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TABLE *of* CONTENTS

I2

The unmanned test vehicle represents a possible future aircraft that replaces the traditional tube-and-wing design with a shape resembling a manta ray — essentially a flying wing



- **FIRST**
5 Operationally Flexible
- **TECKNOW**
6 Made in India
- **EXPERT SPEAK**
16 India-China
Hindi-Chini Bye, Bye!
- **DIPLOMACY**
18 India-Russia
Advancing Defence Ties
- **SPACE**
19 Business
Mission Private Space
- **SHOW PREVIEW**
24 Aero India 2011
Curtain-Raiser
- **INDUSTRY**
26 Interview
Capturing India's
Aerospace Market
- **CIVIL**
27 Regional Aviation
Radical Concept
- **SEMINAR**
29 Aerospace Conference
Fringes to Mainstream

Cover Story

SHAPES OF THE FUTURE
Aviation behemoths such as Airbus, Boeing, Lockheed Martin and a host of others are investing heavily in futuristic programmes of which some may see the light of the day and some may not



Cover Image:
An artist's rendition of Finnair's A1700-2400
Cruiser which can seat 2,400 passengers
Cover Image: Kauko Helavuo / Finnair

- **MILITARY**
30 Industry
Ahead of Schedule
- **SHOW REPORT**
32 MEBA 2010
Stunning Display
- **HALL OF FAME**
34 Douglas Corrigan
- **REGULAR DEPARTMENTS**
4 A Word from Editor
7 NewsWithViews
– GSLV-F06 fails
– LCA clears drop tank
jettison test
9 InFocus
Old-Obsolescent-Obsolete
10 Forum
Combating Obsolescence
35 NewsDigest
40 LastWord
Where are the Dividends?

NEXT ISSUE:
Aero India 2011

TABLE of CONTENTS

PLUS...



↑ **I9** Mission Private Space



↑ **24** Aero India 2011 Curtain-Raiser



↑ **32** MEBA 2010 Show Report



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As the Aero India Air Show grows in size, SP Guide Publications is taking a ring-side view to give the industry relevant information and be part of the growth momentum

FIRST, THE GOOD NEWS—SP Guide Publications is the official media partner for the eighth edition of Aero India International Air Show 2011 being held in Bengaluru from February 9 to 13. As the show grows in size, SP Guide Publications is taking a ring-side view to give the industry relevant information and be part of the growth momentum.

Needless to mention, the global aerospace industry is inclined to gravitate to India attracted by the size of the aerospace market it has to offer over the coming decades. Capturing this essence is Air Marshal B.K. Pandey in the Aero India 2011 curtain-raiser. The global aerospace majors would be the major beneficiaries of this mammoth exercise entailing staggering levels of investment, while the \$30 billion (₹1,35,000 crore) worth of business generated in India for domestic entrepreneurs under “offsets” obligation would be of immense interest to the Indian aerospace industry, especially in the private sector.

To give the sector a further boost, Defence Minister A.K. Antony on January 7 revised the Defence Procurement Procedure (DPP), liberalising it and expanding the scope for the private sector. In a recent conference on “Energising Indian Aerospace industry” the refrain was opening up of the sector for the private sector in a more aggressive manner.

India is indeed a force to reckon with, acknowledged by the many heads of state who visited in 2010. The year 2010 ended with the Russian President Dmitry Medvedev re-affirming Russia’s interest in the booming defence sector here.

The outlook for 2011 appears bright and it is strongly believed that Lockheed Martin’s Super Hercules C-130J would be inducted into the Indian Air Force ahead of schedule, heralding the re-introduction of the US built military transport aircraft into the IAF after a gap of five decades. It almost answers the concerns of the Chief of the Air Staff, Air Chief Marshal P.V. Naik that defence equipment which comes at substantial cost has to be made available at the right time. The Air Chief had remarked that substantial equipment in the IAF was obsolete and needed to be replaced.

And couple of decades down the line, the global air space

is going to be dominated by weird looking planes which would be lot more operationally efficient and ultra-fast. Giving an insight into the engineers’ dream of “Concept Planes” is R. Chandrakanth. As such a number of major aircraft manufacturers are working in that direction—increasing fuel efficiency; reducing noise levels; and making it faster and efficient.

The next-generation aircraft are all demand-driven. In the regional jet category, the Brazilian aircraft company—Embraer has shown to the world how E-Jets make major difference in air travel, particularly connecting towns to metros and this is highlighted in this issue. The Middle East market is one to watch. The Middle East Business Aviation (MEBA) 2010 event held in Dubai recently forecast 10 to 15 per cent business aviation growth in the next decade and the show report has the details.

With the year having begun on a promising note, SP Guide Publications is bracing up for the Aero India show and beyond. We wish all our readers a rewarding year.

Jayant Baranwal
Publisher & Editor-in-Chief

Operationally FLEXIBLE

Fire-X vertical unmanned aircraft successfully
completes first flight



PHOTOGRAPH: NORTHROP GRUMMAN

FIRE-X, A VERTICAL UNMANNED air system (VUAS) developed by Northrop Grumman Corporation and Bell Helicopter completed its first fully autonomous flight at Yuma Proving Ground, Arizona recently. The VUAS has been developed in less than one year's time.

The VUAS can meet the growing needs for cargo and intelligence, surveillance and reconnaissance (ISR) capabilities. Fire-X's operational capabilities can be expanded to meet the emerging military requirements in all the Services and Special Operations Command of the US.

The first flight of the VUAS involved a short-duration hover to validate safe and reliable autonomous flight. Additional flight tests and reliability data gathering will be conducted in the coming weeks. Integration of ISR sensor payloads and cargo carrying capability test flights is set to occur early next year.

The expertise of Northrop Grumman in unmanned systems combined with Bell's rotorcraft knowledge is what makes Fire-X successful. The first flight was accomplished in the eleventh month since development began. It was achieved by integrating Fire Scout's proven autonomous systems developed for the US Navy with the highly successful Bell 407 helicopter, a FAA-certified helicopter that's been in commercial service worldwide since 1996.

The 407 system can carry ISR sensors and a useful load of more than 3,200 pounds for fuel, payloads and enhanced cargo hauling capabilities both internally and externally. Fire-X will also be able to conduct ISR missions up to 16 hours in endurance and various cargo missions in support of the US Army and Marine Corps requirements.

The Fire-X demonstration aircraft will retain the ability to be optionally piloted—a capability which may appeal to military users because of its added operational flexibility. **SP**

—SP's Aviation News Desk



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MADE IN India

DRDO demonstrates indigenous aerostat system

THE DEFENCE RESEARCH AND Development Organisation (DRDO) recently demonstrated its indigenously designed and developed aerostat system capable of carrying electro-optic and communication intelligence (COMINT) payloads for surveillance. Trials of the system have been concluded, which included surveillance over Agra and interception of a variety of communications. Electronic Intelligence (ELINT) and radar payloads are also being developed indigenously. This platform is a result of development of a number of high-end technologies in the field of aerodynamic design of balloon, fabric, fabrication, hydraulic winch, electro-optic tether, high pressure helium cylinder manifold, active pressure control system, etc in association with large and medium sized industrial partners.

The system has been designed, developed and integrated by the Aerial Delivery Research and Development Establishment (ADRDE), a premier laboratory under the DRDO working in the field of parachutes, lighter than air systems, floatation systems and aircraft arrester barriers.

The complete balloon systems, ground based command and control systems, and payloads have been integrated for full exploitation. The gimbals with 360 degree azimuth freedom and high degree freedom in elevation, is highly stabilised and can carry out steering, scanning and tracking with high precision. The payload also carries thermal camera for surveillance at night and in low visibility condition. The electronic intelligence payload carries a communication intelligence system for capturing and analysing all types of communications in air. Health monitoring of aerostat and simultaneous command and control of payload from ground control station has also been demonstrated. The system will be useful for all the three services, the paramilitary forces as well as for civilian applications including disaster management. SP



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GSLV-F06 FAILS

India's ambitious space programme suffered a blow on December 25 when the geo-synchronous satellite launch vehicle (GSLV)-F06 rocket had to be destroyed 63 seconds after lift-off from Sriharikota, 100 km from Chennai. The GSLV-F06 had on board the GSAT-5P satellite that would have boosted the country's television broadcast and telemedicine facilities. ISRO chairman K. Radhakrishnan briefed reporters, "I'm sorry to say that the GSLV-F06 mission has failed. The lift-off was normal. All the strap-on motors generated normal pressure before the solid core was ignited. The performance of the vehicle was normal up to 50 seconds. Soon the vehicle lost control and we had to detonate it at an altitude of eight kilometres."

VIEWS

THE DECEMBER 25 FIASCO at Sriharikota has dealt another blow to India's space programme after back-to-back failures of India's largest rocket, the GSLV. An earlier April 15 launch this year had also resulted in a dismal disaster when the first ever attempt with the indigenously developed cryogenic engine failed immediately after commencement of ignition. The 167-foot-tall launcher lifted off majestically just after 4 p.m. from the Satish Dhawan Space Centre on India's eastern coast but what would have been an ideal Christmas gift to the nation turned into an embarrassing spectacle when close to one minute into ascent the launch vehicle started to wobble and tilt dangerously to one side, veering off the intended flight path and breaking up in a huge fireball. The flight control team had no other recourse but to press the 'self-destruct' button to at least ensure that none of the debris fell anywhere except in the safe waters of the Bay of Bengal.

While the Indian Space Research Organisation (ISRO) would be in the process of constituting a Failure Analysis Committee (FAC) to go into the exact causes that led to the failure of the rocket and make recommendations for preventing their recurrences in the forthcoming missions, the reports emanating from the statistical study of the initial data suggests that, the connectors that take control commands from the on-board computers, did not reach the electronic actuation stage. The signals are transmitted from the flight control system in the equipment bay to various propulsion stages to control the rocket. In this flight, the data shows that the signal link got snapped to the nozzle actuator of one of the four strap-on liquid booster motors used in conjunction with the main solid-fuel first-stage rocket booster.

If this snag does turn out to be the real culprit after the FAC has gone through its fact finding enquiry and deliberations then—notwithstanding the national red face and the huge cost of the failed mission—the good news would be that the problem could comparatively be resolved more eas-

ily as it would be outside the purview of the much more complex issues such as propulsion, stage-separation, etc. On the other hand, does such a simple malfunction which nonetheless has caused irretrievable loss to the exchequer and the national pride point to certain laxity in production and lack of quality control in the production cycle? While it is fervently hoped that it won't be the case, it is equally important that the issue be examined closely and remedial measures initiated, if required. It may be remembered that compared to the PSLV launches which has been a huge suc-

cess story, ISRO's record of GSLV launches—with four failures and one partial and just two complete successes—has been anything but rosy.

Then, there is the issue of cryogenic engine which is central to the overall propulsion requirements for a two-tonne plus payload to be hurtled into a geo-synchronous orbit. Cryogenic propulsion is a highly complex and strategic technology which permits launch of heavier payloads with the same overall weight of the launch vehicle and therefore, a well guarded secret. India had managed to import seven engines from its time-tested friend Russia and the first flight of the GSLV using Russian 'Cryo' stage took place in 2001. Since then, ISRO has already used six Russia supplied engines that included the December 25 launch which did not even reach the 'Cryo' stage.

While ISRO is keeping a bold face by stating that it would compensate loss of GSAT-5P satellite by borrowing transponders from other global agencies, it is imperative that it sorts out the problems of both the 'vehicle' and the indigenous 'cryo' stage if it wants to take forward its planned future space programmes. Perhaps, its next GSLV launch should be with an indigenous cryo and a dummy load to prove both the vehicle as well as the propulsion system to gain the much needed confidence but without endangering a precious payload. ■

—Air Marshal (Retd) V.K. Bhatia



LCA CLEARS DROP TANK JETTISON TEST

On December 17, the indigenous light combat aircraft (LCA) Tejas passed another milestone by successfully carrying out the drop tank jettison test. The feat was achieved by the Tejas over DRDO's air-to-ground facility near Challakare in Chitradurga district, about 250 km from Bengaluru. The 1,200-litre drop tank jettison trial was conducted at a critical point in the jettison envelope on Tejas LSP-3 aircraft. To ensure safety of flight, clean separation with adequate clearances from the mother aircraft or neighbouring external stores need to be established from flight tests covering a number of conditions such as empty, partial and full drop tank under different ejector release unit settings.

VIEWS

JETTISONING DROP TANKS FROM a fighter aircraft may sound like a mundane exercise amidst the more complex accomplishments in the course of detailed flight-testing of an aircraft in its development programme. Nonetheless, it is extremely vital from the operational-cum-flight safety point of view. As the name suggests, jettisoning drop tanks are carried out by fighter aircraft during emergent situations such as a quick getaway after mission completion—by which time the drop tanks would have generally emptied out and become redundant—especially when being chased by enemy interceptors. Other scenarios could include premature return to the base after getting airborne for a mission due to bird strike, aircraft unserviceability, etc. The trial which was conducted at the recently commissioned National Flight Test Centre (NFTC) air-to-ground range at Challakare, Chitradurga in close proximity to Bengaluru obviated the requirement of moving time-consuming and costly detachment to distant locations such as Hyderabad or Pokhran. The near vicinity also ensured that the entire process could be easily monitored from Bengaluru. The test also suggests that the Tejas may finally be coming close to achieving the initial operational clearance (IOC) as such tests are normally carried out towards the end of the 'flight-testing' programme.

Conceptualised as far back as 1983, the indigenous LCA Tejas programme stumbled through a number of roadblocks and weathered many a storm in its turbulent history of development spanning more than a quarter of a century. LCA has indeed been one of the most ambitious indigenous defence related programme. Of the five critical technologies identified at the beginning of the LCA programme to be mastered for India to be able to design and build a 'completely indigenous' state-of-the-art fighter, it would be worth examining the successes and failures in different fields. Where the indigenous effort succeeded was in the development and manufacture of advanced carbon-fibre composite (CFC) structures and skins and a modern 'glass cockpit'. However, self-reliance

goals also included indigenous development of the three most sophisticated and hence most challenging—systems viz the fly-by-wire (FBW) flight control system (FCS), multi-mode pulse-doppler radar (MMR) and afterburning turbofan engine. All these proved real tough nuts to crack. And while being constituted for the purpose, National Control Law (CLAW) team was somehow able to pass muster with help coming from foreign players such as the British Aerospace and Lockheed Martin and later through some innovative effort of its own, it was in the field of multi-mode radar and the power plant systems that the concerned agencies (LRDE for the MMR and GTRE for the Kaveri engine) had to face embarrassing failures.

With no other indigenous recourse left, Aeronautical Development Agency (ADA) overseeing the LCA programme had to settle for obtaining the two major systems from abroad which perforce resulted in considerable shortfall in performance from the original planned parameters. With the help of Israel Aerospace Industries (IAI), a hybrid version of Elta EL/M-2032 was installed for the first time in LSP3 and will be a standard fit till a breakthrough is made in the indigenous MMR development effort. Similarly, to power the LCA, ADA had to settle for the General Electric to supply the propulsion system. The F404-GE-IN20 is an improved version of the original F404-GE-402, specially designed for the Indian LCA with more than 40 on order to equip the first two squadrons for

the Indian Air Force (IAF). But even at 84kN (19,000 lb) max static thrust with afterburning, compared to 78kN (17,700 lb) of the 402, the F404-GE-IN20 still falls way short of the IAF's air staff requirement of 100kN, with inevitable adverse effect on the operational employment of the aircraft. It is quite obvious that till the recently selected (98kN) F414-GE-INS6 starts to power the Mk II version of the LCA, Tejas would at best be akin to a three-legged 'Cheetah' on the inventory of the IAF. SP

—Air Marshal (Retd) V.K. Bhatia



Defence equipment in most cases comes at great costs. Therefore, it is inevitable for it to stay in operational use for long periods in the defence forces the world over. However, prudence would demand that the equipment is replaced before it becomes obsolete.



Old-OBSCULESCENT-OBSOLETE

AT A PRESS CONFERENCE held to mark the 78th anniversary of the Indian Air Force (IAF), the Air Chief, Air Chief Marshal P.V. Naik stated that the IAF was grappling with the problem of large-scale obsolescence of its equipment with as much as 50 per cent of its equipment having become obsolete. If this statement had been true, it would have rung alarm bells of the most serious nature with regard to the state of the equipment on the IAF's inventory. Fortunately, soon after the press conference, the Chief of the Air Staff (CAS), while being interviewed by a TV channel, had the opportunity to clarify that he was actually alluding to obsolescence of some of the IAF's equipment.

So what is the difference between a set of equipment being obsolescent or obsolete? Oxford dictionary defines obsolescent as 'something which is in the act of becoming obsolete or going out of use' and obsolete as 'disused, already discarded or at best, antiquated'.

Defence equipment in most cases comes at great costs. Therefore, it is inevitable for it to stay in operational use for long periods in the defence forces the world over. However, prudence would demand that the equipment is replaced before it becomes obsolete. While most world class armed forces have been able to keep their defence equipment current, how have the Indian armed forces fared in this regard? Even a modest scrutiny would indicate that for a combination of reasons, the Indian armed forces have been unable to avoid reaching this dismal situation in some or much of their operational equipment depending upon the service in question. While the Indian Army perhaps is the greatest victim in terms of obsolete equipment, the IAF would find its place somewhere between the two services, the Indian Army and the Indian Navy.

It is true that at any given time, a service would be concurrently handling many types of equipment in terms of age or operational relevance. The Indian Army, for example, talks of three categories such as new or current, obsolescent and obsolete. However, taking into account the highly capital intensive equipment of the Navy and the Air Force especially the latter, it is suggested that the equipment on

its inventory be divided into four categories i.e. new, old, obsolescent and obsolete. As stated earlier, because of the exorbitantly high costs of initial acquisition, the Air Force equipment invariably undergoes midlife upgrades with life extensions when it reaches the stage where it starts to 'get old' that this second stage has been recommended. However, the impact of technologies is such that no Air Force equipment should ever be allowed to reach the last stage where it becomes obsolete as not replacing the equipment on reaching obsolescence would result in dangerous deficiencies in the operational effectiveness of the Air Force.

The IAF has had a chequered history in so far as this aspect is concerned. There have been times when owing to design deficiencies, flight safety compulsions or operational ineffectiveness, the IAF has discarded equipment—especially the aircraft—much before they came anywhere towards completion of their respective service life and there have been instances when the IAF had to carry on and is still carrying on, with a particular equipment even after it has gone well beyond the stage of obsolescence. There were the classic cases of premature withdrawal of the indigenous Gnat/Ajit and Marut (HF-24) from service mostly due to flight safety constraints. Similarly, the Soviet-built fighters Su-7 and at a later stage MiG-23s were prematurely retired from service even though they had a lot of service life still left in them. The other side of the coin has witnessed the IAF struggling with many MiG-21 squadrons which have reached ominous levels of obsolescence. The situation on the air defence front is equally appalling, especially in the case of AD radars and AD SAMs such as the SAM-3 Pechora, the SAM-8 OSA-AK quick-reaction or SAM-24 IGLA man-portable missile systems concerned. The unprecedented and ominous drawdown as far as the number of jet fighter squadrons is concerned, is of course well known by now.

How is the IAF dealing with the problems of obsolete equipment and what should it be doing to regain and enhance its operational effectiveness? Turn to Forum for some answers. SP

—Air Marshal (Retd) V.K. Bhatia



Combating OBSCOLESCENCE

From greater number of force-multipliers to UAVs and UCAVs et al, the IAF has indeed worked out its modernisation plans well. What is required to be seen now is that it gets the necessary support from the powers that be, and in a timely manner.



WITHOUT GETTING INTO THE controversy on the percentages with regard to the amount of IAF equipment having become obsolete, one statement of the CAS during the IAF's 78th anniversary conference is worth noting when he spoke words to the effect that the IAF was striving to bring down obsolescence levels to around 20 per cent by 2014-15. Describing the security scenario in India's neighbourhood as a "volcano" which could erupt anytime and exhorting the air warriors to be prepared to tackle any eventuality, and while putting up a brave front during his interaction with the media by stating that in spite of shortcomings, the IAF was capable of handling threats, it is clear that the IAF leadership is deeply concerned with the widespread obsolescence of its equipment and the resulting adverse effect it has on its operational capability.

But why has the IAF allowed this level of obsolescence to creep into its inventories? One would be hard put to single out one particular determining factor which might have led to such large-scale obsolescence in the IAF. More accurately,

multiple reasons ranging from the collapse of the Soviet Union in the early 1990s on whom the Indian armed forces were heavily dependent for continued supply of military hardware and the dire financial straits in which India found itself at about the same time might have had a cascading effect leading to obsolescence in the later years. However, even if the financial resources and alternate sources of defence equipment were made available, it is felt in some quarters that the Bofors scandal which had erupted at about the same time, and later Tehelka, so paralysed the politico-bureaucratic regime that none of the acquisition/modernisation plans of the armed forces were allowed to be extricated from the cold storage of inaction they had been consigned to.

Whatever the reasons, the stark reality is that India's armed forces started to feel the heat of obsolescence and reduced inventories by the turn of the century. For example, the IAF in the new millennium witnessed a very quick and alarming decline in its jet fighter squadrons, losing almost a quarter of its fighter force in a few years. Hasty decisions to withdraw some fleets based purely on flight safety and maintenance support concerns further accelerated the process of decline.

While the fighter force in the IAF may have experienced the worst downside, other fleets and systems too have not been left unscathed from the menace of obsolescence or worse. The most alarming decline has been in the field of air defence but other support and infrastructural systems have also been affected in varying degrees. But the good news is that riding on the financial support of an economically resurgent India and backed by its sound and far-sighted plans, the IAF is slowly coming out of the quagmire of obsolescence. The slim ray of hope is turning into an ever brightening dawn beckoning the IAF to establish itself on a purposeful path studded with new acquisitions and modernisation/upgradations. So, how is the IAF combating the scourge of obsolescence?

First, as far as its fighter force is concerned, the IAF is trying hard to come out of a deep well of decline by inducting new fighter aircraft into its inventory. Spearheading the new inductions, are the twin-engine Su-30 MKI state-of-the-art air dominance fighters more than hundred of which have already been inducted into squadron service in the three operational commands of the IAF. With six squadrons of these aircraft operative, two each at Pune in South Western Air Command (SWAC), Bareilly in Central Air Command (CAC) and Tezpur in Eastern Air Command (EAC), the IAF has been able to effectively arrest any further downside in the numbers of its fighter force which had been hovering around 30 squadrons down from the earlier level of 39 ½. Even Western Air Command (WAC) is gearing up to accommodate the next two squadrons at its frontline base at Halwara in Punjab. With these inductions, the IAF would be able to reverse the trend and start building up on its squadron strength once again. The total IAF order for the Su-30 MKIs currently stands at 270 aircraft with their production continuing at the HAL factory at Nasik. The IAF could equip close to 12 squadrons with these aircraft when the order is complete. That would be a formidable fleet and has the potential to be built upon further.

The Su-30 MKIs alone cannot cater for the total requirements of the IAF to meet the emerging threat scenarios. Defence Minister A.K. Antony had made a statement that by the

end of the 13th Five Year Plan i.e. by 2022, the combat fleet of the IAF would be increased to 42 fighter squadrons. How would this be achieved? First are the gradual inductions of the indigenous LCA Tejas which would primarily be used to replace the remaining MiG-21 squadrons in a phased manner. Second, the much-hyped MMRCa project is slowly inching towards the final stages of awarding the contract to the winning competitor which may happen sometimes in 2011 or early 2012. As the order matures it has the potential for the total numbers to go up to 200 aircraft from the present 126. Then, there is the Indo-Russian joint venture to coproduce the PAK-FA fifth generation fighter which should start seeing the light of the day by 2017 or so and the just initiated indigenous medium combat aircraft (MCA) design work on which has reportedly commenced. The new generation aircraft would ultimately replace the by then old models such as the Mirage 2000, Jaguars, MiG-29s, etc. But whether the IAF will be able to achieve the recommended figure of 50 combat squadrons to cater to a possible two-front scenario owing to ever increasing Sino-Pak nexus is likely to remain within the realm of speculation, at least in the foreseeable future.

The second area of major concern for the IAF is air defence network, especially, its ground-based radar surveillance as well as ground-based air defence weapon systems which though continue to be sustained through a series of life extensions, are heavily weighed down by mounting obsolescence. IAF's high and medium power radars such as the THD-1955, PSM-33 and TRS-2215 as well as most of its low level transportable radars (LLTRs) are becoming victims of obsolescence. The IAF has initiated measures to acquire long-range surveillance radars (LRSRs) and high-power radars (HPRs) to not only combat the present obsolescence but also to enhance coverage in the mountainous terrain bordering China and Pakistan. This is in addition to the 19 LLTRs, four medium-power radars (MPRs) and 30 indigenous medium-range Rohini radars along with additional aerostats from Israel.

As far as the ground-based AD weapons are concerned, Pechora SAM-3 systems which were inducted more than three decades ago, cannot be sustained much further, especially, the missiles which have been already subjected to a number of life extensions. The OSA-AK quick-reaction missile systems are hardly faring any better. In a nutshell, all these need urgent replacements. Stung by the failure of the highly publicised indigenous Trishul SAM systems, the IAF was left with little choice but to finally go in for the Israeli Spyder systems, of which, the first lot of the 18 systems on order should

start reaching the Indian shores by 2011. A joint venture has been also set up with Israel to produce what has come to be known as the MR-SAM but which essentially is the 'Barak II' or 'Barak NextGen' missile. The other good news is that the indigenous 'Aakash' SAM systems have been developed sufficiently by the Defence Research and Development Organisation (DRDO) for the IAF to show its faith by ordering eight squadrons worth of equipment. Hopefully, these should get inducted into the IAF before the existing Pechora systems start to fall by the wayside.

In its fixed-wing transport fleets, while the IAF is going in for mid-life upgrades for its close to 100 An-32s, it can do little to bring up the now almost obsolete HS-748 Avro aircraft. These aircraft are on the threshold of retirement in a phased manner. IAF's heavy-lift IL-76 aircraft are also facing obsolescence. The IAF is creditably tackling the problem by adopting a multi-pronged strategy. An unprecedented order

for six C-130J Super Hercules 'special operations' aircraft from Lockheed Martin is close to fructification with the first aircraft arriving in India in February this year. India also inked an agreement to buy 10 Boeing's C-17 Globemaster III aircraft with an option for six more during the US President Obama's visit to New Delhi last November. In a balancing move, it has also formed a JV with Russia to co-develop/co-produce a multi-role transport aircraft (MTA) in the 10-tonne payload class.

The rotary-wing segment of the IAF is also being properly attended

to. With an additional order of 59 helicopters to the original 80 Mi-17 1V from Russia, the IAF would be in a position to replace the Mi-8s and the older models of Mi-17s. The IAF is also on track to acquire light utility helicopters through a joint RFP with the Indian Army and is going in for advanced heavy-lift and attack helicopters. It has already sealed a deal to acquire the AW101 helicopters for VIP travel.

The list doesn't stop here. From greater number of force-multipliers to UAVs and UCAVs et al, the IAF has indeed worked out its modernisation plans well. What is required to be seen now is that it gets the necessary support from the powers that be, and in a timely manner to be able to tackle not only the mounting obsolescence but also be able to modernise; otherwise, the CAS' assertions that the IAF will be able to bring down the obsolescence levels to 20 per cent by 2014-15 and that, it would emerge as a highly potent force in the next 5-7 years, may turn out to nothing but a mere rhetoric. ■ SP

—Air Marshal (Retd) V.K. Bhatia





HIGH ON CONCEPT:
FINNAIR A600-850 CAN SEAT
600-850 PASSENGERS AND
HAS FOUR ENGINES THAT CAN
BE TILTED, ALLOWING FOR
VERTICAL TAKE-OFFS

IN 1893, HORATIO PHILLIPS built a “Flying Machine” which looked like a motorised “Venetian blind”. Over a century later, “concept planes”, some of which are straight out of science fiction, are flying off the drawing boards at supersonic speed. The doable futuristic designs are getting shape and expected to redefine air travel in the not so distant future.

Scientists, innovators, engineers and aircraft manufacturing companies are busy designing and working on “concept planes” driven by different needs. Aviation behemoths such as Airbus, Boeing, Lockheed Martin and a host of others are investing heavily in futuristic programmes of which some may see the light of the day and some may not.

With the turn of the 21st century, a surfeit of aircraft designs surfaced that have been wildly imaginative and unorthodox, particularly military aircraft with stealth and strike features. The designs are weird, exotic and even monstrous. In the civil aviation realm, the aircraft manufacturing companies, propelled by business considerations, are considering investments in designs which improve operational efficiency; consume less fuel or alternate fuel;

By **R. Chandrakanth**

enhance passenger comfort; and are environment friendly.

Airbus Research and Technology head Axel Krein said, “The planes of the future will offer an unparalleled, unobstructed view of the wonders of the five continents —where you will be

able to see the pyramids or the Eiffel Tower through the transparent floor of the aircraft.” This can be done using special ceramics.

SUPERSONIC CRUISING

Sometime around 2030 or 2035, a concept aircraft, envisioned by Lockheed Martin, may take to the skies. The futuristic aircraft is set to revolutionise supersonic cruising by relying upon a so-called “inverted-V” engine-under wing configuration, where the engines sit atop the wings rather than beneath. This is expected to quiet the sonic boom, the main reason why supersonic flights are banned over land routes. That prevented the now-defunct Concorde airliner from going supersonic except over water during transatlantic trips.

In October 2008, NASA gave a mandate to the industry and academia to develop advanced concepts for aircraft that could satisfy anticipated commercial air transportation needs while meeting specific energy efficiency, environmental and operational goals in 2030 and beyond. The

Shapes *of the* Future

Aviation behemoths such as Airbus, Boeing, Lockheed Martin and a host of others are investing heavily in futuristic programmes of which some may see the light of the day and some may not

studies were intended to identify key technology development needs to enable the envisioned advanced airframes and propulsion systems.

NASA's goals for a 2030-era aircraft are:

- A 71-decibel reduction below current Federal Aviation Administration noise standards, which aim to contain objectionable noise within airport boundaries.
- A greater than 75 per cent reduction on the International Civil Aviation Organisation's Committee on Aviation Environmental Protection Sixth Meeting, or CAEP/6, standard for nitrogen oxide emissions, which aims to improve air quality around airports.
- A greater than 70 per cent reduction in fuel burn performance, which could reduce greenhouse gas emissions and the cost of air travel.
- The ability to exploit metroplex concepts that enable optimal use of runways at multiple airports within metropolitan areas, as a means of reducing air traffic congestion and delays.

FOUR TEAMS RACING

The teams were led by General Electric, Massachusetts Institute of Technology, Northrop Grumman and Boeing. Here are some highlights from their final reports:

GE Aviation conceptualises a 20-passenger aircraft that could reduce congestion at major metropolitan hubs by us-

ing community airports. The aircraft has an oval-shaped fuselage that seats four across in full-sized seats. Other features include an aircraft shape that smoothes the flow of air over all surfaces, and electricity-generating fuel cells to power advanced electrical systems.

With its 180-passenger D8 "double bubble" configuration, the Massachusetts Institute of Technology team strays farthest from the familiar, fusing two aircraft bodies together lengthwise and mounting three turbofan jet engines on the tail. Important components of the MIT concept are the use of composite materials for lower weight and turbofan engines with an ultra high bypass ratio for more efficient thrust. In a reversal of current design trends the MIT concept increases the bypass ratio by minimising expansion of the overall diameter of the engine and shrinking the diameter of the jet exhaust instead. The team said it designed the D8 to do the same work as a Boeing 737-800. The D8's unusual shape gives it a roomier coach cabin than the 737.

The Northrop Grumman team foresees the greatest need for a smaller 120-passenger aircraft that is tailored for shorter runways. The team describes its silent efficient low emission's commercial transport (SELECT), concept as "revolutionary in its performance, if not in its appearance." Ceramic composites, nanotechnology and shape memory alloys figure prominently in the airframe and ultra high bypass ratio propulsion system construction.

Boeing's subsonic ultra green aircraft research (SUGAR)



Reaction Engines Limited A2 RANGE OF 20,000 KM

A2 is a design study for a hypersonic airliner intended to provide environmentally-friendly, long range and high capacity commercial transportation. It is being examined as part of the LAPCAT programme of the European Union. Reaction Engines Limited, the British design firm, says it could probably be developed into a working aircraft within 25 years, if there is demand for it.

The vehicle is intended to have about 20,000 km range and good subsonic and supersonic fuel efficiency. The top speed is projected to be Mach 5+ and the fuel is likely to be liquid hydrogen, having twice the specific energy of kerosene, and can be used to cool the vehicle and the air entering the engines via a precooler.

The airliner may be able to fly from Brussels to Sydney in about 4.6 hours.

PHOTOGRAPHS: REACTION ENGINES, BOEING, NASA & REINDY ALLENDRA

Boeing's X-48B MANTA RAY WINGS

Boeing and NASA have completed the first test flight in 2010 of its latest blended-wing-body research aircraft, designated the X-48B. The unmanned test vehicle represents a possible future aircraft that replaces the traditional tube-and-wing design with a shape resembling a manta ray — essentially a flying wing. The prototype has a 21-foot wingspan and weighs 500 pounds.

George Muellner, President, Advanced Systems unit in Boeing's defence division, has said that with continued government funding, a blended-wing-body military-cargo plane could be in use sometime between 2015 and 2020.



SUGAR Volt FOLDABLE WINGS

The Boeing Company's Subsonic Ultra Green Aircraft Research's SUGAR Volt is a twin-engine aircraft with hybrid propulsion technology, a tube-shaped body and a truss-braced wing mounted to the top. The SUGAR Volt wing is longer from tip to tip, shorter from leading edge to trailing edge, and has less sweep. It also may include hinges to fold the wings while parked close together at airport gates. Projected advances in battery technology enable a unique, hybrid turbo-electric propulsion system. The aircraft's engines could use both fuel to burn in the engine's core, and electricity to turn the turbofan when the core is powered down.

team examined five concepts. The team's preferred concept, the SUGAR Volt, is a twin-engine aircraft with hybrid propulsion technology, a tube-shaped body and a truss-braced wing mounted to the top. Compared to the typical wing used today, the SUGAR Volt wing is longer from tip to tip, shorter from leading edge to trailing edge, and has fewer sweeps. It also may include hinges to fold the wings while being parked close together at airport gates. Projected advances in battery technology enable a unique, hybrid, turbo-electric propulsion system. The aircraft's engines could use both fuel to burn in the engine's core, and electricity to turn the turbofan when the core is powered down.

Beneath these high-flying designs, engineers are working on breakthrough airframe and propulsion technologies that are going to improve overall efficiency. These ultramodern designs find shape through memory alloys, ceramic or fibre composites, carbon nanotube, etc.

FINNAIR'S EXOTIC CONCEPTS

Futuristic designs have emerged from the Finnair group which in celebration of its 85th anniversary, released concept aircraft that beat imagination. The collection is based mainly on current trends to create more environment

Fantasy Flight—Airbus Concept Plane

At the 2010 Farnborough International Airshow, aircraft manufacturer Airbus unveiled images of what air transport could be like in 2050—even 2030 if advancements in existing technologies continue apace.

Airbus experts in aircraft materials, aerodynamics, cabins and engines came up with the design which is an 'engineer's dream' to meet the expectations of the passengers of the future. Ultra long and slim wings, semi-embedded engines, a U-shaped tail and light-weight 'intelligent' body all feature to further improve environmental performance or 'eco-efficiency'.

Charles Champion, Executive Vice President Engineering at Airbus, says, "The Airbus Concept Plane represents an engineer's dream about what an aircraft could look like in the long-term. It's not a real aircraft and all the technologies it features, though feasible, are not likely to come together in the same manner. Here we are stretching our imagination and thinking beyond our usual boundaries."

Robin Mannings, an independent futurologist, looks ahead, "Most of us want reduced traffic congestion—both on the ground and in the sky—together with improved comfort for a better travelling experience. By 2050, we'll also expect seamless access to a plethora of technology and applications. And 'flexibility'



GreenSupersonic Machine INVERTED-V ENGINE-UNDER WING

This future aircraft design concept for supersonic flight over land comes from the team led by the Lockheed Martin Corporation. The team used simulation tools to show it was possible to achieve over-land flight by dramatically lowering the level of sonic booms through the use of an “inverted-V” engine-under wing configuration. Other revolutionary technologies help achieve range, payload and environmental goals. This concept is one of two designs presented in April 2010 to the NASA Aeronautics Research Mission Directorate for its NASA Research Announcement-funded studies into advanced supersonic cruise aircraft that could enter service in the 2030-35 timeframe.

NASA's X-43A

NEW YORK - SYDNEY IN 2 HOURS

Flights between New York and Sydney take a minimum of 21 long hours. In future, 40 winks and two hours are all that may be needed.

NASA is planning to develop hypersonic planes that can just do that—travelling at five times the speed of sound. In 2010, an experimental aircraft travelled at a record-breaking speed of 7,200 kmph.

NASA plans to allocate \$5 million (₹22.5 crore) each year over three years to make the design of the new craft a reality as part of its 2010 aeronautics proposal. The engineers will look into ‘entry, descent and landing of high-mass vehicles entering into planetary atmospheres’ and ‘air breathing access to space’.



WB-1010 Aircraft 1,500 PLUS SEATING CAPACITY

The WB-1010 aircraft from designer Reindy Allendra is an entry to the KLM Indonesia aircraft design competition. Looking 85 years into the future, the concept aims to solve the transportation needs for a world with a crowded population. The future aircraft will be similar in design to present day aircraft, only a lot faster and with better technology.

The WB-1010 will be able to seat about 1,500 people and be able to reach a speed of nearly 1,000 kmph. This giant plane's body will be made of a material similar to GLARE used in the Airbus A380, with helium injected inside the body to make the airplane lighter. A robotic extractable stand at the plane's belly will help the plane during landing, and working in conjunction with a super jet, it will be able to land vertically, without the requirement of a runway.



will become the new mantra for air travel, with us as passengers choosing levels of speed or luxury in cruise ships of the sky.”

In ‘The Future by Airbus’ the company talks of morphing seats made from ecological, self-cleaning materials, which change shape for a snug fit; walls that become see-through at the touch of a button, affording 360 degree views of the world below; and holographic projections of virtual decors, allowing travellers to transform their private cabin into an office, bedroom or Zen garden. ●

friendly aircraft technology and to use lightweight materials.

The Finnair A600-850 M resembles a dart—it even has the needle-thin nose. It is little wonder then that this proposed aircraft is described as being a ‘zero-emission supersonic aircraft’. It's most impressive feature is probably the super-light nanoceramic material that will construct the fuselage, making the aircraft super fast and super efficient. The three chosen fuels are solar fuel, biofuel and hydrogen fuel. Passengers on this futuristic vehicle will have all the amenities they could dream of and more. The Finnair 600-850 M would be capable of seating a whopping 600 to 850 passengers.

The Finnair A600-850 looks more like the Voyager spaceship. It has the same seating capacity, but has a completely different look and it is designed for much shorter trips. The aircraft has four engines that can be tilted, allowing for vertical take offs.

The Finnair A1700-2400 Cruiser looks more like a flying saucer than an airplane and is capable of seating up to 2,400 passengers—all of whom get to enjoy luxurious, self-contained cabins complete with toilets, showers and internet access. This is more of a cruise ship than an airplane. The aircraft has seven engines that can be rotated for VOTL take-offs and increased flight stability. SP

RISEING POWERS:
CHINESE PREMIER
WEN JIABAO WITH
PM MANMOHAN SINGH
IN NEW DELHI



What comes out loud and clear from the so-called moderate Wen Jiabao's visit is that China gives little cognisance to India as a rising and matching power even after taking into calculations India's growing strategic closeness to the United States

IF THE OCCURRENCES IN the recent past are any indicators, visits to Delhi by the Chinese dignitaries are invariably accompanied by disconcerting developments in the bordering Tibet Autonomous Region (TAR) or in mainland China, creating more than mere pinpricks to India's security concerns. The recent (December 15-17) Chinese Premier's trip to India was no exception. As Wen Jiabao descended into Delhi, riding on the wave of a 'charm offensive' with a huge business delegation in tow, news broke out of Chinese engineers having blasted through the last part of a tunnel which would provide Metok, a small township of 11,000 inhabitants, an all-weather, round-the-clock connectivity with the rest of Tibet. The 3.3-km Galongla Tunnel, built at an altitude of

12,300 ft, would connect Metok with China's national highway system. Security implications of this new development were not lost on India's defence establishment as Metok sits next to Tibet's eastern border with the state of Arunachal Pradesh. Metok, the region's last isolated county, is also the place where river Brahmaputra enters India.

If there were hopes that Wen's December visit would be based on no-holds-barred contours that would take talks between the Indian leaders and the Chinese Premier to the next level where he had left during his earlier 2005 visit, then the outcome was certainly not as per the expectations. The Indian team was hoping for a forward movement on all controversial issues such as stapled visas, a proposed dam on the Chinese side of Brahmaputra River and India's case for a permanent



seat in the United Nations Security Council (UNSC), not to speak of Pakistan's role in terrorist activities especially against India and the niggling border issue. But on all the above issues, the Indian side cut little or no ice. For example, Wen's 2005 visit had been truly forward-looking at least in establishing a roadmap on settling the border issue, which included respecting settled areas, etc. However, since then, there has been considerable backsliding noticed on the Chinese side such as increasingly assertive claims to Arunachal Pradesh. Not only did Wen's December visit yield no fresh initiatives on the border issue, the Chinese side chose not to resolve even the minor issue of the stapling of visas of Jammu and Kashmir residents. Premier Wen himself nipped it in the bud by asserting that this is a subject that can be discussed between the officials of the two sides, leaving a red rag in India's face. There was nothing but stony silence from the Chinese side on India's bid for a permanent seat in the UN Security Council.

So, what was achieved and what wasn't? There was a measure of success on the non-political front, predominantly in bilateral trade and investment. Armed with a 300-strong business delegation, Wen was witness to the signing of \$16 billion (₹72,000 crore) worth of trade deals. In addition, Beijing committed to redressing the trade imbalance heavily skewed in its favour at present by allowing more market access to Indian products and services. Both sides also set a \$100 billion (₹4, 50,000 crore) bilateral trade target for 2015. A hotline was also operationalised between the two PMs.

But unlike all other heads of states of the permanent members of the UNSC, Wen refused to utter a word against 'all-weather friend' Pak on anti-India terrorism.

**Wen refused
to utter a
word against
'all-weather
friend' Pak
on anti-India
terrorism**

It also gave no commitment to stop nuclear arming Pakistan leave alone rationalising large-scale conventional arming of the Pak military. In direct contrast, immediately after landing on the Pak soil, Wen and his delegation signed a number of deals including a gigantic gigawatt nuclear power plant—sidestepping the Nuclear Suppliers' Group proliferation concerns and infrastructural projects in the Pakistan occupied Kashmir—showing no concern for the Indian sensitivities, shoring up further the proven special relationship with Islamabad which has variously been described as an all-weather, time-tested relationship—higher than the mountains and deeper than oceans.

What comes out loud and clear from the so-called moderate Wen Jiabao's visit to its South Asian neighbours is that China gives little cognisance to India as a rising and matching power even after taking into calculations India's growing strategic closeness to the United States and in spite of overtly echoing Dr Manmohan Singh's statements that there is enough space in Asia and the world for China and India to grow together. Back home, the Chinese hardliners must be finding it difficult to conceal their derisive reaction to 'timid' India with diplomatic finesse.

In response, the Indian leadership seems to have shown some spunk by refusing to once again commit itself to the 'One China' concept given Wen's reluctance to treat J&K as an integral part of India. A step in the right direction for India to take forward the argument that Tibet was never allowed to function as a genuinely autonomous region. As a starter, India may start showing Tibet in different colours in the official/un-official maps—a quid pro quo to China showing PoK as part of Pakistan and the rest of J&K as disputed territory. This may set the score somewhat right against China's growing belligerence, but what India really needs is to not only accelerate the process of economic growth (possible only sans the 'scams') but also to rapidly enhance its military capability by improving infrastructure and modernising its armed forces to be able to ward off any evil designs emanating from Sino-Pak nexus. SP

—Air Marshal (Retd) V.K. Bhatia

**CHINA'S
BELLIGERENCE:
INDIA NEEDS
TO ACCELERATE
ECONOMIC GROWTH**

Advancing DEFENCE TIES

The Russian President's recent India visit strengthened decades old strategic partnership between the two countries

RUSSIAN PRESIDENT DMITRY MEDVEDEV was the last head of the state among the five permanent member countries of the UN Security Council to visit India in 2010. But he seemed to be the foremost among all to grab a major chunk of the country's booming defence market, besides strengthening cultural ties, and co-operation in nuclear and pharmaceutical sectors.

A Cold War ally and a long time strategic partner for decades, Soviet Union (now Russia) has been a major arms supplier to India, but of late the country has been facing competition from the US and Europe. Medvedev's visit gave a boost to the waning Indo-Russian ties. Both nations agreed to double bilateral trade by 2015. Indian Prime Minister Manmohan Singh described Russia as a "time-tested friend...that has stood by us in our times of need in the past". "It is a partnership that has, and will continue, to develop independently of our relations with other countries," he said. Prime Minister Singh and Medvedev reviewed the progress made in bilateral scientific and technological cooperation and expressed satisfaction at the extension of the integrated long-term programme (ILTP) for scientific and technical cooperation for another decade and its focus on identifying innovation-led technology programmes.

Delhi and Moscow signed an agreement for the design and development of fifth generation fighter aircraft (FGFA), 250-300 of which will be acquired by the IAF over 10 years worth up to \$35 billion (₹1,57,500 crore). According to the agreement, India's Hindustan Aeronautics Ltd (HAL) and Russia's Rosoboronexport and Sukhoi will work together to begin delivery of an Indian version



FIRM PACT:
RUSSIAN PRESIDENT
DMITRY MEDVEDEV WITH
PM MANMOHAN SINGH

of the Russian aircraft by 2017. Both countries signed a deal to share high-precision signals from the global navigation satellite system (GLONASS) for defence as well as civilian use and agreed to a protocol to ensure uninterrupted supplies of BrahMos cruise missiles to Indian armed forces. As per the agreement, Russia will provide access to the GLONASS high-precision navigation signals to India.

During his visit to the Indian Institute of Technology, Mumbai, the Russian President assured assistance to India considering their strategic partnership in security and defence. "The decision of using weapons is a prerogative of India. We are ready to help and assist as we are already doing. I am not disclosing a state secret but when I visited India four days after the Mumbai terror attacks I told them (government) a simple thing—if India needs our assistance in terms of anti-terrorism, we are ready to help and provide weapons, modern knowledge and technology. We have to react and strike terror hotbeds and smoke them out of their dwellings," he said.

The two countries also signed many other pacts including a deal to expand a Russian-built nuclear power plant in Kudankalum in southern India and held discussions on the construction of a third and fourth reactor as well.

Like his US and European counterparts, the Russian President also came as a salesman accompanied by about a 100 business leaders and went back home with trade deals worth billions of dollars and hope for enhanced economic ties in future. He also voiced Russia's support for India "as a deserving and strong candidate" for a permanent seat in an expanded UN Security Council **SP**

—Sucheta Das Mohapatra

The Russian
President came
as a salesman
and went back
home with
trade deals
worth billions
of dollars



MISSION

Private Space

STIRRING SAGA:
FALCON 9 TAKING-OFF FROM
THE LAUNCH PAD

In a mission lasting just three hours and 20 minutes from lift-off to splashdown, the massive Falcon 9 rocket and its unmanned Dragon capsule, designed and built by SpaceX, were the stars of the show

DECEMBER 8, A GREAT day for the California-based company Space Exploration Technologies (SpaceX), might ultimately turn out to be a giant leap in the stirring saga of space exploration. In a mission lasting just three hours and twenty minutes from lift-off to splashdown, the massive Falcon 9 rocket and its unmanned Dragon capsule, designed and built by SpaceX, were the stars of the show. This was the first time a private corporation had successfully launched a rocket and space capsule into low earth orbit (LEO) and guided the capsule through a safe re-entry and return to earth. Since the world's first space launch—Sputnik 1 on October 4, 1957, this is a feat that only five nations plus one multi-government agency have achieved: the Soviet Union/Russia, the United States of America, China, India, Japan and the European Space Agency.

Governments have had a monopoly over the final frontier until now, and with good reason. Huge risks, astronomical outlays and uncertain returns have so far made space

By Joseph Noronha,
Goa

launches unattractive to private industry. But now many governments, especially those in the developed world, are strapped for cash and seem only too keen for private entrepreneurs to foot at least part of the bill. A number of companies are getting ready to venture into space. They will introduce

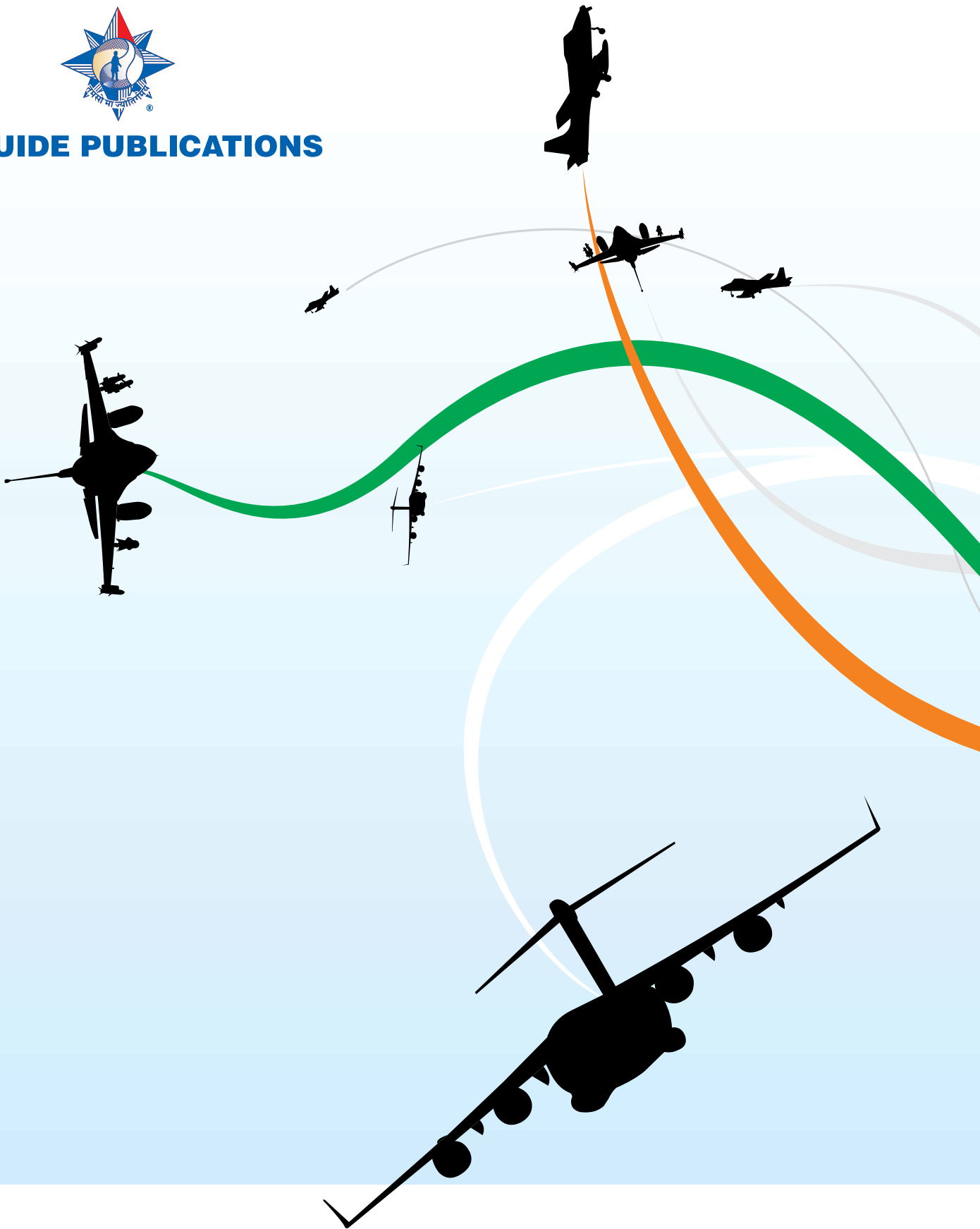
some much-needed competition, which means lower prices and more choices for the customer.

SPACEX—THE SPEARHEAD

The US space agency, the National Aeronautics and Space Administration (NASA), currently depends on the space shuttle and the reliable Russian Soyuz craft to deliver supplies and crew to the International Space Station (ISS). But only a couple of launches remain this year before the shuttle is retired for good; then NASA will be entirely reliant on Soyuz. Dragon's successful mission is a step towards decreasing this galling dependency. It was the first demonstration under NASA's commercial orbital transportation services (COTS) programme, which is aimed at spurring growth in the com-



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mercial space industry and promoting a viable private space cargo industry. In a deal valued at \$1.6 billion (₹7,200 crore), NASA has contracted for 12 cargo flights from SpaceX. The commercial rival of SpaceX, Orbital Sciences Corporation, also has a \$1.9 billion (₹8,750 crore) deal with NASA for eight missions, and plans the first flight test of its Taurus II rocket and Cygnus capsule in May or June 2011.

Success is still sweet and failure all too common in the high-stakes space industry, but Falcon 9 performed flawlessly. Its first stage, powered by nine of SpaceX's proprietary Merlin rocket motors burning liquid oxygen and kerosene, blasted the 48-metre-tall rocket off the launch pad. The first stage burnt for three minutes before being jettisoned; then the second stage, a single Merlin rocket, cut in. Nine minutes after lift-off, the second stage shut down and separated from the Dragon capsule. The Dragon was successfully placed in a 300-km circular orbit inclined at 34.5 degrees to the Equator. After two orbits of the earth, the Dragon fired its thrusters and later deployed its large parachutes to slow down to a descent rate of about eight metres per second. It made its splash-down in the Pacific a few hundred kilometres off the coast of southern California within 800 metres of its designated spot and within a minute of the target time. This flight, which was only the second for the Falcon 9, tested the spacecraft's propulsion, navigation, control and communications systems and precision landing technique, as also the efficacy of its heat shield, which is critical for its survival during re-entry. The only payload that the Dragon had carried, as revealed later, was French cheese.

Besides cheese, SpaceX hopes to prove that its Falcon 9 rocket and Dragon capsule constitute an unbeatable combination to safely and cost-effectively deliver crew and cargo to the ISS. The unmanned version of the Dragon can carry 5,987 kg of cargo in its pressurised and unpressurised cargo bays. To view this capability in perspective, the Indian Space Research Organisation (ISRO) has been working on its geosynchronous satellite launch vehicle (GSLV) for many years. Yet GSLV, currently, ISRO's heaviest launch vehicle, can inject a payload of just 5,100 kg to LEO.

SpaceX plans its next launch before the middle of the year—a five-day mission during which the Dragon will approach within 10 kilometres of the orbiting ISS to prove the accuracy of its rendezvous sensors. If all goes well (and

NASA permits) it may even berth with the station. The first operational cargo flight to the station is slated for November 2011, with regular flights following on at three to four month intervals.

Further ahead, SpaceX believes its Dragon capsule could ferry astronauts within three years of being tasked to make the conversion—time necessary to add an escape system and other safety measures, besides more testing and data analysis. The Dragon has room for up to seven astronauts. Once the space shuttle retires, Dragon will be the only spacecraft capable of returning humans to Earth apart from the Soyuz. Europe's proposed automated transfer vehicle (ATV), Japan's H-2 transfer vehicle (HTV) and Orbital Sciences Corporation's Cygnus capsule will only deliver cargo.



The unmanned version of the Dragon can carry 5,987 kg of cargo in its pressurised and unpressurised cargo bays

VIRGIN'S VISION

Meanwhile, Sir Richard Branson's Virgin Galactic is on a different mission—to be the first to take thrill-seeking tourists on pleasure trips to the edge of space at a cost of \$2,00,000 (₹90 lakh) per ticket. Space scientists might also sign up. The first passenger flight should happen early 2012. In this system, the small SpaceShip Two will separate from its jet-powered mothership WhiteKnight Two at a height of about 15 km, and blast into space at three to four times the speed of sound. It will attain a height of 110 km—well beyond the 100 km Kármán line, which is the generally accepted boundary between Earth's atmosphere and outer space. The 2 1/2-hour trip will include five to six minutes of weightlessness.

SpaceShip Two, built by Mojave-based Scaled Composites, can carry two crew and six passengers. The passengers will have to train for at least three days before making the flight. Last October, the spaceship was released at an altitude of 45,000 ft by its mother ship and safely glided back to Earth. Some 380 people have already made advance bookings with what will be the world's first commercial space line. Until

now, space travel has been limited to professional astronauts and a handful of wealthy folk who have made it to the ISS aboard the Soyuz after paying hefty sums for the privilege. All told, around 450 humans have travelled into space. If Virgin's ambitious plans fructify that number could be repeated within its first full year of operation. The plans received a boost with the recent inauguration of the runway at the world's first spaceport in New Mexico, USA. Spaceport



America, with its three-kilometre long runway, is designed specifically to launch commercial spacecraft.

OTHERS GET GOING

XCOR Aerospace has a more modest business plan. Its goal is to operate suborbital space-tourism flights and scientific research missions on its Lynx space plane. Lynx is smaller than many business jets and should be operational by January 2014. It will have rocket power to briefly blast thrill-seekers into the upper part of the atmosphere (around 65 km altitude) including a brief period of weightlessness at a bargain price of \$95,000 (₹42.75 lakh). It will then land on a runway like a conventional aircraft. Specially designed facilities for

DEBUT IN 2012: SIR RICHARD BRANSON'S VIRGIN GALACTIC WILL TAKE THRILL-SEEKING TOURISTS ON PLEASURE TRIPS TO THE EDGE OF SPACE AT A COST OF \$200,000 PER TICKET; XCOR AEROSPACE PLANS TO OPERATE SUBORBITAL SPACE-TOURISM FLIGHTS AND SCIENTIFIC RESEARCH MISSIONS ON ITS LYNX SPACE PLANE.

Lynx are under construction at Spaceport Curaçao in the Caribbean. Other companies, including Masten Space Systems of Mojave, California, and Armadillo Aerospace of Rockwall, Texas, are testing their own systems designed to lift unmanned payloads to space.

In about five years, space exploration, particularly in the US, should look very different. With a dozen or so companies vying to prove they can successfully undertake spaceflights, a combination of affordable rates and frequent flights will provide scientists a new set of options to investigate space. And freed of the burden of attending to run-of-the-mill missions, NASA could then rein in budgets and expend its energies on more distant and difficult missions, perhaps to Mars or the asteroids. After the space shuttle retires, a single American astronaut's round-trip Soyuz ticket to the ISS could cost around \$51 million (₹230 crore). Against this, SpaceX has publicly committed to a price of no more than \$20 million (₹90 crore) per seat provided NASA buys four flights per year of its seven-seat Dragon. That would permit 28 astronaut visits to the ISS per year which equals the current space shuttle manifest. The real challenge, however, will be to bring down the cost of a small satellite launcher to a few million dollars, in which case the strange spectacle of a satellite costing five million dollars to build but \$30 million (₹135 crore) to launch may well become a thing of the past. Private enterprise is all set to deliver. **SP**

Curtain-Raiser

Aero India 2011 will provide an excellent opportunity to global aerospace majors as also to the Indian aerospace industry to showcase their technological achievements, products and to provide a peep into the futuristic technologies



THE EIGHTH EDITION OF Aero India international air show is scheduled to be held from February 9 to 13, 2011 at Air Force Station Yelahanka on the northern outskirts of Bengaluru. The air show is being hosted by the Defence Exhibition Organisation of the Indian Ministry of Defence in association with the Confederation of Indian Industry (CII). Beginning with the first international air show held at the Indian Air Force (IAF) base in 1996, the biennial event has been growing steadily over the years and has today acquired the status of a 'premier global aerospace exposition'. The seventh edition of the air show, Aero India 2009, witnessed participation by 593 exhibitors. These included 303 entities from abroad representing 33 different countries large and small as also 289 companies consisting of mostly the small and medium enterprises from the Indian aerospace industry. Apart from

By Air Marshal (Retd)
B.K. Pandey, Bengaluru



the exhibitors, the air show was patronised by as many as 55 overseas delegations including one from China. Over a decade ago, the second edition of the show i.e. Aero India 1998, had participation by a total of 194 companies. Of these, the domestic aerospace industry had fielded a minuscule num-

ber of 20, and that too dominated largely by the public sector. Hopefully, the momentum of growth in the level of participation would be sustained and the level of participation in Aero India 2011 would surpass all expectations.

STRATEGIC PERSPECTIVE

The global aerospace industry is inclined to gravitate to India attracted by the size of the aerospace market that the country has to offer over the coming decades. As per Air Chief Marshal P.V. Naik, Chief of the Air Staff, Indian Air Force (IAF), 50 per cent of the equipment held on the inventory

of the IAF is being or has been overtaken by obsolescence. Implicit in this statement is the warning that if appropriate action is not taken in time, there is serious possibility of the IAF being outclassed in the next war by the Air Force of an inimical neighbour Pakistan even when the country has been doddering on the verge of being classified as a "failed state". To contend with the threat from the north-eastern border, China that has been acknowledged as an emerging global economic and military power, the capability of the IAF would have to be elevated to a completely new level. However, the recently promulgated statements from the political and military leadership indicates that the Indian Government has indeed been seized of the problem for some time and is now in the process of implementing plans for a major revamp of the IAF to not only correct the acute deficiency in air power but also to develop or acquire additional capabilities to meet with the new challenges in the future. Aviation assets of not only the IAF but those of the Indian Navy, the Indian Army and the Indian Coast Guard are also slated to undergo unprecedented transformation involving an investment over the next two decades on capital acquisitions alone, estimated officially to be of \$100 billion (₹4,50,000 crore).

While the global aerospace majors would understandably be the major beneficiary of this mammoth exercise entailing staggering levels of investment, the \$30 billion (₹1,35,000 crore) worth of business generated in India for domestic entrepreneurs under 'offsets' obligation would be of immense interest to the Indian aerospace industry, especially in the private sector.

RECENT CAPITAL ACQUISITIONS

The IAF being the flag bearer of the nation's air power will undoubtedly corner a major share of the investment. During the last three years, contracts for the supply of military aircraft to the IAF worth \$3 billion (₹13,500 crore) with both the US and European firms have been concluded. These include three of the customised version of Boeing Business Jet (BBJ), 12 AgustaWestland AW101 helicopters both for VVIP travel and six C130J Super Hercules aircraft for special operations. While the BBJs have been operational since April 2009, the first C-130 J Super Hercules has recently been handed over to the IAF at the factory in the US. In all likelihood, at least two of these aircraft are expected to be on display at Aero India 2011. There are reports to indicate that the IAF is contemplating purchase of another six of these advanced aircraft to make up full squadron strength. Lockheed Martin will undoubtedly use the forthcoming air show to push the deal for the second batch of the C-130J Super Hercules. The fact that the Indian paramilitary forces have also evinced interest in the aircraft should inspire Lockheed Martin to put their best foot forward on this occasion. Also expected at the five-day air show would be the US Air Force's WC130 Weather Bird, a modified version of the C-130 configured for weather data mapping. The WC-130 has an endurance of 15 hours and an unrefueled operational range of 5,600 kilometres.

Boeing that has signed a contract for \$2.14 billion (₹9,630 crore) for eight P8I long-range maritime patrol aircraft for the Indian Navy, is also likely to exploit the opportunity at Aero India 2011 to indulge in some aggressive marketing effort to sell more of the aircraft not only to the Indian Navy but perhaps to the Indian Coast Guard as well.



TEJAS: ON DISPLAY AT
AERO INDIA 2009

FUTURE ACQUISITIONS

Lockheed Martin with the offer of the F-16IN Super Viper and Boeing fielding the F/A-18 E/F are likely to use Aero India 2011 to make the final demarche for the mega deal valued at approximately \$11 billion (₹49,500 crore) related to the acquisition of 126 medium multi-role combat aircraft (MMRCA) for the IAF. The tender is expected to be finalised sometime in 2011. There are indications that selection of an American fighter in the MMRCA tender could pave the way for the IAF to access the next generation technology by way of the F-35 Lighting II Joint Strike Fighter. A fifth generation machine yet under development, the F-35 is going to be the ultimate combat machine in the sky. However, a statement from the US Defence Secretary that "the F-35 will perhaps be the last combat aircraft that the US Air Force will buy" is a clear indication of the shifting of focus on to unmanned aerial systems. As reported in the media, Lockheed Martin has plans to display the F-35 cockpit demonstrator at Aero India 2011 as the aircraft itself is not yet quite ready to be showcased internationally. The company is likely to be pursuing the interest shown by the Indian Navy to procure the carrier version of the F-35 for the indigenous aircraft carrier under construction at the Cochin Shipyard.

Boeing is also in the process of negotiating the sale of a number of other big ticket items such as the 10 C-17 Globemaster III for over \$4 billion (₹18,000 crore) with option for another six at a later date. In the rotary wing regime, in response to the tender for 22 combat and 15 heavy lift helicopters, Boeing has entered the race with offer of the AH-64D Apache and the CH-47F Chinook twin rotor machines. The combined value of the two contracts together is estimated to be in the region of \$2 billion (₹9,000 crore). Having secured a \$900 million (₹4,050 crore) order for the F414 aero-engine for the Indian Tejas Mk II light combat aircraft, General Electric will in all probability, show off its product at the air show as it could have a subtle influence on the final decision related to the MMRCA tender. The GE F414 engine powers the F/A 18 Super Hornet which is competing for the MMRCA tender. Two other acquisitions that are in the pipeline are six flight refuelling aircraft (FRA) worth \$1.5 billion (₹6,700 crore) and 197 utility helicopters valued at \$750 million (₹3,375 crore) for which the major helicopter manufacturers in the US, Europe and Russia would be in the fray. SP

Capturing INDIA'S AEROSPACE Market



In an interview with *SP's Aviation*, HAL Chairman Ashok Nayak said the company's target for 2010-11 is ₹12,600 crore, up from ₹11,500 crore achieved in 2009-10

WITH OVER ₹10,000 CRORE plus investments required in the coming decade in the aerospace industry, defence aviation major Hindustan Aeronautics Limited (HAL) has embarked upon a restructuring programme.

Giving details of the plan in an interview with *SP's Aviation*, the Chairman of HAL, Ashok Nayak said that HAL is bracing up for the competition and called for greater participation from the private sector. "HAL alone cannot handle the massive programmes that are expected in the aerospace sector"

The Chairman said, "Capacity expansion will not happen overnight. The existing infrastructure will not suffice for the new inductions including medium multi-role combat aircraft (MMRCA). We have to build infrastructure now for which we need massive investments and we are working in that direction. We will have to have a different factory for the light combat helicopter LCH. So also, there is need for a new infrastructure for the light utility helicopter (LUH), which at present is on the design board. The first prototype is expected to fly in 2012 and the requirement is 187 units."

Outlining HAL's performance, Nayak mentioned that the

company remained on course with regard to financial and production targets. The target for 2010-11 is ₹12,600 crore, up from ₹11,500 crore achieved in 2009-10. The export target is ₹260 crore and HAL, he said, would soon start renewed marketing efforts in new markets, particularly Latin America.

On the light combat aircraft (LCA) Tejas, Nayak said, "We are working hard on getting the initial operational clearance (IOC) and it should happen in mid-January, taking its last step before induction into the Indian Air Force. Of the eight limited series production, we have five flying and three more will get done soon. Then, we will start series production and the IAF has given orders for 20 more, taking the total orders to 48. As regards engine, the DRDO has opted for GE F414 engine to power the LCA and we have no issues with it." SP

(For the detailed interview read through the Aero India Special Issue of SP's Aviation)

To read the full version of the interview, visit:
www.spsaviation.net/interviews

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HIGH-TECH GADGETRY:
A VIEW OF THE COCKPIT
OF EMBRAER'S E-JET

RADICAL CONCEPT

Suitably placed between the larger mainline aircraft and the smaller regional jets, Embraer **E-Jets** have achieved outstanding success, with more than 900 firm orders logged and 700 jets in operation, worldwide

WHAT GOES DOWN EVENTUALLY comes back up. This statement by Paulo Cesar, the Executive Vice President (Com-

mmercial), Embraer, is typical of Brazilian optimism. Companies, like people, often emerge from economic downturns with renewed perspectives. As airlines are reworking their strategies by introducing new routes, Embraer with E-Jets in its product line, finds itself in an advantageous position.

Cesar substantiates "airlines in countries that never had jet aircraft with fewer than 120 seats have a unique opportunity to re-examine their approach to capacity and seize the untapped potential of that category. As many of our more than 50 E-Jets customers can attest, their fleet decision years ago helped them weather today's economic turmoil."

Embraer forecasts a requirement for 6,875 new jets in the 30 to 120-seat capacity segment over the next 20 years with a total market value estimated around \$200 billion (₹9,00,000 crore). The projections are delivery of 2,895 aircraft between 2010 and 2019 and the remaining 3,980

By R. Chandrakanth

units between 2020 and 2029.

Regional airlines are strengthening their networks, requiring operational efficiency to sustain future growth. In India, one of the fastest growing aviation markets, airlines are working to-

wards connecting II and III tier cities to the metros, calling for smaller seat configuration aircraft. The expansion of low-cost carriers in Asia, Europe and the efforts in linking the African continent, call for right-sizing fleet and E-Jets fits the bill.

MEDIUM CAPACITY

Owing to airline demands for medium-capacity jets, Embraer launched the Embraer 170/190 aircraft family, later called E-Jets, which originally encompassed the Embraer 170, the Embraer 190 and the Embraer 195. Later, the family also included the Embraer 175.

The project was completely new, benefiting from the interactive simulation and modeling technology in Embraer's Virtual Reality Centre (CRV). The high degree of commonality among the models of this family—about 90 per cent of the parts are common to several models—allows airlines to cut

down drastically on operating costs and training, thereby increasing their flexibility and strengthening their profitability.

The launching of the new family was announced during the 43rd Paris Air Show on June 14, 1999. Initially, the airplanes were named ERJ 170, ERJ 190-100 and ERJ 190-200. Later on, during the rollout of the first prototype, the names were changed to Embraer 170, 190 and 195, respectively.

The Embraer 170 was the first model of the new jet family to be launched. Its rollout was on October 29, 2001, and its first flight was on February 19, 2002. In February 2004, it was officially approved in Brazil, the United States and Europe, and in the same year the first unit was delivered to LOT Polish Airlines.

The Embraer 170/190 family of E-Jets consists of four commercial jets with 70 to 122 seats, configured to give passenger comfort while giving the airline business viability. Embraer has emphasised that the four E-Jets are suitably placed between the larger main-line aircraft and the smaller regional jets.

E-Jets are known for their advanced engineering design, efficient performance, outstanding operating economics, low emission levels and a spacious cabin without middle seats. The aircraft have a maximum cruising speed of Mach 0.82, can fly at 41,000 feet (12,497 metres) and have ranges of up to 2,400 nautical miles (4,448 kilometres). Another key feature of the E-Jets is the state-of-the-art, fly-by-wire technology, which increases operating safety, while reducing pilot workload and fuel consumption.

DOUBLE-BUBBLE FUSELAGE

The double-bubble fuselage design provides superior comfort and includes two main passenger entrances and two service doors, thus minimising aircraft turn-around time. The E-Jets offer much more space for passengers, in a single or dual-class layout, than other aircraft with similar seating capacities. The double-bubble fuselage concept, a shape derived from vertically overlapping two circles, with a four-abreast cross section is something unique. The widest point of the upper circle, which forms the main cabin, is at elbow level when passengers are seated. This maximises personal space and allows the installation of wider seats and a wider aisle compared to larger jets. The width of the lower circle is greatest near the cabin floor which boosts baggage and cargo capacity.

Adding to the sense of spaciousness is a two-metre-high cabin, near-vertical sidewalls and large eye-level windows, almost 30 per cent larger than those on other aircraft, that lets in lots of natural light. What's more, under seat areas are free of support railings so that passengers can stretch out in greater comfort.

The core of Embraer's E-philosophy has been passenger comfort. In fact, the company spoke to about 40 prospective airlines before embarking upon the next generation aircraft concept and almost all of them put passenger comfort on a priority list. Embraer then adopted a strategy—"Embracing the rise of the Empowered Passenger" and the result has been efficient ergonomics. E-Jets have been helping airlines to right size low load factor narrow-body routes, to replace older, inefficient aircraft, and to develop new markets with lower operating costs, greater efficiency, and outstanding passenger comfort.

LIGHTER AIRCRAFT

The E-Jets have been designed in such a way that with the lowest possible aircraft operating empty weight it can carry the highest revenue-generating payload. Since fuel consumption is proportional to aircraft weight, a lighter airplane translates directly into cost savings that go right to the bottom line. The E-Jets design allows up to 30 per cent more payloads per pound/kilo of structural weight among aircraft of similar seat capacity.

In terms of engineering, the company has initiated a programme called aircraft health, analysis and diagnostics (AHeAD) on the E-Jets. It is a simple computational web-based platform that allows airlines to continuously monitor the performance of an E-Jet while in flight. It regularly transmits fault identification data for analysis by ground personnel so that they can plan maintenance remedies at a down line station. The system through continuous monitoring helps minimise ground time and maximise air time.

Also the maintenance plans have been structured in such a way that it helps airlines keep costs low with routine checks coming every 120 flight hours or 14 days (whichever comes first). Basic checks are scheduled every 600 flight hours and are easily performed overnight. Heavy checks for aircraft structure occur every 20,000 flight cycles. Embraer claims that this results in

19 per cent to 23 per cent lower hourly direct maintenance costs compared to other similar capacity aircraft and up to 53 per cent lower cost than some out of production jets.

As the world's largest maker of regional aircraft, Embraer is banking on the E-Jets to drive its international business further. The E-Jets have achieved outstanding success, with more than 900 firm orders logged and 700 jets in operation, worldwide. In Europe, there are currently 16 registered airlines flying 161 Embraer E-Jets. Worldwide they have accumulated 4.8 million flight hours and transported more than 200 million passengers. SP



SUPERIOR COMFORT:
THE E-JETS OFFER
MUCH MORE SPACE FOR
PASSENGERS

Fringes to Mainstream

India's aerospace capabilities, if harnessed properly, would be a key driver of economic growth. Time indeed to energise the Indian aerospace industry à la the automotive sector and the space development programme.



A CANDID SUMMATION THAT THE Indian aerospace industry is "way behind", by the Vice Chief of Air Staff, Air Marshal P.K. Barbora is not at all surprising. Countries such as Brazil (Embraer); Israel (Israel Aerospace Industries); China and South Korea are up there with the big aerospace players, but not India. Time indeed to energise the Indian aerospace industry à la the automotive sector and the space development programme.

The refrain thus at the fifth International Conference on "Energising Indian Aerospace Industry", jointly organised by the Confederation of Indian Industry (CII), the Indian Air Force (IAF) and the Centre for Air Power Studies (CAPS) was to "leverage India's emerging economic power".

Accordingly, the Minister for Defence, A.K. Antony announced reworking the defence production policy and also the defence procurement procedure.

"For the Indian aerospace industry to move from the fringes to the mainstream, the private sector had to be encouraged as the Defence Research and Development Organisation and the public sector undertakings had inherent limitations," opined the Chief of the Air Staff, Air Chief Marshal P.V. Naik.

TRENDS IN TRANSFORMATION OF AEROSPACE POWER

Air Chief Marshal Sir Glenn Torpy, former Chief of the Air Staff, Royal Air Force, United Kingdom, said that unpredictability of future conflicts would render the battle-space congested; cluttered; connected; constrained and contested, and all coming under the scrutiny of an intrusive media.

Air Vice Marshal M. Matheswaran, Assistant Chief of Air Staff Operations (Space), said, "India needs to have a leap-frogging strategy with regard to aerospace technology. Dominance



AT THE SEMINAR: DEFENCE MINISTER A.K. ANTONY AND CHIEF OF THE AIR STAFF P.V. NAIK WITH DIRECTOR GENERAL, CII

in aviation; space; communications and computers would bring about new hegemonies in the form of Russia, China and India, away from the traditional USA; the UK; France, Germany and Japan."

MRO OPPORTUNITIES GALORE

The former Chairman and Managing Director of the erstwhile Indian Airlines, Air Marshal (Retd) S.S. Ramdas said that outsourcing in civil aviation had become an "inescapable mantra" and it was time for military aviation to start thinking about it. "Almost 45 per cent of military maintenance in the

US has been outsourced, while the RAF has a mixed policy, whereas in India we are tied down to HAL. With sophisticated

aircraft to be inducted in the near future, the three services had to wean themselves away from HAL and look at the private sector," he said.

OFFSET CLAUSE AND CLARITY

The Chairman and Managing Director, INAPEX, Vijay Mathur said that between 1993-2005, the total volume of offsets was 80 billion with the aviation sector alone accounting for about 68 billion. Offset clauses were operative in about 130 countries and all it required was clarity.

The Deputy Chief of the Air Staff, Air Marshal N.V. Tyagi, said that the procedures were being simplified and that India had to leverage its buying power. Air Commodore Jasjit Singh, Director, CAPS, and Air Vice Marshal Kapil Kak, Additional Director, CAPS, said that the outcome of the conference would reach the Ministry for policy formulation and that the key take-away was that India's aerospace capabilities, if harnessed properly would be a key driver of economic growth. SP

—R. Chandrakanth

Ahead of Schedule



Lockheed Martin's Super Hercules C-130J would be inducted into IAF by early February. It would herald the re-introduction of the US-built military transport aircraft into the IAF after a gap of five decades.

THE INDIAN CAPITAL'S CHILLY winter weather notwithstanding, Delhi-based Western Air Command has much to cheer as it rolls out the red carpet for the January (latest first week of February) to receive the first Super Hercules C-130J for the newly formed No. 77 Squadron, to be located at the nearby Hindon Air Force Station. From getting the governmental nod in early 2008 to its induction into the Indian Air Force (IAF), the C-130J programme has been one of the fastest as the arrival of the first Super Hercules could well beat the stipulated three-year production period. It would also herald re-introduction of the US-built military transport aircraft into the IAF after a gap of five decades.

The US aircraft, such as the ubiquitous Dakota DC-3 of World War II vintage were the first to debut in the transport fleet of the IAF established soon after India's independence. Post-1962, Sino-Indian conflict these were augmented by the Fairchild Packet C-119G transporters. In the subsequent years, however, IAF leaned heavily on the Soviet Union for military equipment, receiving the An-12s in the 1960s followed by the medium-lift An-32 and heavy-lift IL-76 aircraft in the 1980s. Russian military transport aircraft are rugged, reliable and powerful but generally are heavy on the controls and require pilots with as much muscle as brain power to operate. And while the IAF transport crews flew the Russian aircraft with a great degree of skill and confidence, there was always a longing to try their hands at western transports, especially the

By **Air Marshal (Retd)**
V.K. Bhatia



C-130 Hercules which was known both for crew comfort and exceptional operational attributes and has been operating in a large number of air forces around the globe. It may be worth noting that interest in the C-130 had been evinced in some quarters of the IAF in the early 1970s but for various reasons including

the geopolitics of the Cold War, the idea too remained in cold storage. It could not fructify even after a large vacuum had been created in the IAF's air transport capabilities in the 20-tonne payload class with the retirement of the Russian workhorse in the late 1980s and early 1990s.

First flown in 1954, different versions of the 20-tonne class C-130 aircraft are used by more than 60 nations in the world. During its years of service, the Hercules has participated in countless military, civilian and humanitarian aid operations. In 2007, the C-130 became the fifth aircraft—after the English Electric Canberra, B-52 Stratofortress, Tupolev Tu-95, and KC-135 Stratotanker—to mark 50 years of continuous use with its original primary customer, in this case, the United States Air Force. The C-130 is also the only military aircraft to remain in continuous production for 50 years and still continuing in its latest avatar C-130J/C-130J-30 (the stretched version), the 'Super Hercules'.

The Super Hercules is a more powerful and more rugged version of the earlier Hercules with the capability to operate from short, semi-prepared runways in 'hot and high' conditions—most suited for India's 'Himalayan' airfields and advanced landing grounds (ALGs) at Leh, Thoise and beyond.



C-130J SUPER HERCULES

General Characteristics & Performance Details

General Characteristics

- **Crew:** 2 Pilots, 1 loadmaster
- **Capacity:**
 - 92 passengers or
 - 64 airborne troops or
 - 6 pallets or
 - 74 litter patients with 2 medical personnel
- **Payload:** 19,090 kg
- **Length:** 29.79 m
- **Wingspan:** 40.41 m
- **Height:** 11.84 m
- **Wing area:** 162.1 m²
- **Empty weight:** 34,274 kg
- **Max takeoff weight:** 79,378 kg
- **Powerplant:** 4x Rolls-Royce AE 2100D3 turboprop, 4,637 shp (3,458 kW) each
- **Propellers:** Dowty R391 6-blade composite propeller, 1 per engine

Performance

- **Maximum speed:** 362 kts (671 km/h)
- **Cruise speed:** 348 kts (643 km/h)
- **Range:** 2,835 nm (5,250 km)
- **Service ceiling:** 28,000 ft (8,615 m) with full payload
- **Takeoff distance:** 3,127 ft (953 m)
- **Landing distance:** 2,550 ft (777m)

With a computer-controlled automated cargo handling system, the aircraft is also capable of pinpoint accuracy in parades. Equipped with an impressive array of avionics, such as forward looking infra red (FLIR), head-up display (HUD) and sophisticated navigational aids, it can operate accurately in all-weather conditions without loss of performance. It can even operate from and to an unlit airstrip in complete darkness. For self-protection, it carries missile warning and counter-measures systems of the large aircraft infra red countermeasure (LAIRCM) class. In almost all respects, the C-130J is reported to be clearly ahead of its contemporaries from Europe or Russia.

It is of little wonder that nearly three decades after the last of the US-built C-119G 'Packet' was phased out, the IAF is eagerly looking forward to induction of the C-130J Super Hercules, six of which are on order. In a little over \$1 billion (₹4,500 crore) deal with the US aerospace giant Lockheed Martin, the

IAF's C-130Js are to be configured to Indian specifications for the entire gamut of operations including for Special Forces. The contract was sealed under the provisions of direct foreign military sales (FMS) of the United States and therefore, did not have to go through the hassles of procurement through the cumbersome Indian Defence Procurement Procedure (DPP). The sale agreement also includes an option for six more aircraft, which in all probability would be required by the IAF to make up a full squadron to cater to its multifarious tasks. The IAF is also on course to acquire up to 10 or even 16 C-17 Globemaster III aircraft from the US through the FMS route. Once acquired, along with the highly capable C-130Js it would provide a deadly and highly potent combination to the IAF for all of its air transport operations.

Throughout its chequered history of operations spanning more than half-a-century, the C-130 has been instrumental in carrying out unparalleled and unprecedented feats never tried by any other aircraft. For example, the Hercules holds the record for the largest and heaviest aircraft to land on an aircraft carrier. In October-November 1963, a USMC KC-130F made 29 touch-and-go landings, 21 unarrested full-stop landings and same number of unassisted take-offs on the USS Forrestal aircraft carrier. The tests were highly successful though the idea was considered too risky for routine carrier onboard delivery (COD) operations with Hercules aircraft and therefore, abandoned. Similarly, in a highly audacious move, a C-130 was modified with a bank of rockets externally attached on both sides of fuselage to enable it to take-off from a 200-yard strip. The idea was to extricate US personnel from the US Embassy compound in Teheran when it came under siege by the Revolutionary Guards during the Iranian revolution. The aircraft did manage to carry out a rocket-assisted take-off within the stipulated distance but the idea was finally abandoned as landing the aircraft within the confines of the Embassy compound with the help of massive drag parachutes was considered too risky. However, a modified version of a USMC C-130T known as 'Fat Albert' and serving as a logistics support aircraft with the US Navy's 'Blue Angels' formation aerobatic team had been delighting spectators with rocket-assisted ultra-short take-offs and a mini show of its own, at least till last year.

How popular the Hercules has been with different air forces in the world is evident from the fact that in the ongoing Operation Enduring Freedom in Afghanistan, the C-130 in one variant or the other is being used operationally by Australia, Belgium, Canada, Denmark, France, Italy, the Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, the UK and the United States. And now it is India's turn to exploit the C-130 and substantially enhance its capabilities in the field of air transport operations. Known the world over for its innovative use of combat systems, what unprecedented tasks would the IAF have in store for its C-130J fleet? Perhaps the IAF could start with repeating the feat of another US military transporter a C-119G Packet which landed at the highest known airstrip in the world—Daulat Beg Oldie (DBO)—17,000 feet above mean sea level in Aksai Chin during the Sino-Indian conflict in 1962. That Packet however, was carrying atop its cargo cabin an Orpheus jet engine, brilliantly innovated by the Indian aeronautics engineers to give it the necessary extra power to perform the feat. The C-130Js of the IAF, it is hoped, would do it with the power of their own 4X Rolls-Royce AE2100D3 turboprops. That would be a good start. SP



Stunning *Display*

Many aviation majors were at MEBA 2010. There was a stunning array of aircraft ranging from very light jets to corporate jetliners from top manufacturers such as Airbus, Boeing, Bombardier, Cessna, Embraer and Gulfstream

THE MIDDLE EAST IS slowly bouncing back. Testimony to that has been the enhanced interest generated in the aviation sector, a key sector in the region, by different players. The recently concluded Middle East Business Aviation 2010 (MEBA 2010) event in Dubai was a pointer in this direction. The event was big, having attracted 338 exhibitors from 33 countries. Over 50 business aircraft were on display and there was new found enthusiasm in the region.

Consequently, industry experts revised the forecast for the region, predicting 10 to 15 per cent growth over the next four years for a market that currently has 450 business jets, spurred mostly by two dominant economies—the United Arab Emirates (UAE) and Saudi Arabia. The two countries account for nearly 70 per cent of the regional business growth.

Frost and Sullivan has reported that the Middle East will get over 450 business aircraft by 2018, of which Saudi

By **R. Chandrakanth**

Arabia alone will buy more than 150, about 37 per cent of the market potential, followed by the UAE (24 per cent). The report expects a compound annual growth rate of 6.21 per cent in business aircraft movements, touching 1,60,000 by 2018.

Excited about such potential, the Managing Director of F&E Aerospace (organisers of MEBA 2010), Alison Weller said that business aviation companies from across the globe evinced “strong interest” in MEBA 2010.

“With a recent report predicting an annual growth rate for the Middle East business aviation market of over six per cent the next 10 years, the region will surely see an increase in business aviation service providers to cater to this demand,” she said and reminded how MEBA 2008 had reportedly struck deals worth \$1.5 billion (₹6,750 crore).

There is a big spurt in demand for private jets from corporations, high net worth individuals (HNWI) and other agencies. The Middle East, especially the UAE, has been witnessing a

growing demand for private charter flights as the responsibilities of top executives based in the region involve quick and frequent trips abroad. Ali Al Naqbi, the founding Chairman of MEBA, said that the number of registered Middle Eastern business jets has risen by 30-40 per cent over the last couple of years to around 500 aircraft, of which 114 are based in Saudi Arabia, with 78 registered in UAE. From 1975 to 1998, there was one business jet operator; now there are over 25.

Many aviation majors were at MEBA 2010. There was a stunning array of aircraft ranging from the very light jets (VLJs) to corporate jetliners from top manufacturers such as Airbus, Boeing, Bombardier, Cessna, Embraer and Gulfstream were on static display at the world's third largest business aviation show.

BOMBARDIER CLINCHES ORDERS WORTH \$285 MILLION

The leading manufacturer of bizjets closed purchase agreements worth \$285 million (₹1,280 crore) at list price during the show. This included a firm order by Comlux The Aviation Group for two Bombardier Global 7000 business aircraft worth \$130 million (₹585 crore) at list price.

"We were honoured to have Comlux endorse the Global 7000 and Global 8000 aircraft at the recent launch, and it is fitting that now, here at MEBA, they are ratifying their order for two Global 7000 jets," said Bob Horner, Senior Vice President, Sales, Bombardier Business Aircraft.

Bombardier also received a firm order for five mid-size Learjet 85s and two large-cabin Challenger 605 jets, worth a total of \$155 million (₹698 crore) at list price, from multiple companies of the same group, for principal operation in Germany by Munich-based Jet Air Flug.

EMBRAER STRENGTHENS OPERATIONS IN MIDDLE EAST

Embraer delivered its ultra large Lineage 1000 to Abu Dhabi-based Falcon Aviation Services (FAS), the first of two corporate jets the charter company ordered in 2007 at the Dubai Airshow. The aircraft, which has been certified for up to 19 passengers, has five distinct cabin zones and is configured with a full-size luggage compartment of 323 cubic feet.

Embraer also announced the appointment of ExecuJet Aviation Group (EAG) in Dubai as the new Embraer Authorised Service Centre (EASC) for the Legacy 600 and Legacy 650 executive jets, as part of the expansion of its customer support in the region. ExecuJet will provide scheduled and unscheduled maintenance services at Dubai International Airport.

Nick Weber, Maintenance Director, ExecuJet Middle East, said, "ExecuJet welcomes the opportunity to extend its support to the Embraer Legacy 600/650 aircraft, which will be served out of our newly acquired 5,000-square-metre hangar, situated next to our existing facility at Dubai International Airport."



STATIC PARK:
78 AIRCRAFT WORTH
\$1.6 BN WERE ON DISPLAY
AT MEBA 2010

ROYAL STRIDES

Propelled by growing demand for business jets, Abu Dhabi-based Royal Jet has benefited the most. It has emerged as the largest business jet operator in the Gulf with a 16 per cent market share. Its fleet has grown from two aircraft to 12 in less than four years and revenues by 30 per cent.

Royal Jet also holds the distinction of being the only operator in the Middle East region of having the world's largest privately operated fleet of Boeing Business Jets (BBJ). It has six BBJs. Its growing fleet of jets includes

two mid-range Gulfstream 300s, a long-range Gulfstream IVSP and a Learjet 60. In addition to the new A6-DFR, Royal Jet's multimillion-dollar refurbished BBJ will return later this month, while an Embraer Lineage 1000 will arrive later in the year.

QATAR AIRWAYS FORAYS INTO BUSINESS JETS

At the 2009 Paris Air Show, Qatar Airways launched the Qatar Executive to tap the nascent business jet market in the region. "We launched Qatar Executive last year because we had identified a huge gap in the market and are now well on the way to filling that void," Akbar Al Baker, Group Chief Executive Officer, Qatar Airways has stated. The Qatar Executive fleet comprises two Bombardier Challenger 605 jets featuring 11 seats, and the eight-seat Challenger 300 aircraft. Qatar's flourishing natural-gas industry is a major driving factor in spurring interest in aviation-on-demand.

Similar stories emanate from the other countries in the Middle East. States Ammar Balkar of Elite Jets and former President and CEO of MEBA, said "In the next few years, business aviation sector in the Middle East will generate revenues worth \$1billion a year and there will be around 600-650 private jets in the market."

SHOW ENDS ON POSITIVE NOTE

Alison Weller said, "The feedback I have received from exhibitors at MEBA was that the show was all about quality, which is typical of this region, quality over quantity. We are very pleased with the number of aircraft orders and the service agreements made during the three days of the show, although not all the orders were announced. The nature of the private aviation business is exactly that, private, and evermore so in this economic climate when people don't want to be seen to be making considerable purchases, albeit to enhance their business effectiveness, which is the primary role of business aircraft."

The very fact that MEBA will once again return to Dubai in 2014 despite great interest displayed across the region to host it in other venues clearly indicates that Dubai continues to be a unique and best-suited venue for this show. SP

THIS IS POSSIBLY ONE of the drollest stories to have emerged in over a century of aviation. How did an experienced cross-country pilot get airborne from New York, bound overland for California, instead traverse the Atlantic and reach Ireland? According to him, it was simple human error. He read the compass wrong, mistaking the tail of the pointer for the head.

Douglas Corrigan was born in Galveston, Texas, on January 22, 1907. His first flight at the age of 18 captivated him and he signed up for flying lessons. An apt student, he soon became a proficient pilot. He took 20 flights to complete his first solo on March 25, 1926—which he latter called the most important day of his life. Besides flying he was an expert technician and was intimately involved in the construction of Charles Lindbergh's famous Spirit of St Louis. When Lindbergh flew safely across the Atlantic to Paris, Corrigan vowed that some day he would replicate the pioneering feat. Being Irish American, Ireland was naturally his dream destination.

In 1933, Corrigan acquired a ramshackle old aeroplane for \$325 (₹14,625). He installed his own homemade engine built from two other old engines, plus extra fuel tanks. Over the next few years he made several flights across the US. In 1935, he applied for permission to fly from New York to Ireland, but his aircraft was deemed unreliable for a non-stop transatlantic trip. Corrigan made repeated modifications and reapplications for permission but none succeeded. Indeed, in 1937, his beloved plane was officially grounded for some months because it was judged too unstable. Later, his autobiography expressed his utter frustration with obstinate officialdom.

In July 1938, Corrigan left California for New York. During the flight, leaking fuel filled the cockpit with fumes. In New York he investigated the leak, but felt it would take him too long to remove the tank and make repairs. He was raring to go. His flight plan was filed—New York to

California. He was asked to take off in an easterly direction, then at a safe height turn to his designated westerly course for California. He took off at 5:15 a.m. on July 17, 1938, with full fuel tanks, two chocolate bars, two boxes of fig bars, and a litre of drinking water. The only map he had was of the USA, the plane had no radio, and his heart pointed east.



DOUGLAS CORRIGAN
(1907 - 1995)

Douglas Corrigan is remembered as a thoroughly unorthodox and daring pilot—one who achieved his dream of making a transatlantic flight, despite official disapproval and incredible odds

During the long flight, he had to make a hole in the cockpit floor so that leaking fuel would drain out, away from the hot exhaust. Reasoning that the less time he spent in the air the better, he revved up the engine to its full-power setting of 1,900 rpm, hoping it wouldn't quit on him. And why should it? Over the last few

years, he had completely stripped the entire engine and rebuilt it twice over. Corrigan later claimed to have noticed his "navigational error" after flying for about 26 hours. He finally spotted land; it was Ireland. He landed at Baldonnell Aerodrome, Dublin, on July 18, after a 28 hour, 13 minute flight. The first person he met was an army officer. Corrigan explained, "I left New York yesterday morning headed for California." He added, "I got mixed up in the clouds and I must have flown the wrong way." And he stuck to the story. So Douglas "Wrong Way" Corrigan he remained for the rest of his life. Although he could have faced numerous serious charges related to his unauthorized flight, Corrigan's good fortune, his Irish sense of humour and his far-fetched story ensured a happy ending. The only penalty imposed was suspension of his pilot's licence for two weeks.

He became an instant celebrity and more people attended his Broadway ticker-tape parade than had honoured Lindbergh after his feat. H.R. Knickerbocker, a journalist, reported, "As I looked over it at the Dublin airdrome, I really marvelled that anyone should have been rash enough even to go in the air with it, much less try to fly the Atlantic. He built it, or rebuilt it, practically as a boy would build a scooter out of a soapbox and a pair of old roller skates. The nose of the engine hood was a mass of patches soldered by Corrigan himself into a crazy-quilt design. The door behind which Corrigan crouched for 28 hours was fastened together with a piece of baling wire. The reserve gasoline tanks put together by Corrigan left him so little room that he had to sit hunched forward with his knees cramped and not enough window space to see the ground while landing." Douglas Corrigan died on December 9, 1995. He is remembered as a thoroughly unorthodox and daring pilot—one who achieved his dream of making a transatlantic flight, despite official disapproval and incredible odds. ^{SP}

—Group Captain (Retd)
Joseph Noronha, Goa

MILITARY

Asia-Pacific

India, Russia sign contract on FGFA



A contract for preliminary design of the Indo-Russian fifth generation fighter aircraft (FGFA) was signed between Hindustan Aeronautics Limited (HAL), Rosoboronexport and Sukhoi.

The project involves design and development of a FGFA that will have advanced features such as stealth, super-cruise, ultra-manoeuvrability, highly integrated avionics suite, enhanced situational awareness, internal carriage of weapons and network-centric warfare capabilities.

The aircraft to be jointly developed is termed perspective multi-role fighter (PMF). PMF draws upon the basic structural and system design of the Russian FGFA technology demonstrator with modifications to meet Indian Air Force (IAF) specifications which are much more stringent.

171 officers commissioned into IAF

The Indian Air Force (IAF) got a new batch of officers with 171 newly commissioned Flying Officers graduating from the Air Force Academy (AFA), at Dundigal near Hyderabad. Chief of the Air Staff, Air Chief Marshal P.V. Naik reviewed the combined graduation parade and awarded President's Commission to the graduating Flight Cadets that included 39 women Flight Cadets.

Four Indian Navy officers and one Indian Coast Guard officer also received their flying brevet (Wings) at the graduation parade from the Air Chief. ----->

LCA TEJAS GETS INITIAL OPERATIONAL CLEARANCE

PHOTOGRAPH: DRDO



The Minister of Defence, A.K. Antony on January 10 handed over the initial operational clearance (IOC) for the light combat aircraft (LCA) Tejas to the Chief of the Air Staff, Air Chief Marshal P.V. Naik, in Bengaluru.

Antony said, "After crossing a number of challenges and accomplishing a significant series of milestones of envelope expansion, sensor integration and weapon delivery in over 1,500 sorties, the country is poised for a major turning point with the declaration of the IOC of Tejas aircraft. Centre for Military Airworthiness and Certification (CEMILAC) has painstakingly evolved the roadmap for 'release to service certification' and finally ensured all goals are accomplished. This would facilitate delivery of the first lot of the 20 production standard aircraft to the user (IAF) with assured safety and specified performance before the end of the year. I am also happy to announce that the government has cleared the next lot of 20 limited series production aircraft and I am confident that there will be a progressive improvement in the standard of build. Further, there is a scope for supplying more of Mk2 variants of Navy and Air Force. The estimation is that the nation needs about 200 of Tejas aircraft."

The "Release to Service" certificate is prepared by RCMA (A/C), an organisation of CEMILAC, which has thoroughly scrutinised the entire design, development, equipment testing and flight testing results of all the systems of Tejas. This is the first time an indigenously designed and developed military fighter aircraft is being certified for IAF operations.

About two decades ago, the Tejas Programme got initiated to develop the technologies of the fourth generation fighter aircraft and demonstrate them on the two technology demonstrator aircraft. There was a gap of two generations of technologies at that time. The Tejas team consisting of ADA, HAL, DRDO, IAF, CEMILAC, DGAQA, public sector undertakings, private industries and academic institutions took up the challenge and flew the first technology demonstrator encompassing fourth generation technologies on January 4, 2001. By March 2004, with one more technology demonstrator and one prototype vehicle, all the technologies of the fourth generation relevant to the Tejas had been demonstrated successfully completing the technology demonstration phase.

The next phase of the programme got initiated in November 2001 with the government funding for not only building the prototypes for the fighter and trainer but also for establishing the limited series production (LSP) line, and delivery of eight LSP aircraft. Now the programme has reached the stage of demonstrating the integration of all the required sensors and weapons, also demonstration of safe and reliable flying within the specified flight envelope. The above has been demonstrated through about 1,500 test flights using about 11 aircraft flown by over 15 test pilots of IAF and the Indian Navy. ●

QuickRoundUp

AIRBUS

- The first Airbus Military A330 MRTT Future Strategic Transport Aircraft (FSTA) for the UK's Royal Air Force has successfully completed its first contacts with a receiver aircraft. In a 2 hour 40 minute sortie, FSTA conducted a series of dry contacts with an F-18 of the Spanish Air Force, using the fuselage refuelling unit.

Avolon, the aircraft leasing group, had announced a firm order for eight A320 aircraft from Airbus. The eight A320 aircraft will be equipped with the new fuel-saving Sharklets option. Avolon will make an engine selection for the aircraft in the near future.

ALENIA

- Alenia Aermacchi has displayed the first two M-346 advanced trainers from the first batch of six aircraft for the Italian Air Force. Within a few months, the first two T-346As will be delivered to the Experimental Flying Unit at Pratica di Mare Air Force Base, where they will undergo operational evaluation testing.

Alenia Aeronautica has delivered to the Italian Air Force the Tornado IS86 (MM 7087), the series-lead of 15 aircraft envisaged by Italian Air Force's IT Basic Full MLU (RET 7) retrofit programme. RET 7 contract has introduced Night Vision Goggles, Emergency Locator Transmitter, Multi Information Distribution System, allowing the aircraft to operate in a net-centric manner.

BOEING

- Boeing Corporation has been awarded an \$87,952,000 (₹396 crore) contract which will acquire the radar system improvement programme/mission navigation system upgrade installation and checkout for the Japan Air Self Defense Force AWACS fleet of four aircraft.

Boeing has announced that its production rate for the 777 programme will increase to 8.3 airplanes per month in the first quarter of 2013. This is the second production increase announced for the programme this year. In March, the programme announced it would increase production from five to seven airplanes per month beginning mid-2011.

APPOINTMENTS IN INDIAN AIR FORCE

AIR MARSHAL N.A.K. BROWNE



Air Marshal N.A.K. Browne has assumed charge as the new Vice Chief of Air Staff (VCAS) at Air Headquarters. He was formerly the Air Officer Commanding-in-Chief (AOC-in-C) of IAF's Western Air Command (WAC), the largest and the most vital

Operational Command of the IAF. He is a recipient of Param Vishist Seva Medal (PVSM), Ati Vishist Seva Medal (AVSM) and Vayu Sena Medal (VM).

AIR MARSHAL DHIRAJ KUKREJA



Air Marshal Dhiraj Kukreja has been appointed the Air Officer Commanding-in-Chief, Training Command, IAF. The Air Marshal has held various important command, staff and instructional appointments. He commanded No. 25 Squadron during

1995-98 of which, he is now the Commodore Commandant. The Air Marshal is a recipient of AVSM and VSM.

AIR MARSHAL D.C. KUMARIA



Air Marshal D.C. Kumaria has taken over as the Air Officer Commanding-in-Chief, Western Air Command in New Delhi. He was the Assistant Advisor (Air) at Indian High Commission in Bangladesh and has served as Defence Attaché at Indian

Embassy in Rome with concurrent accreditation to the Iberian countries. He was selected to write the Air Power Doctrine of the Indian Air Force in 1994. He is a recipient of AVSM, VM and VSM.

AIR MARSHAL ANJAN KUMAR GOGOI



Air Marshal Anjan Kumar Gogoi has been appointed Air Officer Commanding-in-Chief, South Western Air Command. He was Director General Air (Operations) at Air Headquarters prior to assuming the post of AOC-in-C SWAC, IAF. He is a recipient of AVSM and VSM.

AIR MARSHAL DALJIT SINGH



Air Marshal Daljit Singh has been appointed Director General, Air (Operations) at Air Headquarters. He was ACAS Operations (Air Defence) at Air HQ prior to assuming this post. He is a recipient of Vayu Sena Medal.

AIR MARSHAL P.K. ROY



Air Marshal P.K. Roy has been appointed the Commandant of National Defence College. He has also served as the Military and Air Attaché in the Indian Embassy at Ukraine and also held the appointments of Senior Officer-in-Charge Administration at

HQ Eastern Air Command and Assistant Chief of Air Staff (Personnel Airmen and Civilians) at Air Headquarters. He is a recipient of AVSM, VM and VSM.

India-AGM-84L Harpoon Block II missiles

On December 21, the Defense Security Cooperation Agency (DSCA) notified US Congress of a possible foreign military sale to the Government of India of 21 AGM-84L Harpoon Block II missiles and associated equipment, parts and logistical support for a complete package worth approximately \$200 million (₹900 crore).

The Government of India has requested a possible sale of 21 AGM-84L Harpoon Block II Missiles, 5 ATM-84L Harpoon Block II Training Missiles, captive air training missiles, containers, spare and repair parts, support and test equipment, publications and technical documentation, personnel training and training equipment. India intends to use the missiles on its Indian Navy P-8I Neptune maritime patrol aircraft which will provide enhanced capabilities in effective defence of critical sea lines of communication.

Lakshya-2 flight tested



Aeronautical Development Establishment (ADE), Bangalore belonging to Defence Research and Development Organisation (DRDO) conducted successfully on December 20, 2010 the flight test of Lakshya-2 the pilotless target aircraft (PTA) built to meet the anticipated users' requirements for such a vehicle for testing out their guns and missiles.

The users have indicated their requirement of flying the pilotless target aircraft at very low altitudes (15 to 25 metres above sea level) to simulating trajectory of low-level cruise missiles. Accordingly, ADE prepared Lakshya-2 with necessary hardware and software to meet the user requirements. ----->

QuickRoundUp

The worldwide fleet of C-17 Globemaster III airlifters built by The Boeing Company has surpassed two million flying hours during an airdrop mission over Afghanistan. Reaching two million flight hours equates to 1.13 billion nautical miles—the equivalent of a C-17 flying to the moon and back 2,360 times.

BRAZIL

- Eurocopter's Helicópteros do Brasil (Helibras) subsidiary has delivered the initial three EC725s for Brazil's armed forces, achieving a key milestone in the programme to supply 50 of these multi-role helicopters.

EMBRAER

- Embraer delivered the first Legacy 650 large executive jet in December for the Brazilian market to a businessman from São Paulo. The customer already owns and operates an entry level Phenom 100 jet.

"It is a pleasure to see, less than two months after certification, a Legacy 650 operating in Brazil," says Breno Corrêa, Embraer Vice President, Marketing and Sales, Latin America – Executive Jets. "The unparalleled performance and comfort that made the Legacy 600 a sales success in Brazil are found in the Legacy 650, which, with its extended range, fully promises to continue Embraer's successful incursion into the nation's executive aviation market," he added.

EUROCOPTER

- Eurocopter has recently conducted the first flight of Spain's NH90 TTH tactical transport helicopter. The one-hour mission was performed at Eurocopter's Marignane facility in France.

EUROFIGHTER

- The Eurofighter Typhoon programme, which has delivered 50 aircraft over the past year, achieved another milestone of delivering the 250th aircraft to the Italian Air Force.

INDIA

- An US firm has shown keen interest in the explosive detection kit (EDK) developed by India's DRDO and an agreement on transfer of technology is likely to be signed soon. The EDK, developed by the High Energy Materials Research Laboratory in Pune can

APPOINTMENTS

SAFRAN

Marc Sorel has been named Safran's National Delegate for Russia, based in Moscow. He joins the Group's International Development department and will report to Emeric d'Arcimoles, Executive Vice President for International Development.

EMBRAER

Cynthia Marcondes Ferreira Benedetto has been appointed the Company's new CFO. She takes up the responsibilities of Luiz Carlos Aguiar, who will become the President and CEO of the recently created Embraer Defense and Security unit.

MEADS INTERNATIONAL

David Berganini has been named President of MEADS International (MI). MI is the transatlantic joint venture developing the medium extended air defense system (MEADS), a next-generation, ground-mobile air and missile defense system that will replace Patriot.

BAE SYSTEMS

BAE Systems has announced that Peter Lynas, currently Director - Financial Control, Reporting and Treasury for the Group, will take over as Group Finance Director on April 1, 2011. Peter will be appointed as an Executive Director of BAE Systems plc and will serve on BAE Systems' Executive Committee.

EUROPROP INTERNATIONAL

EPI Europrop International GmbH (EPI) has appointed Simon Henley as President. He will manage the TP400 engine programme for A400M aircraft.

Americas

Lockheed F-35 Programme faces \$1 billion cut



The US Department of Defense has requested \$7.86 billion (₹35,370 crore) for 42 F-35 strike fighters but their plans are unlikely to be accepted as the proposal is likely to undergo \$1 billion (₹4,500 crore) cut which will reduce the inventory by seven aircraft. Maryland-based Lockheed is the largest US defence contractor by sales. The measure's \$667.7 billion (₹30,047 crore) defence section also provides \$450 million (₹2,025 crore) to keep developing General Electric's F-35 backup engine. The air force version will cost \$111.6

million (₹502 crore), the marine corps short take-off and vertical landing model is projected at \$109.4 million (₹492 crore) which is the same as for the navy carrier version.

Northrop Grumman's ASTAMIDS can detect IEDs

Airborne surveillance, target acquisition and minefield detection system (ASTAMIDS) demonstrated it can detect simulated improvised explosive devices (IEDs) in a recently completed US Army evaluation of the end-to-end system. The system was flown on the Northrop Grumman Corporation-owned MQ-8B Fire Scout unmanned air system. ASTAMIDS' laser also demonstrated its capability as a target designator for Hellfire missiles, in three missile firings, all missiles made direct hits on their targets.

Boeing Phantom Ray on NASA's shuttle carrier

The Boeing Phantom Ray unmanned airborne system sat atop a NASA shuttle car-

rier aircraft (SCA), a modified Boeing 747, as it took off on December 13 from Lambert International Airport. The 50-minute flight was conducted in preparation for Phantom Ray's upcoming transport on the SCA to the Dryden Flight Research Center at Edwards Air Force Base, California. The SCA flights with Phantom Ray are being conducted under a Boeing-funded, commercial space act agreement with NASA. Once Phantom Ray arrives at Dryden, it will undergo ground and high-speed taxi tests to prepare for its first flight in early 2011. Phantom Ray is one of several programmes in Boeing's Phantom Works Division that are part of the company's rapid prototyping initiative to design, develop and build advanced aircraft and then demonstrate their capabilities.

US Air Force final integrated system test

The US Air Force/Lockheed Martin-led space based infrared system (SBIRS) team has successfully completed the final integrated system test (FIST) of the first geosynchronous (GEO-1) satellite, a major programme milestone that verifies the spacecraft's performance and functionality in preparation for delivery to the launch site. Having conducted all system environmental testing and now with the completion of FIST, SBIRS GEO-1 is on track to meet its scheduled spring 2011 launch aboard an Atlas V launch vehicle from Cape Canaveral Air Force Station. The SBIRS highly elliptical orbit payloads have already been launched.

Europe

Euro Hawk UAS undergoes a 30-hour flight



Unmanned aircraft system (UAS) Euro Hawk for the German Air Force has ----->

QuickRoundUp

identify a range of explosives such as PETN, Black Powder, Dynamite, NC, NG, CE, Inorganic Nitrates, TNT, RDX and HMX based plastic explosives, and costs about ₹5,000 (\$110).

LATIN AMERICA

- LAN Airlines, one of Latin America's leading passenger and cargo airlines, has signed a firm order for 50 new eco-efficient Airbus A320 family aircraft, making it the largest single airline order for Airbus in Latin America.

LOCKHEED MARTIN

- The US Military Satellite Communications Systems Directorate has announced the award of a cost-plus-incentive-fee contract modification valued at approximately \$1.4 billion (₹6,300 crore) to Lockheed Martin Space Systems, for production of the fourth advanced extremely high frequency satellite by 2017. AEHF is the successor to the five-satellite Milstar constellation and will provide 10 times greater global, highly secure, protected, survivable communications capability for war fighters operating on ground, sea and air platforms.

MBDA

- Lenkflugkörpersysteme GmbH (MBDA Deutschland) has reported that the first medium extended air defense system (MEADS) launcher has been delivered to the German Air Force. MEADS will replace Patriot in the US, Nike Hercules in Italy and will replace Patriot and the retired Hawk system in Germany. MEADS International, a multinational joint venture headquartered in Orlando is the prime contractor for MEADS.

NORTHROP GRUMMAN

- Northrop Grumman Systems Corporation has been awarded a \$486 million (₹2,187 crore) firm-fixed-price modification to a previously awarded indefinite-delivery/indefinite quantity contract for the procurement of up to 99 Litening pods and 241 upgrade kits and associated repair support for AV-8B (domestic and allied), F/A-18A+/C/D, EA-6B, A-10, F-15, F-16, and B-52 aircraft.

PILATUS

- Pilatus Aircraft Ltd has announced that the Swiss Air Force

SHOW CALENDAR

24-26 January
AIRPORT SECURITY
ASIA 2011

Hong Kong SkyCity Marriot Hotel, Hong Kong
www.airportsecurityasia.com

25-27 January
AIR TANKERS AND AERIAL
REFUELLING

CCT Smithfield, London, UK
www.militaryairtankers.com

25-26 January
FUTURE OF BUSINESS JETS
IN THE MIDDLE EAST

Movenpick Hotel, Bahrain
www.quaynote.com

26-28 January
LOW COST AIRLINES
WORLD ASIA PACIFIC

Grand Hyatt, Singapore
www.terrapinn.com/2011/lca

1-2 February
MRO MIDDLE EAST 2011

Airport Expo Dubai, UAE
www.aviationweek.com/events/current/mme/index.htm

2-3 February
FUTURE MRO IN CIVIL
AVIATION CONFERENCE

Cophorne Tara Hotel, London, UK
www.smi-online.co.uk/events/overview.asp?is=1&ref=3503

9-13 February
AERO INDIA 2011

Air Force Station Yelahanka, Bengaluru, India
www.aeroindia.in/Main.aspx

21-23 February 2011
INDIAN BUSINESS
AVIATION EXPO (IBAE)

Hotel Shangri-La, New Delhi, India
www.miuevents.com/ibae2011

-----► successfully proved its long endurance capability with a 30.3-hour flight. It is built by Northrop Grumman Corporation and EADS Deutschland GmbH. The Euro Hawk is the first international configuration of the RQ-4 Global Hawk high-altitude, long-endurance UAS. Based on the Block 20 configuration, the Euro Hawk will be equipped with a signals intelligence mission system developed by Cassidian, providing standoff capability to

IAF-IGNOU JOIN HANDS FOR AKASHDEEP

PHOTOGRAPH: PIB

Addressing professional certification needs of higher learning of its personnel below officers rank including recognition of 'in service' training, Indian Air Force (IAF) has signed a memorandum of understanding with Indira Gandhi National Open University (IGNOU), launching Akashdeep, a project registering existing airmen training institutes as community colleges enabling all serving airmen to obtain a bachelor's degree within 8-13 years of their service.

Under the arrangements, the two modules of the joint basic phase training will enable airmen to earn credit points that would be transferred to IGNOU for completing their certificates, diplomas and associate degrees in arts, science, commerce, business administration, hotel management, hospitality services, medical services, paramedical sciences, office management, automobile trade performing skill, vocal music, instrument music, etc. Subsequent to this, an airman can enroll for a one-year distance learning programme with IGNOU leading to award of bachelor's degree. •



detect electronic and communications emitters.

CIVIL AVIATION

Asia-Pacific

Praful Patel launches India's first sea plane service



The seaplane, that has captured the imagination of people, mainly through James Bond movies, has finally arrived in India too. Union Civil Aviation Minister Praful Patel has launched the first seaplane of the Pawan Hans Helicopters Ltd and has aptly named it 'Jal Hans'. At a ceremony held at the Juhu Aerodrome in Mumbai, Patel said that the government has plans to expand the services to most of the popular island and coastal destinations.

Bombardier sells 15 Q400 NextGen aircraft to SpiceJet
Bombardier Aerospace has announced that SpiceJet, India had placed a firm order for 15 Q400 NextGen turboprop airliners and has taken options on an additional 15 airliners.

Based on the list price for the Q400 NextGen aircraft, the firm order is valued at approximately \$446 million (₹2,007 crore) and could increase to approximately \$915 million (₹4,118 crore) if all 15 options are converted to firm orders. SpiceJet currently serves 22 destinations in India, Nepal and Sri Lanka. Bombardier is making significant investments in the infrastructure for its support and services in India and the Asia-Pacific marketplace. Earlier this year, Bombardier opened its new Regional Support Office (RSO) in Mumbai. This office serves both business and commercial aircraft customers.

First RNP in India

Airbus' Quovadis RNP subsidiary and IndiGo have successfully demonstrated, using an Airbus A320, the first required navigation performance (RNP) flight of any -----►

QuickRoundUp

is to expand its successful PC-21 Jet Pilot Training System with a follow-up order for two further PC-21 turboprop training aircraft with logistics and engineering services plus another debriefing system.

PRATT & WHITNEY

• Pratt & Whitney's F135 engine has crossed 20,000 test hours as it completes the ground development and demonstration phase of the programme. The F135 accumulated 3,600 test hours during the concept demonstration phase, 15,800 test hours during development and more than 700 hours powering the F-35 lightning II flight test programme

RAYTHEON

Raytheon Company has received a contract from Boeing for the production of advanced APG-63(V)3 active electronically scanned array radars. The US Air Force and the US Air National Guard will receive radars from the contract and deliveries will begin in the second quarter of 2011. The radars are intended to enhance the performance of deployed F-15C aircraft and will replace the current mechanically scanned radar systems. With its superior targeting and tracking capabilities, the APG-63(V)3 will enable aircrews to detect and identify targets well beyond the range of the existing systems.

SAAB

• Swedish Matériel Administration has handed over a Saab 340 Erieye AEW and a Saab 340 for transport and training to the Royal Thai Air Force. It is the first element of the integrated air defence system that Thailand has bought from Sweden.

Defence and security company Saab has received an order for the GIRAFFE AMB multi-mission radar system and related services from the Australian Defence Materiel Organisation (DMO). The Giraffe AMB system is a modular and flexible multi-mission radar that is capable of simultaneous air defence, air/ traffic management as well as weapon location.

SAGEM

• Sagem has major hopes for the armement air-sol modulaire (AASM). The AASM is a low-cost weapon that is similar in concept to the Boeing Joint Direct Attack Munition developed by

DEFENCE PROCUREMENT POLICY 2011 ANNOUNCED

The Defence Procurement Policy (DPP) 2011 has been expanded to include "civil aerospace, internal security, training within the ambit of the eligible products and services for discharge of offsets obligations".

The Defence Ministry has announced the changes in the DPP 2011 and included weapons, protective systems and communication equipment for internal security forces and civil aircraft design and component manufacturing in the offsets compliance category.

Minister of Defence A.K. Antony said that the list of eligible offsets will include most aspects of civil aerospace (including air frames, aero engines, aircraft components and avionics, aircraft design and engineering services, technical publications, and flying and technical training institutions). He said that these changes would provide a wider range of offset opportunities to vendors participating in defence procurements and encourage building up of indigenous manufacturing capability in crucial areas.

In the defence sector, the list of eligible offsets include armoured, bullet proof and mine-protected vehicles, riot-control equipment, unmanned aerial vehicles, night vision equipment, navigation and communication systems, training aids such as simulators, and specialised counter terror equipment such as assault platforms and detection devices.

The new policy is expected to give boost to investments by original equipment manufacturers (OEMs). As per the existing policy, overseas vendors bagging deals worth over Rs 300 crore have to invest 30 per cent of contract's worth into the defence sector only. The DPP 2011 will allow foreign vendors to invest in related sectors such as civilian aerospace and industry and internal security (weapons and equipment). Both the OEMs and the local industry had been demanding changes in the DPP to expand the defence production base in the country.

Antony mentioned that the policy had been refined after taking inputs from the defence industry, both Indian and overseas. "The policy also aims to establish a level-playing field for the Indian defence industry, both public and private sector," he said.

Policies regarding the shipbuilding procedures have also been reworked to encourage participation of private shipbuilding industry in India in defence contracts. "These guidelines will provide a level-playing field for Indian shipyards and promote indigenisation and self-reliance in warship construction," he added. ●

-----► commercial airliner in India, at Cochin International Airport—the nation's seventh busiest airport. The new procedure for India, which has been jointly financed by Airbus and the French Civil Aviation Authority (DGAC), brings several benefits to both local authorities and airlines at Cochin International Airport.

INDUSTRY

Asia-Pacific

Honda achieves first flight of FAA-conforming HondaJet
The Honda Aircraft Company announced that it has successfully completed the first flight of its FAA-conforming HondaJet advanced light

business jet. The event is a significant step in Honda's aerospace programme leading to delivery of aircraft in 2012. While Honda enters the flight test programme with its conforming HondaJet, the company also nears completion of its aircraft production facility on its Greensboro campus. The HondaJet production facility is scheduled for completion in early 2011, with the final phase of interior build-out now under way.

Europe

Airbus first fuselage barrel for the A350 XWB

Airbus has started making the first carbon fibre barrel for the A350 XWB fuselage at the company's production plant

in Illescas, Spain. The carbon fibre placement process used for producing the 5.5-metre long, 56-square-metre fuselage barrel, known as section 19, will be completed in the coming weeks. The majority of the A350 XWB fuselage is made from long carbon fibre panels which are easier to manufacture and to assemble than barrel sections.

Eurocopter starts testing of the second EC175 helicopter



The second EC175 prototype helicopter has performed its first flight today at Eurocopter's Marignane, France facility, marking another on-time milestone in the development of this new-generation rotary-wing aircraft. Airborne for 45 minutes, the first flight validated basic handling qualities and system functionality for the twin-engine EC175, which is a joint programme of Eurocopter and Aviation Industry Corporation of China.

SPACE

Americas

Lockheed Martin to support NASA

NASA has selected Lockheed Martin to support cargo mission services for the International Space Station (ISS). The potential value of the contract is \$171 million (₹770 crore), with a three-year base and additional options running until 2017. Having supported NASA's cargo mission since 2004, Lockheed Martin proposed in its bid an innovative set of new tools and processes to help NASA lower the overall cost of processing ISS cargo. Under the Cargo Mission Contract, Lockheed Martin will support planning, coordination, preparation and packing of standardised containers for cargo missions to and from the International Space Station. ●

QuickRoundUp

the US that turns a general-purpose bomb into a precision-guided munition (PGM). In addition, the AASM bridges the gap between weapons such as the BGL laser guided bomb and the AS.30L, and long-range missiles such as the SCALP-EG.

SUKHOI

• The Sukhoi Superjet 100 has completed two tests of vital importance for final AR IAC certification—emergency evacuation testing and rejected takeoff with maximum braking kinetic energy. According to the certification requirements to the emergency evacuation testing, the SSJ100 SN 95007 had 90 seconds to get all 98 volunteers of different age groups and five crew members off the plane. AR IAC Sukhoi Superjet 100 SN 95003 has also successfully completed the most difficult certification test case—rejected takeoff with maximum braking kinetic energy.

THALES

• Thales Raytheon Systems (TRS), in collaboration with Thales Germany, has been selected by the German Federal Office for Defense Technology and Procurement to supply six Ground Master 400 (GM 400) long-range air defence radars for the Aktives Radarrundsuchgerät für den Einsatzführungsdienst programme. The contract is valued around €100 million (\$140 million).

USAF

• The US Air Force has successfully completed evaluation of Raytheon's new distributed common ground system (DCGS) Germany, enabling operational use of the upgraded intelligence, surveillance and reconnaissance (ISR) system. The network-centric upgrade to DCGS is an important element of the US Department of Defense's initiative to enable seamless, real-time, multi-agency intelligence sharing and collaboration.

USMC

• Spirit AeroSystems has celebrated the rollout of the Sikorsky CH-53K helicopter fuselage being delivered to support assembly of the first developmental test vehicle. The CH-53K helicopter is a dual-piloted, multi-engine helicopter that will provide the US Marine Corps with improved heavy lift capability.

WHERE are the DIVIDENDS?

Air Marshal P.K. Barbora retired as Vice Chief of the Air Staff on December 31, 2010. Known for his forthright views, Barbora in his last official public conference did not mince words on the languishing state of the Indian aerospace industry and one which had not “paid back dividends”.

Addressing the fifth International Conference on Energising Indian Aerospace Industry, the Air Marshal began by asking, “Do we have an aerospace industry?” and answered, “Yes, we do have in the form of defence public sector undertakings (DPSUs) and ordnance units.” The next question he put forth was, “Has it paid worthwhile dividends?” The matter-of-fact reply was, “In the last 72 years, it has not paid us back dividends to the desired extent. Size-wise we are comparable and bigger than many countries, but production-wise, we lack commitment and a sense of urgency, resulting in delays and cost overruns. We need to seriously think about this.”

Consequently, India has to rely on imports for all its aerospace needs. “It means we are paying them so that they can pay their people... in other words it is robbing Peter and paying Paul.” The miniscule Indian exports are a blot on the potential that exists.

Indeed it is time to relook at the status of the Indian aerospace industry—time to get the political leadership to back aerospace programmes; time to invest massively in research and development; time to open up the industry for increased private sector and foreign participation; and time to develop domestic and overseas markets. There cannot be a better time than now as Indian aviation requirements, both military and civil, have grown beyond imagination. The requirement of 126 medium multi-role combat aircraft (MMRCA) alone is worth \$11 billion (₹49,500 crore). In the civil aviation realm, increased passenger and cargo movements are the key drivers for airlines to expand and MRO and other facilities to come up at a faster pace.



India relies on imports for all its aerospace needs. Size-wise we are comparable and bigger than many countries, but production-wise, we lack commitment and a sense of urgency, resulting in delays and cost overruns.

The scale of the programmes is massive, requiring a change in mindset, co-ordinated and well-planned approach, moving away from bureaucratic delays that have been plaguing the nation. One of the first things that the country has to get off the block is to set up the much-delayed National Aerospace Commission on the lines of space commission.

Control regimes, Barbora remarked, meant denial of technology from overseas. “Scientists should realise that time and tide, wait for none.... If you do not give us technology at that moment of time, we will have to go elsewhere. By the time you come up with technology, it will be redundant,” he said. It was a clarion call to move away from transfer of technology and licence production approach to core designing and core development.

The refrain at the conference too was that outsourcing is an inescapable mantra as the DPSUs have their own inherent limitations. If the aero-

space industry has to get into a growth momentum, the government has to remove the many anomalies that exist, thus liberalising the environment for the private sector. Competition among the private and public sector units is one way of looking at it—a level playing field.

Taking a pot shot at the offset policy, the Air Marshal mentioned how a foreign vendor had to submit offset requirements about 20 times before giving up. Offset policies of countries such as Brazil, Spain, Israel and South Korea have benefited the host country and the good points can be picked from here. About \$20 billion (₹90,000 crore) of offset is there to be absorbed and with few more deals this year, India could close at \$40 billion (₹1,80,000 crore) offset programmes and an opportune moment for India to truly energise its aerospace industry à la the way the automotive industry was galvanised. **SP**

— R. Chandrakanth

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