Synopsis of Lecture to RAeS Loughborough Branch on 12th Oct. 2010

Nimrod MRA4 by Paul Grady, Nimrod MRA4 Chief Engineer, BAE Systems.

The Nimrod first entered service with the RAF in 1969. It was a new build development of the De Havilland Comet which had itself first flown in 1949. A number of these airframes were updated to MR2 standard from 1979, introducing additional equipment, coupled with a 50 fold increase in computing power.

BAE Systems were awarded a contract in December 1996 to deliver 21 Nimrod 2000 aircraft for service from 2000 onwards. Later a revised production contract for 9 aircraft, now designated the MRA4, was negotiated.

The MRA4 aircraft are required to provide capabilities to:

1. Conduct Anti-Submarine Warfare (this means that the MRA4 radar must be able to detect a submarine periscope at considerable range);
2. Conduct Anti-Surface Warfare;
3. Conduct Search and Rescue operations;
4. Protect the UK's Strategic Capability.

The significant features of the aircraft are:

1. Extended Range and Endurance over MR2, e.g. UK to Middle East with 2 hours on station;
2. Versatility;
3. Autonomous Operations;
4. Capability to Operate in a Hostile Environment.

Other roles include Homeland Security, Counter Terrorist Intelligence and Surveillance.

Its Command and Control features include a comprehensive Communications Networking and Relay Capability together with Real-Time Data Analysis and Decision Making.

The MRA4 aircraft is of all new construction except for the pressure fuselage which has been derived from retired MR2 aircraft. These fuselages were fully refurbished, in particular to treat all corrosion, before being accepted on to the MRA4 programme. N.B. The initial view was that, by basing the MRA4 aircraft on an existing airframe design, there would be considerable read-across in terms of its aerodynamic characteristics. This would in turn reduce the time and complexity of the development programme. In general this has not turned out to be the case.

The MRA4 aircraft has a complete new centre wing and wing box carry through structure, the former incorporating four new Rolls Royce BR710 turbofan engines. The wing has 20% increase in area over the MR2 and a 12ft increase in span. The fuel capacity has increased from 39 tons to 50 tons and the maximum take off weight has gone from 87 tons to 105 tons. The aircraft has new Flight Control and Utility Systems Management systems. The latter incorporates four separate computers and enables the aircraft to be operated by a two- rather than a three-man flight crew. In addition it has a new Autopilot and a Flight Deck incorporating the same displays as are used in the Airbus A320 aircraft. It has been the policy throughout the design of the aircraft to use the best of the existing systems available throughout the world thereby maximising reliability and minimising

risk. The various mission systems in the main cabin are operated by eight crewmen at the different stations.

It incorporates completely new mission systems compared with the MR2. These include:

1. Sensors (radar, electro-optic and acoustic) including the Thales Searchwater Radar;
2. ESM Pods, i.e. end of wing Electronic Support Measures pods to support tactical electronic intelligence gathering;
3. Defensive Aid System (including a capability to launch decoy flares to counter missile attack);
4. Magnetic Anomaly Detector to detect submarines when they are below the surface.

Each aircraft contains 6 million lines of software code which compares with 3 million in the case of the Eurofighter Typhoon aircraft. Despite this complexity of software, the software development programme has proceeded relatively smoothly.

It can carry a variety of stores, in particular, Harpoon, Maverick, AMRAAM, Storm Shadow, PGB's (Paveway Guided Bombs) and Stingray Torpedoes, utilising four wing pylons and the full length bomb bay. Sonar buoys can also be launched, either manually or automatically.

The aircraft has full UHF/VHF/Datalink and SATCOM connectivity, allowing full integration of all data as well as updating en route as required. .

Various development rigs were used during the development programme:

1. Iron Bird for all the mechanical systems including aileron actuators etc.;
2. Structural rigs for static and fatigue testing including stress to failure tests in the aircraft wings;
3. Weapon Systems Integration Rig to test the ability of the aircraft to operate the various weapon systems;
4. Flight Performance Assessment Rig to optimise the ergonomics of the flight deck and other crew stations.

In addition three development airframes were used to conduct Climatic (high temp, low temp) and Lightning testing. Other flight tests have included Icing, Polar Flight, Runway Performance, and Stores/DAS release.

The first production aircraft of the contracted nine, designated PA4, is now ready at Woodford for imminent acceptance.

Post Meeting Note: The Nimrod MRA4 Programme was cancelled in the Strategic Defence & Securty Review on 19th October 2010.