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Life with the Red Arrows

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1. Introduction

This lecture described the history of formation display, the Red Arrows team, the selection of new pilots, the Red Arrows aircraft, the methodology behind the training, the displays and finally the wider roles of the Red Arrows. The lecture included a series of video sequences showing both the historical aspects of display flying and the present day Red Arrows demonstration programme.

2. History

Close formation flying has been taught since the days of the Royal Flying Corps in WWI. Such flying proved to be the most efficient method of getting large numbers of aircraft from A to B. It also encouraged pilots to fly their aircraft to their performance limits. By the 1930s the Royal Air Force (RAF) was fighting for its independence and therefore decided to initiate a series of public demonstrations of its capabilities. These included the now famous Hendon Air Displays in which the RAF showed off both its aerobatics and formation flying skills.

At the end of WWII all fast jet squadrons wanted to have a demonstration flight. By the 1950s no fast jet squadron was without a display capability. Famous demonstration flights of that era included the Yellow Jacks, the Black Arrows and the Red Pelicans. However, the cost of maintaining such flights became unacceptable. As a result, in 1964, the Air Council ruled that only training units could include demonstration flights. This resulted in the formation of the Red Arrows.

Initially the Red Arrows were made up of just seven Folland Gnat jet trainer aircraft but with nine pilots trained to participate in the flying displays. The number of aircraft was later increased to nine. They gave their first public display in 1965 and, over that year, they went on to give a total of 80 public displays. By the mid 1980s, the Gnat was reaching the end of its useful life and was replaced by the BAe Hawk Mk 1 trainer aircraft.



A Typical Manoeuvre during a Red Arrows Display with BAe Hawk Mk. 1 Trainer Aircraft

3. The Red Arrows Team

The team comprises:

- Pilots (the Red Team – Red 1 to 9)
- Operations and Administration Manager.
- Photographic Staff – For safety reasons a video record is taken of all displays. Video records are also used to assist in correcting mistakes during training.
- Engineering Staff (the Blue Team) – Responsible for all aircraft servicing, diesel fuel (for “smoke” generation) and dye (red, white and blue to colour the “smoke”).
- Safety Equipment Team.
- Road Support Team transporting spare parts and responsible for all road vehicle operations.
- Commentator (Red 10).

All team members work together as a closely knit group. In particular the “engineering circus” comprises a team of engineers who fly in the back seats of aircraft on their way to displays. The “circus” members are then responsible for preparing aircraft prior to each display.

4. The Selection of New Pilots

It is a prerequisite that all pilots applying to join the Red Arrows must have a high level of flying experience which must include at least 1,500 hours fast jet flying (which equates to approximately 10 years service in the RAF) and one front line tour of duty. In addition they must have been consistently assessed as being “above average”. Nine such pilots are selected each year from the many applicants. All nine spend one week in the back seat of an aircraft during which their flying skills are assessed by current Red Arrows pilots. These pilots are then assessed for the presentation skills and interviewed by the Commandant of Central Flying. They are also assessed by the current Red Arrows pilots for their ability to “get on” with the Red Arrows team. Finally just three new pilots are selected.

Most pilots spend three years with the Red Arrows. They are each given a different position in the flight each year to “avoid complacency”.

5. The Aircraft

The Red Arrows use BAe Mk. 1 Hawk Trainer Aircraft. These aircraft have been modified to include:

- Smoke generation pod (to contain the diesel fuel used for “smoke” generation).
- Dye containers.
- Red/White/Blue Smoke/Dye controls on the control column.
- Cockpit mounted smoke indicators.
- Tail cone smoke pipes (to inject dye and diesel into the jet exhaust).
- GPS to facilitate A to B travel between display venues.

In addition, the engine control limiters, normally used to prevent engine surges during training, have been removed.

The Mk. 1 aircraft, which have proved very reliable in service, are now fast approaching the end of their lives. To counter this, some Mk. 1 aircraft are being put into storage for future use in maintaining the Red

Arrows flight. N.B. Mk. 2 aircraft are not suited for use in displays as, unlike the Mk. 1 aircraft, they contain a sophisticated cockpit geared specifically to the training of combat pilots.

6. Training for the Display Season

The display season finishes at the end of October each year and is followed by two weeks leave. The training process then begins. This is a sequence of briefing, flying, de-briefing, noting errors and then repeating the process. Typically, Winter training will involve three sessions per day and take the form of a building block approach leading progressively up to a full flight of all nine aircraft.

In its essence the training is about learning a sequence of manoeuvres during which each pilot is required to maintain his aircraft in a given position with respect to adjacent aircraft. Training starts by defining a series of reference points on adjacent aircraft which a pilot can then use as references to maintain the position of his aircraft. In addition pilots must learn to control their aircraft with "smooth flying inputs" to ensure that all manoeuvres by the team are conducted in a seamless and totally coordinated manner.

Winter training includes corporate days to obtain support/funding from industry, local supporter days, passenger days (these days almost all passengers are themselves fast jet pilots), presentations and charity visits.

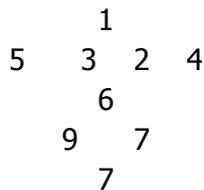
Only a certain amount of training is possible during the UK Winter and, for this reason, the training includes a period in Cyprus in the weeks leading up to each new display season.

During the Winter pilots wear blue flying suits. Just before the start of each display season the Red Arrows are awarded "public display authority". The pilots then switch to their red flying suits for the 5 month display season.

7. The Red Arrows Display

A typical display will last 24 minutes. There are 3 display options, Full, Rolling and Flat Weather (down to 700 ft cloud base and 3.7 km visibility). Which option is selected depends on the weather conditions, especially the cloud base. The aim is to provide a continuous visual display for the watching crowd.

Each display is divided into 2 halves. The first half comprises a series of manoeuvres with all nine aircraft in series of different formations (such as Apollo, Diamond, Phoenix and Swan). A typical formation might be:



in which the three "new" pilots take positions 2, 3 and 5.

The second half of the display comprises a series of "splits" and head-to-head passes. These include a vertical break, a synchro pass and a roll back. "Fudges" are used to give the crowds an impression that the aircraft are closer than in reality. These rely on the sightlines from which the crowds are able to view the display.

A typical "display day" might comprise:

- Transit – Scampton (Red Arrows base) to Bournemouth.
- Display – Bournemouth.
- Transit – Bournemouth to Newcastle.

- Flypast – Great North Run (GNR) Start.
- Display - South Shields (GNR).
- Transit – South Shields to Scampton.

In the case of the above, “dye teams” will be located at both Bournemouth (Hurn) and Newcastle airports. In practise the Red Arrows can do up to 4 displays in one day.

8. The wider Roles and Responsibilities of the Red Arrows

These include:

- Promoting British industry, especially exports – this has resulted in many displays being given overseas, especially in the Gulf States.
- Demonstrating the excellence and professionalism of the UK Armed Forces.
- Defence diplomacy.
- Recruitment.
- On the Ground – meeting the public in the Red Arrows tent, signing autographs and general public relations.

As part of the above, the Red Arrows participated in the 2012 Olympics Opening Ceremony, the Queen’s Diamond Jubilee (with displays both over Windsor Castle and the Mall in London) and the Farnborough 2012 Flypast. In addition, during 2012, they visited the USA, Egypt and the Middle East.

9. Conclusions

The Red Arrows demonstrate the excellence of the RAF, inspire a favourable recruitment environment, promote the quality of British defence products abroad and act as ambassadors for the UK.

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