Case Name: Engine running pens and V/STOL blast grids, Dunsfold airfield

Case Number: 1446285

Background
Historic England has been requested to assess the Engine running pens and V/STOL blast grids at Dunsfold airfield, for listing.

Asset(s) under Assessment
Facts about the asset(s) can be found in the Annex(es) to this report.

Annex	Name	Heritage Category
1	Engine running pens at Dunsfold airfield	Listing
2	V/STOL blast grids at Dunsfold airfield	Listing

Visits

Date	Visit Type
08 March 2017	Full inspection

Annex 1

The factual details are being assessed as the basis for a proposed addition to The National Heritage List for England.

Factual Details

Name: Engine running pens at Dunsfold airfield

Location

Dunsfold Park Ltd, Rutland House,Dunsfold Park, Stovolds Hill, Cranleigh, GU6 8TB

County	District	District Type	Parish
Surrey	Waverley	District Authority	Dunsfold

History

The Engine running pens were built to support the development and manufacture of jet aircraft from c1950 at Dunsfold airfield, which is further explored below, after an introduction to the history of the airfield.

The airfield was constructed for the military in 1942, by Royal Canadian Engineers. Initially it was home to four squadrons of Tomahawks and Mustangs, tasked with training and reconnaissance. By August 1943 it had become a bomber base, supporting Mitchell bombers on European missions, and by 1944 the airfield had three runways and accommodation for over a 1000 personnel.

In the early 1950s Hawker Siddeley were developing jet aircraft for which the short, grass landing strips then available to them, were insufficient. Long hard-surfaced runways were required and Dunsfold was identified as a base which could work hand in hand with their existing factory in Kingston, Surrey. This was a period of consolidation for the many private British aircraft companies, and with the benefit of Britain's lead in jet engine technology, these newly consolidated companies had the financial wherewithal and technical capability to lead the world in jet aviation. During the 1950s and 1960s, huge advances were made and for this brief time, Britain led the world in this area.

On taking over Dunsfold airfield, Hawker Siddeley developed a final assembly and experimental test facility including three engine running pens to test the jet engines in the aircraft prior to delivery. The first aircraft to be developed and assembled at Dunsfold was the Hunter which at the time was at the cutting edge of military jet fighter development, and first took to the air in 1951. Flown by Squadron Leader Neville Duke, it later broke the world speed record achieving a speed of 727.6 mph on the 7 September 1953. Hunters were put into service by the Royal Air Force (RAF) in 1954, and after a number of teething problems, were in operational use until the 1990s.

By the start of the 1960s, the company was developing the concept of V/STOL (Vertical, Short Take Off and Landing) which involved the use of vectored thrust to lift a static or slow moving aircraft in to the air. Once airborne, the engine thrust would be transitioned to the rear and the aircraft would achieve normal forward flight. Hawker Siddeley recognised a need for a fighter that could be operated away from large airfields, therefore reducing dependence on fixed airfields that were vulnerable to nuclear attack. In preparation, one of the engine running pens was redesigned to accommodate the need to test an engine that could create thrust in multiple directions. The existing diffuser (a device for dissipating jet engine thrust) and brick supporting structure were removed, to enable a larger floor area within the pen. This area was then excavated to form a void which was fitted with a blast grid to diffuse vertical thrust. At the rear of the pen, a new diffuser was fitted to contain thrust when the engines were vectored to

the rear. At the same time, a second control room was added and the inside of the pen was fitted out with metal covered insulation. A double-depth metal sliding door was also installed at the entrance so that when closed, noise and debris were suppressed. On 15 July 1960, the first P1127 Prototype V/STOL Strike Aircraft serial XP831, was delivered to Dunsfold Airfield to commence static engine testing in the engine running pen. On 31 August 1960, the Pegasus engine was run for the first time while inside the aircraft.

The first free hover of the prototype occurred on 19 November. In parallel, conventional taxi-trials were performed at speeds of up to 70 knots, and on 13 February 1962, the first conventional flight was achieved.

The P.1127 evolved into the Kestrel and then the Harrier. By 1969, the RAF was using Harriers operationally, and by 1980 the Sea Harrier variant was in use by the Royal Navy. Harriers saw action as part of the Falklands Task Force in 1982, operating from the carrier HMS Hermes some 8,000 miles from England. They flew 1,435 operational sorties, accounting for the destruction of 28 enemy aircraft, with no losses in the air.

The Harrier went on to become probably the most successful British military aircraft to date, with 112 sold to the US Marine Corps. In total 879 Harrier aircraft were built at Dunsfold with an estimated sales value of £2.6 billion (2017 values), all of which were tested in the engine running pen, prior to delivery.

One of the engine running pens has now been demolished, and the north-western example has been modified to accommodate a truck-washing system.

Details
Two brick built jet engine running pens, c1950, with the E example modified c1960 for V/STOL(Vertical/Short Take Off and Landing) testing.

PLAN: the western pen is U-shaped in plan, with the curve being to the N and housing an aperture for the former diffuser (a device for dissipating jet engine thrust). The western example is also U-shaped but has sliding doors to the south. The pens are accessed from the S, which is where the aircraft would have been reversed in and secured to the ground with its engine facing in to the diffuser

MATERIALS: mixed-stock brick, concrete, steel and aluminium.

DETAILS:

Western Pen

This pen is a largely open structure, built of brick in an English bond, with regular brick piers supporting the walls which are topped with concrete copping. The walls are c2m deep and c5m high. The main elevation faces N, and is semi-circular, with the central section marginally higher than the flanking walls. It has a large ovoid aperture where the the diffuser (no longer extant) would have been positioned. Above this area is an internal dome like structure faced in aluminium. Either side there are oversized pedestrian door apertures which give internal access to the former diffuser area. The flanking walls either side of the central curved section, extend to the S, and have a number of irregular access doors or apertures. The working space contained by the walls has been adapted to house a late-C20 truck-wash system. The internal face of the brick walls has a regular pattern of inserted black bricks. The E wall has a single storey brick control room with projects further to the E. It has small rectangular timber casement windows, and a flat roof.

Eastern Pen

This pen is similar to the western example but has been modified to allow testing of V/STOL aircraft. The central section of the NE face is largely open underneath a steel beam which would have supported a diffuser (no longer extant). The walls either side have brick buttresses interspersed along their length, which continue on to the flanking walls. The working space is larger, having been extended to the NE. The floor of the pen is largely concrete, but to the NE end the there is a subterranean diffuser pit, which is now covered in metal plate. The inside face of the pen is covered with brushed aluminium panels, including built-in control rooms to the W and E. The example to the E has a line of small rectangular top-hinged metal windows facing in to the working area. There is also a pedestrian door to the control room, which is fitted out with a bench and seating. To the S, there is a large double-depth sliding aluminium door, which served as the aircraft entrance.

Selected Sources

Websites

Aviation website, accessed 10/4/2017 from http://www.flypast.com/view_article.asp?ID=6029
Friends of Dunsfold Aerodrome, accessed 10/4/2017 from https://dunsfoldairfield.org/
Harrier specific aviation website, accessed viewed on 10 May 2017 from http://www.harrier.org.uk/history/history3_4.htm

Map

National Grid Reference: TQ0214136459

The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF – 1446621_1.pdf.

Annex 2

The factual details are being assessed as the basis for a proposed addition to The National Heritage List for England.

Factual Details

Name: V/STOL blast grids at Dunsfold airfield

Location

Dunsfold Park Ltd, Rutland House,Dunsfold Park, Stovolds Hill, Cranleigh, GU6 8TB

County	District	District Type	Parish
Surrey	Waverley	District Authority	Alfold
Surrey	Waverley	District Authority	Dunsfold

History

The V/STOL (Vertical/Short Take Off and Landing) blast grids were built to support the development of a V/STOL fighter aircraft during the early-1960s at Dunsfold airfield, which is explored further below, after an introduction to the history of the airfield.

The airfield was constructed for the military in 1942, by Royal Canadian Engineers. Initially it was home to four squadrons of Tomahawks and Mustangs, tasked with training and reconnaissance. By August 1943 it had become a bomber base, supporting Mitchell bombers on European missions, and by 1944 the airfield had three runways and accommodation for over a 1000 personnel.

In the early-1950s Hawker Siddeley were developing jet aircraft for which the short, grass landing strips then available to them, were insufficient. Long hard-surfaced runways were required and Dunsfold was identified as a base which could work hand in hand with their existing factory in Kingston, Surrey. This was a period of consolidation for the many private British aircraft companies, and with the benefit of Britain's lead in jet engine technology, these newly consolidated companies had the financial wherewithal and technical capability to lead the world in jet aviation. During the 1950s and 1960s, huge advances were made and for this brief time, Britain led the world in this area.

On taking over Dunsfold airfield, Hawker Siddeley developed a final assembly and experimental test facility including engine running pens to test the jet engines in the aircraft prior to delivery. The first aircraft to be developed and assembled at Dunsfold was the Hunter which at the time was at the cutting edge of military jet fighter development, and first took to the air in 1951. Flown by Squadron Leader Neville Duke, it later broke the world speed record achieving a speed of 727.6 mph on the 7 September 1953. Hunters were put into service by the Royal Air Force (RAF) in 1954, and after a number of teething problems, were in operational use until the 1990s.

By the start of the 1960s, the company was developing the concept of V/STOL which involved the use of vectored thrust to lift a static or slow moving aircraft in to the air. Once airborne, the engine thrust would be transitioned to the rear and the aircraft would achieve normal forward flight. Hawker Siddeley recognised a need for a fighter that could be operated away from large airfields, therefore reducing dependence on fixed airfields that were vulnerable to nuclear attack. On 15 July 1960, the first P1127 Prototype V/STOL Strike Aircraft serial XP831, was delivered to Dunsfold Airfield to commence static engine testing in the engine running pens. On 31 August 1960, the Pegasus engine was run for the first time while inside the aircraft.

Early testing of the concept was performed from the purpose-built V/STOL blast grids, which were located at each end of the main runway. This was a new technology and the physics of vectored thrust were not fully understood. The grids were designed to deflect the hot exhaust gases away from the hovering aircraft, and protect the runway tarmac. They were also thought to be essential in eliminating the adverse effects of thrust losses due to re-ingestion of these hot gases, which was important as the thrust of the prototype engine was only adequate to lift the aircraft with a small fuel load, and all non-essential equipment removed. The designers were also concerned that the aircraft might depart controlled flight in the hover, so tethering points and lines were added to the grids, so that it could be held back in an emergency. Initially the tethers were set at a length of 1ft, and the first hover in this configuration was achieved by Bill Bedford on the 4 November 1961, with one of his legs still in plaster from an earlier car accident. Later, when the tethers were lengthened to 4ft the reaction controls of the aircraft were found to be inadequate. When the aircraft departed from the ground, it had a tendency to lift one wing ahead of the other, and there was too little roll-power within the controls to correct this. This lack of control caused the aircraft to 'cavort around like a drunken cow', until the controls were modified. The first free hover occurred on 19 November. In

parallel, conventional taxi-trials were performed at speeds of up to 70 knots. Finally, on 13 February 1962, the first conventional flight was achieved.

The P.1127 evolved into the Kestrel and then the Harrier. By 1969, the RAF was using Harriers operationally, and by 1980 the Sea Harrier variant was in use by the Royal Navy. Harriers saw action as part of the Falklands Task Force in 1982, operating from the carrier HMS Hermes some 8,000 miles from England. They flew 1,435 operational sorties, accounting for the destruction of 28 enemy aircraft, with no losses in the air.

The Harrier went on to become probably the most successful British military aircraft to date, with 112 sold to the US Marine Corps. In total 879 aircraft were built at Dunsfold with an estimated sales value of £2.6 billion (2017 values).

The V/STOL blast grids have been covered over with steel-plate but are believed to be otherwise intact.

Details
Two steel V/STOL blast grids, c1960, located at either end of the main runway at Dunsfold airfield.

Plan: the grids are rectangular and measure c20m by 30m. Their longer edge faces east-west along the main runway.

Materials: boxed-steel, brick, concrete and steel-plate.

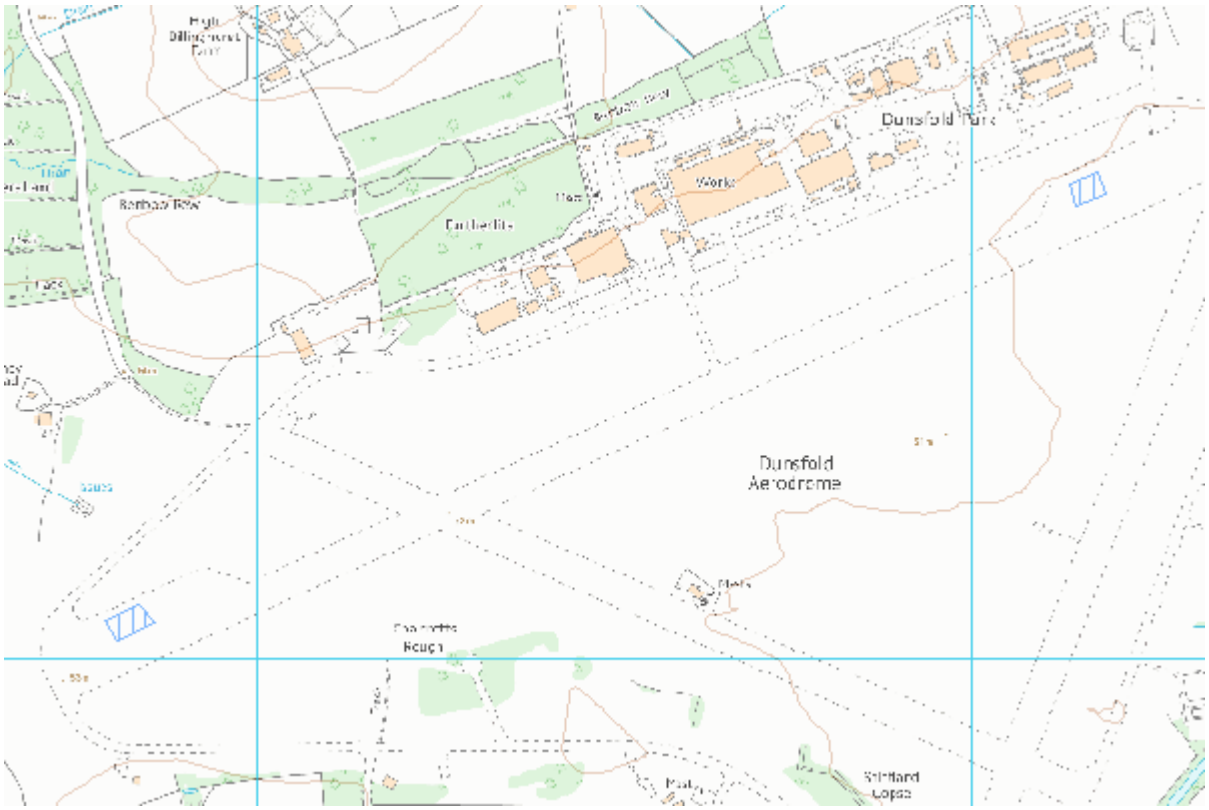
Description: the grids are sunk c2m into the tarmac runway surface and are formed of multiple steel box-sections of c0.5m by c1m, which are supported by steel uprights of c1.5m in height. Within each box-section there is a curved metal vane designed to disperse exhaust gases into the void below. The void is formed by brick walls and a concrete floor. To one side of the grid there is an inset lifting door of finer box-section measuring c2m by 3m, which provides access for maintenance to the underside of the grid. For safety reasons, the blast grids are now completely covered with sections of steel-plate.

Selected Sources

Websites
Aviation website, accessed viewed on 4/5/2017 from
http://www.flypast.com/view_article.asp?ID=6029
Friends of Dunsfold Website, accessed viewed 5/5/2017 from https://dunsfoldairfield.org/
Harrier specific aviation site, accessed viewed on 10 May 2017 from
http://www.harrier.org.uk/history/history3_4.htm

Map

National Grid Reference: TQ0182236055



The above map is for quick reference purposes only and may not be to scale. For a copy of the full scale map, please see the attached PDF – 1447246_1.pdf.