IHS Jane’s All the World’s Aircraft Unmanned

2012-2013

Editor: Mark Daly

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Contents

Alphabetic list of Advertisers .............................................................. [4]
Executive Overview ........................................................................ [7]
Users’ Charter .................................................................................. [12]
Acknowledgements .......................................................................... [13]
Glossary ............................................................................................ [14]
How to use ........................................................................................ [30]
UNMANNED AERIAL VEHICLES .............................................................. 1
AERIAL TARGETS ............................................................................... 281
POWER PLANTS .................................................................................. 359
CONTROL AND COMMUNICATIONS ...................................................... 387
LAUNCH AND RECOVERY SYSTEMS ................................................... 415
Contractors ........................................................................................ 431
Alphabetical index ............................................................................. 441
Manufacturers’ index ......................................................................... 449
Boeing Phantom Ray

**Type:** Technology demonstrator.

**Development:** The company-funded Phantom Ray project was launched by Boeing’s Phantom Works in October 2008, although not announced publicly until 8 May 2009. In essence, it resonates work performed on the X-45C, the ultimate X-45 variant developed by Boeing as its entrant in the former joint-service J-UCAS programme. In October 2004, Boeing received a USD767 million DARPA contract for three X-45C prototypes, the first of which should have had its public roll-out on 2 March 2006. However, this was pre-empted by termination of the J-UCAS programme.

The aircraft never flew and, along with the uncompleted second prototype, was placed in storage. As announced, the X-45C will now serve as the basis for the Phantom Ray, as a testbed for advanced technologies. A 10-flight flying programme is envisaged over a period of about six months, supporting missions that may include ISR, SEAD, hunter/killer and electronic attack. Also tested will be autonomous in-flight refuelling — the X-45C design included space provision in the rear fuselage for a refueling receptacle, and this capability was to have been explored with the third X-45C.

**Description:** Airframe: Stealthy, ‘arrow-head’ flying wing design with about 55° leading-edge sweepback and W-planform trailing-edge; blended fuselage, with internal bay(s); buried turbofan engine with serpentine dorsal intake; no vertical tail surfaces. Retractable tricycle landing gear. All-composites construction.

**Mission payloads:** Specific to individual test flights; details not yet announced.

**Guidance and control:** Fully autonomous, including taxi, take-off and landing phases.

**Launch:** Conventional and autonomous wheeled take-off.

**Recovery:** Conventional and autonomous wheeled landing.

**Power plant:** A and B: One approx 51.2 kN (11,500 lb st) General Electric F404-GE-100D non-afterburning turbofan.

**Performance:**

- **Altitude, Operating altitude:** 12,190 m (40,000 ft)
- **Power plant:** 1 x turbofan

**Dimensions, External**

- **Overall length:** 10.97 m (36 ft 0 in)
- **Wings, wing span:** 13.24 m (50 ft 0 in)
- **Weights and Loadings**
  - **Max T-O weight:** 16,556 kg (36,499 lb)
- **Performance**
  - **Maximum endurance:** 12 hours 45 minutes

**Status:** Design development continued in 2009 and construction was completed in 2010. Phantom Ray was shipped by NASA Boeing 747 Shuttle Carrier Aircraft from St Louis to Edwards Air Force Base, California in December 2010. The Phantom Ray (the successor to the X-45) took its maiden flight on 27 April 2011 at NASA’s Dryden Research Center at Edwards Air Force Base, Calif, US.

**Contractor:** The Boeing Company, Boeing Defense, Space and Security St Louis, Missouri.

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**Boeing ScanEagle**

**Type:** Endurance mini-UAV.

**Development:** ScanEagle is a variant of the Insitu SeaScan, built under a 15-month original agreement announced on 11 February 2002 and being developed separately by Boeing’s Phantom Works in collaboration with Insitu. Boeing equipped the prototype air vehicle using its own systems integration, communications and payload technologies. It made its first, remotely controlled, flight in April that year and its first autonomous flight on 19 June 2002, following a pneumatic catapult launch. Made at Boeing’s Boardman, Oregon, facility, the latter flight lasted 45 minutes, flying a preprogrammed course at a maximum altitude of 457 m (1,500 ft). A number of test waypoints were completed using DGPS, as well as the ability to make real-time updates to the flight plan from the GCS. The UAV was retrieved using the patented Insitu Skyhook technique.

In late January 2003, the ScanEagle made five flights, totalling more than 20 hours, as a communications relay platform in a US Navy exercise (‘Giant Shadow’) in the Bahamas. Small-scale production has ensued, as described under the ‘Status’ heading below. Boeing has quoted potential applications as including persistent ISR, US Navy SEAL operations escort, low-cost sea lane protection, sentient and sentry guard duty, battlefield communications relay network node, and convoy support. In June 2003, Boeing and Insitu signed a longer-term contract to continue their collaboration and begin production of the ScanEagle, three A models of which are understood to have been completed at that time. On 15 September 2003, Boeing announced that in recent flights two of those had been launched simultaneously, the first completing a 15-2-hour endurance flight while, in its latter stages, being monitored by the other, which relayed real-time video to the GCS. That at the time the three A models had completed a total of 70 sorties. Persistent ISR was demonstrated between December 2003 and June 2004 during US Joint Forces Command’s exercise ‘Forward Look II’, providing imagery and targeting to UAVs and other airborne assets, ground stations, command centres and ships at sea. In August 2004, a Boeing-owned aircraft completed a 16 hour 45 minute flight off the US west coast in Puget Sound, Washington, after launch from a fishing boat, thought to be the longest flight up to that time by a UAV launched and retrieved at sea, and in December 2004 another ScanEagle successfully demonstrated high-speed wireless communications relay (voice and video).

ScanEagles have participated in a number of military demonstrations, experiments and exercises, some of which are described under the ‘Status’ heading below.

**Description:** Airframe: Mainly cylindrical fuselage; mid-mounted, sweptback wings with tall endplates and rudders; pusher engine. Modular internal avionics bay. No landing gear. Folding-wing version for air launch under study in 2006.

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*ScanEagle handling (USMC)*

*ScanEagle*
Israel

**Rafael Black Sparrow**

*Type:* Air-launched ballistic target.

*Development:* The Black Sparrow programme was funded jointly by the US Ballistic Missile Defense Organization (BMDO) and the Israeli Missile Defense Organisation (IMDO) in 1996 in order to develop a high-fidelity, threat-representative ballistic target for Israel’s Theatre Missile Defence (TMD) requirements. It simulates the Scud-B ballistic missile and has full telemetry and test range safety capabilities.

*Description:* Mission payloads: Modular warhead simulator, which can be adapted to emulate various warhead threats such as high explosive and bulk chemical for lethality analysis.

*Guidance and control:* The target simulates the trajectory (velocity and altitude profile) and the thermal and RCS signatures of the Scud-B ballistic missile, being able to simulate such re-entry manoeuvres as ballistic and barrel roll. Its telemetry supports full data for interceptor test analysis.

**Qods Saeghe 2**

*Launch:* Air-launched. Design incorporates a fully redundant flight termination system to meet the range safety requirements governing missile interceptor tests.

*Status:* Black Sparrow has been proven in missile defence engagement scenarios with the Israeli Arrow weapon system. By 2005 it was fully developed and market-ready, having successfully completed a series of fly-out and interception tests. The Black Sparrow was selected by the French DGA for testing the SAMP/T system.

*Contractor:* Rafael Armament Development Authority Ltd, Haifa.

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Italy

**Selex Galileo Locusta**

*Type:* Expendable target or subtarget.

*Development:* Described as “a mini-UAV secondary aerial target”, development of the Locusta began in 2004 as a live target for tactical missiles and air defence artillery. It was designed to be deployed either as a sub-target, using a target-launching system, or as a stand-alone target launched from other types of host aircraft. In the former application, one Locusta is carried under each wing of the Mirach parent target. Locusta can simulate incoming threats from both surface-to-air and air-to-air missiles. It can also be configured for such operational roles as decoy and jamming.

*Description:* **Airframe:** Cylindrical body with ogival nosecone and ventral engine air intakes. Four front-mounted fins in cruciform configuration and four larger tails in X configuration. Mainly carbon fibre construction.

*Mission payloads:* Modular payloads include radar cross-section augmentors (S-band and Ku-band) and IR augmentors.

*Guidance and control:* Flight profiles are mainly autonomous, but ground controller can monitor the mission and, if the target survives a hit, it will return to the host aircraft.

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308 Aerial targets > Iran – Italy > Qods Saeghe – Selex Galileo Locusta

**Saeghe 2:** More advanced version. Telecommand and telemetry links between air vehicle and GCS, GPS navigation. Same airframe as Saeghe 1. Specification data apply to this version.

**Dimensions, External**

<table>
<thead>
<tr>
<th>Overall</th>
<th>Length</th>
<th>Width</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>2.81 m</td>
<td>0.70 m</td>
<td>2.86 m</td>
</tr>
</tbody>
</table>

**Weights and Loadings**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Max launch weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>60 kg (132 lb)</td>
</tr>
</tbody>
</table>

**Performance**

<table>
<thead>
<tr>
<th>Altitude</th>
<th>Max. Service ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>35,000 ft (10,000 ft)</td>
<td></td>
</tr>
</tbody>
</table>

**Speed, Max level speed**

<table>
<thead>
<tr>
<th>Speed</th>
<th>Max level speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>215 kt (315 km/h; 196 mph)</td>
<td></td>
</tr>
</tbody>
</table>

**Radius of operation, max, mission**

<table>
<thead>
<tr>
<th>Mission radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 n miles (50 km; 31 miles)</td>
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</tbody>
</table>

**Endurance**

<table>
<thead>
<tr>
<th>Endurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 min</td>
</tr>
</tbody>
</table>

**Power plant**

| Type | 1 x piston engine |

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The Qods Saeghe 2 in flight

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The 48 kW (64.4 hp) Rotax 582 UL

Description: Rotary-valve piston engine with electronic dual ignition, integrated water pump and thermostat, exhaust system, carburetors and rewind starter. Effective compression ratio 5.75:1. Fuel grade RON 91 (leaded or unleaded), in 50:1 mixture with super two-stroke motor oil. Weight quoted includes twin carburetors and exhaust system. TBO is 300 hours.

Dimensions
- Bore: 76 mm (2.99 in)
- Stroke: 84 mm (3.23 in)
- Capacity: 580.7 cc (35.44 cu in)
- Weight: 36.0 kg (79.4 lb)

Performance
- T-O rating (5,500 rpm): 48.0 kW (64.4 hp)
- Max rpm: 5,800
- Generator performance at 5,500 rpm: 155 W at 6,000 rpm
- Voltage: 13.5 V

Status: In service, remains in production (2010). UAV applications have included the Gnat 750, Prowler II, Sperwer and Ugglan.

Contractor: BRP-Rotax GmbH & Co KG Gunskirchen.

The Rotax 912 UL flat-four (BRP-Rotax)

Type: Air/liquid-cooled, horizontally opposed four-cylinder four-stroke.

Description: Generally as for Rotax 912, except that 2.43:1 reduction gear is standard. Weight quoted includes suspension frame, exhaust system and gearbox.

Features include automatic wastegate control; dry sump forced lubrication with separate oil tank; automatic adjustment by hydraulic valve tappet; twin carburetors; dual electronic ignition; electric starter; propeller speed reduction unit; engine mount assembly; air intake system; and exhaust system. Compression ratio 9.0:1. Leaded or unleaded Mogas (RON 95) or Avgas 100LL. TBO increased from 1000 hours to 1200 hours from 2003.

Dimensions
- Bore: 912 UL, A and F: 79.5 mm (3.11 in)
- Stroke: 61 mm (2.40 in)
- Capacity: 912 UL, A and F: 1,132.2 cc (69.51 cu in)
- Capacity: 912 S and ULS: 1,211.2 cc (73.91 cu in)
- Weight: 912 UL, A and F: 55.4 kg (122.1 lb)
- Weight: 912 S and ULS: 56.6 kg (124.8 lb)

Performance
- Max (5 min) rating at 5,500 rpm: 58.0 kW (77.8 hp)
- Max rpm: 5,800
- Generator performance at 5,500 rpm: 250 W
- Voltage: 13.5 V

Status: In service and remains in production (2010). Applications have included I-Gnat, Perseus, Predator, Raptor Demonstrator and Theseus UAVs.

Contractor: BRP-Rotax GmbH & Co KG Gunskirchen.

The Rotax 914 UL flat-four (BRP-Rotax)

Type: Air/liquid-cooled, horizontally opposed, turbocharged four-cylinder four-stroke.

Development: The 914 is essentially a turbocharged version of the Rotax 912. Description: Generally as for Rotax 912, except that 2.43:1 reduction gear is standard. Weight quoted includes suspension frame, exhaust system and gearbox.

Features include automatic wastegate control; dry sump forced lubrication with separate oil tank; automatic adjustment by hydraulic valve tappet; twin carburetors; dual electronic ignition; electric starter; propeller speed reduction unit; engine mount assembly; air intake system; and exhaust system. Compression ratio 9.0:1. Leaded or unleaded Mogas (RON 95) or Avgas 100LL. TBO increased from 1000 hours to 1200 hours from 2003.

Dimensions
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- Capacity: 912 S and ULS: 1,211.2 cc (73.91 cu in)
- Weight: 912 UL, A and F: 55.4 kg (122.1 lb)
- Weight: 912 S and ULS: 56.6 kg (124.8 lb)

Performance
- Max (5 min) rating at 5,900 rpm: 59.6 kW (79.9 hp)
- Max rpm: 5,800
- Generator performance at 5,500 rpm: 250 W
- Voltage: 13.5 V

Status: In service and remains in production (2010). Applications have included I-Gnat, Perseus, Predator, Raptor Demonstrator and Theseus UAVs.

Contractor: BRP-Rotax GmbH & Co KG Gunskirchen.

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RUAG OPATS

Type: Automatic landing position sensor

Description: OPATS consists of a motorised sensor platform mounted on a tripod, an electronic unit and a battery pack platform. It is deployed in close vicinity to the landing area, remote from the GCS. It can be fully operated from the GCS, connected by fibre optic video and computer communications links. The air vehicle is equipped with two parallel, lightweight, 60 mm (2.4 in) diameter passive retro reflectors mounted on the air vehicle’s nose or wings. A laser radar and TV camera on the OPATS platform point towards the approaching UAV, illuminating it by IR light pulses, which are echoed back to the OPATS by the retroreflectors. From these echoes, OPATS determines UAV distance and azimuth or elevation angles, while the TV camera gives the operator visual information. During the landing approach, OPATS continuously measures UAV positions (at a ‘high rate’ of 40 m/s) and transmits them to the GCS, where they are used as feedback in the automatic landing servo control loop, enabling the UAV to be precisely guided on to a predetermined landing point. OPATS operating modes comprise ‘manual point’ (manual pointing for search or target acquisition automatic tracking) and ‘standby’ (system powered up, no laser emission).

Specifications:

- **Type**: UAV Flight Control Unit (FCU)
- **Description**: Adcom describes the ADCOM-3D FCU as making use of the ‘latest electronic technology and advanced digital processing techniques’ for control and measurement. System features include:
  - attitude and heading reference correction (using a strap-down IMU with GPS and 3-axis magnetometer feedback)
  - onboard flight data recording
  - stabilisation and control of the host vehicle’s angular movements
  - an automatic navigation capability
  - independent angular measurement on all three axes
  - measurement of both static and dynamic pressure
  - the ability to change pre-programmed flight plans at ‘any stage in the flight’
  - automatic take-off and landing facilities (with the latter making use of GPS and an optional laser altimeter)
  - an automatic recovery function
  - fail-safe functionality in case of uplink interruption
  - fault identification
  - automatic guidance to a pre-set landing point in case of emergency
  - sensor thermal compensation
  - use of an eCAN bus configuration to facilitate interfacing with servos, a transceiver unit, a laser altimeter and ‘other peripherals’
  - a 3-axis magnetometer interface
  - the availability of two RS-232 serial ports
  - control of up to 16 payloads.

United Arab Emirates

Adcom ADCOM-3D

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Adcom ADNAV GCS

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