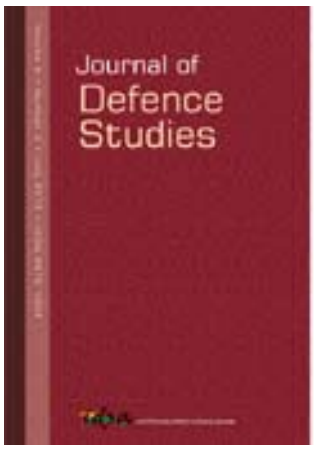

Transformation of Indian Naval Aviation Post New Inductions

Rikeesh Sharma

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The need for credible surveillance over the high seas forms the bedrock and foundation of infallible maritime security, and Maritime Reconnaissance (MR) is the basic input for any successful maritime operation. For the last two decades, Indian naval aviation assets have been dependant on the Ilyushin (IL), the Tuplov (TU) aircraft, the Kamov (KM) 31 and Unmanned Aerial Vehicles (UAVs). The Fleet Air Defence has also received a fillip by the induction of the MIG 29Ks. At the same time, the need for Long Range Maritime Reconnaissance (LRMR) tasking has taken a giant leap forward with the Indian Ocean becoming a common operational ground and a global common for numerous navies. The Indian Navy is looking ahead to work out an asset acquisition plan commensurate with the myriad challenges envisaged in providing maritime security to the nation. This article discusses these acquisitions and showcases their contribution in the broader context of the Navy's maritime strategic aim towards provision of maritime security.

Introduction

Some of the most demanding tasks in naval aviation are to be found in large multi engine aircraft. There is a special satisfaction, not unlike that experienced by the commanding officer of a ship, in directing the efforts of a crew of professionals to accomplish the most challenging mission-MRASW.

Wings—The Challenge

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The importance of air power in MR and in taking on the enemy sea fleet aerially has been tested to its limit right from World War II. The famous Battle of Midway, fought post the air strikes on Pearl Harbour by Japanese aircraft, also bears testimony to the efficacy of the Fleet Air Arm in countering enemy surface fleets. During the Midway campaign, countless sorties were flown to locate and destroy the Japanese aircraft carriers. The US Navy even managed to launch long-range bombers from their carrier decks to bomb Tokyo and broke the Japanese belief of Japan being an impregnable fortress. The irreparable damage caused to the Japanese Imperial Fleet during the Battle of Midway was 'the most stunning and decisive blow in the history of naval warfare.'[1]

The realization that sea supremacy can be established once air threats are ruled out was reinforced during the British Falklands Campaign in 1982. As the British Task Force sailed towards the Islands, the Argentine Navy was well aware that the centre of gravity of the British armada was the Royal Navy aircraft carriers carrying air assets like Sea Harriers and Sea Kings. Well within the range of shore-based Argentine Air Force fighters and bombers, the 20-odd Sea Harriers onboard the carriers had an unenviable task cut out for them to establish air superiority enroute to successful sea denial for the Argentine Navy. All this was in the face of the Argentine armed forces exploiting their ageing SP-2H Maritime Patrol Aircraft (MPA) to successfully track the British armada as it sailed towards the Falklands. However, the lack of suitable assets—submarines, ships or aircraft—did not allow prosecution of the armada at extended ranges. Had the SP-2H Neptune been armed with Anti-Ship Missiles (ASM), like the current breed of MPAs, the outcome of the Falkland war could have well been different. In fact, the Argentine MPA had to be withdrawn from the campaign midway due to airframe attrition, which further handicapped Argentine operations, reiterating the importance of the aerial force multiplier for the fleet.

While the Sea Harriers did a laudable job in taking on the Super Etenards, the A-4 Skyhawks, IAI Daggers, Canberras and Mirage IIIs that the Argentines flew against them, the lack of an air early warning aircraft and an MPA on the British side too buttressed the case of the MPA in fleet support. The MPA is an asset to the Fleet Commander as it can extend the reconnaissance/detection capability of the fleet manifold in all directions. If stationed along the anticipated threat axis, the MPA could actually allow the Fleet Commander to detect and track inbound air raids in real time. This functionality also correlates with the need

for credible surveillance over the high seas in the present geo-political scenario, which forms the bedrock and foundation of infallible maritime security.

Maritime reconnaissance is the basic input for any successful maritime operation and, needless to say, needs to be carried out diligently. For maritime forces to carry out their missions effectively, it is essential that the capability to monitor and gather maritime information in the assigned Area of Responsibility should remain readily available at all times. This real-time information can be gathered through a plethora of platforms like Space-based systems, long-range MPA, ship-borne systems, Airborne Early Warning (AEW) radars, Electronic Support Measures (ESM), UAVs, and various maritime and intelligence agencies.

For the last two decades, the momentous task of carrying out long-range reconnaissance over the high seas by Indian naval aviation assets has been met relentlessly by the Ilyushin (IL) and Tuplov (TU) aircraft. At the same time, the need for LRMR tasking has taken a giant leap forward with the Indian Ocean becoming a common operational ground and a global common for numerous navies. This has per force necessitated a look ahead for the Indian Navy to work out an asset acquisition plan commensurate with the myriad challenges envisaged in providing maritime security to the nation.

While the Indian Navy has augmented reconnaissance capabilities for the fleet by the induction of the Kamov (KM) 31 and the UAVs, Fleet Air Defence has also received a fillip by the induction of the MIG 29Ks and the soon-to-be-inducted Vikramaditya, their mother ship. Further, the fitment of the Sea Dragon Mission Suite on the erstwhile IL 38 post Mid-life Update has ensured that the platform will remain a potent force well into the twenty-first century. Similarly, with the TU 142M also reaching the end of their operational life, the Navy has contracted for 12 (eight plus option for four) P8I aircraft to replace the ageing LRMR aircraft.

I will now briefly discuss these acquisitions and showcase their contribution in the broader context of the Indian Navy's maritime strategic aim towards provision of maritime security.

IL 38SD[2]

The Ilyushin IL 38 is a long-range maritime patrol and anti-submarine aircraft designed by the Russia-based Ilyushin Aviation Complex.

Having evolved from the Ilyushin IL 18 turboprop transport aircraft, the IL 38 can be deployed in surveillance, search and rescue, maritime reconnaissance, and anti-submarine warfare operations. The aircraft can detect and intercept surface vessels and submarines, and its latest avatar is the IL 38SD boasting of the Sea Dragon (SD), a state-of-the-art mission system.

While Long Range Maritime Reconnaissance and Patrol (LRMP) in distant areas is the primary role of the IL 38SD, the aircraft can also be employed in the following roles:

(a) *ASV Role:* The aircraft is capable of launching Kh 35 Air to Surface Missiles to prosecute enemy surface combatants in the Anti-Surface Vessel role.
(b) *Search and Rescue:* The IL 38 aircraft is capable of dropping indigenous Rakshak life rafts to aid survivors from distressed surface vessels at sea. These rafts carry basic rations and can provide safety to survivors when dropped by the aircraft into the sea.
(c) *Limited Intensity Maritime Operations (LIMO):* In the present day scenario, the likelihood of participation of the Indian Navy in LIMO is very high. These operations are likely to be in the littorals, coastal regions and hinterlands. With the availability of features like the Synthetic Aperture Radar in SD1 (Sea Dragon 1), IR (Infra Red) and LLTV (Low Light Television) in SD5 and SD6 ESM (Sea Dragon 6 Electronic Support Measures), the IL 38SD can be deployed for search of hidden boats, personnel and even small war vessels in creeks and deltas.

These missions are facilitated in view of the following automated search and patrol mission capabilities available onboard:

(a) Accurate navigation
(b) Ability to track multiple targets
(c) Positive identification of targets
(d) Surface plot transfer
(e) Computerized weapon release
(f) Over the Horizon Targeting
(g) Strike homing
(h) Air-sub co-operation

The various sensor packages which enable the IL 38SD to accomplish all these mission requirements comprise the Sea Dragon Mission Suite (SDMS). The new fully digital mission system comprises high-resolution radar, under water acoustic processors, a magnetometer, computerized data busbars with integrated displays, thermal and infrared sensor imaging sub-system, an Electronic Intelligence (ELINT) system, and indigenous retro-fitments to enhance the overall potency of this aerial platform. The aircraft is also fitted with internal weapon cargo bays in the fuselage belly to carry torpedoes, PLAB 250 free-fall bombs, and various sonobuoys. The anti-ship missiles are carried under slung on the wings.

The following paragraphs discuss the various components comprising the entire sensor and weapon package fitted on board the aircraft.

Radar (SD1)

The SD1 Radar System is a multi-functional coherent phased array radar system, which can provide surface radar coverage, track multiple surface targets, snorting submarines and missiles, carry out Land Installation Mapping (LIM) for surveillance of shore installations, and build up Synthetic Aperture Radar (SAR) images of land/coast, and, finally, provide target imaging through Inverse Synthetic Aperture Radar (ISAR).

Radio Sonic System (SD2)

The SD2 Radio Sonic System is designed for processing and display of Hydro Acoustic Information (HAI) received from sonobuoys for the purpose of searching and tracking submarines and generating hydrological details of the area.

Magnetometric System (SD3)

The SD3 Magneto Metric System is designed for submarine search and tracking through the principle of Magnetic Anomaly Detection (MAD), by measuring the magnetic field of a dived submarine against the earth's magnetic field in the area of operations.

Control Computer System (SD4)

The SD4 Control Computer System (CCS) is intended for control over the components of the Sea Dragon Mission Suite (SDMS), for managing the data interchange between SDMS systems via Multiplex Data Buses (MDB), for processing and displaying the data coming from the SDMS

systems, for checking the SDMS for serviceability in flight and on the ground as well as for providing interaction between the SDMS and the IL 38SD aircraft avionics.

Infrared Television System (SD5)

The SD5 Infrared Television System (IRTV) is designed for both day and night surveillance of the sea surface within visible and infrared spectrum intervals to detect and identify surface objects.

SD6 ESM System and Radar Finger Printing System (RFPS)

The SD6 Electronic Reconnaissance System is designed for detection, direction finding, and measurement of parameters and identification of all intercepted electromagnetic emissions in tandem with the RFPS facility.

Trigun (AIS-MDA-Hurricane)

The fitment of Trigun (AIS-MDA-Hurricane) has enabled the IL 38SD to undertake Network Centric Operations by improving Battle Space Awareness and informed decision-making. The Maritime Domain Awareness (MDA) is interfaced with a host of onboard systems which include Global Positioning System (GPS), Automated Identification System (AIS)and High Frequency (HF) communication sets through Hurricane Interface Box (HIB) thereby enabling collation, display and real-time transmission of information about the maritime domain in the vicinity of the unit. AIS data comparison onboard the aircraft helps sanitize the plot and instantaneous data transmission also updates it at the Maritime Operations Centres (MOC) of the Navy.

The Genesis of the P8I[3]

Coming on to the next giant leap for the Indian Navy, the P8I is a logical technology step up from the older P3C Orions, and puts the strategic India-US partnership in its correct perspective. The new Boeing P8I aircraft is based on the 737-800 Next-Generation line and is a combination of 737-800 and 900 series components and performance characteristics. Being an aircraft which is a standard commercial offering the Boeing P8I shares considerable commonality with the Next-Generation fleet, with the avionics and navigation equipment on the P8I being the same as those of the 737-800 series.

There are a few structural modifications which change the normal Boeing 737 into a potent P8I. The major features are provision of wing weapon pylons and a weapons bay with bi-folding doors, which is capable of carrying torpedoes or depth bombs. Additional antennas for enhanced communication systems and sensors, three pneumatic release sonobuoy launchers in the aft of the aircraft, countermeasures dispensing systems against anti-aircraft missiles, a MAD boom in the tail of the aircraft, the Electro Optic Sensing Head and a completely revamped internal layout form part of the differences list. There are five mission workstations located on the port side of the fuselage with the forward fuselage housing the nose radome and the air-refuelling receptacle. The nose section has a strengthened 737 landing gear and would also house the P8I radar. The centre fuselage would include raked Boeing 737-900 wing tips which are being further strengthened for additional all up weight.

All these changes would enable the P8I to support the Indian Navy realize its vision of utilizing cutting-edge technology on aviation platforms to provide maritime security. Consequently, the operations which this new LRMR MPA could be tasked for can include the following.

(a) As a defensive role platform:
  (i) The P8I offers defensive assurance by controlling the seas, maintaining a forward presence and providing networked intelligence. This tenet is the area in which the P8I capabilities will be most utilized.
  (ii) LRMR, Anti-Submarine Warfare (ASW) and Anti-Surface Vessel strike (ASV) missions all support this objective by enhancing sea and littoral control.
  (iii) The reconnaissance of maritime areas requires the P8I to gather, process and disseminate vast amounts of data. The P8I provides these capabilities through a fully-integrated and open architecture mission system.
  (iv) In addition to onboard sensors, the P8I is interoperable with other manned/unmanned platforms, effectively extending its set of capabilities and reach.
  (v) P8I is an integral asset to support the projection of defensive assurance with an increased surge capability from home bases and forward deployment sites.

(b) As an offensive role platform:
   (i) P8I offers precise and persistent offensive power through ASMs to exert direct, decisive and sustained influence.
   (ii) The sensors and sub-systems that ensure success in ASW and ASV missions also enable the P8I to provide persistent intelligence, surveillance and reconnaissance, time-sensitive strike and information dominance.
   (iii) The P8I will prove to be a highly effective surveillance asset with the employment of Synthetic Aperture Radar/Inverse Synthetic Aperture Radar (SAR/ISAR), Electronic Support Measures (ESM), a robust self-protection suite and track management capabilities.
   (iv) The P8I's extensive communication suite ensures inter-operability with joint platforms and ground units.
   (v) It also serves as a long-dwell asset, capable of providing time-sensitive targeting data and delivering ordinance with devastating accuracy and power.

The P8I Mission System: Operational Concepts and Advantages

The P8I mission system is designed, first and foremost, to enable it to be the one of the most advanced ASW and ASV platforms for maritime dominance. An open, modular, and integrated architecture enables a multi-mission capability that allows this platform to excel in all required mission fields in support of joint forces, or to have the flexibility to operate in an autonomous role well in advance of other forces. In addition, the open architecture would imply easier upgrades and additions in the future.

The sensor suite of the MPA is designed to maximize performance for ASW and ASV, and provide the capability to accomplish its other primary and secondary mission areas. Some mission areas require the P8I to gather, process, manage, and disseminate tremendous amount of data. To do this, the Mission Computing and Display System's (MCDS) ample computing, storage and data transfer capability aids the crew to manage these resources with little effort. Within the core of the system, an impressive array of vital mission planning and analysis functions are programmed to aid the crew in the execution of their diverse missions.

The advanced communication suite of the P8I meets the requirement of executing operations and information exchange simultaneously. The

combination of sensor processing and robust communication makes the P8I a vital node in the network-centric Indian Navy of tomorrow. During ASW operations, the P8I is expected to conduct a multi-sensor prosecution led by its acoustic processing capability and supported by periscope detection functions of the radar, improved capabilities of its next-generation MAD system, and a highly accurate ESM system. For ASV operations, the P8I radar suite would serve as the primary search sensor, supported by its ISAR function, the ESM suite and Electro Optics for target identification and intelligence gathering.

Mission Capabilities

The P8I is expected to have sufficient time on task for ASW missions far out at sea without re-fuelling in a HI-LO-HI (High altitude ingress to operational area, Low altitude flight in operational area and High altitude egress from operational area) profile. The aircraft can operate at high subsonic speeds and altitudes which would allow for weather avoidance, threat evasion and better sensor performance. Additionally, low-level flight can be performed at the slow patrol speeds required to release sonobuoys and weapons. Adding to the advantages are the high-bypass engines of the P8I which allow fuel efficiency as good as that of a turbo-prop, even at low altitudes.

Another principal advantage of the P8I over existing maritime aircraft is its transit speed. Its higher transit speed also allows the P8I to enjoy a significant advantage in the fuel versus distance covered ratio, resulting in improved time on task at longer distances.

Role Equipment

An integrated and composite mission suite, quite on the lines of the SDMS on the IL 38SD comprising various sensors and role equipment, has been designed for the P8I. Looking at the vast multitude of functions envisaged in a multi-tasking role with numerous mission spin-offs by the P8I, the Mission Suite includes:

(a) The Maritime Patrol Radar (MPR)
(b) Sonic System
(c) Magnetic Anomaly Detector (MAD)
(d) Electronic Support Measures (ESM)
(e) Electro Optical Device/Forward Looking Infra Red
(f) Missile Approach Warning System (MAWS)

(g) Air Deployable Chaff and IR Flares
(h) Integrated Data Link
(i) Armament Package

KM 31 and UAVs

Fleet Air Early Warning got a shot in the arm with the induction of the Kamov 31 helicopters. Carried onboard the new stealth frigates of the Indian Navy, this helicopter is intended for long-range detection of air targets at all altitudes, ships, their tracking, and automatic transmission of their data to the command posts through a dedicated system. The helicopter has considerably increased the combat mission efficiency of the ships by providing them timely information about the position of the ships, fixed-wing aircraft and combat helicopters of the enemy force. In addition, the helicopter is also capable of carrying out Over the Horizon Targeting (OTHT) of enemy ships and vectoring of strikes by own aircraft.

Similarly, the induction of the UAVs has also been a huge success vis-à-vis intelligence gathering and maritime surveillance. The large loiter time of the UAV and her ability to take high-resolution pictures to support her radar pickups is an added plus point for the Fleet Commander. ELINT and Communication Intelligence (COMINT) facilities accord greater snooping prowess to these sentinels of the seas in the same manner as the LLTV and the Forward Looking Infra Red (FLIR) accord reconnaissance details and Battle Damage Assessment (BDA). The only operational limitations for the UAVs are weather, air space management and communication ranges with their control stations.

Future acquisitions in the UAV field for the Indian Navy ought to look for the utilization of armed UAVs or drones to prosecute inimical targets. Their acquisition and deployment would help cut down on the lead time between target detection, attack preparation process (targeting), and the actual execution of the attack. The advantage of having armed UAVs will give the Indian Navy an improved 'deadly persistence' capability, with the UAVs flying over a combat area night and day waiting for a target to present itself, complementing piloted strike aircraft. The weapons repertoire could cut a wide swath from Air to Air Missiles (AAMs) to Air to Ground (AGMs) to High-speed Anti Radiation Missiles (HARMs) and bombs for role diversity, and operations from aircraft carriers would further add to their overall lethality and utility.

MIG 29K

The Mikoyan MiG-29K is an all-weather carrier-based multi-role fighter aircraft developed by the Mikoyan design bureau in Moscow, Russia, and was developed in the late 1980s from the MiG-29M. The MIG-29K has features such as a multi-function radar and several new cockpit displays; the adoption of HOTAS (Hands-On-Throttle-And-Stick) controls; the integration of RVV-AE air-to-air missiles, along with missiles for anti-ship and anti-radar operations; and several ground/strike precision-guided weapons.

The aircraft has an enlarged and folding wing, a reinforced undercarriage and arrester hook, and a corrosion-protected reinforced fuselage for operations from an aircraft carrier. The MIG 29K could also offer a solution to the problem of a lack of aircraft carrier-based Airborne Warning and Aircraft Control System (AWACS) platform through further development of a dual-seat MiG-29KUB. The MiG-29KUB could increase its functions in areas such as electronic warfare by providing encrypted data links to permit networking of multiple MiG-29KUB aircraft for AEW coverage and long-range interdiction while carrying out Fleet Air Defence and surface attacks, both on water and land. They could also work in tandem with the naval light combat aircraft (LCA), once inducted, to provide layered air defence from far to near in an endeavour to safeguard the Fleet Air Space.

LCA (Navy)

The need of an indigenous combat aircraft was realized for two main reasons. The principal reason was the requirement to develop a replacement aircraft for the MiG-21 fighters of the Indian Air Force and the Sea Harriers of the Indian Navy. The LCA Navy has twin and single-seat carrier-capable variants and they are slated for deployment on the INS Vikramaditya as well as the Vikrant class aircraft carrier. The LCA Navy will be equipped for carrier operation with Short Take-Off But Arrested Recovery (STOBAR) system with strengthened airframe and landing gear, and a drooped nose for better cockpit vision. The LCA programme's other main objective was to advance India's domestic aerospace industry by not only producing aircraft but also by building a local industry capable of creating state-of-the-art products with commercial spin-offs for a global market.

The LCA design was finalized in 1990 as a small tail-less delta winged machine with relaxed static stability (RSS) to enhance manoeuvrability performance. Named Tejas, the aircraft has a delta wing configuration, with no tailplane or foreplane, and features a single vertical fin. The aircraft is an amalgamation of integrated technologies such as fly-by-wire flight control systems, advanced digital cockpit, multi-mode radar, integrated digital avionics systems, advanced composite material structures, and a flat-rated engine. Additionally, the Tejas is designed with 'relaxed static stability' for enhanced manoeuvrability and the flexibility of this design allows for a variety of guided air-to-surface and anti-shipping weapons to be integrated for multiple roles and accords multi-mission capabilities.

A Night Vision Goggles (NVG) compatible 'glass cockpit' dominated by a Council for Scientific and Industrial Research-Central Scientific Instruments Organization (CSIR-CSIO) developed indigenous Head-Up Display (HUD), three 5 inch by 5 inch Multi-Function Displays (MFD), two Smart Standby Display Units (SSDU), a 'get-you-home' panel providing the pilot with essential flight information in case of an emergency, an Elbit-furnished DASH Helmet-Mounted Display and Sight (HMDS), and HOTAS controls reduce pilot workload and increase situational awareness by allowing the pilot to access navigation and weapon-aiming information with minimal 'head down' time in the cockpit.

A Ring Laser Gyro based Inertial Navigation System provides accurate navigation guidance to the pilot. Other navigation aids include a GPS with the usual avionics suite of an Instrument Landing System (ILS) and a Ground Proximity Warning System (GPWS) based on the Terrain Referenced Navigation (TRN) system. Threat detection methods include a Radar Warning Receiver (RWR) and a Laser Warning Receiver (LWR). The LCA's self-protection Electronic Warfare (EW) suite is developed by the Defence Avionics Research Establishment (DARE) with support from the Defence Electronics Research Laboratory (DLRL). This EW suite, known as 'Mayavi', includes the RWR, a Missile Approach Warning System (MAWS), a Self-Protection Jammer (SPJ), LWR and a chaff/flare dispenser.

Target acquisition is accomplished through a state-of-the-art coherent pulse-Doppler Multi-Mode radar designed to track 10 targets with simultaneous multiple-target engagement. The target acquisition is also supplemented by a laser designator pod and a FLIR to provide accurate

target information to enhance kill probability. The LCA also has secure and jam-resistant communication systems such as the IFF transponder/ interrogator, VHF/UHF radios, and air-to-air/air-to-ground datalinks. The ADA Systems Directorate's Integrated Digital Avionics Suite (IDAS) integrates the flight controls, environmental controls, aircraft utilities systems management, stores management system (SMS), etc., on three 1553B buses by a centralized 32-bit, high-throughput mission computer.

The Naval Prototype flew its maiden sortie on 27 April 2012 at Goa and is expected to join service by 2014. Along with the MIG-29s, they are expected to perform a critical role in layered air defence of the Indian Carrier Strike Group (CSG), while performing additional roles, such as like anti-ship strikes, limited aerial reconnaissance, communication link, and aerial photography.

Impact on Naval Operations

All these strands point to the central motif that the Indian Navy is keeping pace with emerging technology and her aviation inductions are on track. The P8I will be a futuristic LRMP Aircraft and is likely to become the Indian Navy's maritime reconnaissance mainstay along with the IL 38SD. The KM and the MIG-29K too hold promise and are poised to become a formidable team once INS Vikramditya is operationalized, as the Indian CSG will then boast of state-of-the-art eyes, ears and teeth.

On the MR front, the P8I is different from other aircrafts in production today and its impact on naval operations is likely to shape India's maritime security in more ways than one. It is for the first time that the Americans have developed an aircraft which can virtually take-off, fly to the area, carry out search, under take drops of both weapons and stores, and return to base with a pre-programmed mission fed into the MCDS. Even the P3C Orion, with its sensor capability similar to the P8I, does not have this feature. This would also accord greater freedom to the planners, who can now weave in last minute details into the wider tapestry at the base before briefing the crew. Previously, aircraft were launched on intel received much earlier in the strategic timeline.

The technological impact of a robust open architecture of a MIL (Military) standard data busbar, capable of interfacing and overlaying data from the various sensors, would imply easier upgrades and multiple supplier options for the MIG-29K, the IL 38SD and the P8I. The

mission crew would, therefore, have a complete tactical picture, with the flexibility to operate any sensor from any station on the two MPAs, and would give unmitigated flexibility of operating any combination of sensors depending on the mission.

Faster transit speeds of the P8I would provide smaller areas of uncertainty and increased probability of detection. Greater operating radius and increased time on task allows for more base location options. Further, the P8I, being a derivative of the commercial Boeing 737-800, has a proven reliability up to 99.97 per cent, making the aircraft available virtually 24×7, 365 days a year with a requirement of limited maintenance support. The Ground Support Equipment (GSE) is standard for the P8I making deployments much simpler with no requisition for AN-32s or IL-76 for load lift requirement. Being part of the Boeing 737 family, the P8I boasts of an existing worldwide operational logistics support system with a large pool of spare parts, worldwide repair capabilities, and the synergies of large commercial and military fleets.

The versatility of the new aviation inductions will allow the aircraft to carry out almost all the missions that any Fleet Commander's wish list would contain. The ability to track and destroy inimical elements at large distances from the fleet would only increase the fleet's strategic deterrence value. The ability of the two MPAs to take on any ASW threat with the availability of a diverse and varied combination of Low Frequency Acquisition and Ranging (LOFAR)/Directional Frequency Analysis and Recording (DIFAR)/Directional Command Activated Sonobuoy System (DICASS) sonobuoys on a single platform provides a wide spectrum of coverage. This will increase the Fleet's distant search and monitoring capability, not just in size of buoy field but in ranges of pick-up as well. These sonobuoys can be remotely controlled pre and post deployment to change the hydrophone depth, channel number and, most importantly, switching on or off the buoy to enhance its life.

All these will have a positive effect on fleet operations and holistically impact naval operations to provide greater maritime strategic gains and security in the IOR and designated areas of operations. The indigenous private sector has also proved to be a boon in the development of systems fitted onboard these new inductions and has successfully married Western and Russian technology, especially on ESM equipment. However,

requisite infrastructure in the form of laboratories and hangars would need to be given due weightage to ensure longevity of service of the newly-inducted assets. Investment in real-life simulators would be prudent as they would not only save valuable airframe hours and aircraft availability, but would also ensure safe training for aircrew and maintainers without compromising the aircraft.

The Indian Navy would also need to look at the ratio of the number of assets required versus the number of assets held in order to ensure maritime security. Leading navies of the world such as those of the US and Japan hold a ratio of 5:1 for air assets versus surface vessels in order to ensure the security of their maritime areas. Large numbers of air assets would be required for surveillance and ASW in the littoral regions in the IOR and beyond. The Indian Navy would need to build up an enviable inventory for the same to warrant a semblance of security in its areas of interest.

A bigger challenge for the Indian Navy would be the optimum absorption of the new technology which accompanies these new inductions. Six level depth data cards, new maintenance schedules, complex circuitry, advanced avionics, and critical sub-systems are the tip of the iceberg and need a revolution in the current practices followed. Central warehousing, inter-connectivity between the various material organizations to optimise the benefits of equipment commonality do exist intra-Navy, but now will need to be extended to the private sector too as outsourcing and private sector involvement in the defence sector increases. Performance Based Logistics (PBL) yardsticks would need to be applied ruthlessly to arrive at the best alternative and in choosing the right option. A radical mindset change would be required to ensure that the advantages of a new aviation fleet are not frittered away.

Identification of future assets could well afford to take a close look at the V-22 Osprey, an American multi-mission, military, tilt-rotor aircraft with both a Vertical Short Take-off and Landing (VSTOL) and Short Take-off and Landing (STOL) capability. It is designed to combine the functionality of a conventional helicopter with the long-range, high-speed cruise performance of a turboprop aircraft. Most Osprey missions use fixed wing flight 75 per cent or more of the time, reducing wear and tear on the aircraft and reducing operational costs.

The Osprey could be used in an AEW or ASW, or troop-carrying role to improve the capability and reach of the fleet at sea. In terms of

weight, cargo, distance or speed (it can travel twice as fast and three times farther than any existing medium-lift utility helicopter), the Osprey can be a vital game-changing force multiplier when employed for effecting maritime/amphibious manoeuvres from the sea as well as for high-altitude, all-weather air assault, Special Forces operations, aerial logistics, and casualty evacuation. Operations of the Osprey from the aircraft carrier would serve to make the CSG more powerful while amphibious assaults from Landing Platform Docks (LPDs) will also have more teeth.

The Indian naval aviation stable could also benefit from looking at the Japanese Maritime Self Defence Forces (JMSDF), wherein their marine element is using amphibious aircraft quite profitably. The procurement of an amphibious aircraft like the ShinMaywa US-2, currently operated by the 31st Fleet Air Wing from the Iwakuni and Atsugi Air Bases, would help the Indian Navy enhance her search and rescue capabilities in addition to providing logistic support to the Fleet at large distances and in fire fighting. The Bombardier 415 and the Beriev Be-200 could also be compared in this field to arrive at the best aircraft option.

Finally, strategic alliances with neighbouring island countries and coastal states would also help in increasing the range of the aircraft manifold. While the airstrips at Diglipur, Car Nicobar and Campbell Bay can support forward area operations and the subsequent extending of reach, a strategic and tactical tie-up with the Maldives for using the Hulule and Gan airstrips would ensure the Indian Navy's MPA operations extending up to the coast of Africa and beyond, with good time on task (TOT) or loiter time. A tie-up with Seychelles would enhance the reach further and bring India to the fore on the world stage.

Conclusion

As the Indian Navy progresses from a platform-centric philosophy of operations to becoming network-centric, the presence of new technology will bring synergy to the application of the nation's maritime might. All of what the aircraft sees or hears would be transferred through data link on the a/c at the click of a button across the vastness of the IOR simultaneously to the commanders and to planners ashore. With the punch that the new inductions will be capable of delivering, they will pose a serious and real threat to an adversary at sea.

The IOR is a vast expanse of area to cover and the associated naval operations will need to exploit air assets optimally to cover the Areas of Responsibility. The Indian Ocean Naval Symposium (IONS) initiative could be tapped to strategically enhance reach through Operational Turn Round (OTR) in distant IOR countries. Basing, maintenance, infrastructure support and training will form distinct challenges which can be met through modern-day management practices.

The strong indigenization elements in the new acquisitions augur well for the operational readiness of the Indian Navy, which will no longer be a prey to international sanctions and politics as was the case with the Seakings in 1998 (post-Pokhran II) with the US actually pulling the strings on the UK, the Seaking original equipment manufacturer. Diligence and patience have seen Indian avionics and systems come of age and their contribution is only going to increase in the future. The indigenous systems onboard the P8I suite are custom-made and their integration can be done without going back to Boeing.

The new acquisitions along with their mission suites and network-centric connectivity are going to revolutionize the existing skewed weapon versus ship borne sensor ratio and contribute extensively towards ensuring maritime security in the IOR. The Indian Navy has come of age and has kept pace with technology in all three dimensions of sea-borne operations to make sure that the security of India's maritime legacy is not compromised. It is hoped that the same sagacity and tactical acumen will continue to guide the Navy further in the years to come.

Author's Note

The author is a naval aviator with nearly 4,500 hours of flying experience. He has nearly 2,500 on the IL 38SD aircraft and was closely involved in its Mid Life Update. While an attempt has been made to keep the article current with information sourced from the open domain, the requirement to keep doctrine and technical equipment information uncompromised has been given due credence. This could lead to some gaps in the explanation of air assets exploitation for which the author renders his apologies.

Notes

1. Keegan, John, The Second World War, New York: Penguin, 2005, p. 275.

2. The information disseminated in the ensuing paragraphs is based on the author's interaction with the scientists of the Ilyushin Design Bureau, Zhukovsky, Moscow, and the Leninets Design Bureau, St Petersburg, Russia.
3. The information in the succeeding paragraphs has been sourced from the author's interaction with Boeing researchers in New Delhi and Boeing company literature.