THE SCOUT SYSTEM

A REAL TIME INTELLIGENCE AND SURVEILLANCE SYSTEM

DR. D. HARARI

ISRAEL AIRCRAFT INDUSTRIES
LOD AIRPORT, ISRAEL

ABSTRACT

The SCOUT remotely piloted vehicle system was developed to provide the customers with real time intelligence and surveillance on the modern battlefield.

Design requirements are presented and the history of the SCOUT program is reviewed briefly with emphasis on the effort at ISRAEL AIRCRAFT INDUSTRIES (IAI) to develop a "total weapon system".

INTRODUCTION

The SCOUT program was initiated in 1976 in co-operation with the Israel Ministry of Defense, to develop a Remotely Piloted Vehicle System for various Israel Defense Forces (IDF) missions.

The SCOUT system was designed to satisfy the following customer requirements:

* military weapon system
* flexible, multi mission operation
* cost effectiveness
* reliability
* survivability
* maintainability
* human engineering
* growth potential.

After the development phase (between 1977 and 1979) over 300 test flights were flown (by IAI crew and by the IDF crew at the phase end) to evaluate the product and determine its viability as a real time intelligence system in a battlefield environment.

These tests evaluated system design and performance capabilities, especially:

* the ability to navigate to and from an area and to control mission payload
* the ability to maintain the system quickly and simply
* the ability of operators to concentrate during relative long time missions.

During these tests, information necessary to evaluate system reliability and to improve it was also acquired.

After this period the system became operational and the hundreds of successful sorties accumulated by the SCOUT System have justified the emphasis placed on reliability and maintainability during development.

REQUIREMENTS

The basic requirements of the SCOUT System are to provide the observer with real time information beyond the line of contact, and the artillery units with targeting information of sufficient accuracy to permit first-round fire for effect and adjusting artillery fire by observing burst distances from the target.

The system was to be mobile, capable of rapid deploying and operable by special IDF personnel without extremely high skill levels or extensive training.

GENERAL SYSTEM DESCRIPTION

The SCOUT System consists of an air vehicle (RPV), a ground control station (GCS), a launcher and a retrieval system. (See Fig. 1).

Fig. 1. General Scout System

The RPV payload consists of a video camera for real time information.

Two flight vehicle configurations are available: (See Fig. 2 and 3).

* a launching/retrieval configuration, where the RPV is launched from a launcher and retrieved by a retrieval system
* a wheeled configuration where the RPV takes off and lands on a runway.

Command and control of the SCOUT System consists of four basic functions:

1. Take off/launch and navigation of the RPV over enemy territory, followed by return to the recovery area.
2. Control of the on board TV camera by the ground observer to acquire and track targets.
3. Accurate location of targets in UTM (Universal Transverse Mercator) co-ordinates.
4. Processing and transmission of flight and target date to the various military users.

Guidance and navigation of the SCOUT System is based on range and azimuth meaured by a ground tracking antenna.

A communication link from the GCS to the RPV provides uplink commands for controlling the RPV and its payload. A communication link from the RPV to the GCS provides downlink video and the RPV status information.

Remote Piloted Vehicle (RPV) Description

1. The RPV is of a monocoque construction with twin booms, twin tail assemblies and launching legs for the launching configuration or a tricycle landing gear for the wheeled configuration. It has a low radar cross section, small IR signature and control surfaces.

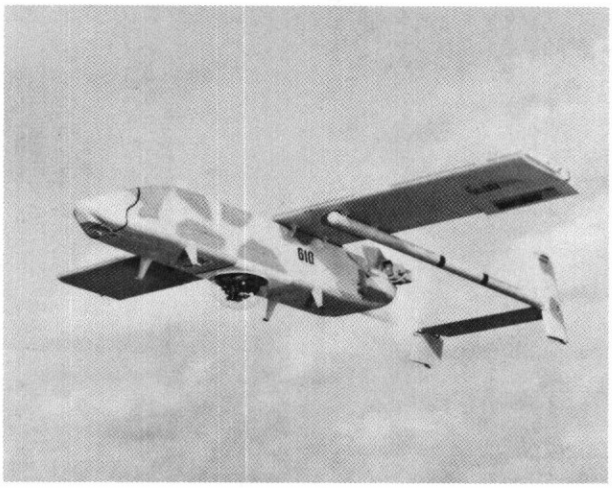

Fig. 2. RPV Launching/Retrieval Configuration

It is propeller driven by a rear mounted two cylinder gasoline/oil engine.

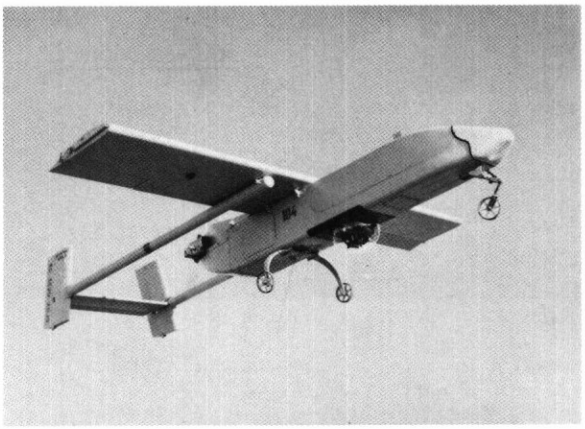

Fig. 3. RPV Wheeled Configuration

A generator, coupled to the engine shaft provides the outboard electronics power supply and keeps the emergency NiCad battery charged.

2. The RPV is radio controlled from the ground station to which it transmits real time video reports and local system status reports.

The payload is carried in the belly for optimum area coverage, and performs its surveillance through and opening in the bottom of the fuselage which is protected by a transparent plexiglass bubble. (See Fig. 4).

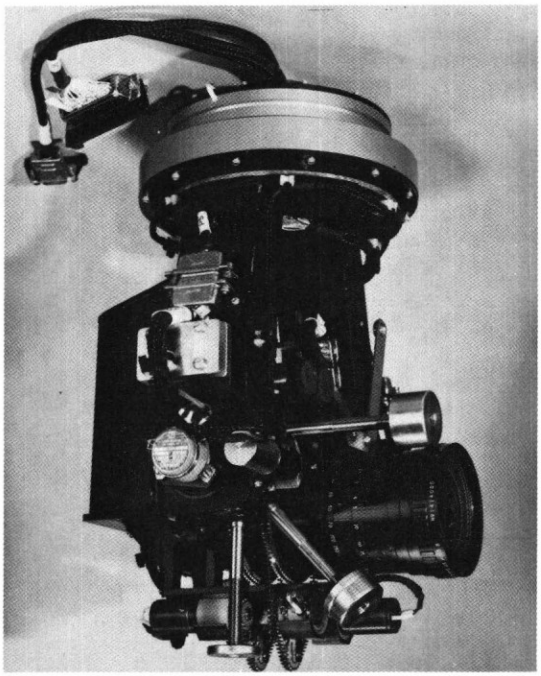

Fig. 4. Scout TV Payload

3. The Airborne command and control are effected through the control processing assembly (CPA).

The CPA is an electronic control box which:

* performs command, programmer and autopilot functions for the payload, the communication and the navigation systems
* incorporates the status report, autopilot and encoder/decoder units
* translates and issues commands to the flight controls and receives the data of five sensors: vertical gyro, rate gyro, altimeter, airspeed indicator and flux valve (compass).

4. The Flight Control Subsystem enables the operator to control the RPV flight manually or automatically through the autopilot. A preprogrammed flight mode is also possible.

In case of a failure in the command uplink, the return home mode is activated and the RPV returns to the retrieval area.

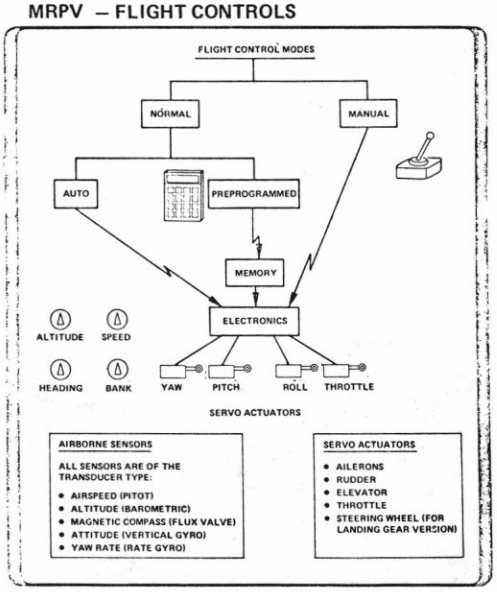

Fig. 5. Scout Autopilot Modes

5. RPV Technical Data:

Dimensions	Span	:	5.00 m.
	Length	:	3.68 m.
	Height	:	0.90 m.
Maximum take off weight		:	135 kg.
Maximum fuel weight		:	22 kg.
Maximum payload weight		:	25 kg.
Maximum altitude		:	12000 feet.
Flight endurance at ISA conditions		:	7.0 hours.
Engine (two stroke)		:	18 HP.

Ground Control Station (GCS) Description

The GCS is equipped and manned to operate a RPV, carrying a TV payload. (See Fig. 6)

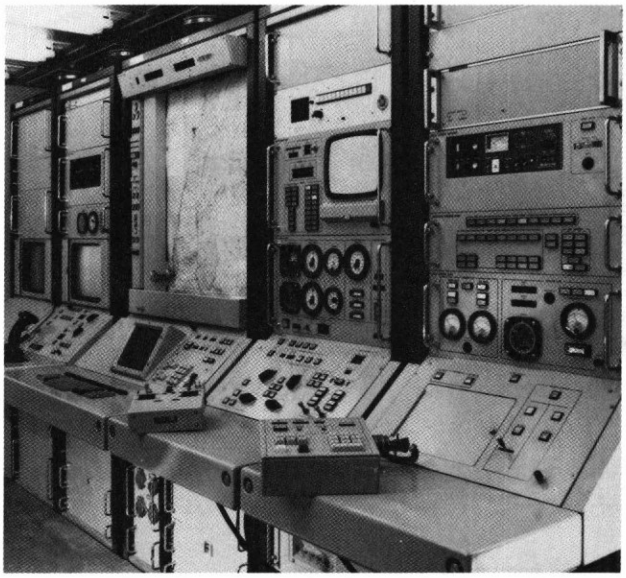

Fig. 6. Scout Ground Control System

The system is based on a military ground computer which handles the in flight programs and can perform the system preflight checks.

The GCS is operated by the following crew:

- Pilot; responsible for flight command and control of the RPV, from launch/take off to retrieval/landing
- Observer; responsible for the operation and control of the payload and for relieving the pilot in emergencies
- Technician; responsible for GCS preflight checkout of the GCS and the RPV, for the maintenance of GCS equipment and for RPV tracking. The range of the tracking sytem is 100 km.

Launcher Description

The launcher consists of two parallel rails mounted on an integral air tank (see Fig. 7). An air motor is installed forward of the air tank. Upon receiving the launch signal, the air motor accelerates the RPV by pulling it with a dacron strap. The strap is automatically released when the RPV reaches the end of the rails.

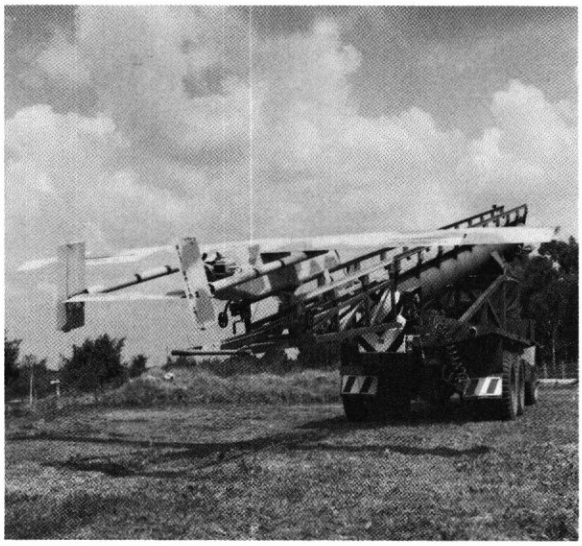

Fig. 7. Scout Launcher

Retrieval System Description

The retrieval system is rugged but simple. It includes:

- Three truckmounted and a sliding arresting net, 11 meter high masts (collapsible), secured by guy wires
- A TV ground camera mounted on front mast retrieval
- A control box mounted in the GCS. (See Fig. 8).

Deviations of the aircraft from desired trajectory are detected by the ground TV camera and corrected by the GCS observer using the joystick. Aircraft flight parameters that are transmitted by the downlink communication system are fed into the retrieval microprocessor which, in turn, issues correction orders to the RPV until impact with the retrieval net is achieved.

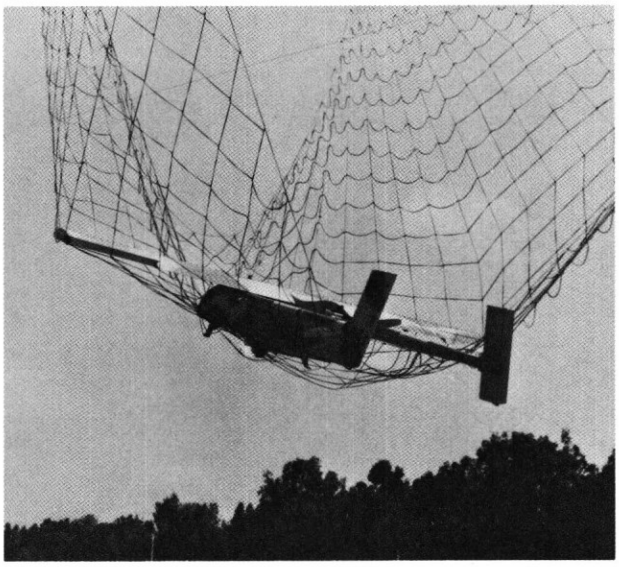

Fig. 8. Scout Retrieval System

MAINTENANCE POLICY

The SCOUT System is a military system which has to be deployable on short notice when required. The maintenance policy established during the development phase is based on the following requirements:

- That the airframe can be rapidly assembled/disassembled for transport/storage/deployment in the field, using pins and safety pins only. (See Fig. 9).
- That the avionics and payload were entirely made up of line replaceable units.
- That all system elements can be checked by BITE which is generated by a preflight program.

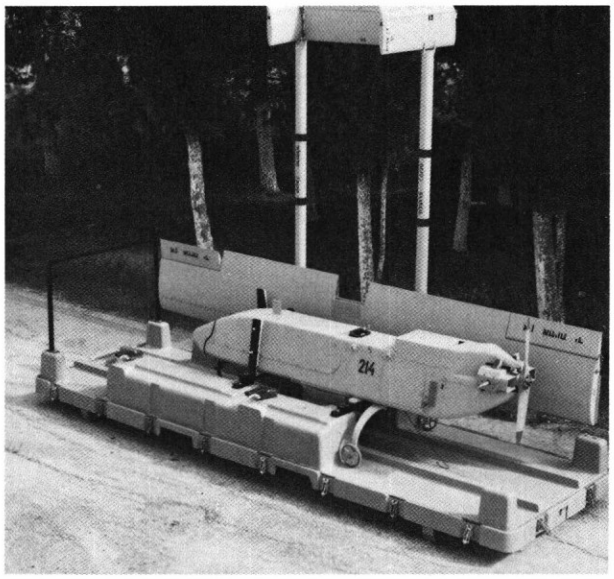

Fig. 9. Scout RPV Container

SURVIVABILITY

The SCOUT System was developed to operate in an intensely hostile environment where manned aircraft survivability would be extremely low.

RPV radar cross section, infrared emissions, acoustic level and visual signature are minimized to enhance survivability of the flight vehicle.

High mobility and rapid emplacement/displacement are important in reducing detection and the implementation of effective countermeasures against ground installations.

The SCOUT RPV navigation and guidance system permits autonomous operation of the RPV (without communication from the ground) for relative long periods. During this mode of operation the GCS operators have a continuous display of RPV video and status data without the need for transmission from the ground antenna.

SUMMARY

The SCOUT System had been developed to provide the customers with real time information,target acquisition and location capability which will significantly enhance the effectiveness of the artillery.

The ability to see battlefield areas at longer ranges and to recognize and identify targets through use of onboard image sensors are the keys to its utility.

In battlefield application, the SCOUT System played a vital role in maximizing overall force effectiveness and validated its high reliability, maintenability and availability characteristics.

It can provide the answer to many of the information and target acquisition needs which are essential for success on the future battlefield.