SP's
AN SP GUIDE PUBLICATION
KEY OFFICIAL MEDIA PARTNER

Special Supplement

Aero India 2013

We are at Hall B, Booth 4.18

ATTACK HELICOPTERS

www.spguidepublications.com
www.spsmilitaryyearbook.com
www.spsaviation.net
www.spsairbuz.net
www.spslandforces.net
www.spsnavalforces.net
www.spsmai.com
www.spsshownews.com

HAVE BEEN HONOURED TO SERVE THE INDIAN PEOPLE.

AND THE INDIAN AIR FORCE.

60
YEARS
OF SERVICE

Rafale at Aero India 2013

60 YEARS. 5 AIRCRAFT TYPES. 1 NATION.

TOOFANI I MYSTERE IV I ALIZE I JAGUAR I MIRAGE 2000

RAFALE INTERNATIONAL

DASSAULT AVIATION • SNECMA • THALES

www.rafale.co.in

Content

SP's Special Supplement
AN SP GUIDE PUBLICATION
Aero India '13

IAF's transport aircraft:
Lockheed Martin C-130J Super Hercules

COVER PHOTOGRAPH: AH-64 APACHE TWIN-ENGINE ATTACK HELICOPTER

SP GUIDE PUBLICATIONS PVT LTD
A-133 Arjun Nagar,
(Opposite Defence Colony)
New Delhi 110 003, India.

Tel: +91 (11) 24644693,
24644763, 24620130
Fax: +91 (11) 24647093

Email: guidepub@vsnl.com

REPRESENTATIVE OFFICE
204 Jal Vayu Vihar
Kalyan Nagar
Bengaluru 560043, India.
Tel: +91 (80) 23682204

www.spguidepublications.com

THE ARMED FORCES of India are on an unprecedented modernisation drive and particularly of their aviation assets. Leading this ambitious forward march is the Indian Air Force (IAF) that is undertaking comprehensive revamp of aviation assets across the board. The ongoing programmes include upgradation of the third-generation fighters such as the Mirage 2000, MiG-29 and the Jaguar, augmentation of capability through induction of a new fourth-generation combat fleet and the joint development as well as production in India of a fifth-generation fighter aircraft (FGFA). By the beginning of the next decade, the IAF plans to enhance its strength of combat squadrons from the current level of 34 to 42. The ultimate objective is to have a fighter fleet of 45 squadrons to cope with the demands of simultaneous conflict on two fronts. Induction of modern combat platforms will necessarily be accompanied by new and sophisticated weapon systems currently not available on the inventory of the IAF.

The transport fleet is also being transformed through the induction of Boeing C-17 Globemaster III, strategic airlift aircraft and Lockheed Martin C-130J. A 20-tonne payload capacity twin-engine transport aircraft is also under development by the Hindustan Aeronautics Limited (HAL) in collaboration with Russian companies. Dubbed as the medium-tactical transport aircraft (MTA), this aircraft is meant to replace the fleet of An-32 aircraft that have already been overtaken by obsolescence. Also on the cards is the new requirement of 56 medium tactical transport aircraft to replace the fleet of Avro aircraft of the IAF. About ₹12,000 crore have been earmarked for the project and a request for proposal (RFP) is expected to be issued soon.

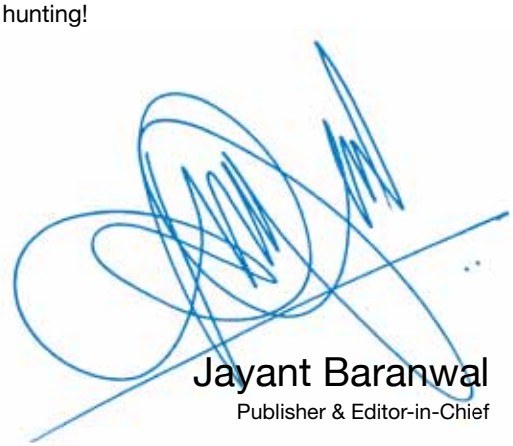
Apart from fixed-wing platforms, the IAF is going in for extensive modernisation of its airfield infrastructure including radio and navigational aids. This should have considerable potential for companies venturing into aerospace regime.

In the rotary-wing arena, following government's sanction for the Indian Army to have their own attack helicopters, fresh demands are likely to emerge in the near future. The Indian Navy is also looking for replacement of their ageing Sea King fleet. Lt General (Retd) B.S. Pawar has a detailed coverage of the ongoing programmes for rotary-wing in the three services. The author also looks at future developments on this field. Similarly, Air Marshal (Retd) Dhiraj Kukreja and Wing Commander (Retd) B. Menon survey the requirements of platforms and weapon systems that the IAF would need if it is to remain a power to reckon with. Even though some big-ticket purchases have already been decided, Aero India would still have a lot to offer especially in the regime of opportunities generated by the humongous offset obligations that will follow the deals concluded in the recent past.

Hopefully, Aero India 2013 will provide new windows of opportunity for not only the three services to attain their objective of complete transformation over the next decade, it should have lucrative business potential for the Indian aerospace industry both in the public and private sector.

Welcome aboard and do visit us at Aero India 2013; Hall B: 4.18.

Happy hunting!



Jayant Baranwal
Publisher & Editor-in-Chief

Beechcraft Air Ambulance.
Dispatch reliability saves lives.

Air Ambulance Aircraft That Make All the Difference.

It's a mission as critical as life itself. And Hawker Beechcraft is there, with air ambulance configurations to deliver medical attention and evacuation wherever and whenever they're needed.

Speed, range, payload and multi-engine safety provide mission flexibility. Beechcraft aircraft have large, air conditioned, pressurized cabins that give medical crews a comfortable environment to provide life-sustaining critical care. The aircraft interiors are customizable for dedicated or temporary ambulance configurations – with dual medical sleds and specialized equipment storage cabinets.

When the mission is critical, the right decisions can make the difference.

Mission Ready.

For more information please contact: India +91 98 7138 2233
or email: explore@hawkerbeechcraft.com

Hawker Beechcraft
SPECIAL MISSIONS

HawkerBeechcraft.com

Flying Through to the Centenary

Currently, the IAF is embarked on a comprehensive modernisation drive to significantly enhance all facets of capability through a string of new acquisition and upgrades

By Air Marshal (Retd) Dhiraj Kukreja

IAF's future refueller aircraft: Airbus A330 MRTT

PHOTOGRAPH: AIRBUS MILITARY

THE INDIAN AIR FORCE (IAF) has come a long way from its humble beginnings to becoming a strategic force today with tremendous potential to deter adversaries. Currently, the IAF is embarked on a comprehensive modernisation drive to significantly enhance all facets of capability through a string of new acquisition and upgrades. Its long-term perspective plan (LTPP), based on the perceived security challenges up to the end of the Fourteenth Five Year Plan indicates that it will progressively build its strength and capability to face a two-front war. It aims to possess a credible airlift capability with extended reach and ability to deploy Special Forces. It will continue to maintain a combat fleet strength of 34 squadrons through the Twelfth Five Year Plan, reaching 42 squadrons by the Fourteenth Five Year Plan and hopefully touch 45 squadrons by the centenary year of 2032.

Combat Aircraft

As part of the modernisation programme for the combat fleet which is the sharp end of the IAF, the Mirage 2000, Jaguar and the Mig-29 fleets are being upgraded to meet the needs of the future. The IAF is also keen for a replacement for the five-squadron fleet which has been overtaken by obsolescence. The choice for the medium multi-

Embraer has delivered the first: AEW&C aircraft to India

role combat aircraft (MMRCA) has been narrowed down to the Dassault Rafale and is in the final stages of contract negotiations. The contract was to be signed in the current fiscal but with the cut in the budget announced recently, finalisation of the contract may be pushed to the next financial year. The first batch of aircraft would then be inducted in service with a slight delay from the initial schedule of late 2014, to remain flying for the next 40 years. Including in the list of multi-role platforms, the IAF has also decided to increase the size of the Su-30MKI fleet and build up to a strength of 15 squadrons.

With a view to induct fifth generation technology with stealth and swing role capability, India has entered into an agreement with Russia for the joint development of a fifth-generation fighter aircraft (FGFA), a twin-seat derivative of the PAK-FA T-50. The FGFA programme is progressing well and the first prototype is likely to be delivered in India next year followed by two more prototypes subsequently in 2017 or a little later. By the end of the Fifteenth Five Year Plan, it is expected that the IAF inventory would largely comprise fourth- and fifth-generation combat aircraft.

Phasing out of the MiG-21, which commenced some years ago, will continue and is likely to be completed by end 2013 barring a few MiG-21 Bison which will continue in service for a few more years.

The indigenous light combat aircraft (LCA) Tejas is yet to achieve final operational clearance (FOC), leading to a delay in its induction. This aircraft to be fitted with the GE-414 engine to exploit its full potential is expected to serve the IAF till its centenary year.

Transport Aircraft and Helicopters

Apart from the combat element of the IAF, there is a special focus on the strategic reach capability too. With the bulk of the transport fleet being almost three decades old, there was an urgent need for new acquisitions. The first step towards modernisation was taken by the induction of the state-of-the-art C-130J Super Hercules four-engine turboprop aircraft. Six of these were procured initially and a follow up order for another six have been placed. This fleet is meant to provide the reach and delivery capabilities of the Special Forces. These aircraft also fill the gap in the medium-heavy category, resulting from the phasing out of the An-12 fleet in the late 1990s.

The IL-76 strategic airlift aircraft has performed well since its induction in the IAF. It may still have a few years of service life but it cannot be ignored that the aircraft is ageing. IAF has done well to induct the C-17 Globemaster III, which as a 75-tonne payload capability and trans-continental range. Ten of these have been ordered with the first likely to be delivered sometimes this year and the delivery is to be completed in 2014. There is also likelihood of the IAF ordering additional six to ten aircraft, which if procured, would make it the largest C-17 operator outside of the US. The aircraft, with its capability of operating from high-altitude airfields in hot weather conditions, will provide the long required means to shorten the effective deployment timelines, both inter-theatre and intra-theatre, besides giving the flexibility of response at the national and international levels.

The more than 100-strong fleet of An-32 with five-tonne payload capability inducted in the mid-1980s has been the workhorse of the IAF. The fleet has been given a fresh lease of life with a mid-life upgrade and will see the IAF through to the centenary year of 2032. It is planned to be supplemented and in due course replaced by a 100-seater multi-role transport aircraft (MTA) that is being developed as a joint venture with Russia. This 15 to 20-tonne class aircraft is expected to meet the tactical requirements of the air forces of Russia and India. A civil version will also be produced for the domestic and export markets.

PHOTOGRAPH: EMBRAER

The Ministry of Defence has recently approved a replacement for the HS748 Avro aircraft procured in the mid-1960s from the UK. For the first time, the Hindustan Aeronautics Limited (HAL) is not being involved as its order-books are already overflowing. The selected original equipment manufacturer will chose either a public or a private sector company as its partner and will provide a tremendous boost to the domestic aerospace sector. The light-weight Do228 Dornier produced by HAL is likely to continue in service as a communication and training aircraft, as the IAF has ordered an additional 14 of these.

The strength of the helicopter fleet is also slated for an increase. In the indigenous segment, induction in large numbers is under way of the advanced light helicopter Dhruv, its weaponised version, the Rudra, the newly designed light combat helicopter and the light utility helicopter. The IAF is also inducting the AH-64D Apache attack helicopter, the CH47F Chinook heavy-lift machine and the Augusta AW101 for VIP use. In addition, 80 MI-17V5 medium-lift helicopters are also under procurement and the global tender for 197 light-utility helicopters is expected to be finalised soon. With the numbers being ordered and an option for "more of the same", the fleet will have a varied inventory of Russian, American, European and indigenous helicopters to see it through to the centenary year.

IAF's choice for MMRCA:
Dassault Rafale

PHOTOGRAPH: DASSAULT AVIATION

Other Acquisitions

The IAF has paid attention to other areas as well, where new acquisitions or upgrades would take it to the end of the Fifteenth Five Year Plan (2032). The modernisation programme includes trainer fleets, force multipliers, an updated air defence system and modernisation of airfield infrastructure. The IAF has already ordered the PC-7 Pilatus as the replacement for the HPT32 basic trainer. On induction, hopefully by mid-2013, the option for more aircraft will be exercised to have the same aircraft for the Stage-II training as well, since the HJT16 Kiran is ready to be phased out after serving in the IAF for more than four decades. Besides, the time frame for the availability of the HAL-designed intermediate jet trainer is uncertain. After the initial teething problems, the BAE Hawk132 advanced jet trainer (AJT) fleet has stabilised and will definitely see the IAF through to the end of the Fourteenth Five Year Plan and even beyond.

A gap-free radar cover for the Indian air space will be in place with the induction of new radars and aerostats to replace the legacy systems. Radars of different types, some indigenous, are in the process of being acquired, with a few already having been delivered. The IAF was the first in the region to acquire three airborne warning and control system (AWACS) aircraft. While the case for another three aircraft is being progressed, IAF is also going ahead with the procurement of a different airborne early warning and control (AEW&C) system based on the Embraer 145 aircraft. Apart from these, the number of unmanned platforms (UAVs) will also be continuously increasing for tackling varied threats that are envisaged in the future.

The case for additional flight refueller aircraft (FRA) after the initial three, has been cleared, with the IAF opting for the Airbus A330 MRTT. With such high-technology aircraft and weapons, the IAF is also focused on upgrading its operating environment at the airfields with the state-of-the-art navigation and avionics systems and seamless integrated communications for effective air defence command and control. The IAF will also acquire a platform in the fourth dimension space, with a dedicated satellite for itself.

Budgetary Support

The LTPP of the IAF has been integrated with those of the Army and the Navy in the long-term integrated perspective plan (LTIPP) and accepted by the government. Though acquisitions have already commenced, there are roadblocks in the modernisation programme such as the recent budget cut of ₹10,000 crore. Hopefully, adequate budgetary support would be available in the years to come through to the Fourteenth and Fifteenth Five Year Plans for the programme to stay on track. The IAF may have its wish list, but the budget must provide for at least the next decade, if not more, for plans to transform into reality. ■

Total solutions. It's in our DNA.

Our world-leading solutions meet your most demanding requirements in space, in the air, on land and at sea. We aspire to redefine adaptability, performance and reliability, for today and tomorrow, to fulfill our dream of a safer and secure world.

SEE US AT
AERO INDIA 2013
Israel Pavilion, Hall A

IAI

Israel Aerospace Industries | E-mail: corpmkg@iai.co.il | www.iai.co.il

PHOTOGRAPH: IAF

IAF's Combat Power

Multi-role fighter: Su-30MKI

The IAF of the future would need certain assets and capabilities in terms of quality and quantity. Training and planning to utilise these assets optimally would also be an essential prerequisite. No combat force has ever had enough of assets to fully satisfy its commander. Courage and innovation can increase effectiveness of a combat force but cannot replace training and hardware.

By Group (Retd) Captain B. Menon

THE WORLD OF technology is evolving at a pace unthinkable two decades ago. This article will focus on the demands likely to be placed in the years ahead on the Indian Air Force (IAF) and the tools required to meet this challenge. The thrust will be on combat aircraft which would include weapon delivery platforms.

Tasks for the combat fleet of the IAF are as follows:

- **Control of Airspace:** Control of the air over the area of interest is a primary responsibility of air power and an important prerequisite to influence the outcome of military action on the surface, on land or over the sea. Control of airspace is defined as favourable air situation, air superiority or air dominance depending on the degree of control surface forces require.
- **Operations against Surface Forces:** Influencing the outcome of the land or sea conflict by neutralising enemy forces engaged in such operations, isolating them and denying them the logistical wherewithal to conduct effective operations.
- **Attacks on Key Assets:** Destabilising the enemy by attacks on his centre of gravity, be it economic, political, infrastructure or sources of materials, thereby degrading his

One Source-Weather/Search and Rescue Radar

Indian Air Force Standard High-Performance Weather Avoidance

RDR-1600

- Over 9,000 Systems in Operation Worldwide
- Proven High Performance
- Enhanced Mission Effectiveness and Efficiency
- We are Search and Rescue Radar Experts

Mahindra TELEPHONICS

Mohit Garg, Land line: +91-11-41220402

38039-4

Enormous potential: Dassault Rafale

ability to continue the war.

- **Direct Support to Surface Forces:** Supporting land and naval forces in their operations by using offensive air power against deployed enemy forces.
- **Deterrence:** Deterrence to convince the enemy that use of military options will be unworkable and counterproductive in achieving his aim.
- **Reconnaissance:** All these aspects require knowledge of the enemy, surveillance and reconnaissance to acquire information and knowledge about the enemy.

Tools Required

In order to undertake these tasks effectively, the IAF of the future would need certain assets and capabilities in terms of quality and quantity. Training and planning to utilise these assets optimally would also be an essential prerequisite. No combat force has ever had enough of assets to fully satisfy its commander. Courage and innovation can increase effectiveness of a combat force but cannot replace training and hardware.

Reconnaissance: Unmanned aerial vehicles and space-based systems are increasingly taking over this role. Using such systems in peacetime gives the option of plausible deniability and avoidance of having own personnel fall into enemy hands. High-flying and long-endurance platforms with low radar and thermal signatures are more cost-effective than manned aircraft. Our reconnaissance assets need to be built around such platforms. UAVs are also vital tools in counter-insurgency/militancy operations where real-time intelligence is essential. This is relevant to our land borders, coastal areas and insurgency prone areas especially in peacetime.

Air Space Domination: Long-range fighters with long-range air-to-air missiles are the first part of an air dominance system. These should have high speed capability to reduce reaction time and also super cruise capable engines so that high speed transit is possible. Modern fighters being larger, they would need some form of stealth with enclosed weapon bays to reduce radar cross section, exhaust masking and low observable exhaust trails. Target identification and guidance systems for these fighters are the second part. Airborne warning and control system (AWACS), aerostats and ground-based radars, the latter two being more effective over own airspace, are preferred over the air search and intercept radars of the fighters themselves to avoid premature detection and subsequent targeting of the attacking aircraft. Transfer of data over secure links to pass on target information and post-launch guidance for radar guided missiles need to be provided by the independent radar platforms to make such weapons truly fire-and-forget as far as the fighters are concerned. Missiles with active radar seekers and independent of external guidance at closer ranges are an asset. Optimal employment of such aircraft is at long ranges to utilise their full potential and to prevent them from getting into visual air combat situations where small size, agility and numbers count. This requires depth of airspace. In this aspect, India has an advantage over its neighbours in the west and east. Light-weight fighters with shorter range are needed to protect own assets. UAVs have become offensive action capable. Their main advantage is loiter time measured in hours and even days plus cheaper operating costs with no risk to humans.

Operations against Surface Forces: Multi-role fighter aircraft with self-defence capability against air threats and air-to-ground weapons delivery capabilities with the range to project these capabilities are needed for long-range interdiction missions against enemy forces and their supporting infrastructure in the rear. Aircraft must be able to use stand-off precision-guided all-weather munitions to reduce their vulnerability. The

PHOTOGRAPH: DASSAULT AVIATION

IRON DOME
Air Defense Against Short Range Artillery Rockets

SPICE-1000
Autonomous Stand-Off Guidance Kit

RECCELITE
Tactica Reconnaissance System

SPYDER
Air Defense System

IMILITE
Imint for Airborne Missions

LITENING
Targeting and Navigation System

Superior performance for all your airborne and air-defense missions

RAFAEL
SMART AND TO THE POINT

www.rafael.co.il

Fifth-generation jet fighter: First flight of Sukhoi PAK-FA

days of successful low-level attacks directly overflying targets to drop dumb bombs are over. Dedicated aircraft for suppression of ground-based defences may be required.

Attacks on Key Assets: Here again the requirements are the same as above. Longer distances to targets will be the norm. Lack of geographical depth of neighbours will be an advantage in the west and east but this will not hold good against the neighbour in the north.

Direct Support to Surface Operations: Shorter range aircraft capable of stand-off precision-guided air-to-surface weapons delivery will be the main requirement for direct support tasks. If a sufficient degree of control of the air is achieved, attack helicopters can also be used at night. It was evident during the Gulf War of 1991 that low level attacks with unguided weapons by day resulted in high attrition rates. UAVs would be another viable option. Gunship type aircraft such as modified medium-tactical transport aircraft can be effective in providing concentrated volumes of fire provided they operate in low air threat areas and at night.

Deterrence: Long-range bombers with stealth capability and ground-based ballistic systems can provide this capability, both with special conventional weapons and nuclear weapons.

General Requirements

In Flight Refuelling: The IAF has already indicated that all aircraft acquired in the future for combat roles will have the capability to be refuelled in flight. This is an essential force multiplier.

Defensive Countermeasures: Such capability would be a must for all combat aircraft as also for other non-combat platform as well.

Avionics: Target acquisition is mission critical. Onboard navigational aids with satellite, inertial or ground mapping inputs are a must for all operations.

Night and Adverse Weather Capability: The IAF for most of its existence has had no true night or adverse weather capability insofar as combat operations especially air-to-surface weapons delivery was concerned. The IAF has recently acquired some capability restricted to certain fighter types and very few transport and helicopter platforms. Extending this capability is critical.

Precision-Guided Stand-Off Munitions: Combat aircraft must be capable of delivering such munitions in all roles including those in close support of own land and naval forces. The lack of accuracy of unguided weapons delivered in combat situations make most of them barring area weapons redundant on the modern battlefield, irrespective of the steadiness of the platform or the skill levels of the aircrew.

Long-Range Weapons: Manned bombers and ballistic missiles are needed to project force at long distances.

Multi-Role Capability: As the IAF cannot afford to have dedicated aircraft for each task, a certain level of multi-role capability must exist on the majority of combat platforms.

High-Altitude Operations: Combat aircraft must be able to not only operate tactically but carry out accurate air-to-ground weapons delivery at altitudes where other air forces only carry out air combat. In addition they must be able to operate from high-altitude bases. The IAF has been constrained by this factor in every conflict in the past.

Training: Mission-oriented training is essential. In the future very few air crew will drop live weapons except in combat as these are just too expensive. Aircraft operating costs and constraints on availability of weapons ranges are other factors. Simulators and simulation technology can provide realistic training in most areas especially in weapons delivery and preplanned mission profile rehearsals.

Integrated Command and Control: Successful air operations in the last two decades have highlighted the need for planning, airspace management and control, air operations tasking and a single unified entity for command and control of operations. ■

PHOTOGRAPH: SUKHOI

CAE's dynamic synthetic environment solution allows real-time changes to a database in response to actions taken by those interacting with the virtual world, such as a weapons detonation.

Where Did the Bridge Go?

CAE's dynamic synthetic environment makes virtual world more like real world

DEFENCE CUSTOMERS WITH an appetite for state-of-the-art training solutions are faced with much smaller budgets as a result of fiscal austerity and the changing face of military operations, which require them to "do more with less" wherever possible. The inevitable result of this is an increasing demand on the supplier community to provide better, more result-oriented and above all more cost-effective solutions for training soldiers, airmen and sailors for the type of operations they are likely to face in the future.

One of the methods of providing the type of broad spectrum enhancement increasingly required, as far as simulation is concerned, is to provide a more realistic environment for training to take place in—a virtual environment in which the "willing suspension of disbelief" is no longer necessary for trainees to gain maximum benefit from an advanced simulation.

CAE has leveraged its experience in modelling and simulation to address this requirement in the development of what it calls a dynamic synthetic environment (DSE). What that translates to, in effect, is enhanced realism, a higher fidelity virtual environment and more effective training, mission rehearsal and decision-making.

The CAE dynamic synthetic environment is a suite of tools and simulation software that can be added on to the existing capabilities of common database (CDB) users.

"We recognised quite early in the development process that it was pretty simple to make event-dependent changes to terrain features in the database on a network server, but not quite so simple to make those changes effective in real-time without advance preparation and without human intervention," says Dave Graham, CAE's Director of Technology Application.

Changes in terrain that result from events within the simulated scenario have

PHOTOGRAPHS: CAE

always been difficult for providers to cater to in real time. DSE makes it possible for scenario designers to provide trainees with a truly dynamic environment, in which those effects become apparent—and more importantly exercise a subsequent effect on the unfolding of the scenario—as they actually happen. An artillery strike on a major crossroads, for example, leaves craters that make the area impassable to heavy armoured vehicles. "The development has been primarily in response to an unmet requirement," says Graham. "It started life as simply 'dynamic terrain' but we believe DSE is a better and more appropriate description, given the broad approach to the synthetic environment it involves."

Graham believes that DSE does this in a wholly new manner—or at least in a manner that allows a wholly new approach to integrated training, mission rehearsal and decision support.

"Weapons effects, falling trees, ruined buildings—all of these were done previously as special effects in the visual, but didn't leave behind a useful or lasting impact on operations within the scenario," explained Graham. "The dynamic synthetic environment now allows run-time changes in the database, which are then independently written back to storage."

Effectively, this means that commanders and troops involved in a simulation now have an additional level of complexity to deal with—one that increases the 'fog of war' effects and adds realism to the decision-making processes that are a major component of the readiness and preparation objectives.

"This is the kind of technology required to truly make a virtual environment that realistically simulates the real world," says Graham.

In order to deliver capability, however, DSE needs to be not only dynamic—providing real time changes to the database; but also persistent—ensuring the impact of changes in the environment continue through the period of the simulation and beyond; based on open data model and format standards rather than proprietary solutions; and perhaps most importantly, scalable, so that it is able to cater to large, federated networks.

Graham believes DSE does just this. "If dynamic is all you need, simply buy a video game. But if you need dynamics coupled with persistence, openness and scalability for joint and multinational training and mission rehearsal, then DSE is a leading technology in the field right now."

CAE will be demonstrating DSE in its booth (Hall C, #1-6) at Aero India 2013. ■

NEW TOOLS FOR NEW RULES

ANVIS/HUD® Day

ANVIS/HUD® Night

Other Pilot LOS

Visit us at
AERO INDIA 2013
Israel Pavilion, Hall A

DUST-OFF System – The proven solution for Degraded Visual Environment

Now helicopter pilots can land safely in brownout, whiteout and other low visibility conditions. Based on Elbit Systems' fully integrated ANVIS/HUD®24T* (with Tracker), **DUST-OFF** clears the way to enhanced situational awareness, obstacle avoidance and safe landings even in the harshest landing conditions. **DUST-OFF** is an integrated, affordable, end-to-end system that presents innovative 3D symbology on the ANVIS/HUD®24T, which guides pilots to safe landings every time.

* In the USA the system is designated HDTS
* In the UK the system is designated DNVG

Elbit Systems

NEXT IS NOW®

www.elbitsystems.com

Vital for IAF

In the near term, diminishing fighter assets will stretch the IAF to its limits if it has to sustain a "two-front war strategy." The Tejas is central to IAF's combat power and their induction has to be accelerated if the IAF is to retain its edge.

By Air Cmde (Retd) K.B. Menon

A long way to go: The IAF is likely to get six squadrons of LCA Tejas by 2022

PHOTOGRAPHS: ANOOP KAMATH

THE INDIAN AIR Force (IAF) is transiting a crucial phase in its glorious history. The induction of current generation transport aircraft and helicopters have brought about far reaching changes in airlift capability. The acquisition of the medium multi-role combat aircraft (MMRCA) and the light combat aircraft (LCA) Tejas, will propel the IAF into a different league. However, it is estimated that in the next decade, the number of combat squadrons will dwindle to an all-time low and the downward trend will be reversed only around 2022. The replacement for the MiG-21 fleet by the LCA Tejas that has been under consideration for over two decades continues to be dogged by delays.

LCA Project

The LCA project was launched in 1983 with two major objectives, the primary one being to develop an indigenous replacement for the MiG-21, the then premier air defence fighter of the IAF. The IAF had projected that the MiG-21 would reach the end of its life by 1990 and by 1995 the

strength of combat squadrons would reduce to 60 per cent of the authorised figure unless augmented by new inductions.

The other objective of the LCA programme was more ambitious and envisaged the coming together of Indian industrial and scientific entities to design and produce state-of-the–art fighter aircraft from scratch. The Aeronautical Development Agency (ADA) was designated the nodal agency to manage the project and the Hindustan Aeronautics Limited (HAL) to be the primary contractor for the design and system integration, assembly, manufacture, flight testing and technical support during the service life of the aircraft. The National Aeronautics Laboratory (NAL), the Electronics and Radar Development Establishment (LRDE) and Gas Turbine Research Establishment (GTRE) were responsible for the design of the flight control system, the airborne radar and the Kaveri engine respectively.

As a matter of prudence, it was decided that full-scale engineering development would be done in two phases. Phase-I would entail building two technology demonstrator aircraft (TD-1 and TD-2) and two prototypes (PV-1 and PV-2). Phase-II would include a production model (PV-3), a naval version (PV-4) and a two-seater trainer version (PV-5).

The first flight of the Tejas LCA TD-1 took off on January 4, 2001, with Squadron Leader Rajiv Kothiyal at the controls and till date various versions of the LCA have completed almost 1,900 flights. Ten years after the first flight, the initial operational clearance (IOC) was granted on January 10, 2011, and pilots from the IAF are now permitted to fly the LCA. Recently, three Tejas aircraft completed weapons trials at the air-to-ground firing range in Pokhran, which involved the carriage and release of 1,000 lb laser-guided bombs and dumb bombs. The aircraft is yet to test fire the Raphael Derby or the Russian Vympel R-77 BVR missiles.

In August 2011, A.K. Antony, the Minister of Defence, informed the Parliament that the LCA would be inducted into the IAF by March 2012 but that deadline slipped like many before. The LCA programme has been plagued by delays but 2012 was to have been a watershed year with the Tejas Mk I obtaining final operational clearance (FOC). This deadline has also slipped and it is possible that FOC may now be accorded only in late 2013 after the LCA meets all design parameters and capabilities.

Combat Fleet of the IAF

In April 2012, the Ministry of Defence and senior IAF officers made a presentation to the Parliamentary Standing Committee informing about the severe shortage of fighter aircraft, support infrastructure and other requirements. The IAF stated that while squadrons of combat aircraft were being phased out, replacements were not keeping pace. The strength of combat squadrons therefore could hit an all-time low of 29 by 2017. Until the contract for the 126 MMRCA was inked, there was no assurance of inducting the fourth-generation fighters soon.

The Defence Minister informed the Parliament in May 2012 that the IAF would receive six squadrons of the LCA Tejas by 2022. Forty of these would be the Tejas Mk I with the GE F-404 engine and the remaining 80 would be the Tejas Mk II with the new GE F-414 engine. The Indian Navy is also committed to purchasing 40 Tejas Mk II.

The Tejas Mk II is being developed by HAL with the GE-F414-GE-INS6 engine which will incorporate fifth-generation technology. The preliminary design and configuration of the

On display:
LCA during Aero India 2011

In flight:
LCA's flying display

PHOTOGRAPH: PIB

Tejas Mk II has been completed. This version will be one metre longer than the Tejas Mk I for incorporating a stretched nose, a larger section behind the cockpit for housing avionics components and is designed to carry an extra 1,000 kg of external stores more than the 4,000 kg carried by the Mk I version. The prototype is to roll out in 2013 and the first flight is scheduled for 2014. These are optimistic projections considering that the FOC for the Tejas Mk I is yet to be accorded and the current production line can roll out only eight to ten aircraft per year.

The Tejas induction plan promises the IAF a high technology fighter in the near future but till the promises translate into "aircraft on the tarmac", the IAF will be left in the lurch. The MiG-21 and the MiG-27 fleets are to be phased out by the Thirteenth Five Year Plan period i.e. by 2022 and replaced by Su30-MKI, 126 MMRCA, Tejas Mk I & Mk II and the fifth-generation fighter aircraft. If these inductions are delayed, the IAF will have to reckon with extending the use of its current fighter assets till the new aircraft take to the skies. The next decade is very crucial for the air defence fleet of the IAF.

Project Afflicted by Delays

Delays in the LCA project persist and in August 2012, it was reported to the Parliament that the project had slipped in its delivery schedule with ensuing cost overruns. The contract for the 99 F-414 engines is a clear sign that the Kaveri engine is yet to reach its full potential as the engine of choice for the LCA. Flight tests of the Tejas Mk-II had to be put on hold in 2012 as modifications to the ejection system had to be carried out to cater to the introduction of newer model helmets for pilots.

The fact that the Tejas Mk I is in the process of obtaining FOC assures the government that the aeronautical industry in India has acquired the technologies needed to make the LCA and possibly leapfrog in the next decade into making fifth-generation fighters. One objective of the original LCA programme has been achieved but the ability to manufacture the Tejas in large numbers is yet to be proven.

LCA – Crucial for the IAF

Traditionally, young pilots of the IAF have built up their operational flying experience on the MiG-21 before moving onto the more sophisticated fighters. The next generation of pilots are slated to cut their teeth on the LCA before graduating to the combat aircraft of the future. The Tejas will be the stepping stone for young pilots in their quest for excellence. The IAF cannot brook any more delays in the induction of the Tejas.

Air Chief Marshal N.A.K. Browne has gone on record and admitted that the IAF will have a shortfall in its operational strength in the next five years and the build-up to 42 squadrons will commence only by 2022. The IAF claims that its combat punch will be sustained by the ongoing upgrades on the Mirage 2000, MiG-29, Jaguar and Su-30 fleets but technological superiority is merely one facet of combat power. Numerical superiority coupled with superior technology offers the tactical commander a wider range of military options.

In the near term, diminishing fighter assets will stretch the IAF to its limits if it has to sustain a "two-front war strategy". The Tejas is central to IAF's combat power and their induction has to be accelerated if the IAF is to retain its edge. ■

IAI`s Heron with satellite communication electro-optic maritime radar COMINT and ELINT payloads

IAI Heron

ISRAEL AEROSPACE INDUSTRIES (IAI) is a world leader for over 40 years in unmanned aerial systems (UAS). One of its leading products is the Heron, a master in performance of intelligence surveillance reconnaissance (ISR) missions. The Heron covers hundreds of square kilometres in any terrain: deserts, mountains, peeking through dense tropical forest, scanning the coastal plains deep at sea, etc.

Heron's sensors provide the optimal sensing for every possible scenario at all times. With mission endurance spanning over days and nights, its electronic intelligence gear is sweeping the spectrum for suspicious signals, on-board radars perform wide-area surveillance over land, sea, jungle or urban terrain, while sharp-eyed electro-optical payloads enable operators to positively identify and designate targets for further action.

The Heron I UAS is a robust, combat proven multi-mission system, adapted for a broad range of tasks, utilising diverse mission payloads. The modern Heron carries multiple payloads for line-of-sight missions or beyond line-of-sight using satellite communications. Its sensors feed ISR data to the ground segment and to tactical-level end-users in real-time.

IAI divisions deliver most of these sensors, while others are provided by third party suppliers. The current Heron represents the fourth spiral development of the system, integrating the latest avionics systems, an advanced ground segment offering the ultimate level of man machine interface (MMI) through advanced, ergonomic and modular design. A choice of payloads enables Heron I to perform its missions over any terrain, including forests, jungles or swamps, at sea or over urban terrain, where the use of a single payload will render a mission ineffective. For such missions, the Heron can be equipped with communications intelligence (COMINT) radio interception gear, instantly localising radio and cellular transmissions indicating potential activity even under tree canopy. Similarly, when operating over open terrain, the synthetic aperture radar (SAR) from IAI's subsidiary Elta Systems provides efficient wide area coverage, automatically spotting moving targets. Once potential targets are located, electro-optical sensors developed by IAI's Tamam division can be deployed to seek out their signature through gaps in the canopy. Alternatively, a new foliage penetrating radar developed by Elta Systems, can be used to locate activity and targets hidden in the woods. The airborne satellite communications (SATCOM) link provided by Elta Systems extends the operational range of the Heron only to the range and endurance limited by fuel availability—and enables missions ranging about 1,500 km from its operating base. It also provides for increased flexibility in flight profile, particularly in mountainous terrain and long-range maritime patrols, where the UAV can descend below the data link's line of sight, maintaining uninterrupted communications with the control centre via SATCOM.

Automated Control Ensures Flight Safety

Heron 1 is equipped with an automatic take-off and landing system (ATOL) developed by IAI, based on many years of operational experience. The system integrates two redundant reference systems—laser and differential GPS (DGPS), to maintain maximum safety through these critical phases of the mission, in day night rain and zero visibility. Since 1995, IAI has deployed the ATOL on eight different autonomous platforms and performed thousands of missions accumulated to more than 10,00,000 operational flight hours. In contrast to conventional UAS, using automatic flight management for mission control, but often reverting to manual control for take-off and landing, ATOL takes over during these critical phases, defining the pilot a safe 'corridor' for the ascend path. Moreover, the automatic system can respond faster to changes, such as wind gusts or turbulence that may cause sudden altitude drop, by immediately initiating appropriate emergency measures to bring the aircraft back to safe flight on any weather condition. The new function also helps avoid deviation from the pre-planned mission course, preventing

PHOTOGRAPH: IAI

Setting Aim for Future Growth

Joseph Weis
President & CEO,
Israel Aerospace Industries Ltd.

WITH ANNUAL SALES of over $3.4 billion, and orders backlog exceeding $9 billion, Israel Aerospace Industries (IAI) is ranked among Israel's top five industries. As Israel's largest aerospace and defence exporter, and an important supplier for India's military services, IAI is involved in major programmes that implement the most advanced technologies.

In the missiles domain, IAI sees the air and missile defence as an important growth opportunity. IAI's leading edge in this area is the comprehensive network-centric integration of weapon systems as reflected in the Barak 8 programme, currently under way for Israeli and international customers.

In the UAS domain, IAI's Heron family of medium-altitude long-endurance (MALE) drones is already positioned as a world leading UAS in terms of number of operators and operational hours. Deployed across five continents, Herons are proving themselves on a daily basis as reliable, flexible, combat-proven unmanned platform suitable for a wide range of missions. Of a particular value for India is the maritime surveillance capability of the Heron UAS; its wide range of sensors have proved highly effective in supporting naval operations, maritime surveillance as well as homeland security missions. IAI is investing much effort to further develop the Heron system, its ground segment, payloads and performance. Offering higher operating altitude, longer endurance and heavier payload capacity than most drones currently available on the world market, Heron TP is positioned to become a platform of choice for Europeans and other leading air forces.

In the segment of special mission aircraft, IAI's systems are already operational with a number of customers worldwide with maritime surveillance, intelligence gathering (SIGINT), and aerial early warning (AEW).

IAI AWACS

IAI expects its commercial aviation business line to continue and thrive, reflecting an expected recovery in the global economic market and specifically in commercial aviation. The company has recently completed Federal Aviation Administration (FAA) certification of the new G280 medium-size business jet built for Gulfstream.

Space is another growth area for IAI. The company currently has a few active satellite programmes under way for communications and surveillance satellites. Amos-4 satellite, built by IAI for Spacecom, is scheduled for launch in June 2013 from Baikonur, Kazakhstan. Once positioned at 65°E, it will cover Russia, India and the Middle East with multiple Ku and Ka transponders creating a powerful platform, enabling a wide range of cross-band, cross-beam connectivity options.

IAI has also commenced the construction of Amos 6—the next generation communications satellite, offering new capabilities unavailable before. Other satellite projects currently on the horizon include various reconnaissance satellites based on the latest Opsat 3000 platform.

IAI completed in January 2013 a successful public offering of bonds totalling about $317 million, issuing a new series of Shekel-based and unlinked bonds with a fixed interest rate. The extent of demand during the auction reached about $846.5 million. The final rate of interest was 4.1 per cent, reflecting a gap of 0.8 per cent above the yield of government bonds of the same average maturity.

The amount issued is impressive, since it is the largest offering conducted during 2012 in the Israeli capital markets. This is the third time the company has issued bonds and this is the largest of the three. The bond series received an "AA/stable" rating from the Ma'alot-S&P rating agency, with an average maturity of 5.7 years. ■

PHOTOGRAPHS: IAI

Marketing Feature (Contd...)

potential 'hijacking' of UAVs by electronic deception and interference. These new features are becoming imperative for integration in civil controlled airspace, where the unmanned aircraft must follow strictly controlled routes without deviation. In fact, Heron has been demonstrating its capability to operate with manned aircraft in the same airspace for several years, in Israel and abroad, utilising internal communications relay and strobe lights, clearly indicating its position to other aircraft. These new features ensure the Heron remains one of the world's safest UAS.

Impressive Operational Record

IAI Malat UAVs are being operated by 49 customers from 19 countries worldwide. The evaluation process of customer requirements and operational experience further contributes to IAI/Malat offering and system maturity, as demonstrated in its over one million operational flight hours flown throughout the world: in Afghanistan, Iraq, Kosovo, Libya, and the Middle East, from the Asian and North African deserts, through the mountain ranges of the Himalayas and Andes, to the African, Asian and Amazon tropics, to the cold winter of northern Scandinavia and Canada. Among the operational services currently using the Heron in combat are the German and French air forces that have deployed the UAS's for several years in Afghanistan; the Australian and Canadian forces are leasing Heron through turnkey service. The French air force has used the Heron to support the North Atlantic Treaty Organisation's (NATO) operations in Libya. The Spanish and Singaporean military are also operating Searcher UAVs in Afghanistan. The Israel Air Force is operating the Heron and the latest variant Heron TP (turboprop) with its operational UAS squadrons. Heron and Searcher UAS are operational with all the Indian military branches, in a variety of mission profiles and climatic conditions, including operations from the Indian Air Station at Leh, one of the highest military airfields in the world, located at an altitude of over 11,000 feet. In Brazil, Herons are supporting the Federal Police forces in law enforcement and border surveillance, demonstrating the advantage of UAVs in support of homeland security missions. Heron UAVs are also operating in Ecuador and Turkey. Supporting UAV mission is another dimension where IAI's Malat division excels. Beyond the customer support, which the company provides for more than 15 years, IAI Malat division is offering its customers full independence in operating and supporting their UAS, up to the highest depot maintenance (D-level). The company has also established a new UAV Academy, providing the training equipment, simulators, syllabuses and facilities, for the training of operators and technical staff. ■

PHOTOGRAPH: DEFENSEIMAGERY.MIL

Lagging Behind

The IAF currently has only a medium-range capability. A long-range capability in excess of 150-200 km and beyond to deal with ballistic missile and cruise missile threats, as well as to attack enemy AWACS deep inside their airspace, may be required

By Group Captain (Retd) B. Menon

Air-to-ground munition: AGM-88 high-speed anti-radiation missile being fired from F-16C Fighting Falcon

IN THE MODERNISATION of the Indian Air Force (IAF), weapons systems have usually lagged behind aircraft induction. However, there have been changes in the last decade. Systems other than surface-to-surface ballistic missile defence and gun systems are highlighted in this overview.

Air-to-Air Missiles (AAMs)

The existing inventory of infrared (IR) short-range missiles is a mix of Russian, French and Israeli equipment. Russian R-60 and R-73 equip Russian origin fighters and can be fitted on the light combat aircraft (LCA) Tejas. The French Matra Magic II IR missile is on the Mirage 2000. The Hawk can carry the Magic II and the R-60. The Israeli Python 4/5 (IR) is reportedly in service also.

MBDA's weapon systems: Meteor on Rafale

Medium-range missiles include the Russian R-23, R-27 and R-77. The R-77 has longer range and is highly manoeuvrable with some variants having capabilities akin to the US advanced medium-range air-to-air missile (AMRAAM). These can be carried by all the newer Russian origin fighters. The radar guided French Matra Super 530D has significant shoot up/down capability and is used on the Mirage 2000. With the induction of the Rafale and the Mirage 2000 upgradation, the Matra Mica (radar and IR versions) with a medium-range capability is likely to be inducted shortly. The AH-64D Apache attack helicopter will come with the AIM-92 air-to-air version of the Stinger IR missile acquisition of the AIM-9X is also a possibility.

Air-to-Ground Missiles (AGMs)

The Russian KH31, Israeli Popeye and the forthcoming BrahMos air-launched version are or will soon be in the inventory. The Harpoon for the Navy's P8I can be carried by the Jaguar. The Apache should have the Hellfire laser-guided air-to-ground (AGM) and the Maverick AGM. This can be fitted on fixed-wing fighters also. The Rafale has the AASM Hammer which is a kit to convert 125 to 1,000 kg bombs to smart bombs with inertial navigation (IN), global positioning system (GPS), imaging infrared (IIR) or semi-active laser homing (SALH) guidance. The US Paveway laser-guided bomb (LGB) kit has already been used by the IAF in operations and is Rafale compatible.

Other Air-to-Ground Munitions

Unguided rockets from 57-240mm calibre have long been in the IAF inventory. Runway penetrating bombs such as the BAP100 series and the Russian BetABShP retarded and rocket boosted bombs are already deployed. Unguided free fall and retarded bombs of various weights and incendiary bombs are available but risks of low-level attack profiles against modern defences plus lack of accuracy with high circular error probability (CEP) reduce their utility. The IAF is about to get delivery of the US Raytheon smart sensor fused CBU 105 anti-armour cluster munitions system. This system has a smart and standoff capability with delivery at higher altitudes. It also circumvents the export ban on such munitions imposed because of possible collateral damage post-attack due to unexploded munitions. The ban is for sub-munitions weighing 4-20 kg without self-destruct capability in case the sub-munitions does not lock on to a target. The CBU105 sub-munitions weigh 29 kg and have active and passive sensors plus a self-destruct mode in case no target is acquired.

The Israeli Harop "kamikaze" type UAV has been inducted. The UAV itself is the weapon and can be called an unmanned combat aerial vehicle (UCAV) as well as a precision-guided AGM. Its single use limitation (it destroys the target be crashing into it) makes it an expensive proposition and being light weight, it does not have the power to destroy large hardened targets. The Helena air-launched anti-tank guided missile (ATGM) which is a variant of the Defence Research and Development Organisation's (DRDO) Nag ATGM may soon be fitted on Indian attack helicopters. The Apache can also carry a range of the US origin ATGMs.

Surface-to-Air Missiles (SAMs)

The Akash medium-range surface-to-air missiles SAM system has been inducted. The variant of the Israeli naval Barak system is also likely to be inducted and as also the Spyder Quick Reaction SAM which has both short and medium-range variants. The Stinger is likely to join the existing Igla19 class of man-portable IR SAMs.

Future Requirements

Air-to-Air Missiles: The IAF currently has only a medium-range capability. A long-range capability in excess of 150-200 km and

PHOTOGRAPH: MBDA

Indigenous endeavour: DRDO's Akash Missile

beyond to deal with ballistic missile and cruise missile threats, as well as to attack enemy AWACS deep inside their airspace, may be required. The US has retired the AIM54 Phoenix long-range AAM and has only the AMRAAM class of weapons which have lesser range than the Phoenix. If a Phoenix type weapon is required, off-the-shelf purchases may not be possible and a joint venture development will be needed. For shorter ranges, the French Meteor beyond visual range air-to-air missile (BVRAAM) with active radar guidance for the Rafale or similar class of weapons may fit the bill. The DRADM air dominance system for aerial and ground targets is under development by the US.

AGMs: High speed anti-radiation missiles (HARM) with GPS/inertial navigation system (INS) guidance in addition to passive home on to radar emitters guidance can destroy radar emitters even if they shut down to break the missile guidance lock. The US HARM 88 is such a system. The British ALARM has a loiter mode. If the emitter shuts down, it deploys a parachute and goes into the loiter mode till it gets a radar return. Such technologies may be worth developing within the country.

SAMs: A long-range system is required as the Akash falls short of requirements. Either DRDO development or import, are the options.

UAVs and UCAVs: The use of both these will increase. UCAV technology is hard to obtain. Smart bombs, AAMs and AGMs can be carried and delivered from these platforms effectively especially in high threat areas. The DRDOs stealth Aura UCAV programme is worthwhile provided it is successful.

Smart Munitions: Converting dumb bombs to smart ones with laser/optical/imaging infrared guidance kits is a cost effective option and indigenous research and development (R&D) should be able to deliver in this area. Satellite and inertial guided free fall bombs have a fire-and-forget capability and are needed for precision attack on hardened targets such as underground command and control centres, weapons storage bunkers and missile silos as well as dams. There is certainly a requirement for the IAF to have deep penetrating bombs.

Cluster Weapons: Sensor fused cluster munitions barring ones with specifications like the CBU105 are not available for import. These would have to be developed in-house. These weapons are very effective against concentrations of vehicles, personnel, missile sites, and equipment and fuel complexes. Their stand-off capability reduces risks to attacking aircraft.

Special Weapons: Thermobaric weapons or fuel air explosives (FAEs) create far higher blast and temperature effects than equivalent weights of explosives. These are effective in confined spaces such as valley floors and cave mouths. These can also be employed to clear areas for helicopter assault landings. However, their effectiveness decreases rapidly at high altitudes because of lowered ambient pressures and oxygen content. Directed energy weapons such as lasers are coming out of science fiction into reality. If attenuation problems caused by the atmosphere are solved, these would be ideal against targets moving at high speed since the weapon travels at the speed of light. Weapons that create electromagnetic pulses to destroy electrical and electronic equipment (other than nuclear air bursts at very high altitudes which have similar effects) are under development with Boeing having done some trials recently. Defence against such weapons is critical also since modern aircraft are fully dependant on electronics.

Command and Control

Forward air control (FAC) has to be revamped with ground kits with GPS and laser range finders and designators data linked to close air support (CAS) aircraft. The USAF used this technology effectively in Kosovo. With extended ranges of weapons, integrated and effective command and control is a must. ■

PHOTOGRAPH: SP GUIDE PUBNS

Aerospace & Defence SMEs: To Move Up in Value Chain

By Chandra Prakash

DEFENCE FORCES ARE required to acquire the latest technology to have superiority over the enemy forces. At the same time, foreign companies are reluctant to transfer the latest technologies for fear of competition and losing market share. The defence sector therefore needs small and medium enterprises (SMEs) more than other sectors due to their capability to innovate, and being major contributors in the overall technology intensive business sector. SMEs provide primes with greater flexibility, increasing their capacity and technical capability at the peak of demands on major projects. As most of the SMEs are specialised and have narrow range of technical capabilities, few are able to grow to next level unless they keep pace with current technology and establish appropriate business models to address newer product requirements.

Presently the SMEs are the suppliers of components or subsystems to industry majors. Looking at the huge offset opportunities available through various acquisition programmes, all defence companies, be it small or big, are required to move up in value chain so as to meet the emerging offset requirements of foreign OEMs. More than that, it helps the nation in building indigenous capabilities by strengthening the aerospace and defence base, a key objective of the policy guidelines.

Successful defence SMEs have the potential to become the prime contractors of the future, may be in limited domain. However, to graduate from technology intensive components/ sub-systems to sub-systems/complete systems, SMEs generally face several challenges. Some of the common difficulties faced are: lack of access to systems level technology, limited availability of high-end test facilities needed in this sector, ability to shorten product development and delivery time, shortage of highly skilled manpower and access to funds. SMEs would not be able to cope up with the above challenges alone, and would require help of supporting organisations to enable them graduate to the next level.

Suggested Approaches

Following are some of the avenues available for SMEs to move up in their business segment:

Providing System Solution to Defence Services: Long Term Perspective Plan of Defence Services provide valuable inputs and SMEs can identify the systems which predominantly fall under their technical expertise. One of the SMEs which is technologically/financially strong can assume the lead role to address the overall requirement and finalise the terms of approach paper. As this will require system level expertise, the approach paper can be made jointly with experts from cluster/ networked SMEs and where necessary expert/consultant with key domain knowledge. The paper brings out the critical technologies involved, role of various SMEs, funding requirements, fund sharing pattern, loan requirements etc. As defence requirements are normally projective in nature and RFP released dates cannot be predicted with certainty, it is necessary to initiate some activities on base model proactively and continue development for offering the product for NC-NC trials as part of technical evaluation. In the phased development programme, initially one should concentrate on the development of new critical technology elements based on which, full system can be realised in time as per the requirements of RFP. Appropriate MoU/teaming agreements can be firmed up among the participating SMEs for the lead SME to approach the concerned Defence Directorate for issue of RFP.

PHOTOGRAPH: OIS

Associate with Large Industry/PSUs: In cases where critical elements of technology are available or can be developed by SMEs but due to financial/other reasons, e.g. non-availability of infrastructure, the company is not able to participate in the business, it may approach large private company/DPSU having system, infrastructure capabilities. The team can work jointly to bid for the

system, wherein critical elements of technology are provided by SMEs and overall system level responsibility rests with the lead player. Various steps of equipment development and responding to RFP can be worked out by all stakeholders. This effectively should lead to building long-term strategic relationship between SMEs/private company/DPSU as associate partners.

The initiative to partner with SMEs can also be taken by larger player specialising in system integration. Such companies should have a database of SMEs with a list of technologies and capabilities available. In line with International trend, large companies should concentrate on system level design and integration, sourcing sub-blocks from partner SMEs. Large companies often deploy their R&D resources to build on the base model and grow towards futuristic technology products through innovation.

Upgrades/Obsolescence Management of in Service Equipment: The defence forces employ and field equipment typically for 15-20 years. During the intervening periods, many a time, customers express interest in upgrades of the equipments in line with currently available systems with latest technology. Similarly, towards last phase of equipment life cycle, the end-users often face acute problem of obsolescence calling for redesign of component/sub-system for 'form and fit' replacements. It is observed that though knowledge base may be available with large industries/ PSUs for upgrades, obsolescence management; they are reluctant to divert their precious R&D resources for the same. In such a scenario, there is a case for providing upgraded equipment to fill the void. In this regard, desired upgrade/ obsolescence issues of users if formally made available to SMEs through a website / other means, can help the interested companies to address these opportunities.

Joint Ventures with Foreign Technology Companies: At this time when the business scenario in Europe and US is low, SMEs/ medium industries can tie up with technology companies to address emerging business in India in aerospace and defence sector. The tie-up may be in the form of joint ventures, transfer of technology of critical elements. Absorption/availability of critical technology elements can subsequently help the Indian companies in building up their R&D base towards self-reliant status. Further developments can be done on the transferred technology on its absorption to come up with variants/upgrades.

Risk/Revenue Sharing: Most of the SMEs have a small capital base and generally may not be able to make significant proactive investment. It is therefore appropriate that consortia approach suggested above are modelled on risks / revenue sharing basis safeguarding interests of all the stakeholders. All elements of project, costing, responsibility, risk mitigation and fallback options should be factored under this.

Networking/Cluster Development

SMEs can form networks to complement their strengths/technology portfolio to enable them develop system level capabilities. Networking does not require geographical proximity, and includes interaction across supply chain without the necessity of having either formal links or equity participation. Clustering of technology companies in an area is also beneficial. The cluster can provide common testing facilities; can be single-point contact with government/state, national level industry associations. The major advantage of cluster development over networking is the availability of common opportunities, which help SMEs in creating a conducive ground for the development of inter firm cooperation thus promoting collective innovation and learning.

Government Support: Presently most of the defence SMEs are dependent on defence public sector undertakings, DRDO laboratories, ordnance factories who outsource their development and production requirements to them. In select cases, they are allowed to use environmental, EMI/EMC and other testing infrastructure at nominal charges to validate the performance of the items outsourced to them for production, development. However, once SMEs aspire and graduate to system level, the expensive infrastructure may become inaccessible to them. The available infrastructure of government test laboratories like ERTL, if upgraded as per full range of defence equipment, can certainly help SMEs in this respect.

Finance is another area where SMEs require government support. Due to low capital base, banks are not readily willing to provide loans to them. Provision of soft loan to SMEs and amendment in DPP to consider providing stage payments linked to the progress of the project, could be of great help.

Another area where government can provide the right impetus is by increasing number of tenders under Make Indian, category. Indian companies can tie-up with foreign partners and supply equipments based on joint developments/transfer of technology. Absorption of technology will also help the Indian industry provide upgrades and long-term support for the equipment.

Conclusion: Defence and aerospace offsets provide unprecedented opportunities for Indian industry to step into high technology areas, bringing in with it associated benefits. The purchasing power of the country and large emerging requirements can be leveraged to form technology tie-ups with foreign companies, create synergetic organisations within the country by pooling talent, skill sets and business knowledge. Networking of SMEs among themselves, with large industry players including DPSUs will help all stakeholders to reap in the advantages. Aerospace and defence Industry in India must rise to the occasion, transform themselves in terms of high quality suppliers with focus on cutting-edge technology, to stake claim for emerging opportunities. ■

Chandra Prakash is an Alumnus of University of Roorkee. He had a long stint at BEL in Research & Development on Radars & Communication Systems. Currently he is VP (Technical) with OIS Advance Technology Pvt Ltd.

Attack helicopter from Boeing: AH-64D Apache Longbow

Eurocopter: AS-550C3

Modernisation of Helicopter Fleet

The weakest link in the military helicopter capability is the attack helicopter. The two units of Russian origin Mi-25/Mi-35 held are Army assets, though manned, controlled and operated by the IAF.

By Lt General (Retd) B.S. Pawar

THE ARMY AVIATION Corps (AAC) today holds the largest number of helicopters amongst the three services, the majority being of the light surveillance and observation class Cheetah and Chetak. These are of 1960/1970 vintage and this ageing fleet's replacement is crucial. The trials for their replacement have been completed and decision by the Ministry of Defence (MoD) is awaited. In fray are the French Eurocopter AS 550 Fennec and the Russian Kamov Ka 226T. While the Fennec is a single-engine helicopter with a standard main and tail-rotor design, the Russian Kamov is twin-engine and has contra-rotating rotors. The induction of the selected helicopter at the earliest is crucial as further delay will have disastrous operational consequences.

In the light-utility category, the induction of indigenously manufactured advanced light helicopter (ALH) by the Hindustan Aeronautics Limited (HAL) has already commenced. The latest version of ALH fitted with the more powerful 'Shakti' engine, enhancing its performance in high altitude, especially for operations in Siachen Glacier has also recently entered service. Another variant of the ALH is the armed version called the ALH weapon systems integrated (ALH WSI) which is to be inducted into the AAC. This is an armed helicopter to be integrated with an array of weapon systems to include gun, rockets, air-to-air and air-to-ground missiles along with a modern sighting system and sensors. While integration of the gun, rocket and air-to-air missile has been completed, the project is delayed due to non-

PHOTOGRAPHS: US ARMY, EUROCOPTER

availability of a suitable anti-tank guided missile (ATGM). The air-launched version of Nag ATGM 'Helina', being developed by the Defence Research and Development Organisation, is not yet ready. Plans for the interim are to import this weapon system for which the contenders are the Pars 3 of MBDA France and Spike ER of Israel. Trial reports are under evaluation. The induction of the ALH WSI is therefore likely to be delayed.

In the medium-lift category, the IAF continues to stonewall all attempts of the Army to acquire a suitable helicopter in the 10 to 12-tonne class which is an essential requirement. This will provide tactical airlift capability for a field commander who need not look over his shoulder in the midst of a battle. The HAL is looking at the feasibility of a joint venture with a foreign vendor for a 10 to 12-tonne class multi-purpose helicopter whose variants would be available to the Army, Navy and the IAF. However, very little progress has been made in this regard so far.

The weakest link in the military helicopter capability is the attack helicopter. The two units of Russian origin Mi-25/Mi-35 held are Army assets, though manned, controlled and operated by the IAF. The case for their takeover by the Army has been ongoing ever since 1986 on the formation of the AAC. These helicopters are once again obsolete and need replacement on a priority basis. Trials for their replacement have been completed and the American Apache Longbow AH-64D has emerged as the preferred machine against the Russian Mi-28 (Havoc). The Apache Longbow is a veteran of conflicts in Iraq and Afghanistan and sports many of the advanced technologies being considered for deployment on future attack helicopters. It has a radar dome atop the main rotors which facilitates firing of anti-tank Hellfire missiles in full fire-and-forget mode, allowing the helicopter to stay masked behind terrain as it acquires and engages targets. The MI-28 also is a state-of-the-art attack helicopter and has the 'Ataka' anti-tank missile, an improved version of the 'Vikhr' fired from the Mi-25/Mi-35 helicopters. Induction of the selected attack helicopter is likely to commence this year.

Indian Air Force

The Indian Air Force (IAF) is also in the process of modernising its helicopter fleet. Its existing fleet of Chetaks and Cheetahs are also to be replaced by either the Russian Ka-226T or the French AS-550 Fennec. However, of main concern are the medium- (Mi-8 and Mi-17) and heavy-lift (Mi-26) helicopters. While the Mi-8 is an ageing fleet and need phasing out, the existing Mi-17 holding is not adequate. The existing Mi-17 fleet is being refurbished for night operations and an additional 80 Mi-17V5 helicopters with glass cockpit are being inducted for the requirement of Army and paramilitary forces.

In the heavy-lift category, Mi-26 helicopters are available only in limited numbers. The Army and the IAF need a suitable helicopter in this category capable of lifting under loads such as the ultra-light howitzer being acquired from the US. In contention are the American Chinook and Russian Mi-26. Both are capable of carrying 22 fully-equipped troops. Induction of this class of helicopters will greatly enhance intra-theatre troop movement/logistical support during critical phases of the battle. In addition, the IAF is gearing up to induct AgustaWestland 101 for VVIP travel. A contract for 12 helicopters has already been signed. The AW101 Merlin is a state-of-the-art helicopter well known for its excellent reliability and operational capability. Powered by three engines, the helicopter is able to operate in hot and high conditions.

Made in Russia:
Ka-226T

Indian Navy

The Indian Navy today operates a helicopter fleet consisting of the Sea King (anti-submarine warfare (ASW)), Kamov anti-surface vehicle and the modified Chetak-MATCH (mid-air torpedo carrying helicopter). In addition, the Navy has Chetaks for ship-borne operations. These helicopters are also old and the naval version of ALH has not met its requirements. The Navy is progressing a case for the acquisition of multi-role helicopters for which in the race are the NH-90 and the American Sikorsky S-70B.Black Hawk. In addition, the Navy is in the process of midlife upgrade of their Sea King fleet and is also looking at replacing its Chetak fleet. It has also shown an interest in the HAL joint venture of 10 to 12-tonne class multi-role helicopter, a project yet to takeoff. ■

PHOTOGRAPH: WIKIPEDIA

The Future

Designed as weapon systems integrating multiple functions, helicopters will have to become truly modular, making it possible to change part of the system without affecting overall integrity. The concept of modularity is likely to increase, especially with the emergence of multi-role machines.

By Lt General (Retd) B.S. Pawar

Tiltrotar tech:
CV-22 Osprey

WHILE JET FIGHTERS are in their fifth-generation, the helicopters are still strutting around with the same old airframes for the last several decades, with mostly upgrades to its credit. The Apache Block-III is a vivid example of the same even though 26 new technologies have been incorporated in the upgraded version. However, the new generation helicopter platforms are now featuring the latest advances in aeronautics giving military helicopters improved flight performance. These platforms are also weapon systems that the incremental technological and technical progress has taken to the highest level. This offers the new generation machines unprecedented capabilities: lighter and stronger materials of construction, increased autonomy, more powerful engines, reduced acoustic signatures, more accurate navigation systems, enhanced data acquisition and protection systems and more effective weapon systems. Designed as weapon systems integrating multiple functions, helicopters will have to become truly modular, making it possible to change part of the system without affecting overall integrity. The concept of modularity is likely to increase, especially with the emergence of multi-role machines.

In terms of data acquisition, day/night observation and detection capabilities will increase and become more diversified especially in respect to information sharing and cooperation with other aircraft and UAVs. Target engagement capabilities with regard to weapon range and precision is likely to remain the focus of future development. With sub-conventional operations gaining ascendency around the world, helicopter survivability will assume greater significance. Advances in stealth, such as reductions in radar and acoustic signatures offer major results in this area, as does the development of early detection/jamming countermeasure capabilities. Aerial navigation today has become an art which nears to perfection. Both external navigational aids and onboard systems help navigate aircraft over thousands of miles with such accuracy that could only be imagined a few decades back. Pilots today have various navigation aids that help them take-off, fly and land safely. These include the inertial guidance system, long-range navigation (LORAN), GPS, weather radar, traffic collision avoidance system (TCAS) and the terrain awareness warning system (TAWS). The TAWS is very significant for combat helicopters which have to fly very low during operations.

Some of the above technologies are already being incorporated in the development of Eurocopter X2 and X3 and Sikorsky's X2 coaxial compound helicopter as technology demonstrators. The main emphasis is on speed, stealth, reliability and survivability. In fact in its demonstrative flight, Sikorsky X2 achieved a speed of 459 kmph, a major leap from the current standard helicopter speeds. Its military version, the Sikorsky 'S-97 Raider", is stated to be the future light-tactical helicopter of the US military. Finally, the development of innovative concepts along the lines of V-22 Osprey (tilt rotor technology), could generate fresh momentum in the utility/logistics domain. The V-22 is already deployed in Afghanistan and was instrumental in the rescue of a downed US pilot in Libya last year. The US is looking at a joint heavy-lift rotorcraft platform designed to enter service by 2030.

Another area of future development is helicopter UAVs. Two avenues are already being explored and implemented in different countries—UAV-helicopter cooperation and development of rotary wing UAVs. Lockheed Martin's K-MAX helicopter UAV is currently deployed in Afghanistan for logistic resupply and is proving to be quite a hit. It has been able to fly in adverse weather conditions when manned helicopters could not fly.

Military helicopters will play a vastly enhanced role in any future conflict. Their crucial role in counterinsurgency and counterterrorist operations also cannot be overemphasised. The operations in Afghanistan have fully corroborated this aspect. ■

PHOTOGRAPH: USAF

Engineering with Confidence:
The Critical Role of Physics-Based Simulation

By Robert Harwood, Ph.D.
Aerospace and Defense Industry Marketing Director
ANSYS, Inc.

Physics-based simulation, used early in the design process and deployed systematically in the organization, is a key defining factor of smart engineering

AS INDIA SIMULTANEOUSLY pursues the development of domestic aerospace and defense (A&D) technology, a national space exploration program and her major A&D companies seek to become technology exporters as well as consumers the stakes to perform and deliver on time have never been higher. Programs in pipeline are therefore under tremendous contractual pressure to deliver on performance, cost and time targets.

Those programs, program managers and contractors that successfully meet these criteria will benefit significantly from the A&D industry boom in India. Those that fail against the key performance indicators of time, budget and quality risk facing a very uncertain future. In this article we review some of the techniques available to address specific mechanical engineering issues. However, at ANSYS we empower engineers to leverage simulation in fluids, thermal, electrical and embedded mission critical software. Our overall infrastructure enables a true virtual multiphysics simulation so you can predict with confidence the performance of your A&D technology in its working environment before you build it.

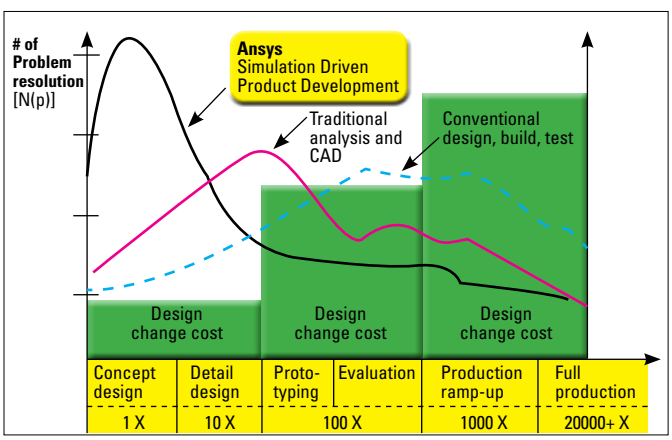
Smart Engineering Adds Quantifiable Value

In the US, Colonel David Bassett, Army program manager for tactical vehicles, believes that the answer to the pressing challenges lies in engineering. “Industry has learned that there is no silver bullet. It’s about smart engineering. We think the companies that understand that are going to be postured to compete effectively”.

Smart engineering would, presumably, allow projects to be completed in shorter timeframes on smaller budgets, without compromising the desired quality and performance of the end product. But what contributes to smarter engineering?

Research by the Aberdeen Group measured the performance of over 600 engineering companies against key performance indicators, such as time, cost and quality, to identify what strategies distinguished best in- class firms from the rest. The differences in performance were clear.

Assessing the most highly differentiated strategies between the best-in class firms and laggards, Aberdeen Group found that the systematic use of physics-based engineering simulation tools early in the engineering process was a standout factor. Specifically, Aberdeen concluded that best-in-class companies:



- Meet quality targets 91 percent of the time, compared with a 79 percent industry average
- Meet cost targets 86 percent of the time, compared with a 76 percent industry average
- Launch on time 86 percent of the time, compared with a 69 percent industry average

This assertion has also been proven beyond doubt in a three-year return on investment study performed by the U.S. Department of Defense. The study found that “for every dollar invested (in software and computing infrastructure to support simulation), the return on investment is between $6.78 and $12.92.”

The Many Roles of Physics-Based Simulation Tools

Physics-based simulation tools harness the power of computers to solve the fundamental equations of physics. Designers and analysts can use the software to create and test virtual representations of components, subcomponents and complete systems (or very close approximations, at least) so they can determine the performance envelope without actually building anything.

Physics-based simulation can be deployed in a wide variety of areas to make engineering and design processes more efficient and effective. The case studies that follow highlight just a few of the ways that technology can be valuable to critical A&D engineering programs.

Load data on fighter jet components is recorded after each mission. ANSYS structural mechanics technology has been found to deliver very accurate results in revealing stresses and temperatures for each mission.

Identifying Crack with simulation of equivalent stresses

Case Study 1: Tracking Part Wear to Reduce Existing & Future Service Costs- Making Cost Benefit Analysis between product variants much easier

Component fatigue assessment is often based on a standard load duty profile. The duty profile method of calculating fatigue frequently results in parts being serviced and replaced sooner than necessary and maintenance performed more often than required. This adds cost and unnecessary equipment downtime. To develop a more effective, condition-based maintenance scheme for jet engine parts, one jet manufacturer coupled physics-based simulation tools and analysis with historical part performance data and in-service equipment monitoring

The result is a system that accurately tracks and predicts component life consumption in fighter jet engines. At the end of each mission, load data from an aircraft is sent to a server that automatically matches this data with the individual engine parts. The system uses structural and thermal calculations within physics-based simulation software from ANSYS to determine the life consumption of engine parts. ANSYS structural mechanics technology has been found to deliver very accurate results in revealing stresses and temperatures for each mission.

The system can therefore allow jet owners to predict cost, avoid unneeded expenses and replace parts that have exceeded what the standard duty cycle would advise, ultimately enhancing reducing costs, improving safety and accelerate decision making.

Case Study 2: Maximizing Load Cycles while Minimizing Weight

Pratt & Miller Engineering is globally recognized as a force in-high-level engineering. When the team discovered premature cracking in a particular design configuration, they took notice. Investigations revealed that this was caused by mechanics.

Because the original part design had not accounted for any aftermarket modification, Pratt & Miller engineers set out to redesign this critical component. The goal was to greatly increase fatigue life without compromising performance. Simply overengineering the part was not an option, as weight is a vital consideration for mobility and fuel efficiency.

To speed the redesign, the team employed structural mechanics simulation using ANSYS Mechanical software as well as fatigue analysis. The team evaluated a variety of options within the ANSYS Workbench™ environment, which allows users to set up structural mechanics models as much as three times faster than other FEA software.ANSYS DesignXplorer™ software performed automated design iterations to determine the lightest-possible design without exceeding material limits.

The engineering team checked the redesign and found that it greatly improved fatigue life — well over 1 million minimum load cycles. The original design predicted a life of 16,567 cycles, while the redesigned pedal has a predicted life of more than 10 million cycles. The new design is now in production and on the track. By using physics- based engineering simulation tools, the engineering team increasedconfidence in getting the redesign right first time — in effect, outpacing the competition by designing a lightweight part with a lower target fatigue life factor [9].

Engineering Provides the Critical Edge

There's no question that delivery timelines and development cycles will continue to be under pressure. The time and costs associated with physical testing of individual components and complete systems are a luxury A&D clients can no longer afford— particularly when it comes to getting assets to defense forces to address ever-changing threats and environments.

Fortunately, using physics-based simulation to measure performance, calculate preferred options, determine appropriate materials, and troubleshoot problems virtually has proven itself to be a reliable, efficient alternative with proven ROI. Engineers can now balance competing needs — aerodynamics and stealth, weight and mobility, comfort and protection, and more — by reviewing a range of scenarios in minutes, making it fast and easy to identify and move forward with the optimal solution. ■

For further details, please scan the QR Code or visit us at: *www.ansys.com*

PHOTOGRAPHS: ANSYS

NextGen aircraft:
Bombardier Q400

E-Jets:
Embraer 190

Short-Haul Flights

The growing middle class and rising aspirations of people in Tier-II and Tier-III cities cannot be ignored for long and there is a vast regional market waiting to be discovered. And whosoever goes into these untapped territories with the right strategies and right combination of cost-efficient operation would be the winner.

By Shriniwas Mishra

REGIONAL AIRLINERS ARE small commercial aircraft with a seating capacity of about 100 passengers. These airliners are meant to fly on short-haul routes to act as feeder airliners from smaller airports to large hubs from where large carriers operate. In the 1990s, fierce competition in the market for regional airliners resulted in the exit of Saab AB, Daimler-Benz Aerospace and British Aerospace. From the year 2000 onwards, the competition for regional airliners has been mainly between ATR, Bombardier and Embraer. While the regional turboprop market is dominated by ATR and Bombardier, the regional jet market is fiercely contested by Bombardier (CRJs) and Embraer (E-Jets). With replacement market as well as demands

PHOTOGRAPHS: BOMBARDIER, EMBRAER

from emerging Brazil Russia India China (BRIC) economies, the regional airliner market has become extremely attractive, thereby enticing newer players such as Sukhoi (Superjet 100), COMAC (ARJ) and Mitsubishi (MRJ), who plan to give the established players a run for their money.

Dominant Regional Airliners

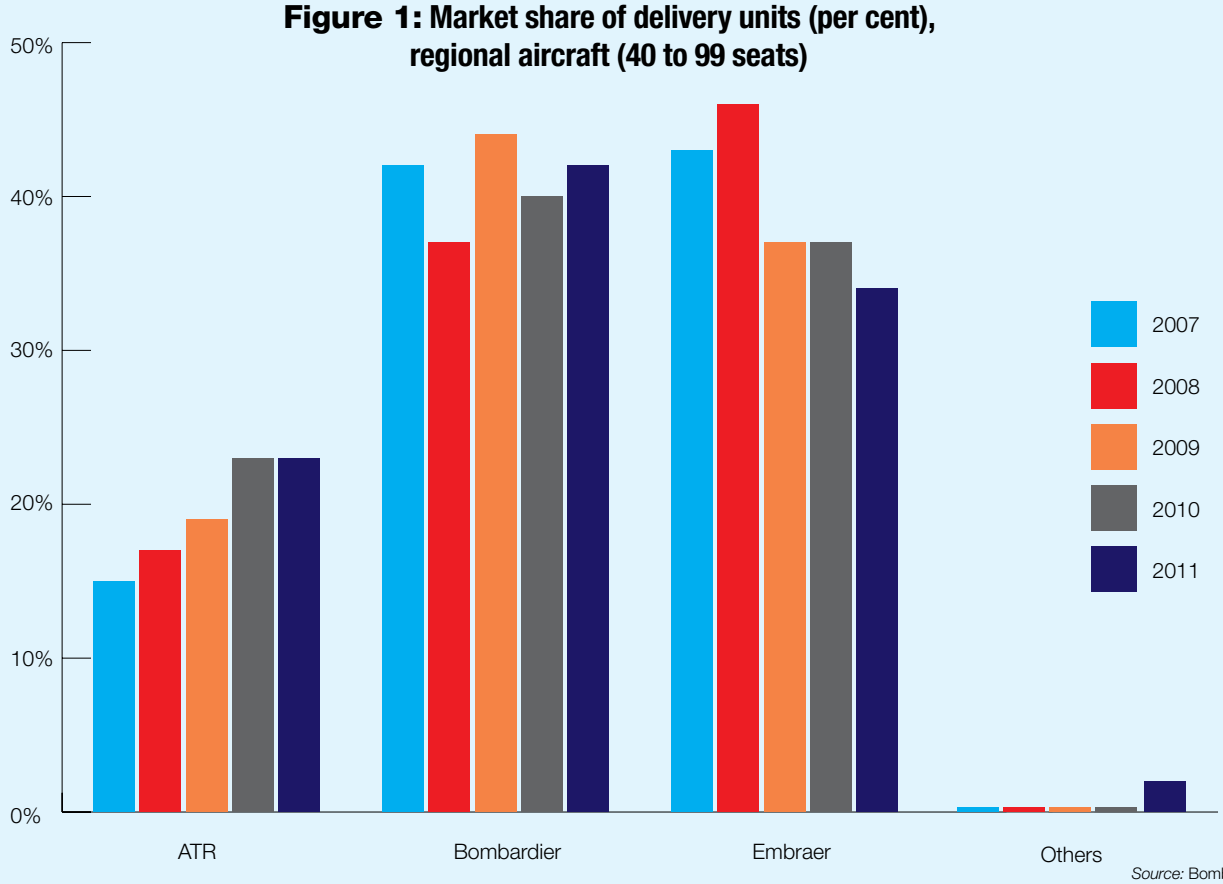
The ATR, a Franco-Italian company jointly owned by EADS, manufactures ATR 42 and 72 series of twin-engine turboprop aircraft. The ATR 72 is an enhanced version of ATR 42 with higher seating capacity of 78. Till date, the company has delivered around 1,020 ATR series aircraft. The Bombardier Dash-8 series of turboprop aircraft, with DHC-8-100 as the first aircraft, has been a success due to path-breaking sound and vibration dampening systems. The latest aircraft, the Q400, is comparable to a jet aircraft in terms of speed and sound levels. Since its launch in 1999, about 600 of these have been delivered by the company.

The CRJ series is manufactured by Bombardier Aerospace, the CRJ100 being the first. Thereafter the series evolved into different configuration and performance with the latest being

Table 1: Snapshot of the regional airliners

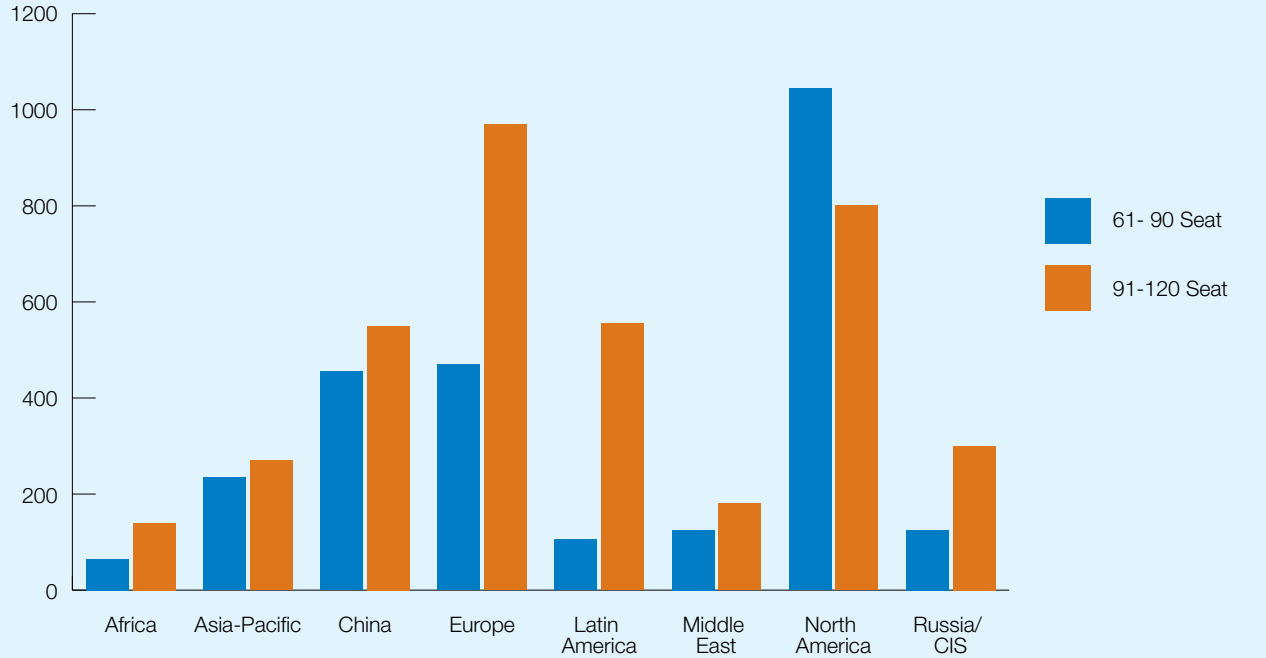
	ATR 72-500	Q400	Embraer 190 LR	ERJ 145 LR	CRJ 900
Length (m)	27.2	32.8	36.2	29.9	36.2
Wingspan (m)	27	28.4	28.7	20	23.2
Height (m)	7.65	8.4	10.6	6.75	7.6
Max T/O weight (kg)	22,800	2,9260	50,300	22,000	36,500
Max landing weight (kg)	21,850	2,8010	43,000	19,300	33,340
Max payload (kg)	7,350	8,750	12,700	6,100	10,320
Max fuel (litres)	6,400	6,530	16,250	6,480	10,990
Range with max payload (km)	1,650	2,500	4,200	2,780	2,500
Cruise speed (kmph)	510	667	890	830	830
Max operating altitude (m)	7,600	8,200	11,900	11,300	12,500
Take-off field length (m)	1,220	1,300	1,890	1,780	1,780
Landing field length (m)	1,050	1,290	1,260	1,350	1,600
Passengers	74	84	106	50	86
Cabin width (m)	2.57	2.51	2.74	2.10	2.55

Figure 1: Market share of delivery units (per cent), regional aircraft (40 to 99 seats)



Source: Bombardier

Figure 2: Projected new deliveries 2012-31 (jet segment)



Source: Embraer

the CRJ1000 with a seating capacity of 100. Since the year 1999, around 1,400 CRJs have been delivered by the company. Embraer followed on the success of its turboprop EMB-120 Brasilia with ERJ series of regional jet aircraft like ERJ-135, 140 and 145, having a seating capacity of less than 50. Since the beginning of production in 1996, around 870 aircraft have been delivered by the company to various regional airlines. Embraer 170 jet was the first in the series of aircraft in the 70- to 120-seat range with Embraer 195 being the latest with seating capacity of about 120 (see Table I for snapshot of dominant regional airliners).

Market Share and Outlook

Success of Bombardier CRJ led to a host of the competitors emerging in the market, with Embraer giving them tough competition with their ERJ145. ERJ's success is being followed up with Embraer E-series and Bombardier C Series. With Sukhoi and Antonov trying to capture a slice of the market, newer players like Mitsubishi and COMAC too are prospective contenders in the regional airliner space.

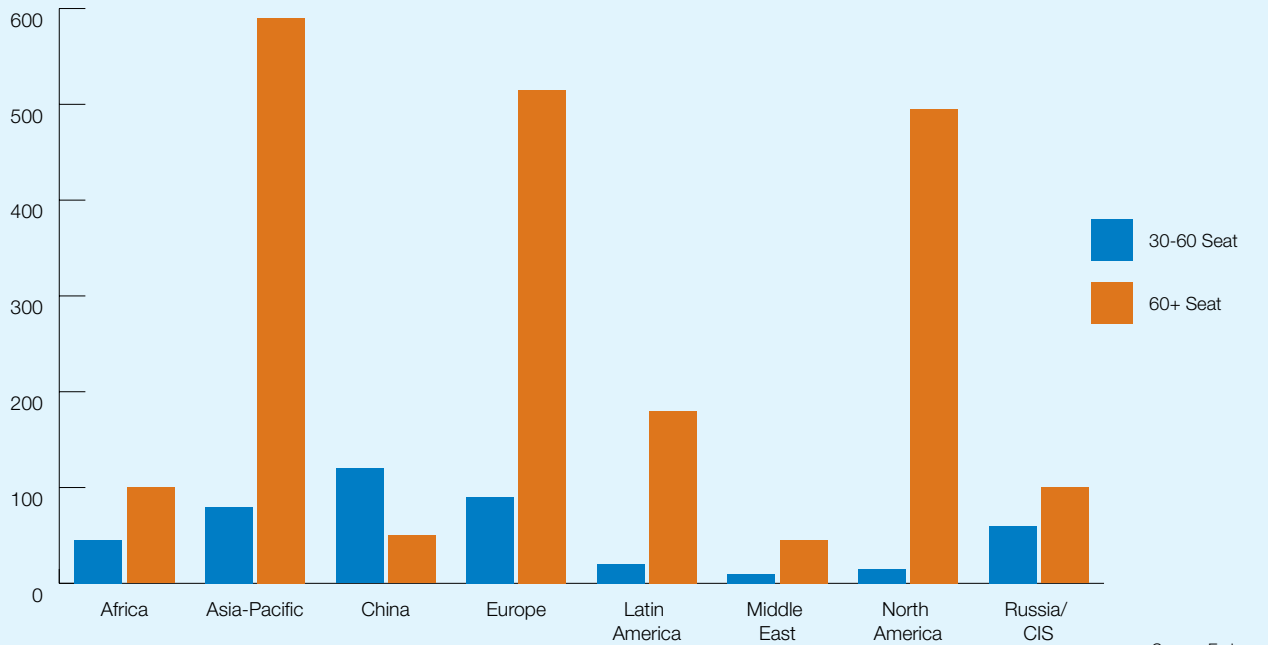
However, in the current high oil price regime, it is likely to be difficult for the regional jets to be able to cater to the price sensitive regional markets and break even unless the bigger airlines contract the regional players to act as feeder airlines and provide compensation. The arrival of Bombardier Q400 has changed the market dynamics. With higher seating capacity, higher cruise speed, lower noise and vibration levels, the Q400 has become an instant success offering serious challenge to the regional jets in the market.

Data for the last five years (Figure 1) suggests a head-to-head fight between Bombardier and Embraer for the market share. While Embraer predicts the delivery of around 6,390 aircraft in the period 2012 to 2031, Bombardier's estimate is 12,500 aircraft for the same period (See Figure 2). As against Bombardier's forecast of 2,515 and Embraer's 2,475 (Figure 3), ATR estimates the requirement of around 3,100 regional turboprop aircraft in the next 20 years. Considering the actual delivery of the aircraft in the 20- to 99-seat range, between 2001 and 2010 (Figure 4), it is evident that the relevance of turboprop aircraft has been growing by the day. In view of the higher oil prices and growing regional demand from countries such as China and India, the lucrative market for high quality turboprop aircraft is likely to be sustained.

Indian Scenario

As per conservative estimates, the Indian market needs around 250 regional airliners in the next 15 years. A study by Embraer suggests that 27 per cent of flights depart with loads appropriate for 70- to 90-seat aircraft and 34 per cent with loads appropriate for 90- to 110-seat aircraft. Therefore, there is a definite need for the regional airliners with 70- to 100-seat regional jet for long haul, connecting farther Tier-II cities to metro hubs and lower seat capacity turboprop aircraft for connecting shorter routes/smaller cities with regional hubs in especially inacces-

Figure 3: Projected new deliveries (turboprop segment)



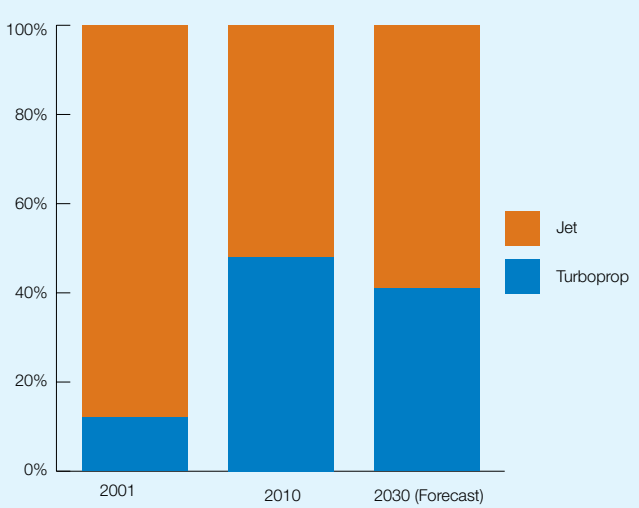
Source: Embraer

sible terrain/airports of Northeast India. Till now, the regional market was out of the radar of major of Indian carriers with competition mainly concentrating on the metro routes like Delhi-Mumbai. The Indian regional market has been dominated by ATR 72 flown by the major airlines. However, with SpiceJet's recent acquisition of Q400, the market dynamics is likely to tilt in favour of this aircraft.

Considering the fact that the Indian Government has been liberal in promoting regional connectivity, there is a tremendous scope for regional airliners in the Indian civil aviation market. Aircraft up to 80-seat capacity are exempt from paying landing and parking charges. Also, sales tax by some of the states on aviation turbine fuel (ATF) for aircraft up to 40,000 kg maximum take-off weight is about four per cent as against 30 per cent for larger aircraft. As there are large numbers of smaller, less developed airports including those in hilly regions, there is a greater potential for turboprop aircraft in comparison to regional jets. The shorter routes from Tier-II and III cities, acting as feeders to metros, are likely to be dominated by the Q400 and the ATR variants due to their cost-efficiencies and short-field operational capability.

The growing middle class and rising aspirations of people in Tier-II and III cities cannot be ignored for long and there is a vast regional market waiting to be discovered. And whosoever goes into these untapped territories with the right strategies and right combination of cost-efficient operation would be the winner. However, despite this huge potential, the immediate problem would be finances for aircraft acquisition, especially against the backdrop of the vitiated atmosphere in the wake of the Kingfisher fiasco, which has led to the world's largest aircraft financier DVB Bank, vowing to suspend financing to Indian carriers. ■

Figure 4: Regional turboprop and jet aircraft (20-99 seats) market share



Source: Bombardier

MILITARY

Asia-Pacific

India-US finalise ₹3,000 crore deal for jet engines

India and the US have finalised a ₹3,000 crore deal for supplying 99 jet engines to be used in the indigenous light combat aircraft Tejas being developed by the DRDO. About two years ago, India had selected the American company General Electric over its rival European Eurojet 2000 for the LCA Mark II programme expected to be ready around 2014-15. As per the contract, the order could be for 99 engines initially but India will have the option of ordering another 100 engines in the future. The engine on offer for the LCA Mark II is GE F-414 engine, which is more powerful than the GE F-404 engines fitted in the first batch of LCAs that the Indian Air Force would receive in the near future. The need for changing the existing engines in the LCAs was felt after the IAF found out that the GE-404 engines were not providing enough power to the aircraft and more powerful engines were needed for the purpose.

Boeing delivers Indian Air Force's first C-17

Boeing has delivered the first of the 10 C-17 Globemaster III airlifters for the Indian Air Force (IAF) on January 22. India's first C-17 will now enter a US Air Force flight test programme at Edwards Air Force Base in Palmdale. Boeing is on track to deliver four more C-17s to the IAF this year and five in 2014.

"The C-17 met the stipulated airlift requirements of the IAF when it flew field evaluation trials in India during June 2010," said Air Commodore Sanjay Nimesh, Air Attaché at the Indian Embassy in Washington, D.C. "The C-17's ability to operate in extremely hot and cold climates; transport large payloads across vast ranges; and land on short, austere runways makes it ideal for India's airlift needs," said Nan Bouchard, Boeing Vice President and C-17 Program Manager.

India had signed an agreement with the US Government on June 15, 2011, to acquire 10 C-17 airlifters, making India the largest C-17 customer outside the US. The foreign military sales contract was finalised on June 6, 2012. Boeing has delivered 250 C-17s worldwide, including 218 to the US Air Force active duty, Guard and Reserve units.

Americas

Airborne laser

Lockheed Martin has received a $9.5 million to cost-plus-fixed-fee contract modification under the aero-adaptive/aero-optic beam control (ABC) programme. Turbulence and other atmospheric conditions can de-focus laser beams, limiting their range and effectiveness. A laser that can adapt its focus to the conditions in its path offers a way to mitigate these problems, which makes it a topic of keen interest to militaries around the world. The famous 747 airborne laser has done some pioneering work in this field. Lasers have both defensive and offensive uses beyond ballistic missile defence.

General Dynamics and Alenia Aermacchi join hands

General Dynamics and Alenia Aermacchi, a Finmeccanica company, have announced the signing of a letter of intent (LOI) to join forces and compete for the US Air Force's T-X trainer programme, which will replace the aging T-38 trainer jets and related training systems. The agreement leverages General Dynamics' legacy of successfully integrating and delivering large, complex systems to the US Air Force, Army, Navy and other government customers with Alenia Aermacchi's proven jet training aircraft and demonstrated manufacturing capability. General Dynamics C4 Systems, a business unit of General Dynamics, will serve as the prime contractor.

Together, the team will offer a fully-integrated advanced pilot training system built around the Alenia Aermacchi T-100, a market variant of the company's established M-346 military aircraft trainer which is an advanced jet trainer that is currently training the world's air forces to operate fourth- and fifth-generation air-combat aircraft.

Northrop's new unmanned aircraft for at-sea surveillance

Northrop Grumman Corporation is building a company-owned unmanned aircraft for use as a development and demonstration platform for at-sea surveillance under the US Navy's MQ-4C Triton programme. Triton provides a detailed picture of surface vessels to identify threats across vast areas of ocean and littoral areas and complements many manned surveillance and reconnaissance aircraft.

Precautionary suspension of F-35 flights

The F-35 Joint Program Office has issued a precautionary suspension of flight operations for development and testing of F-35B short take-off and vertical landing (STOVL) variants. A similar action was taken by Naval Air Systems Command for all F-35B production aircraft operating at Eglin Air Force Base, Marine Corps Air Station Yuma and at Lockheed Martin's production facility in Fort Worth, Texas. These actions were taken as a result of an incident involving an F-35B at Eglin AFB. The precautionary flight suspension will provide time to

QuickRoundUP

AeroVironment

• AeroVironment, Inc., has announced that the US Army has selected it and four other companies to compete for future small unmanned aircraft system (SUAS) requirements under a new Firm Fixed-Price Indefinite Delivery Indefinite Quantity contract with a $248 million maximum value. The contract will enable the continued procurement of AeroVironment's RQ-11B Raven and RQ-20A Puma AE systems as well as competing medium- and long-range SUAS.

Airbus

• Singapore Airlines has firmed up an order for 25 more wide body aircraft from Airbus, comprising five of the world's most efficient, high capacity aircraft, the A380, and 20 A350-900s. The deal was completed in 2012 and follows an agreement in October 2012.

Airbus delivered a company record of 588 aircraft to 89 customers (17 new) and exceeded its order target of 650 by winning 914 gross orders during 2012. These orders include 305 CEO, 478 NEO, 82 A330/A340s, 40 A350 XWB and nine A380s.

Airbus Military

• Kazakhstan has taken delivery of the first two C-295 transport aircraft that it ordered last year, marking Airbus Military´s entry into the CIS regional market.

Bombardier

• Bombardier Aerospace has announced that Qantas Airways Limited has placed a firm order for three Q400 NextGen turboprop airliners for approximately $98 million.

Dassault Falcon

• Dassault Falcon has awarded its two training partners, CAE and FlightSafety International, certificates demonstrating full compliance with requirements of the new Falcon Training Policy Manual. The certificates cover training of pilots, maintenance personnel and cabin crew.

Embraer

• Embraer SA has announced that Pratt & Whitney´s Pure-Power Geared Turbofan engines have been selected for its future, second generation of

understand the origin of a failure of a propulsion fuel-draulic line. The fuel line in question enables actuator movement for the exhaust system associated with the B-model's engine. Instead of traditional hydraulic fluid, it instead uses fuel as the operating fluid to reduce weight. The line enables actuator movement for the STOVL vectoring exhaust system.

Europe

Swiss plans for acquiring 22 Saab Gripen E combat aircraft

As part of Armaments Program 2012, the Swiss Federal Council has asked Parliament to approve the acquisition of 22 Gripen E combat aircraft for a total cost of 3.126 billion francs (about $3.35 billion). These aircraft are to replace the air force's obsolete F-5E Tiger fighters. A special fund (Gripen Fund) will be set up to finance this acquisition. Its creation is based on a federal law which may be subject to an optional referendum. Gripen meets the requirements set by the armed forces, and is significantly cheaper than its competitors. It has the best cost-benefit ratio and the lowest operating costs. It is expected to make the larger payments at the conclusion of the contract—payments made in 2014 and 2016—and during deliveries, the latter being provided between 2018 and 2021.

Eurocopter's Tiger helicopter's "Appui-Destruction" version

The French Directorate General of Armaments has awarded the military type certificate to the Eurocopter's Tiger combat helicopter's "Appui-Destruction" version. The award of the type certificate is an important milestone in the development of the latest version of Tiger. The Tiger programme is intended to equip the French, German and Spanish armies with new-generation fire support and attack helicopters suited to the wide variety of current operational scenarios.

NATO sets up Missile Defense Shield in Turkey

At the beginning of February 2013, German, Dutch and US patriot missiles are expected to be set up in southeastern Turkey, to deter possible missile attacks by Syria towards NATO ally, Turkey. The Germans are stationed in Kahramanmaras, the Dutch in the Mediterranean city of Adana and US troops in Gaziantep. Major cities like Diyarbakir or Batman lie outside the protection zone. The six patriot missile launchers will not suffice to effectively protect the 900-kilometre border with Syria.

Russia

Russia sells record $15 billion of arms in 2012

Russia has sold a record $15.16 billion worth of weaponry in 2012 while expanding its foreign client list, the Federal Military-Technical Cooperation Service (FSMTC) reported on January 21. Russia reported arms sales of $13.2 billion in 2011, enough to maintain its position as the world's second arms exporter after the US. FSMTC chief Alexander Fomin stated that "in the past ten years, we have seen a general increase in exports, which have tripled since 2003". India is the leading purchaser of Russian arms, with Myanmar, Vietnam, Venezuela and Middle East countries also among the main clients. Fomin said that FSMTC was drafting new legislation that would allow Russian arms manufacturers to open their own service centres abroad and to import defence-related products to satisfy their own needs.

CIVIL AVIATION

Americas

NASA's Green Aviation Research

NASA has selected eight large-scale integrated technology demonstrations to advance aircraft concepts and technologies that will reduce the impact of aviation on the environment over the next 30 years, research efforts that promise future travellers will fly in quieter, greener and more fuel-efficient airliners.

The demonstrations, which are part of by NASA's Environmentally Responsible Aviation Project, will focus on five areas—aircraft drag reduction through innovative flow control concepts, weight reduction from advanced composite materials, fuel and noise reduction from advanced engines, emissions reductions from improved engine combustors, and fuel consumption and community noise reduction through innovative airframe and engine integration designs.

INDUSTRY

Russia

Maiden flight of first AW139 helicopter assembled in Russia

HeliVert, a Russian Helicopters and AgustaWestland joint venture, has announced that the first AW139 helicopter assembled in Russia has successfully performed its maiden flight. On December 18, 2012, the first AW139 built in Russia, with the tail number 60001, was rolled out at the HeliVert assembly plant to perform ground testing. On the following day, December 19, at 1630 hours Moscow time the test programme continued with the helicopter's first lift-off and controlled hover. The new helicopter remained in the air for 37 minutes and completed the scheduled tests approved by Russia's aviation authorities. ●

QuickRoundUP

E-Jets, with entry into service planned for 2018.

Embraer has made its debut in Bangladesh with the official inauguration of two ERJ 145 jets purchased by NovoAir, a new scheduled operator.

Hungary

• Hungarian Minister of Defence Csaba Hende, on a visit to Estonia, has announced at a meeting with Estonian counterpart Urmas Reinsalu that Hungary would contribute its fighter aircraft to NATO's Baltic air policing mission. Hungary will bring its Jas Gripen fighters to patrol Baltic airspace in the latter half of 2015.

Northrop Grumman

• Northrop Grumman Technical Services has been awarded a $37 million cost-plus-fixed-fee contract. The award will provide for the modification of an existing contract to supply logistics and engineering support for the Hunter unmanned aircraft system. Work is likely to be completed by January 14, 2014.

Saab Sensis

• Naviair, the air navigation service provider for Denmark, has selected Saab Sensis automatic dependent surveillance-broadcast (ADS-B) for surveillance of flights over Greenland and the Faroe Islands. Naviair will be providing ADS-B data of equipped en route flights to the Reykjavik Control Area Centre.

Singapore Technologies Aerospace

• Singapore Technologies Engineering Ltd has announced that its aerospace arm Singapore Technologies Aerospace Ltd has secured new contracts worth about $450 million in the fourth quarter of 2012. The contracts are for airframe, component and engine maintenance, as well as engineering and development.

US Air Force

• Eclipse Aerospace has responded to the US Air Force's request for information for a large fleet of very light jets to support their Specialised Undergraduate Pilot Training Multi-place Training Track. Eclipse Aerospace's proposed solution could save 13 million gallons of jet fuel per year.

DEFENCE OFFSET

LEADERSHIP
STRATEGY TO IMPLEMENTATION

OIS
OFFSET INDIA SOLUTIONS

OIS-AT

Advisory & Project Management Services

- Adaptive Strategy
- Proposal Services
- Legal and Regulatory
- Monitoring and Compliance
- Implementation Services

Offset India Solutions
An ISO 9001-2008 Certified Company
www.offsetindiasolutions.com

Technology based Offset Delivery

- Advanced Technology Products
- Research and Development
- Quality Manufacturing
- Strategic SME Partner Network
- Technology and Product Collaboration

OIS Advanced Technology
An ISO 9001-2008 Certified Company
www.ois-at.com

12A Community Centre, Panchsheel Park, New Delhi 110017 India. Tel: +91-11-4923-9901 Fax: +91-11-2649-5802