



*Main:* It's been a long and often difficult road for Australia's Seabird Seeker light surveillance platform, but there has been some success and recent developments should ensure its future. This is the first production SB7L, VH-SBO (c/n 006).

*Right:* Before the Seeker came the SB5 Sentinel. VH-SBI (c/n 001) was the first prototype, powered by a Norton rotary engine and flown on 1 October 1989. Photos: Seabird



# Seeker

## Made in Australia

**Designing, developing, certifying, selling and putting a new aircraft into production is never an easy task, especially if that aircraft is a niche product emerging from a small manufacturer on the 'wrong side of the world'. It can be a long, hard road, as Hervey Bay, Queensland-based Seabird Aviation has discovered with its Seeker light surveillance platform.**

BUT THERE IS ALSO a potential upside – establishing a new market segment with a niche product has the advantage of not being in direct competition with the large established US manufacturers.

The Seeker has resulted from more than two decades of development. By 2009, Seekers had flown some 11,000 hours including 5000 on surveillance and patrol duty, and were operating in Australia, Azerbaijan, Jordan, Iraq, South Africa, Tanzania, the United Arab Emirates and the USA.

What evolved into today's Seeker was conceived as a much less expensive alternative to the helicopter in the 'low and slow' observation/surveillance roles it is intended to perform. Seabird sees the aircraft as "the preferred fixed wing platform for military, security and commercial customers worldwide."

The co-founders of Seabird Aviation are well-known names in the local industry: company chairman and industry veteran Don Adams; and his son, managing director Peter Adams. Don Adams served with the RAAF in World War II and subsequently worked as a commercial pilot, agricultural aircraft operator and in airfield construction. One of his most significant achievements was to successfully introduce the Britten Norman Islander to Australia.

Peter Adams has overseen the design, engineering and manufacture of the Seabird including prototype concepts and testing. He also oversees Seabird's international operations, including establishing the vital partnership with the Jordanian industry.

Design work on Seabird's first product – an >>>

*Above centre:* The establishment of the jointly owned Seabird Aviation Jordan in 2003 was a major breakthrough. The first three Seekers were shipped to Jordan ahead of local assembly. JY-SEA (c/n 005) is the former VH-OPT, the second Seeker built.

*Above:* The second and third Seekers went from Jordan to the newly reconstituted Iraqi Air Force. YI-101 is the second (c/n 005), formerly VH-OPT and JY-SEA. Photos: Seabird

• What evolved into today's Seeker was conceived as a much less expensive alternative to the helicopter....



**Above left: The first Jordanian-assembled Seeker (JY-SE1) was flown in early 2006 and subsequently delivered to South Africa.**

**Above: A number of items of operational equipment have been integrated into the Seeker platform including the gimbal-mounted Cineflex high definition camera. Photos: Seabird**

advanced single seat ultralight – began in 1982. Called the Rouseabout, it was of ‘pod and boom’ configuration with pusher engine, strut braced high wing and tricycle undercarriage. The semi-enclosed cabin and primary structure were of fibreglass and Kevlar construction and a floatplane version was built.

The Rouseabout first flew in 1983 – the same year Seabird Aviation was incorporated – and four were manufactured of which three were sold to customers.

#### STAGE ONE: THE SENTINEL

Design work on what would become Seabird's surveillance platform light aircraft was begun in early 1985 under the direction of well-known aeronautical engineer Bill Whitney.

Designated the SB5 Sentinel, the side-by-side two-seater's major characteristics included a pod and boom configuration, tailwheel undercarriage, strut braced high wing, pusher engine mounted at the top rear of the cabin pod at the wing roots and extensive glazing on the pod itself to give the required ‘helicopter-like’ visibility.

A primary design aim was to provide good low speed handling and loiter capabilities, necessary for the aircraft's intended surveillance role. Seabird also saw training and agricultural flying as possible uses for the Sentinel.

The forward fuselage/cabin pod was built around a chromoly steel tube structure with Kevlar non-load bearing skin; the tubular tailboom was of aluminium alloy; and the wings and tail unit were conventional aluminium alloy stressed skin structures.

The Sentinel was designed to be fully certified to FAR 23 standards, maximum takeoff weight was initially put at 650kg (1430lb), estimated cruising speed was 85 knots (157km/h) and range with reserves 380nm (704km).

The choice of powerplant was interesting but – as it turned out – also unfortunate. Two as yet uncertified British engines were offered. Primary choice was the 90hp (67kW) Norton NR 642 twin rotor rotary which promised a

high power-to-weight ratio, small frontal area, low fuel consumption and low vibration.

The option was the 87hp (65kW) Emdair CF 112, a lightweight flat-twin cylinder, air cooled four stroke piston engine of 1.8 litres capacity. It featured an epicyclic gearbox which reduced the crankshaft speed of 3600rpm to 2500rpm at the propeller.

The two-bladed fixed pitch wooden and composites MT propeller was driven via a 3:1 reduction ratiion gearbox integral with the engine.

Work on the SB5 continued during 1985 and 1986. Seabird received two research grants into pusher aircraft designs and structures, radio controlled test models were built and flown and also tested in Sydney University's wind tunnel, tooling was developed and structural testing carried out.

Construction of the first SB5N Sentinel (VH-SBI, c/n 001) with Norton engine began in January 1988 and test pilot David Eyre took the aircraft up on its maiden flight on 1 October 1989. A second non-flying airframe (c/n 002) was built for static testing.

Seabird was let down by Norton, which failed to certify the NR 642 as promised. This left the company with no alternative but to offer the aircraft with the Emdair engine and the second flying Sentinel (SB5E VH-SBU, c/n 003) with that powerplant flew on 11 January 1991.

But the CF 112 also failed to gain certification, leaving Seabird with a problem and facing very substantial delays and costs. It was time for a rethink and a move to a more conventional, proven, certified, widely used, well supported and readily available powerplant for the aeroplane.

#### FROM SENTINEL TO SEEKER

Under the direction of well known aeronautical engineers John Corby (SB7L-235 project) and Dafydd Llewellyn (SB7L-360 project), the decision was made to modify the design of the SB5 Sentinel to take Lycoming power and create the SB7L Seeker.

The 116hp (88kW) O-235 (Seeker SB7L-235) and 180hp (119kW) O-360-B2C (Seeker

SB7L-360) flat-four engines were chosen, the latter derated to 168hp (125kW) with a lower compression ratio to enable it to run on Mogas fuel. It subsequently became the Seeker's sole powerplant.

The propeller was a Bishton BB177 two-blade unit named after its Australian designer Barry Bishton. A Hoffmann propeller is offered as an alternative, but the Australian-designed Bishton has proved to be more effective.

Compared to its predecessor, the Seeker also has a wing of slightly greater span and area, about 50 per cent more fuel capacity, and its maximum takeoff weight as initially planned was 850kg (1874lb) for the SB7L-235 and 897KG (1973lbs) for the SB7L-360. Inside, the cabin was lengthened by 380mm (15in) and widened by 30mm (1.2in).

The engine change obviously increased weights and fuel consumption and these factors had to be taken into account with the redesign, which involved a considerable number of engineering modifications.

It was an expensive and time-consuming process, but even though it didn't look this way to Don and Peter Adams then, with the benefit of hindsight it was probably a blessing in disguise for the longer term.

The aircraft was always going to get heavier as time went on and the need to attach more items of role equipment became necessary. This in turn would require more power.

The Sentinel's maximum weight takeoff weight had gone up by 100kg (220lb) to 750kg (1653lb) by the time the engine change became necessary and performance would have been degraded on just 87 or 90 horsepower.

Then there were the questions of the growth potential of the Norton and Emdair engines to cope with the inevitable weight

increases, their level of international customer support and so on.

The engine change and necessary redesign resulted in a more capable aeroplane with much greater growth potential than the original and – of considerable importance given that export sales would be essential for long term success – it now had a powerplant in widespread use around the world.

The first SB7L-235 Seeker (VH-ZIG, c/n 004) flew on 6 June 1991 and was awarded Australian certification on 12 March 1993. The production SB7L-360A (VH-OPT, c/n 005) with O-360 engine flew in 1993, Australian type approval was granted on 24 January 1994 and the Production Certificate was issued in 1995. A significant milestone occurred four years later – the awarding of US certification to FAR Part 23 in March 1999.

#### DEVELOPING THE CONCEPT

In the meantime, testing, demonstrating and developing the Seabird as a multi-purpose surveillance platform continued over the next few years, with particular emphasis on benign low speed and stall handling characteristics. In 2003 an ‘airflow kit’ including vortex generators and leading edge cuffs were incorporated into the design.

Operational testing included its use as an airborne surveillance platform in trials with the Australian Army in 1995 and a decade later to Jordanian and US forces.

In 1994 an aircraft was flown around Australia promoting the Royal Flying Doctor Service and taken to Thailand and Malaysia (with ferry tanks fitted) and displayed at several air shows including Singapore.

Work was conducted with Redpath Technologies, the Defence Science & Technology Organisation (DSTO) and power company Powercor in developing the ‘Seeker System’ with integrated infra-red (IR) and video installation.

This proved to be effective in the roles of powerline and pipeline inspection, oil slick management and fire surveillance. Powercor subsequently leased the second Seeker (VH-OPT) and used it for powerline inspections with an upgraded Redpath IR system.

In 1999 the US-manufactured Inframetrics stabilised IR and colour imaging system was installed in the prototype Seeker (VH-ZIG) and successfully demonstrated to Queensland Rescue, the Queensland Police Air Wing and State Emergency Services.

Other systems were developed during this period including one for coastal environmental trend mapping and information gathering, and a South Australia-developed river and stream survey videography system which was successfully tested by the Environmental Protection Agency.

Components for an initial production



**A significant recent development with considerable potential has been the integration of the Wescam MX-10 video/IR sensor. It has been successfully demonstrated on Seeker VH-SUA (c/n 0010). Seabird**

batch of five aircraft had been completed by December 1997 but by the start of the 21st century no further Seekers had been built beyond the first two.

The Seeker's concept as “a complete integrated system useful for many applications, not simply an aircraft” was proving itself, but the need to turn all the positive demonstrations and feedback into orders was pressing.

#### SEEKING PARTNERS

2000 to 2002 were lean years for Seabird as investors were sought, both in Australia and overseas. The company was operating with minimal staff but continued marketing, developing production processes and demonstrating the aircraft.

A franchised producer was apparently found in 2000 with the signing of a Memorandum of Understanding with the Czech Republic's Evektor-Aerotechnik. Negotiations continued for some time but eventually came to nought, as the project would have had to be moved to the Czech Republic.

The breakthrough came in early 2003 when commercial discussions opened with Jordan's King Abdullah II Design and Development Bureau (KADDB), resulting in the establishment in July 2003 of the joint venture Seabird Aviation Jordan (SAJ) which would assemble Seekers at Marka.

In the meantime the third Seabird (VH-SBO, c/n 006) had been built, the first new aircraft produced in a decade. It was also the first to conform to production certification.

The Initial Jordanian order covered two aircraft for use in the Aqaba Special Economic Zone Authority for maritime surveillance. The Royal Jordanian Air Academy also ordered two in October 2003 plus options on two more but these were not taken up.

The first Seeker for Jordan (JY-SEE, ex-VH-ZIG) was shipped from Australia in September 2003. It flew in Jordan on 2 October 2003 and was subsequently joined there by JY-SEA (ex-VH-OPT) in March 2004 and VH-SBO in July 2004. VH-SBO was transported from Amberley in a USAF C-17 along with jigs and tooling.

After the integration of communications >>>

#### SEABIRD SB7L-360A-2 SEEKER

<b>POWERPLANT</b>	One 180hp (134kW) Textron Lycoming O-360-B2C four-cylinder piston engine derated to 168hp (125kW); two bladed fixed pitch pusher propeller of 1.77m (5ft 10in) diameter; useable fuel capacity 172 litres (38imp gal); provision for auxiliary fuel tanks on underwing hardpoints.
<b>DIMENSIONS</b>	Wing span 11.07m (36ft 4in); length 7.01m (23ft0 in); height 2.03m (6ft 8in); wing area 13.06m <sup>2</sup> (140.6sq ft.)
<b>CABIN</b>	Length 2.21m (7ft 3in); max width 1.12m (3ft 8in); max height 1.09m (3ft 7in); baggage compartment volume 0.75m <sup>3</sup> (26.5cu ft), weight limit 45kg (99lb).
<b>WEIGHTS</b>	Basic empty 604kg (1332lb); max takeoff and landing 925kg (2039lb); payload with max fuel 189kg (416lb); two underwing hardpoints max load 40kg (88lb) each.
<b>PERFORMANCE</b>	Max cruise 108kt (200km/h); normal cruise 100kt (185km/h); minimum patrol speed 65kt (120km/h); initial climb 1085ft (330m)/min; service ceiling 15,250ft (4648m); takeoff run 265m (870 ft); landing roll 199m (655ft); range with reserves at normal cruise 570nm (1056km); endurance with reserves at minimum patrol speed 6hr 30min.

• A primary design aim was to provide good low speed handling and loiter capabilities....

equipment, avionics and surveillance systems by Seabird Jordan, the last two were supplied to the newly-reconstituted Iraqi Air Force. Iraq had a requirement for a fleet of 16 in the surveillance role but disappointingly, the opposition Jordan Aerospace Industries Sama CH2000, a locally-built version of the Zenair CH2000 conventional light aircraft was selected instead.

The two Iraqi aircraft (YI-101 and YI-102) were the former VH-SBO and VH-OPT, respectively, delivered to Iraq by a USAF C-130 Hercules in August 2004 to equip 70 Squadron. They have FLIR Systems 8500 surveillance systems installed.

The Jordanian joint venture was amended to a licence agreement in 2005 as SAJ reorganised with Iraq's Dabin Group acquiring a "significant portion" of its equity.

SAJ assembled Seabirds at a leisurely pace from kits supplied by Seabird and by mid-2010 more than 10 had been completed. Deliveries of new-build Jordanian aircraft began in early 2006 with JY-SE1 for South Africa.

Jordanian Seekers have been flown to many Middle Eastern destinations including Egypt, across North Africa to Libya and down the Gulf



The Seeker cockpit showing the helicopter-like layout with centre instrument console. This is VH-SUA with the Wescam MX-10 video/IR sensor installed with its associated computer mounted in front of the operator's seat. Seabird

to Dubai. In 2008 Jordanian Air force pilots tasked to establish a surveillance squadron of Seekers were trained at Hervey Bay.

### SEEKER TODAY

Australian production of the Seeker resumed in 2007 to order and further equipment and operational upgrades have been introduced. South African type acceptance was awarded in 2006 and Indian approval in 2007.

In addition, a joint venture with Seabird Aviation American Inc was established in 2006 with a view to building the aircraft at a facility at Albuquerque, New Mexico. A demonstrator (N94399, c/n 009) was shipped to the USA in July 2006 and was joined by N381GC (c/n 0010) the following year and displayed the Oshkosh and Sun and Fun shows.

Both aircraft were demonstrated to Homeland Security, police and commercial operators. The site of US manufacture and assembly is still to be determined.

Recent upgrades include developing the important modification required for the integration of gimbal sensors, this including repositioning the battery aft to allow for the heavier nose-mounted sensor systems. The integration of a Cineflex high definition camera and Power Sonix loud hailer for bushfire and beach warnings has also been completed.

Two new sub-variants have been developed. The SB7L-360A-2 has an increased maximum all up weight of 925kg (2039lb), increased optional fuel capacity, Garmin avionics and wing modifications including leading edge cuffs, vortex generators, wing fences and vortex generators on the horizontal and vertical stabilisers.

The SB7L-360A-3 has more powerful Lycoming IO-390-A1A6 or IO-390 A1B6 engines, Auracle CRM2100 engine management system and Garmin Glass cockpit. Maximum takeoff weight is further increased to 974kg (2143lb).

In collaboration with L-3 Wescam, a significant recent development with considerable future potential has been the integration of the gimbal-mounted Wescam MX-10 video/IR sensor. This MX-10 installation is the first on

a manned fixed wing aircraft and has been successfully demonstrated on VH-SUA (c/n 0010) including during 'Marine Watch' trials on behalf of the Gold Coast City Council.

Future developments in the works include a Piloted Autonomous Flight Vehicle (PAV) variant, combining the benefits of a piloted aircraft with a pre-programmed autonomous waypoint navigation flight and sensor operation mode capability. Work has also begun on a Sensor Ready Aerial Monitoring Vehicle (SRAMW) Seeker variant in association with Garmin and Auracle.

More derivatives of the basic design have also been examined. The SB9 Stormer is an armed observation version 40 per cent larger than the Seeker with a maximum takeoff weight of 2000kg (4409lb), tandem two-seat cockpit and Rolls-Royce 250 turboprop engine.

It has a chin gun turret below a nose-mounted sensor package, pylon for a gun pod and underwing hardpoints for bombs or rocket launchers. Although the SB9 is on hold pending the availability of development funding, it remains a long term project.

The SB10 Sequella is a more straightforward planned Seeker derivative with 4-5 seats and increased payload. It would be able to perform the traditional Seeker surveillance roles but also tourism, sightseeing and normal passenger transport duties thanks to the extra seating capacity. Like the SB9, the SB10 is on hold until development funding becomes available.

By mid-2010 Seabird Aviation had built and flown two Sentinels and ten Seekers with one SB7L-360A and two of the new SB7L-360A-3 model under construction. Ten more have been assembled in Jordan from kits.

It's been a long and often difficult road for Don and Peter Adams and Seabird's loyal shareholders. But perhaps with a number of significant items of operational equipment now integrated into the Seeker's airframe and capability proven, the best years of the story are still to come, especially as demand for aerial imagery and intelligence data is increasing around the world.

### SEABIRD SENTINEL & SEEKER PRODUCTION (Australia)

C/NO	VERSION	REG'N/NOTES
89001	SB5N	prototype Sentinel VH-SBI; ff 1/10/89; Norton engine; withdrawn
002		static test airframe
90003	SB5E	VH-SBU; Emdair engine; withdrawn
91004	SB7L	prototype Seeker VH-ZIG; ff 6/691; later JY-SEE
92005	SB7L	VH-OPT, JY-SEA, YI-101
02006	SB7L	VH-SBO, YI-102
SAJ06001	SB7L-360B	JY-SE1, ZS-SEE
SAJ06002	SB7L-360B	
07009	SB7L-360A	VH-APJ, N94399
070010	SB7L-360A	VH-SUA
070011	SB7L-360A	VH-SBO
070012	SB7L-360A	VH-SZS
0013		not built
070014	SB7L-360A	N381GC
070015	SB7L-360A-2	VH-SZF under construction
070016	SB7L-360A-3	under construction
070017	SB7L-360A-3	under construction

**Jordan:** Completed approximately 10 Seekers (under Jordanian production certificate) with a further 14 shipsets being or awaiting assembly.

**Total built and flown by mid-2010:** Australia – 2 Sentinels and 10 Seekers, total 12; Jordan – 10 Seekers; overall total 22.