014, only 66 were used.
- Of all the PGM expended on Op HERRICK by fixed-wing armed RAF aircraft, half were by Reaper, and half by Harrier or Tornado. The proportion which were expended by Reaper increased through 2008 to 2010, and averaged 82% between 2011 and 2014.
- Similarly to the rates of WREs, the overall average rate of PGM expended was highest for Harrier (1 every 62 flying hours), followed by Reaper (1 every 140 flying hours), then Tornado (1 every 240 flying hours). The rate for Reaper peaked in 2008, and reduced thereafter.

Detailed figures on **numbers** and **rates** of PGM expended can be found in [Tables 4](#) and [5](#).

2. Unmanned Aircraft Systems operated by the British Army

- Desert Hawk 1 and 3 were used in Afghanistan from 2006, and between then and 2014 flew more than 18,000 hours in total. Hermes was introduced in 2007, and flew over 85,000 hours in total. T-Hawks were used from 2010, Black Hornets from 2012, and Watchkeeper in 2014. Information on the number of hours flown by Black Hornets, the 16g nano aircraft, was not recorded, so this aircraft is excluded from the results.

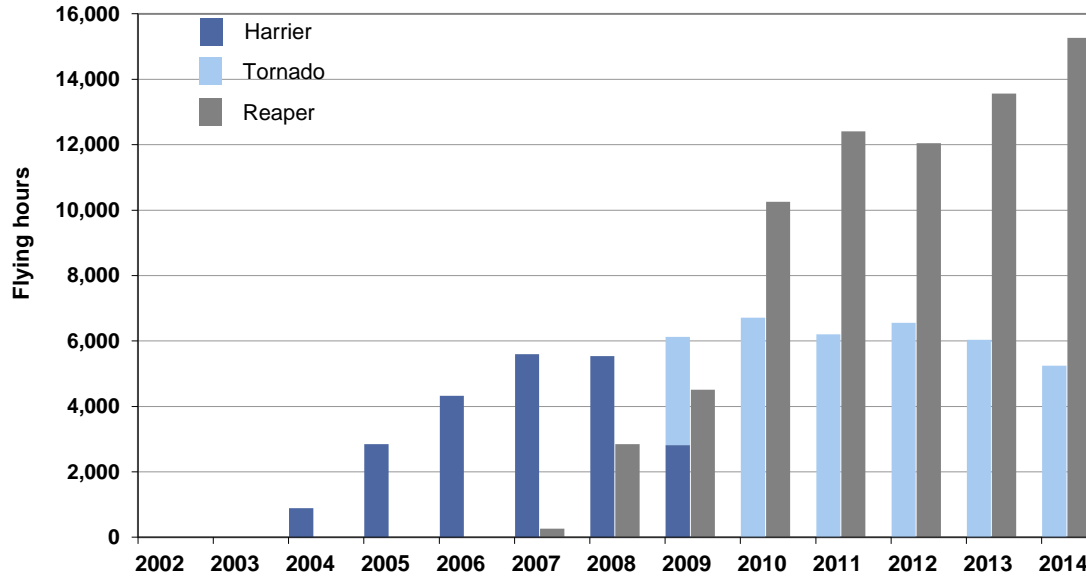
Note: All the Army's Unmanned Aircraft Systems are unarmed.

Detailed figures on **flying hours** can be found in [Table 6](#).

Charts & Table 1

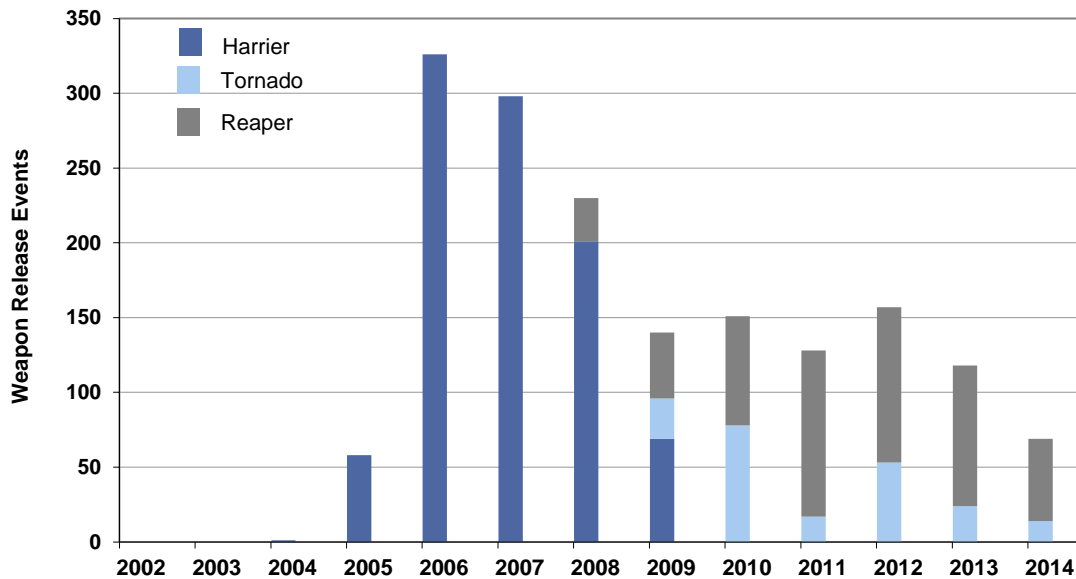
Number of flying hours and Weapon Release Events, and rate of Weapon Release Events, on Op HERRICK by fixed-wing armed aircraft operated by the RAF

Flying hours



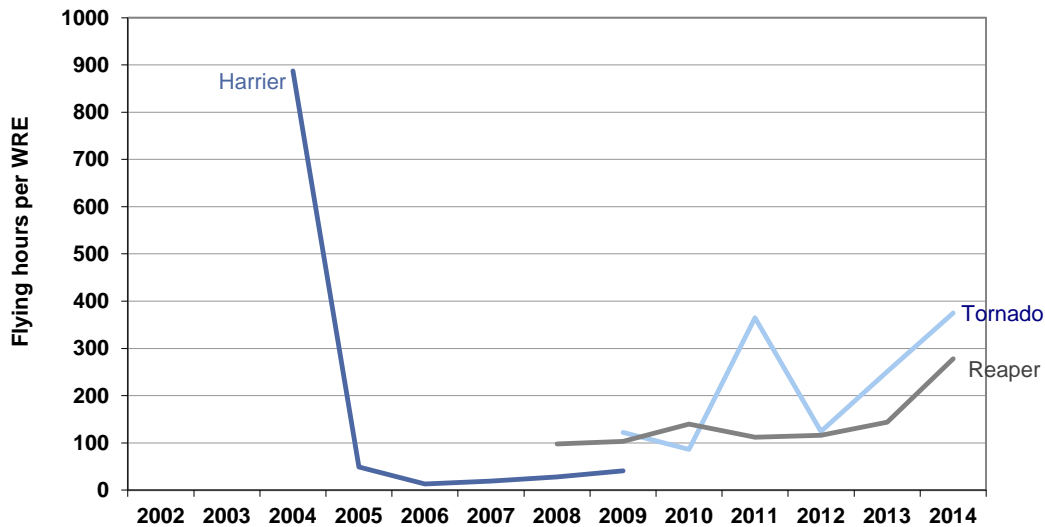
Weapon Release Events

Weapon Release Events (WREs) are a measure of the overall weapon usage frequency, which provides the most representative comparisons of usage frequency between aircraft types, by accounting for the different types of weapon available to each aircraft. A WRE is defined as: (a) each unitary (i.e. single round) warhead weapon release, or (b) for multi-round weapons, one or more rounds fired at the same target in a single attack run.



Flying hours per Weapon Release Event

Comparisons of WRE rates between aircraft types should be made with caution (see Background Information, p.16). The overall average rate of WREs was highest for Harrier (1 every 23 flying hours), followed by Reaper (1 every 140 flying hours), then Tornado (1 every 160 flying hours). The reason for the reduced frequency for Tornado in 2011 is that the focus of Tornado effort that year was Op ELLAMY (Libya).



Flying hours, Weapon Release Events, and Flying hours per Weapon Release Event

Year	Harrier GR7&9			Tornado GR4			Reaper MQ-9		
	Flying hours	Weapon Release Events	Flying hours per WRE	Flying hours	Weapon Release Events	Flying hours per WRE	Flying hours	Weapon Release Events	Flying hours per WRE
2002	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-
2004	887	1	887	-	-	-	-	-	-
2005	2 851	58	49	-	-	-	-	-	-
2006	4 324	326	13	-	-	-	-	-	-
2007	5 593	298	19	-	-	-	261	-	*
2008	5 540	201	28	-	-	-	2 843	29	98
2009	2 817	69	41	3 306	27	122	4 510	44	103
2010	-	-	-	6 714	78	86	10 256	73	140
2011	-	-	-	6 204	17	365	12 405	111	112
2012	-	-	-	6 560	53	124	12 046	104	116
2013	-	-	-	6 034	24	251	13 562	94	144
2014	-	-	-	5 247	14	375	15 264	55	278
Total	22 012	953	23	34 065	213	160	71 147	510	140

Source: MOD Air Warfare Centre

Flying hours per WRE = Flying hours ÷ WRE.

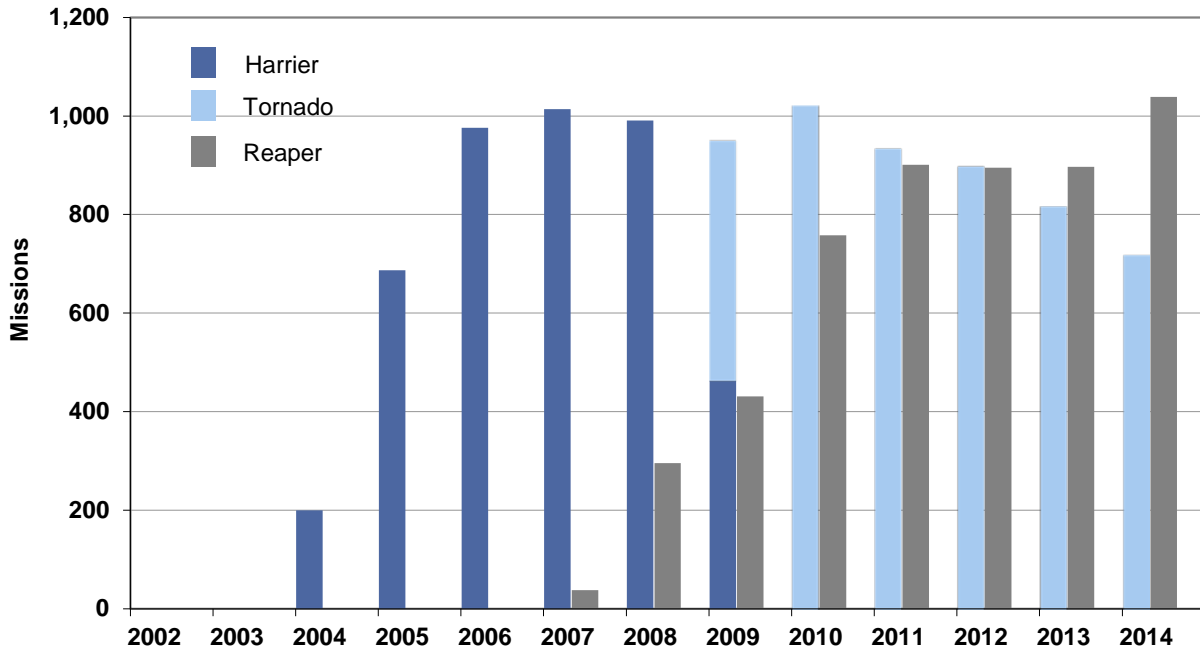
Weapon usage can vary in the total number released and the rate of releases from year to year and even month to month. Military operations are complex and there is a number of factors that can affect weapon usage. It does not follow that any such change is caused solely or even partly by a change in UK or NATO policy.

Charts & Table 2

Number of missions flown, and missions with Weapon Release Events, on Op HERRICK by fixed-wing armed aircraft operated by the RAF

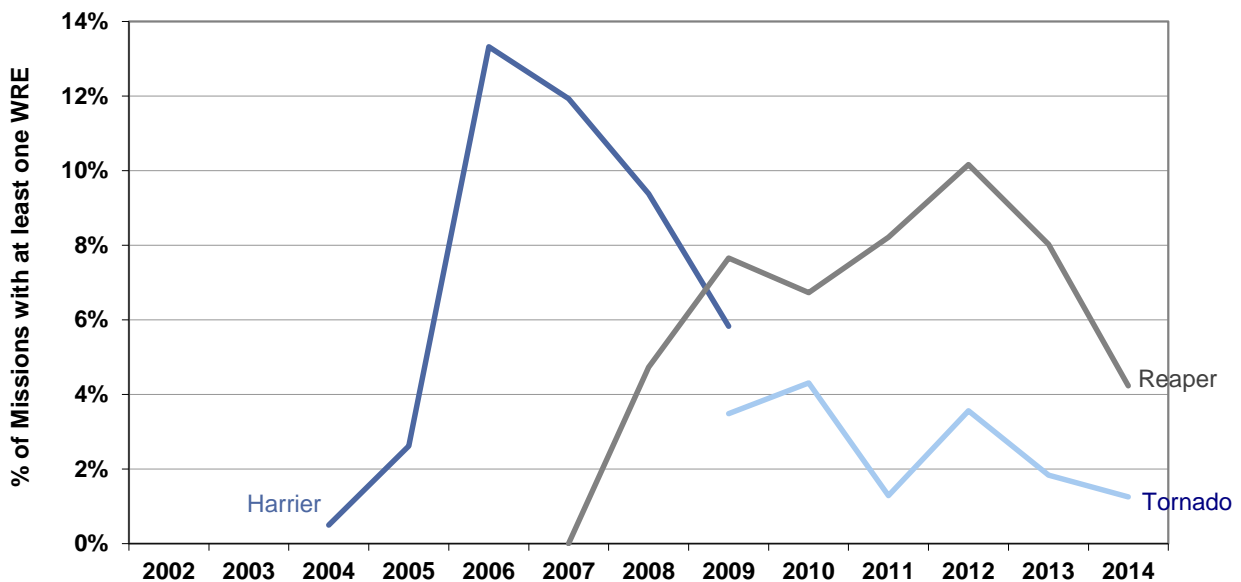
Missions flown

A mission is a particular task which one or more aircraft are ordered to accomplish.



% of Missions flown with at least one Weapon Release Event

Comparisons of WRE rates between aircraft types should be made with caution (see Background Information, p.16). The overall average rate of WREs was highest for Harrier (9% of missions), followed by Reaper (7%), then Tornado (3%).



Missions, Missions with Weapon Release Events, and % of Missions with Weapon Release Events

Year	Harrier GR7&9			Tornado GR4			Reaper MQ-9		
	Missions	Missions with WRE(s)	% of Missions with WRE	Missions	Missions with WRE(s)	% of Missions with WRE	Missions	Missions with WRE(s)	% of Missions with WRE
2002	-	-	-	-	-	-	-	-	-
2003	-	-	-	-	-	-	-	-	-
2004	200	1	1%	-	-	-	-	-	-
2005	687	18	3%	-	-	-	-	-	-
2006	976	130	13%	-	-	-	-	-	-
2007	1 014	121	12%	-	-	-	38	-	0%
2008	991	93	9%	-	-	-	296	14	5%
2009	463	27	6%	488	17	3%	431	33	8%
2010	-	-	-	1 022	44	4%	758	51	7%
2011	-	-	-	935	12	1%	901	74	8%
2012	-	-	-	899	32	4%	895	91	10%
2013	-	-	-	818	15	2%	897	72	8%
2014	-	-	-	719	9	1%	1 039	44	4%
Total	4 331	390	9%	4 881	129	3%	5 255	379	7%

Source: MOD Air Warfare Centre

A sortie is an operational flight by one aircraft. A mission is a particular task which one or more aircraft are ordered to accomplish. A Reaper mission usually involves one Reaper, so Reaper sortie count is approximately equal to Reaper mission count. Tornado and Harrier missions usually comprise two aircraft, so sortie count is approximately 2x mission count. It is therefore fairer to compare missions with WREs than sorties with WREs.

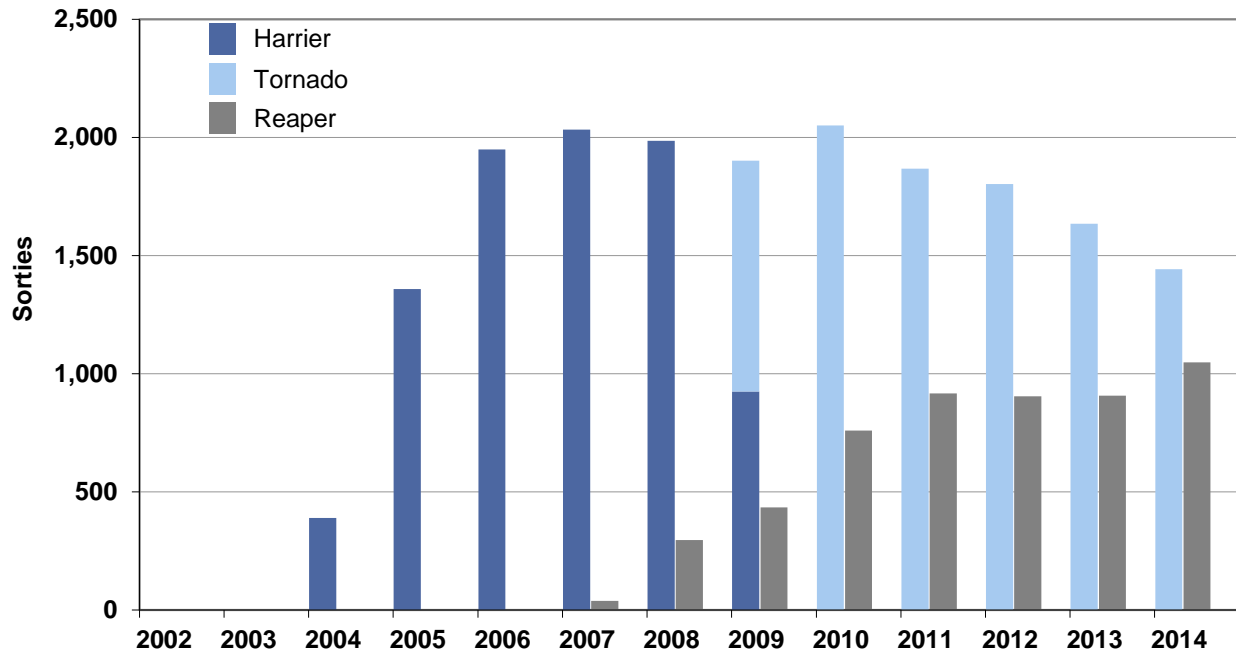
'Missions with WRE(s)' is the number of missions with at least one WRE.

% of Missions with WRE = Missions with WRE(s) ÷ Missions.

Weapon usage can vary in the total number released and the rate of releases from year to year and even month to month. Military operations are complex and there is a number of factors that can affect weapon usage. It does not follow that any such change is caused solely or even partly by a change in UK or NATO policy.

Chart & Table 3

Number of sorties flown on Op HERRICK by fixed-wing armed aircraft operated by the RAF



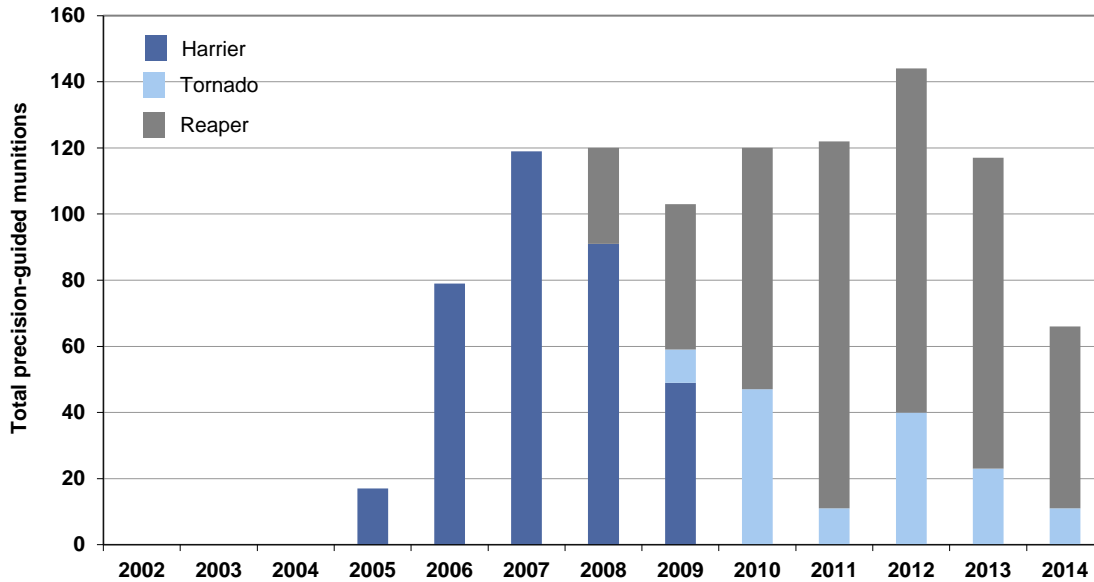
Year	Sorties			Annual Total
	Harrier GR7&9	Tornado GR4	Reaper MQ-9	
2002	-	-	-	-
2003	-	-	-	-
2004	390	-	-	390
2005	1 358	-	-	1 358
2006	1 949	-	-	1 949
2007	2 033	-	38	2 071
2008	1 986	-	296	2 282
2009	924	978	434	2 336
2010	-	2 051	759	2 810
2011	-	1 868	916	2 784
2012	-	1 803	904	2 707
2013	-	1 634	907	2 541
2014	-	1 442	1 048	2 490
Total	8 640	9 776	5 302	23 718

Source: MOD Air Warfare Centre

A sortie is an operational flight by one aircraft. A mission is a particular task which one or more aircraft are ordered to accomplish. A Reaper mission usually involves one Reaper, so Reaper sortie count is approximately equal to Reaper mission count. Tornado and Harrier missions usually comprise two aircraft, so sortie count is approximately 2x mission count.

Chart & Table 4

Number of precision-guided munitions expended on Op HERRICK by fixed-wing armed aircraft operated by the RAF



Year	Harrier GR7&9			Tornado GR4			Reaper MQ-9			Annual Total	Per cent expended by Reaper
	Paveway II & Enhanced Paveway II	Paveway IV	Harrier Total	Paveway IV	Dual Mode Brimstone	Tornado Total	GBU-12	Hellfire	Reaper Total		
2002	-	-	-	-	-	-	-	-	-	-	*
2003	-	-	-	-	-	-	-	-	-	-	*
2004	-	-	-	-	-	-	-	-	-	-	*
2005	17	-	17	-	-	-	-	-	-	17	*
2006	79	-	79	-	-	-	-	-	-	79	*
2007	119	-	119	-	-	-	-	-	-	119	0%
2008	83	8	91	-	-	-	13	16	29	120	24%
2009	-	49	49	9	1	10	12	32	44	103	43%
2010	-	-	-	24	23	47	15	58	73	120	61%
2011	-	-	-	6	5	11	11	100	111	122	91%
2012	-	-	-	25	15	40	-	104	104	144	72%
2013	-	-	-	5	18	23	-	94	94	117	80%
2014	-	-	-	5	6	11	-	55	55	66	83%
Total	298	57	355	74	68	142	51	459	510	1 007	51%

Source: MOD Air Warfare Centre

Per cent expended by Reaper = $\text{Reaper Total} \div \text{Annual Total}$. Reaper was introduced in Afghanistan in 2007, so this is the first year a rate is calculated in the table.

Reaper is the only armed remotely-piloted aircraft in UK service. Reaper is not an autonomous system, and all weapons employment depends upon commands from the flight crew. The weapons are only released under the command of a pilot in line with Rules of Engagement that are no different to those used for manned UK combat aircraft.

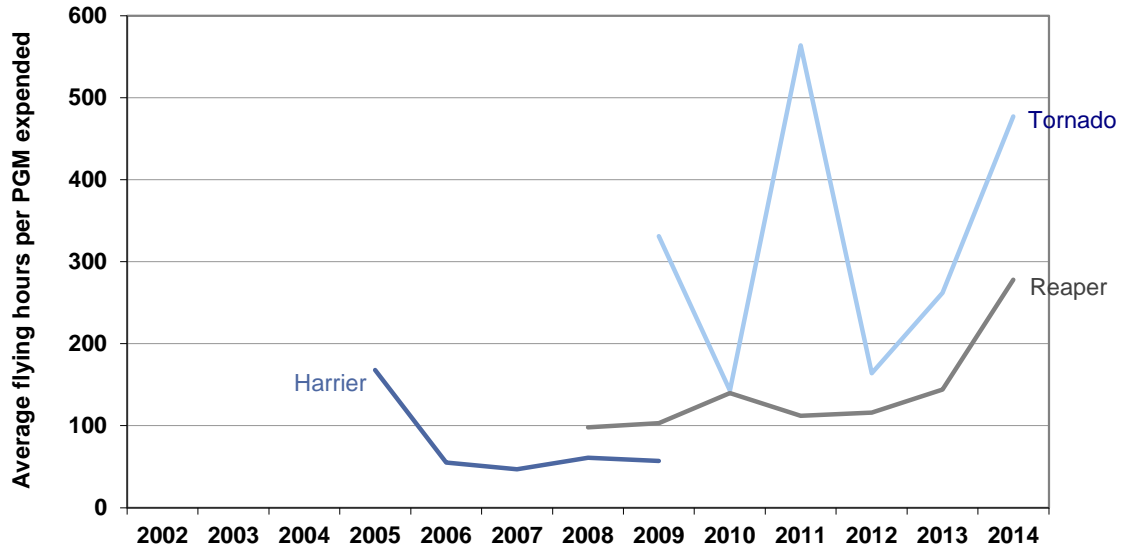
All of Reaper's munitions are precision-guided, and this Table shows the expenditure totals of all precision-guided munitions (including both self-propelled and gravity bombs) by RAF fixed-wing aircraft. The Table does not include the unguided weapons/rounds used by Harrier and Tornado, or any figures for PGM released by rotary-wing aircraft (see Background Information).

Weapon usage can vary in the total number released and the rate of releases from year to year and even month to month. Military operations are complex and there is a number of factors that can affect weapon usage. It does not follow that any such change is caused solely or even partly by a change in UK or NATO policy.

Chart & Table 5

Rate of precision-guided munitions expended on Op HERRICK by fixed-wing armed aircraft operated by the RAF

The figures on average flying hours per PGM expended are calculated from Tables 1 and 4. Comparisons of release rates between aircraft types should be made with caution (see Background Information, p.16). The reason for the reduced frequency for Tornado in 2011 is that the focus of Tornado effort that year was Op ELLAMY (Libya).



Year	Average flying hours per PGM expended		
	Harrier GR7&9	Tornado GR4	Reaper MQ-9
2002	*	*	*
2003	*	*	*
2004	* ¹	*	*
2005	168	*	*
2006	55	*	*
2007	47	*	* ¹
2008	61	*	98
2009	57	331	103
2010	*	143	140
2011	*	564	112
2012	*	164	116
2013	*	262	144
2014	*	477	278
Overall average	62	240	140

Source: Tables 1 and 4

PGM = Precision-guided munitions

1. Harrier in 2004 and Reaper in 2007 had flying hours but no PGM expended.

* No rate exists as no hours were flown or no PGM were expended.

Average flying hours per PGM expended = Flying hours ÷ PGM.

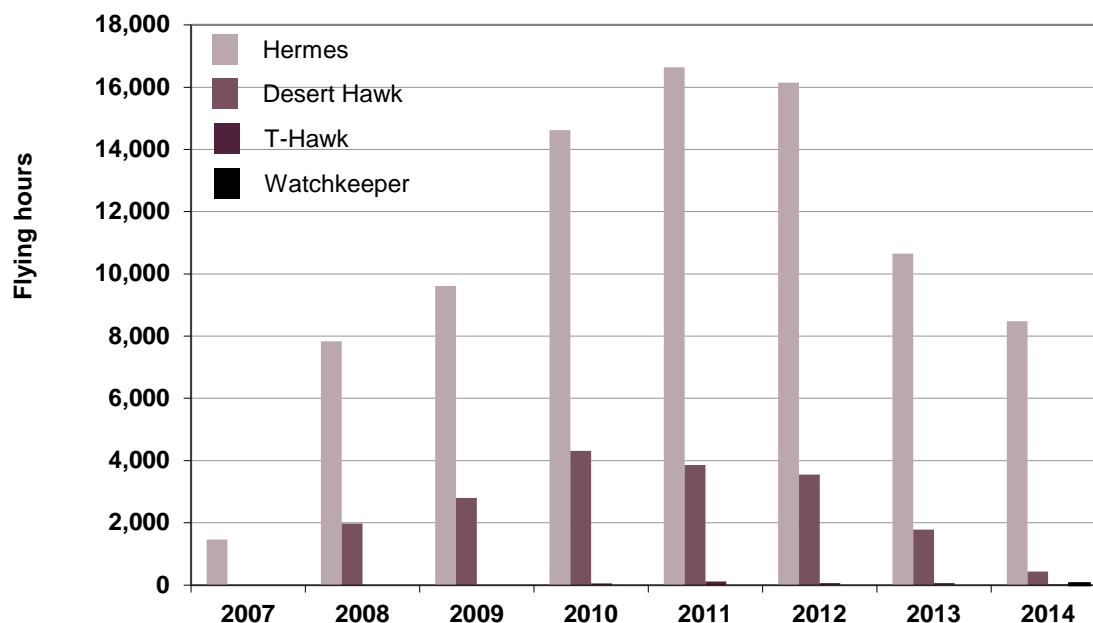
Reaper is the only armed remotely-piloted aircraft in UK service. Reaper is not an autonomous system, and all weapons employment depends upon commands from the flight crew. The weapons are only released under the command of a pilot in line with Rules of Engagement that are no different to those used for manned UK combat aircraft.

Weapon usage can vary in the total number released and the rate of releases from year to year and even month to month.

Military operations are complex and there is a number of factors that can affect weapon usage. It does not follow that any such change is caused solely or even partly by a change in UK or NATO policy.

Chart & Table 6

Number of flying hours on Op HERRICK by Unmanned Aircraft Systems operated by the British Army



Year	Flying hours			
	Aircraft type			
	Hermes 450	Desert Hawk 3	T-Hawk RQ-16A	Watch- keeper
2006	-	-	-	-
2007	1 457	..	-	-
2008	7 835	1 978	-	-
2009	9 613	2 803	-	-
2010	14 625	4 310	56	-
2011	16 643	3 864	110	-
2012	16 141	3 552	61	-
2013	10 652	1 783	64	-
2014	8 475	433	21	60
Total	85 441	..	312	60

Source: British Army

The Desert Hawk 1 force operated from 2006 until it was replaced by Desert Hawk 3 in 2007. DH figures are only recorded back to 2008, so the 2007 and overall total figures are unknown. The DH3 total for 2008 to 2014 is **18,723 hours**.

Hermes was introduced in May 2007.

T-Hawk was procured in 2010.

Watchkeeper was deployed to Op HERRICK in 2014.

Flying hours are not recorded for the Black Hornets, the 16g nano aircraft.

All the Army's unmanned aircraft are unarmed.

Background Information

Introduction

There has been considerable interest from politicians, the media, researchers, and the general public in statistics on the use of aircraft by the British Armed Forces on Op HERRICK (Afghanistan).

This bulletin is a one-off Official Statistics publication which provides information on flying hours, missions flown, sorties flown, and weapons expended by aircraft on Op HERRICK, separately by year and by aircraft.

All the tables in this bulletin are [official statistics](#), and have been released in accordance with the [UK Statistics Authority's Code of Practice for Official Statistics](#).

Context

This bulletin is the primary means by which information on the use of aircraft on Op HERRICK will be made widely available.

The information in this bulletin has a range of users including the media, politicians, academic researchers and the general public who use the information to:

- gain an understanding of the way the Armed Forces' aircraft are used;
- set the context for other information on Defence;
- assist in understanding the impact of initiatives and policy on operational outcomes.

Public accountability requires that MOD should account for how its assets are used. Although internal systems may be sufficient for internal use, publication as a statistical bulletin makes this information available publicly and as a time series. The tables include definitions and other information, so that the data are set in context and can be understood by a lay audience as well as those with professional interests.

Data Sources and Production

The raw data for RAF aircraft is provided by the MOD's Air Warfare Centre, which extracts the information from its database of operational actions. The raw data for Army aircraft is provided by the British Army, who extract the information from their fleet tracking databases.

Government statisticians have collated and sense checked the data; defined and calculated rate statistics; analysed, interpreted and decided how to present all the statistics; and published this report.

Definitions

A complete set of definitions is given in the Glossary.

Data Scope and Data Quality

RAF Fixed-Wing Aircraft

This bulletin provides statistics on flying hours, missions flown, sorties flown, and weapons expended for the three types of fixed-wing armed aircraft used by the RAF on Op HERRICK – Harrier, Tornado and Reaper. It gives figures separately by year and aircraft, for all the years of Op HERRICK.

The data in these tables are extracted from live administrative systems held by the Air Warfare Centre (AWC). During operations, these data are frequently reviewed, updated and subject to change as mission reports are received from theatre. Errors arise from theatre in the form of missing or late mission reports and operational summaries. Absolute accuracy is practically impossible to achieve. The data in these tables are therefore given complete and correct as recorded in the databases at the time of extraction.

However, by publishing this report several months after the end of Op HERRICK, most of the updates to the systems should have been made, so there should be few future changes. However, it is possible that future extractions of this data may not match exactly. The AWC regrets any difficulty this may cause but emphasises that its aim is to ensure that its records are as complete and correct as possible.

These Harrier, Tornado and Reaper sorties were all flown from Afghanistan airfields, and were intended to take place in their entirety inside the borders of Afghanistan. The AWC does not track the aircraft during the sorties, so cannot confirm categorically that each sortie took place entirely within the borders of Afghanistan, but the AWC has no information to indicate that any aircraft breached that border to enter the airspace of a neighbouring nation during an operational sortie.

In addition to being checked by staff who have carried out the data extraction, the data in these tables have been subjected to sense checks and analysed by Government statisticians.

Helicopters

The Apaches are the only helicopters that use precision-guided weapons comparable to Harrier, Tornado and Reaper. The Air Warfare Centre has, despite extensive efforts, so far been unable to compile a complete dataset of British Army Apache missions and weapon expenditure for Operation HERRICK. Efforts continue, and if successful, the equivalent statistics will be published for the Apache.

Army Unmanned Aircraft Systems

All the Unmanned Aircraft Systems operated by the British Army are unarmed, so they release no munitions.

Data on flying hours is recorded accurately for Desert Hawk 3, T-Hawk, Hermes and Watchkeeper, but is not recorded for Black Hornets, the 16 g nano unmanned aircraft.

Some data on numbers of flights is recorded for Desert Hawk 3, but is not recorded for T-Hawk, Hermes, or Black Hornets. However, the Desert Hawk 3 data is not held in a form which enables annual totals to be known exactly, and numbers of flights are not recorded since cease of operations in Afghanistan.

Therefore flying hours are the accurate measure of usage for these aircraft, and this data is provided in this bulletin separately by year and by aircraft.

Comparisons of weapon expenditure between aircraft types

It is difficult to make genuine like-for-like comparisons between the numbers or rates of weapons expended by Harrier, Tornado and Reaper. The reasons for this include:

1. Harrier mainly flew during the first half of the campaign, whereas Reaper and Tornado mainly flew during the second half, and the conditions and intensity of operations were different throughout the campaign.
2. Harrier mainly operated as the sole RAF combat aircraft in Afghanistan, whereas Reaper and Tornado mainly operated concurrently.
3. Sorties and missions are substantially longer for Reaper than Harrier and Tornado¹, so weapon use per sortie and per mission are expected to be higher for Reaper. Calculating weapon use per flying hour instead has the difficulty that Harrier and Tornado usually fly in pairs, whereas Reaper flies singly, so flying hours accumulate twice as quickly for Harrier and Tornado during mission time.
4. Reaper has a different role in Theatre to Harrier and Tornado. Reaper is primarily tasked in an Intelligence, Surveillance and Reconnaissance role. This means it will encounter different events during its missions to Harrier and Tornado, and so its expenditure rates are expected to be different to Harrier and Tornado.
5. The types of weapon available to each aircraft are different:
 - a. Reaper uses precision-guided unitary² weapons only (GBU-12, a 500 lb bomb³, and Hellfire, a missile⁴).
 - b. Harrier and Tornado use precision-guided unitary weapons (Paveway II and IV, 1000 lb and 500 lb bombs respectively, and Brimstone, a missile), unguided unitary weapons (e.g. 1000 lb bombs), and unguided multiple-round weapons (e.g. 27 mm cannon shells and CRV7 rockets).
6. British Army Apache also use precision-guided unitary weapons. As noted above, the AWC has, despite extensive efforts, so far been unable to compile a complete dataset of Apache missions and weapon expenditure for Op HERRICK. This means that comparing just Harrier, Tornado and Reaper excludes the part of the picture provided by Apache.

¹ From Tables 1 and 3, the overall average flying time per sortie was: 2.5 hours for Harrier, 3.5 hours for Tornado, and 13.4 hours for Reaper. From Tables 1 and 2, the overall average flying time per mission was: 5.1 hours for Harrier, 7.0 hours for Tornado, and 13.5 hours for Reaper.

² i.e. Single round (as opposed to multi-round weapons such as Tornado 27mm cannon).

³ Bombs are unpowered and fall under gravity.

⁴ Missiles are self-propelled.

Symbols and Conventions

Symbols

- * Not applicable
- .. Not available
- Zero

Revisions

There are no regular planned revisions of this bulletin. Amendments to figures may be identified. This will be addressed in one of two ways:

i. where the number of figures updated in a table is small, figures will be updated and those which have been revised will be identified with the symbol "r". An explanation for the revision will be given in the footnotes to the table.

ii. where the number of figures updated in a table is substantial, the revisions to the table, together with the reason for the revisions, will be identified in the commentary at the beginning, and in the commentary next to affected tables. Revisions will not be identified by the symbol "r" since where there are a large number of revisions in a table this could make them more difficult to read.

Abbreviations

See Glossary.

Glossary of Terms and Abbreviations

ATS Air-to-surface

AWC Air Warfare Centre

ISR Intelligence Surveillance and Reconnaissance

Mission A particular task which one or more aircraft are ordered to accomplish.

PGM Precision-guided munitions

ROE Rules of Engagement

RPAS Remotely Piloted Air(craft) System

Sortie An operational flight by one aircraft.

Weapon Release Event (WRE) Each unitary warhead weapon release, or for multi-round weapons (e.g. cannon rounds, or unguided rockets), one or more rounds fired at the same target in a single attack run.

Definitions taken from MoD Joint Doctrine Note 2/11: *The UK Approach to Unmanned Aircraft Systems*¹

Unmanned Aircraft (UA)

An aircraft that does not carry a human operator, is operated remotely using varying levels of automated functions, is normally recoverable, and can carry a lethal or non-lethal payload.

Note: In the UK, cruise and ballistic missiles are not considered to be unmanned aircraft.

Unmanned Aircraft System (UAS)

A system, whose components include the unmanned aircraft and all equipment, network and personnel necessary to control the unmanned aircraft.

Remotely Piloted Aircraft (RPA)

An aircraft that, while it does not carry a human operator, is flown remotely by a pilot, is normally recoverable, and can carry a lethal or non-lethal payload.

Remotely Piloted Air(craft) System (RPAS)

The sum of the components required to deliver the overall capability and includes the pilot, sensor operators (if applicable), RPA, ground control station, associated manpower and support systems, satellite communication links and data links.

¹ <https://www.gov.uk/government/publications/jdn-2-11-the-uk-approach-to-unmanned-aircraft-systems>