Swedish sensors

By IRVINE COHEN

SWEDISH DEVELOPMENT of infra-red (IR) reconnaissance systems was initiated in 1966 and has led to production of two IR pods, the active Blue Baron and the passive Red Baron, both supplied by the State-owned FFV (Förenade Fabriksverken) group.

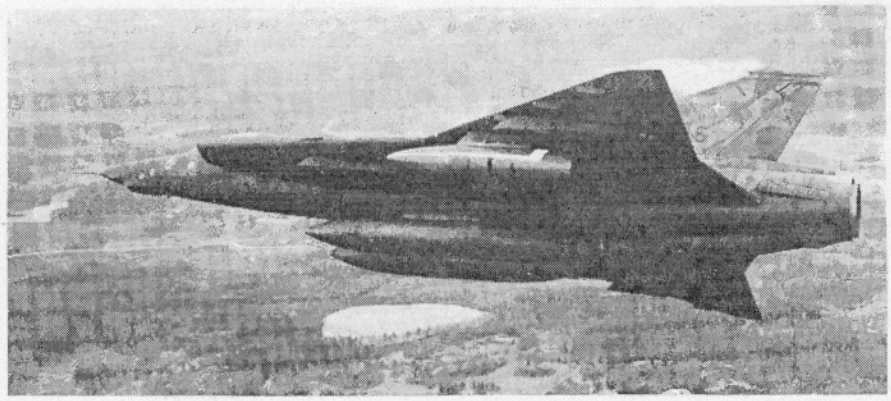
Blue Baron entered local service with Saab 35E Drakens last year. Red Baron has been ordered by the Danish Air Force—again for Drakens—with deliveries beginning early next year. Both units are suitable for day or night operations and are compact, self-contained and fit a standard stores rack. They are considered to be complementary; Red Baron can pick up what Blue Baron cannot distinguish while Blue Baron provides high resolution. The former may be operated at low and medium altitudes, but Blue Baron gives best results between 150ft and 1,000ft.

Both pods, which are produced at FFV's Malmslätt works (on the other side of Linköping from the Saab plant), use advanced foreign technology. Blue Baron integrates three British Vinten 70mm cameras, specially designed Canadian Leitz lenses and an illumination system from American EG&G. Heart of the Red Baron is a Texas Instruments line-scanner.

As it is an active IR system, Blue Baron operation depends for film exposure on a bank of flash heads. Infra-red filters are fitted to flash units and cameras, eliminating back-scatter generated by white light and in most circumstances avoiding detection from the ground. The cameras, each capable of taking ten frames per second, have a total field of view of 120° × 40°. Area coverage depends of course upon both altitude and flying speed (the system may be used in excess of Mach 0·95) but in a typical mission flown at 300m the fully loaded cameras would photograph a strip 3km wide and about 100km long. Normal image overlap is 10 per cent but this can be remotely adjusted to 55 per cent to provide a three-dimensional picture—when viewing through a stereoscope—for detection and identification of masked objects.

The logical step from Blue Baron was a passive counterpart, and FFV had been thinking about the form it should take even before the Danish specification was presented. FFV's proposal, prepared jointly with Texas Instruments, was selected last year in competition with four other systems (British, American, Dutch and French).

The RS-702 scanner converts detected radiant energy into a picture on normal 70mm film. The scanner operates in the 8-14μ region, a band in the spectrum where atmospheric interference is minimal and the high emission levels from most terrain are nearly proportional to the absolute temperatures, and distinguishes between natural features and man-made objects, which have different radiometric and actual temperatures.



A prototype Red Baron pod is flight tested aboard a Draken, mounted beneath the port wing. Effect on aircraft performance is minimal. First deliveries to the Royal Danish Air Force are due early next year

Reconnaissance systems based on an IR line-scanner have wide information-gathering possibilities, including camouflage penetration, latent-image detection (for example showing the "shadow" of a recently moved vehicle), decoy detection (different radiation signatures are associated with the real object and the decoy) and location of vulnerable areas within a target. Surface effects of sub-surface objects—e.g., a submarine's thermal wake—will also show up, though to what depth has not yet been established in Red Baron tests. More in the realm of strategic/economic intelligence, a scan of, say, an oil storage farm would indicate contents levels.

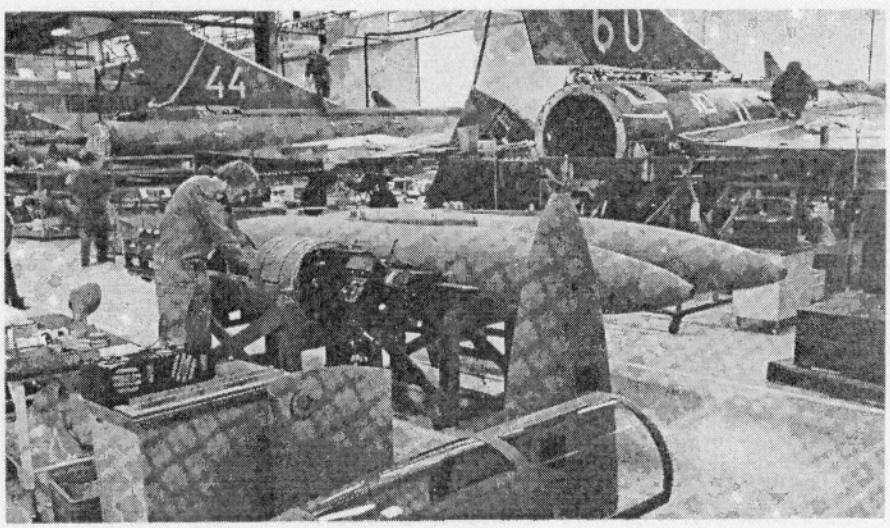
In the Red Baron, radiation received by a series of mirrors is focused on to an array of helium-cooled mercury cadmium telluride detectors which convert it into electrical signals. With further processing using light-emitting diodes the energy readings are transformed into a photographic representation of the traversed terrain. Up to 150ft of film may be carried.

Film exposure rate is proportional to the velocity-to-height ratio. Speed information is taken from the aircraft, and height from an integral Honeywell all-weather radar altimeter. A Lear Siegler gyro provides roll reference. The system is mass stabilised and the scanner remains stationary while the aircraft rolls at up to 300°/sec. Field of view is 120°. A servo-operated door protects scanner components during take-off and landing.

A number of features are built in to give additional operational flexibility. Possibly the most useful of these is cockpit-operated "oblique slew," tilting the scanner 15° to right or left so that a picture is obtained without overflying a particular area. Another, operated from the control stick, is an event indicator which prints a mark in the film margin when the pilot wishes to draw the evaluating staff's attention to a particular point.

Ground coverage varies according

Production of Blue Baron recce pods for the Royal Swedish Air Force, and modification of Drakens, are carried out at FFV Maintenance Division, Malmslätt



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to whether the scanner is in the vertical or oblique slew position. Area covered in the former case is in the ratio of 3·5 × height, and in the latter 5 × height.

Aircraft modifications required for carrying Red Baron are similar to those necessary for Blue Baron. Red Baron is markedly smaller and lighter than the other pod, weighing 275lb, 125kg all-in compared with 705lb, 320kg. In Danish trials the prototype was carried under one wing of a Draken without needing a counterbalancing store under the other. Manoeuvrability and performance of the carrying aircraft are only marginally affected by the pod, which may be jettisoned if necessary. FFV makes the point that it may be mounted on a wide range of aircraft, including slower types such as the Britten-Norman Defender.

The group's Maintenance Division is responsible for Red Baron design, development and production. Flight-testing is carried out in association with the Defence Materiel Administration (air materiel department) test centre on the other side of Malmslätt airfield. With Blue Baron it is the prime supplier to the DMA (the Swedish equivalent of the British Procurement Executive), having been chosen largely because of its extensive experience in pod-related technology. Having started with drop tanks, the division's products now include pods for the 30mm Aden cannon and, as sub-contractor, for Bofors 135mm air-to-ground rockets.

FFV is heavily involved in back-up services for the Swedish forces—particularly the air force, for which it acts as a central workshop—and final assembly of reconnaissance pods is in a hangar currently mainly used for Draken modification.

Contrary to some reports, neither of the Barons has been ordered for the Viggen although the technology of both systems is being installed, in different packaging. The line-scanner is being mounted internally in the SF37. Blue Baron equipment will be carried in *two* Saab-made pods, cameras in one, power unit and controls in the other.

It is notoriously difficult for Swedish defence producers to export their wares beyond certain "traditional" markets, principally other Scandinavian and neutral countries and a limited number of States which are thought unlikely to use the equipment in anger. There are signs though that the Government will look more favourably on sales of non-shooting systems. FFV reports wide foreign interest in the pods, with more than 20 countries enquiring about Blue Baron alone.

The company is thinking about the next step in Red Baron development. Talks are being held with the air force command on the supply of a pod incorporating two day cameras, which would be mounted fore and aft of the IR system to give a stereoscopic effect. Other sensors could be installed. Notwithstanding such possibilities, which are seen as significantly enhancing capability with no great increase in complexity, FFV remains wedded to the notion that for maximum operational flexibility "button-on" reconnaissance systems should be kept simple, small and light.

The diagram illustrates the principle of oblique slewing of reconnaissance cameras