Synopsis of Lecture to RAeS Loughborough Branch on 25 Jan 2011

Sentinel ASTOR Operations by Ft Lt Simon Coates and Flying Officer Andrew Dearing, 5AC Sqn., RAF Waddington

No.5 Squadron was founded in 1913. The first time in active service was with the British Expeditionary Force in France at the start of WW1. Here it played a lead role in aerial reconnaissance. In 1920 the squadron was reformed at Quetta, India when it was supplied with Bristol biplane fighters which it continued to operate until 1931. It was then supplied with Hawker Harts.

During WW2 the squadron operated Mohawks (1942), Hurricanes (1943) and Thunderbolts (1944). The squadron was disbanded in 1947 but reformed in 1952, when it operated Vampires and Javelins. In 1965 it was supplied with Lightning F6s and in 1987 Tornados. In 2004 it became the No.5 Army Cooperation Squadron (No. 5 AC Sqn) based at Waddington and in 2008 was supplied with, amongst others, 5 Sentinel R1 Airborne Surveillance Aircraft.

The Sentinel pilots are trained via the conventional RAF pilot training route. Initial training is on the Grob Tutor (54 hours) after which pilots are streamed between fast single jet, fast multijet and multijet/turboprop. Sentinel pilots follow the fast multijet route which continues with a 30 hours Multi-Engine Lead-in (MELIN) course. This is followed by a 70 hours Multi-Engine Advanced Flying Training course which includes formation flying. Pilots then gain their “wings” and are sent to an Operational Conversion Unit (OCU). Further training includes a course at the Global Express civilian training unit (Brighton) and Sentinel Conversion and Mission Systems courses at RAF Waddington. Pilots are now classified as being “limited combat ready” and spend a further six months gaining experience with the Sentinel aircraft. They are then deployed to an operational squadron.

Sentinel R1

The Sentinel R1 provides a long-range, battlefield-intelligence, target-imaging and tracking using its Airborne Surveillance and Tracking Radar (ASTOR). It is fitted with two Rolls-Royce Deutschland BR710 turbofan engines each with a maximum thrust of 14,750lbs. It has a maximum speed of 0.75Mach and an operating altitude in excess of 40,000ft. Its crew comprises a pilot, co-pilot, airborne mission commander and two airborne image analysts. The Sentinel airframe is a modified version of the Bombardier Global Express business jet aircraft and has a length of 30.3m and a wingspan of 28.5m.

The ASTOR radar operates as a synthetic aperture radar (SAR) and is capable of being operated in both moving target indication (MTI) and non-MTI modes. The SAR permits all-weather, day and night reconnaissance and surveillance to be carried out; the MTI mode allows operators to monitor the activity of mobile ground targets.

In addition to the aircraft, the ASTOR system includes two transportable Ground Stations (GS) to support a deployed Army ground HQ and six mobile GS to support an Army Division or Brigade. Each GS can receive, store and exploit radar information down-linked from the air-platform and present it, via existing communications networks, in a variety of formats to commanders, tacticians and weapons operators on the battlefield. The GS are operated by the Army. All the ground equipment is normally transported using C17 aircraft.

Finally, a support segment provides important mission-support functionality, such as mission planning and mission data replay, at the main operating base (RAF Waddington) and for deployed operations.

The SAR mode provides high quality radar images of the area surveyed, while the MTI mode detects moving vehicles operating in the area. The SAR can be operated in spot mode to produce high-resolution imagery over relatively small areas of fixed location. The SAR swath mode can collect lower-resolution imagery broadside to the aircraft as it proceeds but at a much greater width than SAR spot. Multiple passes using SAR swath mode can effectively provide wide area surveillance of fixed and static targets.

These images can be exploited by the airborne mission crew, or down-linked from the aircraft in near real time to the ASTOR GS, to generate intelligence reports for Army ground commanders.

The Sentinel aircraft are currently being used out of a deployed base in the Middle East to provide valuable surveillance support to the UK and US Armies in Afghanistan. One of their major roles is to “build up pattern of life” images of large swathes of land in order to allow ground forces to be made aware of pattern of life changes. These can be the result of terrorist insurgency movements or the activities of drug smugglers. There have been many cases where “pattern of life” change detections have lead to successful ground operations against enemy forces. As such the Sentinel aircraft have played a pivotal role in the assymetric (terrorist/guerrilla) warfare being conducted in Afghanistan.