

# The DHC-8-Q300 Maritime Surveillance Aircraft for the Swedish Coast Guard



In December 2003, the Swedish Defence Materiel Administration (FMV) issued an international Request for Quotation for 3 Maritime Surveillance Aircraft on behalf of the Swedish Coast Guard (SCG). The new aircraft will replace the SCG's fleet of 3 CASA 212 aircraft that have provided maritime surveillance for almost 20 years.



The competitive tender process was culminated in December 2004 with a contract being awarded to Field Aviation for 3 new Bombardier DHC-8-Q300 aircraft modified into Maritime Surveillance Aircraft. Field Aviation was, for this project, teamed up with Bombardier and L-3 Integrated Systems as sub-contractors for the basic aircraft and for the sensors/mission management system respectively.

The SCG and FMV followed a very well defined and structured process to ensure that they would end up with the right aircraft solution for the right price at the end of the tender. To ensure that there was a common basis for all acquisition related activities such as the Request for Information, the Tender Specification and the Evaluation Criteria, the Coast Guard first defined their objective for new aircraft system. This definition was confirmed in its final form in October 2002.

The definition and system objective was on its side dictated by the policy areas the Swedish government has set out for the Coast Guard, and the degree to which each such policy area is applicable to the use of multi-role surveillance aircraft within the Coast Guard system.

In this process, the primary objectives for the aircraft system were defined as:

**Environmental protection, combating and preventing pollution at sea,**



**as well as evidence gathering and prosecution of offenders.**



**Marine traffic supervision and safety at sea  
(protection against accidents as well as  
Search and Rescue)**

**Food policy  
(fishing control)**



**Judicial system (police activity, including  
border controls for persons at sea)**

**Tax, customs duty and other charges  
(customs check and border controls for  
goods at sea)**

In the tender specification that followed, the Swedish Coast Guard went to great detail in specifying system capabilities that were mandatory or desired in order for the Maritime Surveillance Aircraft to work effectively within the Swedish integrated protection and enforcement system, but the process left the bidders with sufficient freedom to propose the best solutions and optimize the aircraft system's performance within the Coast Guard's budget.

The following describes the aircraft system solution that was selected as the winning tender by the Swedish Coast Guard and contracted by FMV:

## The DHC-8-Q300 MSA, by Field Aviation.

### Basic aircraft

The basic aircraft platform for this system is the Bombardier DHC-8 Series 300 aircraft. This is a civil certified transport aircraft which is predominantly used throughout the world as a regional airliner. The “Dash 8”, which the aircraft is also known as, was first introduced into passenger service in 1984. More than 700 Dash 8’s of various models and sizes have been built to date, and the aircraft is a world leader in terms of popularity, regularity and safety.

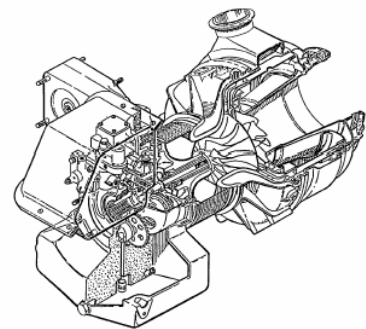


The Dash 8 is a high wing aircraft powered by two Pratt & Whitney Canada turboprop engines. The version selected for the SCG is the series 300, model 311, which typically carries 50 passengers and has a maximum take off weight of 41,300 lbs (18,734 kg). The engines for this version are designated PW123, and each engine produces 2380 SHP for take off.

### MSA features and performance

All Dash 8 aircraft are able to operate from short airfields, and at maximum weights and with all civil reserve factors included, the DHC-8-Q300 MSA requires less than a 1,300 m (4,270 ft) runway for take off and landing under standard (ISA) conditions. The MSA can operate for extended periods of time away from its maintenance base, and it is equipped with an Auxiliary Power Unit which facilitates operations from airfields with no external power and other ground support equipment.

In the tender documents, the SCG defined mission profiles for Environmental surveillance, Fisheries surveillance and Environmental – Search and Rescue missions that the new aircraft system had to meet. The DHC-8-Q300 MSA, fully outfitted as per the mission requirements, meets all of these mission requirements with significant margins.

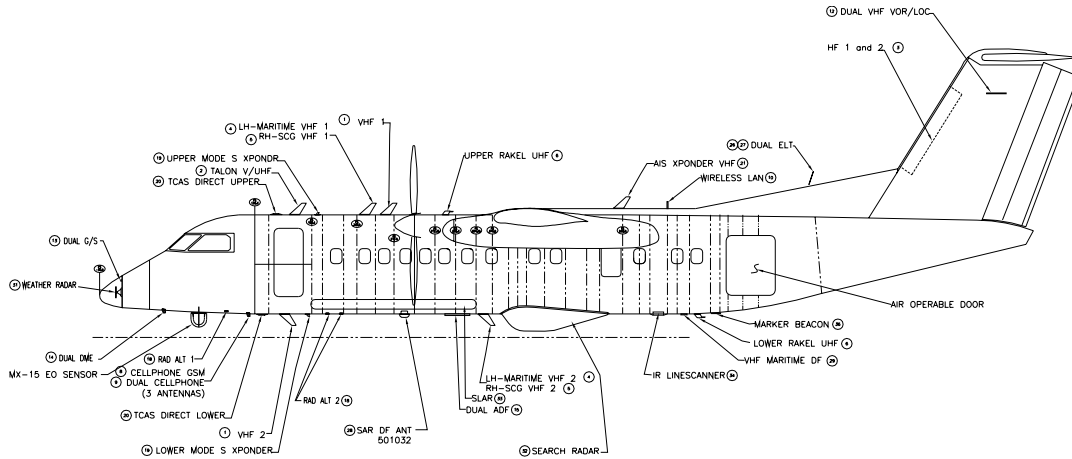


The DHC-8-Q300 MSA is equipped with long range fuel tanks integral to the wings. Full fuel capacity is 10,244 lbs (4,647 kg) which gives the aircraft a range without refueling in excess of 2,200 Nm (4,100 km).

In a low level surveillance role, the MSA can transit 200 Nm, descend to below 2,000 ft and fly a search distance of around 1,000 Nm before transiting 200 Nm back to base, Alternatively, the aircraft can transit and loiter at the same low altitude for around 7 hours over an area of interest.



It is also worth noting that the DHC-8-Q300 MSA's for the SCG can at any future date be upgraded to a higher maximum take off weight, which will give an additional payload capability of 1,700 lbs (772 kg)



One of the objectives for the Surveillance Aircraft within the SCG policy areas is to be an instrument in sea rescue actions, and to facilitate the immediate response and “first aid” action. The surveillance sensors and the speed of the DHC-8-Q300 MSA makes the aircraft capable of quickly finding small objects (life rafts, floats or persons ) in rough seas and to initiate the rescue action.

DHC-8-Q300 MSA will be equipped with “drop tubes” for flares as well as a large rear cargo door which can be opened in flight for dropping of life rafts and other survival equipment. Each MSA will normally carry two life rafts for air deployment on all missions, but this does not represent a limit to quantities that can be carried. Other types of loads, including paratroopers, can also be air dropped from the aircraft.

In the first aid role, the MSA can carry one or more stretchers as well as medical personnel.

### **Surveillance sensors**

The DHC-8-Q300 MSA's primary sensor for long range, large area surveillance and detection is the Elta EL/M-2022(V)3 maritime search radar. The antenna is installed in a radome underneath the center of the fuselage, thus giving the radar a full and un-obstructed 360° field of view. This radar is capable of detecting small targets in rough seas as well as larger targets at ranges up to 200 nautical miles when the aircraft flies at its maximum operating altitude of 25,000ft.



The EL/M-2022(V)3 search radar incorporates a number of electronic features that will assist the operator in detection, classification and tracking of all targets of potential interest. These include ISAR (Inverse Synthetic Aperture Radar) and size measurements which aid in target identification, SAR (Synthetic Aperture Radar) which greatly enhances the surface mapping capability, and MTI (Moving Target Indication).



To facilitate closer inspection of targets where such action is warranted, the MSA is equipped with a Wescam MX-15 Electro-Optic/Infrared Sensor (EO/IR) which provides stabilized day and night imagery. The EO/IR pod includes multiple cameras and sensors that will allow the SCG to positively identify ships and read ships names at long ranges under very low light conditions.



The EO/IR sensor is installed under the aircraft's nose section and has, similarly to the radar, a full and un-obstructed 360° field of view. The EO/IR sensor can be pointed to a target by the search radar, be manually controlled or be kept on a designated target via its own auto-tracking system. Images from the EO/IR sensor are annotated with position, time and other data that are relevant to further analysis and legal proceedings.

As is evident from the listing of aircraft system capabilities, the Swedish Government has placed a major emphasis on being able to quickly detect and map any pollution at sea. However, the Coast Guard's objective is not only to gather evidence, document and apprehend, but also to create an environment where pollution is reduced to negligible levels - since "would be" polluters will know they are under constant surveillance.

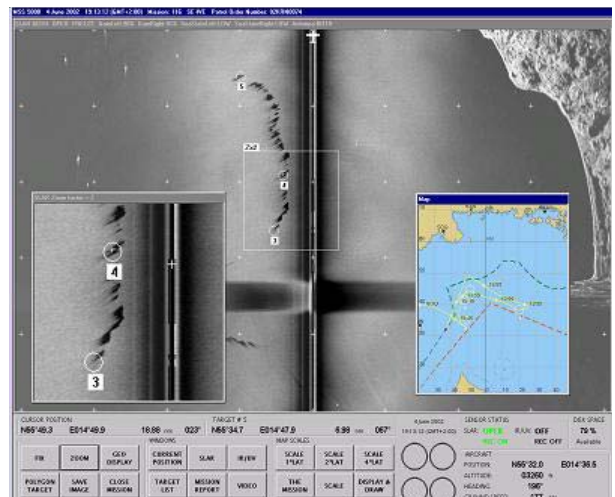
Gathering the necessary evidence will in many cases necessitate mapping and identification of environmental spills concurrent with monitoring and tracking ships in order for the offender to be pin-pointed and subsequently followed.

The Elta search radar can also provide extended pollution mapping capability using the Strip SAR mode (fixed antenna SAR mode on one side of the aircraft at a time). There is, however, a potential draw back with such combined use inasmuch as the radar has to rely on dead reckoning instead of active search in order to track a target while the antenna is fixed for the imaging (SAR) mode. This may result in lost target tracks, particularly in dense shipping lanes.

The solution to the SCG requirement was therefore to install a Swedish Space Corporation Side-Looking Airborne Radar (SLAR) system in addition to the 360° search radar. The SLAR is optimized for the detection of very fine details on the sea surface and provides excellent imagery for oil spill detection as well as information about currents and other phenomena affecting the capillary waves. With antennas on both sides of the aircraft, the SLAR compliments the search radar and facilitates high quality pollution detecting and mapping simultaneous with the search for and tracking of ships.

Another important tool in the fight against polluters is a small buoy that can be dropped from the MSA to sample and analyze the contents of a spill. The chemical “fingerprint” from the polluted waters can then be compared with residue in an apprehended vessel and provide positive proof for prosecution. To further enhance the Coast Guard’s ability to map, analyze and identify changes to the sea surface (whether caused by chemicals or by biological phenomena such as concentrations of algae), the DHC-8-Q300 MSA is also equipped with an Infrared/Ultraviolet (IR/UV) line scanner. In a spill situation, the UV portion of the scanner is used for area determination, while the IR portion is used for thickness estimation.

The MSA is also equipped with visual sensors that enhance the gathering of information inasmuch as pollution colour profiles from still and video cameras and images from the EO/IR turret can be captured, analyzed and stored. With this sensors suite, the DHC-8-Q300 MSA is capable of indicating the extent of most spills and pollution incidents, not only in terms of the affected area, but also in terms of an estimated volume.



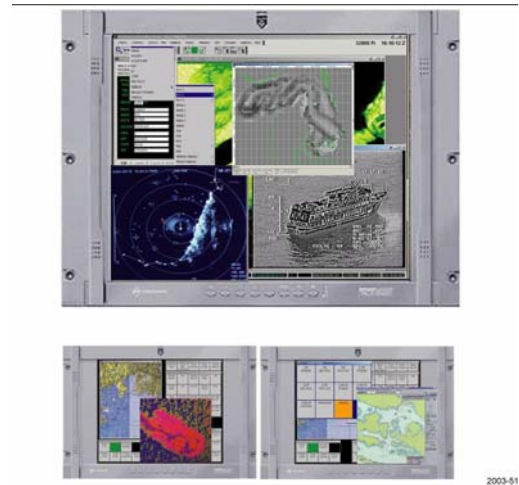
The aircraft's ability to accurately measure pollution thickness as it flies over an area can be further enhanced by installing supplementary equipment such as a Radio Wave Micrometer. The DHC-8-Q300 MSA has the space and the payload reserve to facilitate future growth in equipment and capabilities.

### **Display and Management System**

The DHC-8-Q300 MSA's will be equipped with three identical forward facing operator consoles for sensor controls and display. The Mission Management System (MMS), which is supplied by L-3 Communications – Integrated Systems, gives each operator a total mission view including MSA situation awareness, and provides task orders, coordination, evidence gathering and reporting.

Each console features a flat-panel tactical crew display, two Programmable Entry Panels (PEP), keyboard and trackballs. This gives each operator integrated command, control and display for all sensors, as well as capability for image capture and analysis, recording and playback.

The MMS is based on Commercial Off The Shelf (COTS) equipment and is Microsoft Windows based. It has resizable windows for video, images, text and multiple tactical situation displays, flexible operator control with touch panels, dialogue boxes and toolbars, and provides map and other databases.



### **Navigation and communications**

The navigation and communications equipment that is basic to the Dash 8 as a passenger aircraft is significantly enhanced for the Maritime Surveillance role. Each MSA is equipped with dual multi-mission Flight Management Systems that can fly the aircraft through a variety of mission search patterns, and an Inertial Navigation System provides secondary long range navigation input as well as the required stabilization for the radar system.



Additional surveillance equipment includes direction finding/homing for radio transmissions, covering all frequencies from Maritime bands to Search and Rescue.

The mission communications system provides voice and data capability and covers marine, land and air VHF frequencies, UHF and HF as well as Satcom, and the MSA's are equipped to be compatible with the next generation of the Swedish Coast Guard's own communications system



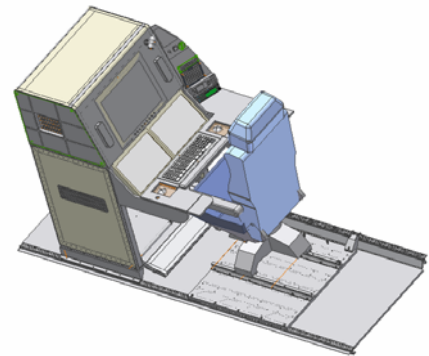
An Automatic Dependant Surveillance – Broadcast (ADS-B) system for the North Atlantic region will periodically transmit the position of the MSA via the aircraft's Communications Management Unit and the INMARSAT communications link, and this system can also provide the MSA with text weather uplinks.

### **Crew and Work Environment**

The DHC-8-Q300 MSA is equipped to carry a flight crew of two pilots and a mission crew of 3 operators and two observers. Additional seating is provided via a fold down seat in the cockpit, a fold down seat adjacent to the forward cabin entrance and a four person crew rest seating area in the forward cabin.

The prevention of human fatigue is of paramount importance for crew efficiency and awareness during long missions, and this requires that the MSA provides a good total work environment.

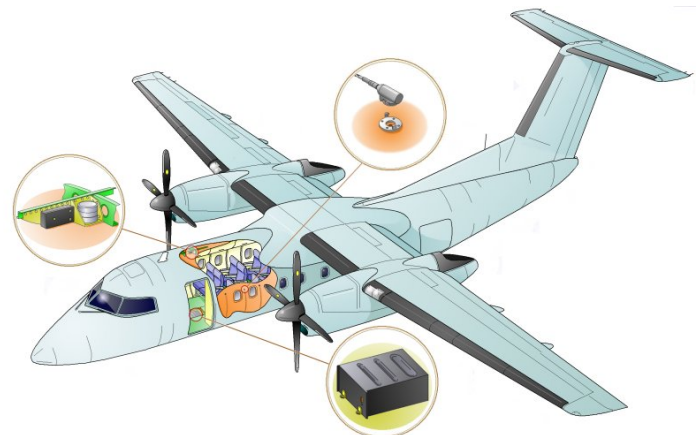
The Swedish Coast Guard set rigid requirements for the operator work station and made it a contract requirement that form and function be finalized with operator input. The result of this team work is an operator work area where the console has been designed around ergonomic considerations, and the operator seat can be moved in height and recline, can rotate, slide forward, aft and sideways and has adjustable lumbar support and armrests.



The same operator seats are also used for the mission crew observer stations.

Other crew amenities include an externally serviced toilet, warm water wash, and a full airline style galley with refrigerator. In the crew rest area, the seat backs can recline to 30° from the horizontal.

In some aircraft it is still difficult to achieve a satisfactory overall work environment due to vibrations and noise that are inherent to the aircraft itself, but that is not the case with the DHC-8-Q300 MSA.



The propellers on the aircraft are slow turning (typically 900 rpm during cruise), which keeps the external and internal noise levels down, and the Dash 8Q (Q for quiet) has another system that makes this aircraft uniquely suitable for long missions. This is the aircraft's Active Noise and Vibration System (ANVS), which works to counter and thus greatly reduce the noise and vibration that is traditionally introduced via aircraft propellers.

The result of this is a cabin sound level comparable to quiet jet aircraft, and when the Swedish Coast Guard examined the Dash 8Q during their tender evaluation process, it was concluded that the aircraft met all of the mandatory requirement and that the DHC-8-Q300 MSA would provide the low noise, comfortable work environment that is appropriate for a future generation aircraft system.

### **The Dash 8 Maritime Family**

The Maritime Patrol – or Maritime Surveillance variants of Bombardier’s DHC-8Q aircraft have been created by Field Aviation by adhering closely to our customer’s mission requirements. The fact that this product has been selected through several open tender / selection processes – attests to the competitiveness and cost efficiency of Field’s DHC-8Q MPA/MSA family.

The first DHC-8 Maritime Patrol Aircraft were developed in cooperation with National Jet System of Australia for the Australian COASTWATCH tender, and three aircraft have been in operation with Surveillance Australia since 1996. The fleet has grown to 5 aircraft, and accumulated close to 60,000 surveillance hours with each aircraft flying some 2,000 hours per year.



The DHC-8Q MPA is also in service with the United States Department of Homeland Security, Bureau of Customs and Border Protection. The first aircraft was modified by Field in late 2004 before going to ATK – Mission Research Integrated Systems in Fort Worth for installation of final sensors and the Integrated Sensor and Display System (ISADS). ATK is the prime contractor for this program which has 3 aircraft on firm order and a requirement for at least 9 more.



The Maritime Patrol Aircraft for the above two programs are based on the DHC-8Q Series 200 aircraft, which in the airline role typically carries 37 passengers. The larger DHC-8-Q300 MSA for the Swedish Coast Guard is natural growth version of the same family of surveillance aircraft, and there is a high degree of commonality in terms of structural modifications, systems and equipment.



The SCG's strong emphasis on environmental surveillance in addition to the more traditional search and monitoring of surface ships dictated the installation of SLAR and IR/UV scanner as well as search radar and EO/IR in these aircraft, and with consideration for future growth, the DHC-8-Q300, which is some 11 ft (3.4 m) longer than the Q200, became a more suitable platform for the Swedish application.

For further information regarding the DHC-8-Q300 MSA for the Swedish Coast Guard, the DHC-8-Q200 MPA's for Surveillance Australia or the U.S. Customs and Border protection, or regarding any other special mission aircraft requirements and modifications; please contact:



**FIELD AVIATION COMPANY inc.**

Business Development  
2450 Derry Road East, Hangar # 2  
Mississauga, On. L5S 1B2  
Canada

P: +1 905 676 1540

F: +1 905 676 0977

e-mail: [busdev@fieldav.com](mailto:busdev@fieldav.com)

[www.fieldav.com](http://www.fieldav.com)