



IT'S OFFICIAL: F-35 IS ONLY \$65 MILLION (PER UNIT),
SAYS LOCKHEED MARTIN – SP'S EXCLUSIVE (PAGE 24)

ISSN 2230-9225



₹75.00 (INDIA-BASED BUYER ONLY)



AN SP GUIDE PUBLICATION

SP's Aviation

News Flies. We Gather Intelligence. Every Month. From India.

www.spsaviation.net

AUGUST • 2011

» Infrastructure for Business
Aviation in India

» Boeing 787 Debut

» Mirage Deal Done

» Regional Aviation:
Networking India

» IAF's Role in
Homeland Security

» Show Report:
2011 AirVenture Oshkosh

Salute the Shuttle

PAGE 39

THE ENTIRELY NEW G650

FASTEST. FARTHEST. LARGEST.

With a maximum operating speed of Mach 0.925, the G650® offers the longest range and fastest speed of any other business jet flying today. Imagine going farther, reaching your destination faster and accomplishing more in a day than ever before. Imagine no more. The world's most remote destinations lie well within the G650's nonstop range, and worldwide city pairs are never more than a single refueling stop away.

Please contact our regional vice president or Gulfstream authorized independent sales representative to learn more.



Gulfstream®
A GENERAL DYNAMICS COMPANY

ROHIT KAPUR
JASON AKOVENKO

+91 98 182 95755
+65 6256 8301

rohit.kapur@arrowcharters.com
jason.akovenko@gulfstream.com

GULFSTREAMG650.COM

TABLE *of* CONTENTS



39

A view from the international space station shows the Space Shuttle Atlantis backdropped over terrain as the two spacecraft were nearing their much-anticipated link-up in Earth orbit.

■ TECKNOW

10 Fly Like a Bird

■ FIRST

12 Flying Safe & Efficient

■ BUSINESS AVIATION

14 **Infrastructure**
The Road Less Travelled

17 **Viewpoint**
Regulatory Snags

18 **Viewpoint**
Are We Ready?

■ CIVIL

20 **Boeing 787**
Dreamliner Lands

21 **Regional Aviation**
Networking India

■ MILITARY

24 **Exclusive**
\$65 million only

Lead Story

THE ROAD LESS TRAVELLED

Privatisation of airports pose their own problems in terms of exorbitant and escalating cost of operation for aircraft operators



Cover Photo:
Fisheye view of Earth and NASA's Space Shuttle Atlantis as seen from Russia's Mir Space Station
Image By: NASA

26 **Homeland Security**
Keeping a Close Watch

29 **Upgrade**
Deal Done, Finally

32 **Rafale**
Agile & Distinct

35 **Snapshot**
Browne is the New Air Chief

■ SHOW REPORT

36 **AirVenture 2011**
Enthusiasts' Delight

■ SPACE

39 **Atlantis**
Salute the Shuttle

■ HALL OF FAME

43 **Kalpana Chawla**

■ REGULAR DEPARTMENTS

4 **A Word from Editor**

5 **NewsWithViews**
– Fighter deal gets bigger
– Yet another MiG-21 crashes, pilot killed

7 **InFocus**
IAF Controlling HAL

8 **Forum**
Steering HAL Projects

44 **NewsDigest**

48 **LastWord**
A Growing Liability

NEXT ISSUE:

Civil Aviation in India: An Overview

TABLE of CONTENTS

PLUS...



↑ **I4** The Road Less Travelled



↑ **32** Agile and Distinct



↑ **36** Show Report: 2011 AirVenture Oshkosh



SP GUIDE PUBLICATIONS

www.spguidepublications.com

PUBLISHER AND EDITOR-IN-CHIEF

Jayant Baranwal

ASSISTANT GROUP EDITOR

R. Chandrakanth

SENIOR VISITING EDITOR

Air Marshal (Retd) V.K. Bhatia

SENIOR TECHNICAL GROUP EDITORS

Air Marshal (Retd) B.K. Pandey

Lt General (Retd) Naresh Chand

SENIOR COPY EDITOR &

CORRESPONDENT

Sucheta Das Mohapatra

CONTRIBUTORS

INDIA

Air Marshal (Retd) N. Menon

Group Captain (Retd) A.K. Sachdev

Group Captain (Retd) Joseph Noronha

EUROPE

Alan Peaford

USA & CANADA

LeRoy Cook

CHAIRMAN & MANAGING DIRECTOR

Jayant Baranwal

ADMIN & COORDINATION

Bharti Sharma

Survi Massey

PHOTO EDITOR

Amit Bhardwaj

Owned, published and printed by Jayant Baranwal, printed at Kala Jyothi Process Pvt Ltd and published at A-133, Arjun Nagar (Opposite Defence Colony), New Delhi 110 003, India. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, photocopying, recording, electronic, or otherwise without prior written permission of the Publishers.

DESIGN & LAYOUT

Senior Art Director: Anoop Kamath

Designers: Vimlesh Kumar Yadav,

Sonu Singh Bisht

DIRECTOR SALES & MARKETING

Neetu Dhulia

SALES & MARKETING

Head Vertical Sales: Rajeev Chugh

SP'S WEBSITES

Sr Web Developer: Shailendra Prakash Ashish

Web Developer: Ugrashen Vishwakarma

© SP Guide Publications, 2011

ANNUAL SUBSCRIPTION

Inland: Rs 900 • Foreign: US\$ 240

Email: subscribe@spguidepublications.com

LETTER TO EDITOR

editor@spsaviation.net

expert@spsaviation.net

FOR ADVERTISING DETAILS, CONTACT:

guidepub@vsnl.com

neetu@spguidepublications.com

rajeev.chugh@spguidepublications.com

SP GUIDE PUBLICATIONS PVT LTD

A-133 Arjun Nagar,
(Opposite Defence Colony)
New Delhi 110 003, India.

Tel: +91 (11) 24644693,

24644763, 24620130

Fax: +91 (11) 24647093

Email: guidepub@vsnl.com

REPRESENTATIVE OFFICE

BENGALURU, INDIA

534, Jal Vayu Vihar
Kammanhalli Main Road
Bengaluru 560043, India.

Tel: +91 (80) 23682534

MOSCOW, RUSSIA

LAGUK Co., Ltd., (Yuri Laskin)
Krasnokholmskaya, Nab.,
11/15, app. 132, Moscow 115172, Russia.

Tel: +7 (495) 911 2762

Fax: +7 (495) 912 1260

Dassault Aviation • Snecma • Thales



What will protect India in the 21st century?



RAFALE 
INTERNATIONAL

DASSAULT AVIATION • SNECMA • THALES

In matter of national defence, there can be no substitute for complete trust in the source, no compromise on the reliability and the availability of the aircraft and its technologies. For over half a century, we have proudly been supporting India's air defence mission. Today, we look forward to keeping the privilege of serving India, for the next 50 years, with the world's most advanced latest generation aircraft, *Rafale*. The *OMNIROLE* fighter ■



As the country decides on which of the two European fighters is chosen for the medium multi-role combat aircraft contract, there is now an US offer for the F-35 joint strike fighter, lower in cost than the two finalists

ONE OF THE MAJOR challenges of the economic surge in India has been how to handle this phenomenal growth. The aviation sector is faced with this scenario and it is here that the wisdom of the government in formulating policies comes to the fore. Liberalised policies go a long way in encouraging growth. The policies have to be proactive and here it needs to be mentioned how while the Terminal 3 (T3) at Delhi Airport showcases international class to the world, there are still niggling issues which the airlines are not comfortable with. Kingfisher Airlines and Jet Airways have approached the Ministry of Civil Aviation wanting to move back to Terminal 1D as they find the cost of operations, particularly the price of fuel at T3, very high. These have to be amicably sorted out.

The general aviation sector which is in the cusp of growth is faced with several challenges. The President of Business Aircraft Operators Association, Rohit Kapur in the article "Are We Ready?" has clearly outlined what needs to be done by the authorities, if India has to be a favoured destination for all general and business aviation (GBA) aircraft manufacturers in the coming decade. India is expected to have approximately 2,000 GBA aircraft by 2020. The biggest challenge is that the country lacks infrastructure and worse that there is no planning for infrastructure.

In another article, A.K. Sachdev mentions that the foremost impediment to corporate aviation has been purchase of aircraft, caught up in regulatory imbroglio. Echoing similar concerns as Rohit Kapur, he mentions how the corporate aviation sector has to contend with lack of infrastructure; no fixed based operators, ineffective ground handling systems, etc.

With the prospect of phenomenal growth of the aviation sector, the government has no doubt embarked upon modernisation of airports, albeit the pace is not as desired. R.Chandrakanth writes about how with low cost carriers gaining currency, secondary and tertiary airports will get increasingly active in the years to come. There are 136 airports in the country and once properly networked, sustaining the economic growth momentum will become easier.

Moving from civil aviation to defence, Air Marshal (Retd) B.K.Pandey opines that even as the country decides on which

of the two European fighters is chosen for the medium multi-role combat aircraft (MMRCA) contract, there is now an US offer for the F-35 joint strike fighter, lower in cost than the two finalists. In an exclusive interview with *SP's Aviation*, Lockheed Martin has clarified that the fifth generation fighter F-35 is highly affordable and have an average unit recurring flyaway price of \$65 million (₹292.5 crore) in 2010 dollars.

Air Marshal (Retd) V.K.Bhatia makes a case for the IAF to improve its proactive surveillance capabilities by acquiring more capable and more persistent platforms both manned and unmanned aerial vehicles and space-based satellites of all types. The upgradation of Mirage 2000 would usher in state-of-the-art technologies with modern radar, weapons and electronic warfare capabilities. But the way the contract is structured, it would take seven to eight years from now for its completion, which means it could be the end of 2018 by the time the 51st aircraft is configured into its new avatar.

In both military and commercial aviation, the wisdom and foresight of the government is required and required urgently.

Jayant Baranwal
Publisher & Editor-in-Chief

FIGHTER DEAL GETS BIGGER

The “mother” could well become the “granny” of all defence deals in the years ahead. India is likely to go in for another 63 fighters after delivery of the first 126 medium multi-role combat aircraft (MMRCA) if the “timelines” for its other fighter development projects are not met, say top defence officials. This comes even as the Ministry of Defence (MoD) within a week or two is all set to open the commercial bids of the two jets left in the MMRCA fray—the French Rafale and the Eurofighter Typhoon. The MoD has already rejected “any scope for comeback” by the other four jets, including the American F/A-18 and F-16, eliminated from the MMRCA race in April 2011.

VIEWS

THE CASE FOR 126 MMRCA, initially called the multi-role combat aircraft (MRCA) was initiated by Air Headquarters in 2001. However, the proposal underwent a number of modifications in the initially defined weight parameters, the aircraft types and the list of vendors before the request for proposal (RFP) for MMRCA was finally issued in 2007. While reports indicate that the tender is close to finalisation, it may take yet another four to five years before the MMRCA finally enters service with the IAF.

In the intervening period since 2001, the strength of the combat fleet of the IAF has declined from the authorised figure of 39.5 squadrons to around 34 and in the next few years is expected to reduce further to fewer than 30 squadrons as vintage fighters of Russian origin are consigned to the museum. The acquisition process followed since the mid-1960s was through government-to-government transaction initially with the Soviet Union and later with Russia, was replaced by the Defence Procurement Procedure (DPP) 2005. Intended to ensure transparency in the procurement process, widen options and ensure best value for money, the DPP which has been amended several times since promulgation, has also served to introduce infinite complexity in the process leading to excruciating delays in procurement. Compare this with the speed of procurement of the Su-30 fleet; the process for which began in 1994 and the first batch of aircraft was inducted into squadron service in 1997. The decision for licensed production of the fourth generation Su-30 MKI was taken in 2000 and the first aircraft was delivered in 2004. Timeframe for the procurement of the C-130J through the foreign military sales route is also similar.

The proposal to enhance the MMRCA tender by 63 aircraft is apparently to cater for the possible delay in the Tejas light combat aircraft and/or the Indo-Russian FGFA projects. As uncertainties continue to afflict both the projects, the possibility of delay is real. Hence the proposal to enhance

the MMRCA fleet by 50 per cent would appear a reasonable and logical step. However, there may be impediments, imponderables and alternatives. Despite the heightened expectations that the tendering process is in the last lap, given the experience so far, one can never be sure as to when the final word will be said. The issues related to transfer of technology, long-term relationship between the aerospace industries of the selected vendor and the buyer as also plans for fulfilling huge offset obligations especially when provisions of the liberalised rules in this regard are not available to the vendor in the MMRCA tender, can pose a daunting challenge to the bureaucracy in the MoD in finalising the contract especially as this is the first experience of its kind. Besides, the murky and scam-riddled milieu could seriously impede decision-making.

The second and perhaps the more serious problem may be cost escalation. Ironically, the Rafale and the Typhoon are the two most expensive combat platforms from among the six original contenders. With a unit cost of around \$100 million (₹450 crore) a piece, the value of the contract would clearly overshoot the initial assessment of \$10.4 billion (₹46,800 crore) made in 2007. While there was a built-in option for up to 63 additional aircraft at the originally quoted price, the vendor may find it difficult to oblige at this stage on account of cost escalation attributable to the inordinate delay in the finalisation of the tender. A total of 189 aircraft may well involve twice the level of investment originally envisaged, pushing the entire deal into a price regime that India may find difficult to afford.

And then there is the possibility of the US offer for the F-35 joint strike fighter coming India's way, an offer that could give a new dimension to the decision-making dilemma at the MoD. But perhaps increasing the size of the Su-30 fleet to compensate for deficiency in the combat potential may be an option least expensive and most expedient. SP

—Air Marshal (Retd) B.K. Pandey



YET ANOTHER MiG-21 CRASHES, PILOT KILLED

On August 2, a MiG-21 fighter aircraft crashed soon after taking off from Nal airfield in Rajasthan's Bikaner district killing the pilot. "The pilot ejected but died due to injuries sustained by him," a defence spokesperson said. The MiG-21 'Type-96' aircraft was on a routine sortie and crashed near the airfield, which is about 15 km from Bikaner city, he said. This is the second crash of a MiG series fighter aircraft this year. On February 4, an IAF MiG-21 'Bison' fighter plane had crashed apparently due to an engine problem while on a routine sortie in Madhya Pradesh's Sheopur district but the pilot had ejected safely.

VIEWS

AS ONLY 48 HOURS had elapsed at the time of writing since the tragic air accident occurred at the IAF's Nal Air Base, there was no clarity as to what happened which led to loss of life of a young pilot in the desert sands of western Rajasthan. While a court of inquiry (COI) has been ordered, the IAF is understandably tight-lipped about the details of the accident at this stage. What has been revealed by the defence correspondents indicate that the pilot was on a routine training sortie, perhaps part of the Ops U/T syllabus required to be completed for the newly inducted pilots to become 'Fully Ops' on type in the IAF's operational squadrons. Preliminary findings as reported in the media however lead one to believe that the accident occurred due to certain complications during the landing phase of the sortie, which led the pilot to abandon the aircraft at low level. The ejection however was unsuccessful which ultimately resulted in fatal injuries to the pilot.

There could be a host of reasons which might have led the pilot to take a conscious decision to eject and while it is not intended to indulge in premature analysis, some probabilities could however be discussed. The accident occurred during broad daylight i.e. at 11:30 a.m. Spatial-disorientation—one of the major causes involving fighter accidents—could reasonably be ruled out. The other most probable cause could be loss of thrust/flame out due to technical malfunction of the engine/bird strike. Even though Type 96 (MiG-21 M) involved in the accident has a comparatively smaller radome, a large bird strike can still choke the intake to cause engine flame-out. As the preliminary reports suggest, the pilot was approaching the runway at Nal for a landing and therefore the possibility of a bird hit cannot be ruled out. Losing the sole source of power in the single-engine MiG-21 aircraft; that too at a low height and low speed (in landing phase of the flight), leaves few options for the pilot to take corrective emergency actions except to eject as soon as possible.

Operational requirements demand the combat jet fighters to be mean machines where performance concerns override safety in case of a conflict between the two. That is why fighter aircraft are inevitably equipped with ejection seats to enable the pilot to safely leave a stricken machine under extreme circumstances. That brings to the fore the question of ejection seats and their capabilities. Whatever may be the safety concerns of Russian aircraft especially of older vintage, nobody can fault their ejection seat technology which has always been on par or even better than the 'west'. For example, Russians

were the first to invent rocket-assisted flight crew escape systems. MiG-21M may be old vintage but it is fitted with either zero (altitude)/zero (speed) or zero-90 kmph ejection seat, greatly increasing the ejection envelope. But there is a caveat as these, especially the 'zero-altitude' capability can get seriously eroded in case of an aircraft in descent.

While figures may vary slightly in each case, basic thumb-rules could limit minimum altitudes at five to seven times the rate of descent for a successful ejection. MiG-21M (Type 96) variants are derivatives of the original Mach 2, razor-thin delta-wing design, which in a powerless glide could drop like a tonne of bricks, losing height at an abominable 40 m/sec rate of descent. Translated into decision-altitude for safe ejection, this works out to 200 to 280 metres—a great departure from the original zero-altitude capability. Grievous injuries suffered by the pilot would be indicative of ejection being only partially successful due to insufficient height for the ejection sequence to be fully completed. While nothing can be said with certainty at this stage, it is quite possible that the pilot impacted the ground with less than wholly opened parachute. The effect of descent on successful egress from the aircraft is ingrained in young pilots during training, but these are split-second decisions, which unfortunately, can and do go wrong sometimes. ^{SP}

—Air Marshal (Retd) V.K. Bhatia



IAF Controlling HAL

MEDIA, BOTH PRINT AND electronic, seems to be abuzz with the IAF's call on the Ministry of Defence (MoD) to appoint one of its three-star officers (Air Marshal) as the Chairman and Managing Director (CMD) of Hindustan Aeronautics Limited (HAL), when the present incumbent Ashok Nayak lays down office on October 31 this year. MoD sources confirmed the IAF's request stating that the IAF had even proposed a specific name for the post if agreed to by the Ministry. The matter is under examination at the MoD, but no final decision has been taken as yet. Simultaneously, a panel of names has been reportedly drawn up to include bureaucrats from different organisations such as Pawan Hans, MSTC and of course, the MoD itself.

Not known for an elephantine memory, the media while supporting the IAF proposal —“As HAL's biggest customer, it (IAF) has every reason to be worried that most projects being handled by the PSU, have been plagued by time and cost overruns” — has also labeled it revolutionary. IAF's contention in forwarding the case to the MoD is that the HAL Chief should be someone who “understands aerospace concepts” and can “transform” HAL into a cutting-edge company, capable of delivering on time, to stem its fast eroding combat edge.

How far the IAF is dependent on HAL is evident from the fact that practically all combat fleets of the IAF are manufactured by HAL either through indigenous route or through licence-manufacturing. The ones that have been imported from foreign original equipment manufacturers (OEMs) directly are also routed through HAL. Some current examples include, manufacture of 180 Su-30 MKIs under a contract worth \$3.2 billion (₹14,400 crore), indigenous light combat aircraft Tejas which may eventually total up to more than 200 aircraft worth more than \$5 billion (₹22,500 crore) and licence-manufacture under transfer of technology of at least 108 aircraft under the MMRCA project with a total value exceeding \$10 billion (₹45,000 crore). These are just a few examples but the story does not end here. There are

examples of mid-life upgrades of most existing fleets starting from MiG-21 Bison at the lower end right through MiG-27, MiG-29, Jaguar, Mirage 2000 and even the Su-30 MKI where HAL has played or will be directly involved in the programmes as and when they get under way. HAL is also involved in the joint development and production of PAK-FA

fifth generation fighter with Russia—a programme which may finally be worth more than \$35 billion (₹1,57,500 crore). Other than the fighter fleets, HAL is in the middle of manufacturing under licence Hawk AJTs, developing the IJT as well as the indigenous basic trainer for the IAF. When one includes different types of helicopters and transport aircraft also in the scheme of things, the story appears to be endless.

HAL currently boasts of generating business worth around \$2 billion (₹9,000 crore) annually and while it is true that it has been off and on catering to the requirements of other services and in recent times even got some export orders, its bread and butter has been and will continue to be the Indian Air Force. With so much at stake—operational capabilities et al—it is but natural for the IAF to be

deeply involved with HAL, with a direct say to ensure the overall well-being and efficient running of the organisation. HAL on the other hand, should have treated the IAF, its most valued customer, with the utmost care, meeting all its requirements properly and in as timely a manner as possible. Unfortunately, that has not happened.

Little wonder then, the IAF—stung by its eroding operational capabilities and fed up with the bureaucratic culture pervading the aerospace behemoth—wants to take charge of HAL, to stay on course for the metamorphic transformation it is striving for. But will the mere appointment of a three-star IAF officer as its CMD, transform HAL into a world-class aviation company? What are the many-faceted issues involved? Turn to Forum for individual opinions and possible solutions. ■

—Air Marshal (Retd) V.K. Bhatia

Stung by HAL's eroding operational capabilities and fed up with the bureaucratic culture pervading the aerospace behemoth, IAF wants to take charge of HAL. But will the mere appointment of a three-star IAF officer as its CMD transform HAL into a world-class aviation company?

Steering HAL Projects

It must be clearly understood that as the major practitioner of aerospace power in India's context, it is the IAF which should be in the driver's seat to steer such projects. Going a step further, it would be most desirable for the IAF to emulate the Indian Navy and gradually establish its own design bureaus for aircraft and systems development.



HAS THE REPORTED REQUEST by the Indian Air Force (IAF) to the government to appoint a three-star Air Force officer as the next Chairman and Managing Director (CMD) of Hindustan Aeronautics Ltd (HAL) stirred a hornet's nest? While there is little doubt that it will generate considerable controversy, the IAF's proposal is not at all revolutionary as it is being made out to be in some quarters. But the bigger question is, will the mere appointment of a three-star Air Force officer as its CMD transform HAL into a world-class aeronautics company capable of providing an effective source for meeting the aviation needs of the IAF and other defence forces? On the face of it, reviving the earlier practice of appointing IAF officers to head the HAL is not only desirable but eminently sensible too. But this alone would not help matters much unless major reforms are simultaneously carried out – not only the way HAL and all other public sector enterprises are run in this country, but also to effectively integrate design, development and production activities; closely knitted together in an almost seamless fashion—if, meaningful capability accretion is the ultimate goal.

To redux, after India's independence for 10 years till 1957, HAL was headed by bureaucrats. But from 1958 onwards till 1997, its Managing Directors (MDs) and later the CMDs have all been IAF officers in an unbroken chain. The importance of the post could be gauged from the fact that at least four of them; Aspy Engineer, P.C. Lal, O.P. Mehra and L.M. Katre, subsequently went on to head the IAF itself. However, three officers

including the last two of these had come up from within HAL itself having retired from the IAF for permanent absorption in the company. This may have provided the precedence for the selection of the CMD from the HAL cadre, except that they ceased to be from the Air Force. This, though never brought out in the open, might have further dented the level of cooperation and interaction which existed between the two organisations.

The present imbroglio with regard to finding a suitable replacement to the outgoing CMD, if anything, could worsen the matters further. A question that looms large is why is it that the panel drawn up by the government does not include any

name from the HAL cadre? Does it mean that HAL has failed to find a suitable replacement from within its own cadre? On the other hand, the government shortlist, mostly of civil servants, also does not inspire much confidence in their ability to oversee an aerospace giant that is so vital for the country. Opinions vary, as would be normal in any vibrant democracy, but generally they lean towards non-inclusion of bureaucrats in running the show at HAL. Reacting to the panel of short-listed candidates for HAL's top post, Kapil Bhargava, a retired ex-Air Force test pilot of eminence, who served in HAL for a long time opines, "My personal view is that first of all, bureaucrats and financial experts must be totally banned from being considered for this appointment. The best man from IAF or having come up from within HAL should head it." Manoj Joshi is of the view that if there is no internal candidate (within HAL) of the right calibre then, "this is a particularly opportune moment for the



government to push for an IAF man to head the outfit.”

But based on his long association as a test pilot with HAL and deep knowledge of its working, Kapil Bhargava strongly feels that even the best man from the IAF will not be able to improve matters because of the inherent multi-fold ills of HAL. “If improvement is considered essential, HAL must be taken out of the control of the Ministry of Defence (MoD), including control by the Secretary Defence Production,” he contends, to allow it to run as an autonomous organisation with no bureaucratic remote control. Even though in the defence sector and notwithstanding the fact that it has been conferred the title of ‘Navaratna’, afflictions associated with public sector undertakings, such as overstaffing, indifferent work culture, mediocrity, low productivity, lack of operational efficiency and unionism pose debilitating challenges to HAL as well. These are the corporate ills which can only be addressed by the political top brass through sweeping industrial reforms. It is to be hoped that ultimately these will form part and parcel of the overall economic reforms being adopted to shore up the country’s economic progress. That said, a senior service (Air Force) officer, with an inherent sense of discipline, commitment and leadership, could at least bring about positivity in the areas of work culture and productivity. In addition, being intimately au fait with HAL’s prime customer IAF’s requirements, he would be in a better position to steer and synergise HAL’s activities.

It would perhaps be in order to understand what HAL stands for and what are its objectives? H.K.L. Anand, a retired Managing Director of eminence from HAL opines about his former company: “Hindustan Aeronautics Limited is much more than just a public sector undertaking. It is an aerospace industry of unique embodiment of the country’s aspirations for attaining self-sufficiency in development and production of highly sophisticated aircraft and allied equipment in the defence aerospace sector.” Its aim should therefore be to serve as a tool to translate the national policy of achieving self-reliance in the design, development and production of aircraft and aeronautical equipment to meet the country’s growing needs. Post-independence, HAL was actually entrusted with these tasks but somehow lost its way midstream for a variety of reasons, especially in the field of design and development of new products and essentially became a facility for licence-production of aircraft and allied equipment procured from abroad. It was after many wasted decades, a push was finally given to revive indigenous design and development capabilities with the launching of the LCA programme. Here again, adoption of piece-meal policy formulations and formation of ad hoc establishments led to many difficulties preventing smooth and time-efficient progression of the overall effort as HAL had literally lost its design expertise. But the Aeronautical Development Agency (ADA), which was created exclusively for the LCA project, proved to be a topsy-turvy solution as it failed to provide a seamless connect between the user,

design, and development agencies—in that order. Air Marshal (Retd) Philip Rajkumar, who once headed the ADA is of the firm view that “it is the user service which should be managing such projects.”

Back to the basics; it must be clearly understood that as the major practitioner of aerospace power in India’s context, it is the Indian Air Force which should be in the driver’s seat to steer such projects. Going a step further, it would be most desirable for the IAF to emulate the Indian Navy and gradually establish its own design bureaus for aircraft and systems development. The naval model for design, development and manufacture of warships not only incorporates a Directorate of Naval Design as also the Weapon and Electronics System Engineering Establishment (WESEE) for system development and integration under the Naval HQ, but also a Controller of Warship Production with the defence shipyards in the country being headed by suitable

high-ranking serving and ex-naval officers. The Navy has been able to build a strong self-reliance capability by keeping the design, development and production in a seamless synergy with Defence Research Development Organisation (DRDO) and other research agencies being consulted as required.

Can the IAF do the same? According to Air Commodore (Retd) Jasjit Singh, Director, Centre for Air Power Studies (CAPS), the new order can be implemented by the simple method of appointing the Director General of ADA under the Chief of the Air Staff as an additional Deputy Chief of Air Staff (DCAS) and merge the HAL’s design bureaus, little that exists, with the ADA. The other alternative would be to transfer ADA to HAL (or vice versa) to build a larger

design bureau for the future, eliminating the need for the DG DRDO to remain as the Chairman of the ADA society. Whatever the case may be, one cannot but underscore the need for the IAF to control the specific projects from design to development and timely induction of the end products to maintain operational capabilities at the desired levels. By emulating the Navy, the IAF would be able to define the architectural design of the desired platforms/equipment with the manufacturing agency HAL, entrusted with the specific engineering designs for the development and production of the end products maintaining a seamless synergy as the Navy maintains with the defence shipyards in the country. The DRDO agencies could engage in pure research and called upon to develop specific technologies on as required basis.

Reverting to the current controversy on the subject, could there be any further argument as to who should be heading the HAL to ensure the necessary synergies—not only in all departments of indigenous design, development and production of defence aeronautical products, but also in the field of joint ventures? For the IAF to not repeat the alarming situation of depressingly low level of combat strengths it has been driven to in recent times, the final verdict can’t be anything else but the obvious. SP

— Air Marshal (Retd) V.K. Bhatia

Why is it that the panel drawn up by the government does not include any name from the HAL cadre?





Fly LIKE A BIRD



The SmartBird can start, fly and land autonomously
with no additional drive mechanism

UK BASED FESTO, A leading supplier of automation technology globally, has succeeded in unravelling the mystery of how birds fly. SmartBird is an ultra light powerful flight model with excellent aerodynamic qualities and extreme agility. With SmartBird, Festo has succeeded in deciphering the flight of birds.

The bionic technology-bearer, which is inspired by the herring gull, can start, fly and land autonomously with no additional drive mechanism. Its wings not only beat up and down, but also twist at specific angles. This is made possible by an active articulated torsional drive unit, which in combination with a complex control system attains an unprecedented level of efficiency in flight operation.

An unusual feature of SmartBird is the active torsion of its wings and the fact that it dispenses with the use of additional lift devices. The aim of the SmartBird project was to achieve an overall structure that is efficient in terms of resource and energy consumption, with minimal overall weight, in conjunction with functional integration of propulsion and lift in the wings and a flight control unit in the torso and tail regions. Further requirements were excellent aerodynamics, high power density for propulsion, and maximum

agility for the flying craft. The outcome is an intelligent bio-mechatronic overall system.

The onboard electronics ensure precise wing control. In addition, the torsion control parameters can be adjusted and thus optimised in real time during flight. The wing flapping and twisting sequence is controlled within a few milliseconds and results in optimum airflow around the wings. The SmartBird flight model has no rotating parts on its exterior and therefore cannot cause injury.

The system operates in an energy-efficient manner—the propulsion and lift are achieved solely by the flapping of the wings and have a power requirement of only around 23 watts. SmartBird has a total weight of around 450 grams and a wingspan of two metres; electromechanical efficiency factor of around 45 per cent and an aerodynamic efficiency factor of up to 80 per cent. SmartBird demonstrates optimal use of airflow phenomena. ^{SP}

PHOTOGRAPH: FESTO



E-mail your comments to:
letters@spsaviation.net



Upgrade a little. Upgrade a lot.
It's all up to you.

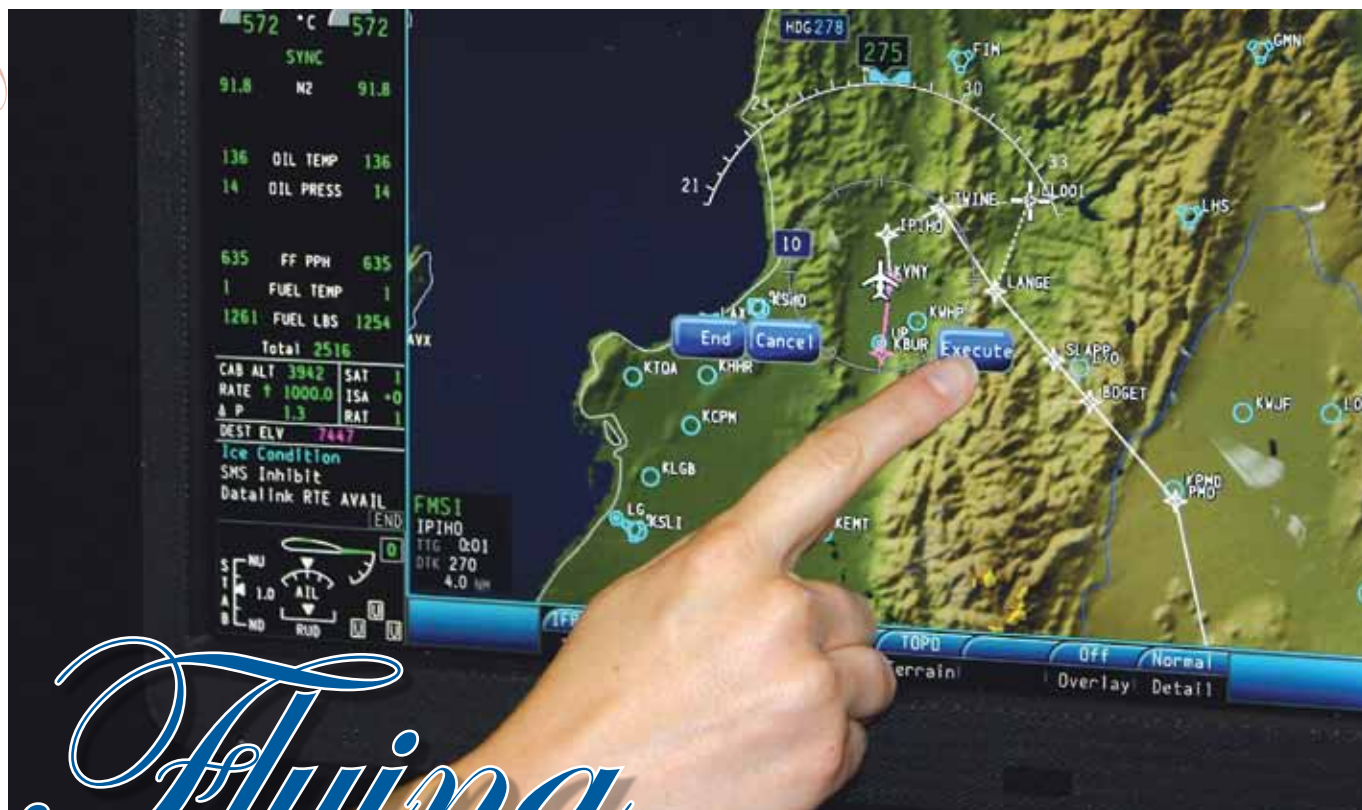
© 2011 Rockwell Collins, Inc. All rights reserved.

Step up to Rockwell Collins Pro Line 21™ avionics for your retrofit requirements and you'll have plenty of options. From crystal-clear LCDs to an integrated flight management system, communication-navigation-surveillance capabilities, weather radar, enhanced digital charts and map overlay functions. Upgrade faster and less expensively with an avionics system that is certified and flying on many different aircraft. There's no better time to transform your aircraft to meet current and future operating requirements worldwide.

www.rockwellcollins.com

**Rockwell
Collins**

Building trust every day



Flying Safe & Efficient

Rockwell Collins unveils touch-control flight displays to enable pilot's eyes focused up and forward

AT THE 59TH ANNUAL Experimental Aircraft Association (EAA) AirVenture in Oshkosh, Rockwell Collins unveiled the industry's first touch-control primary flight display for business jets and turbo-prop aircraft. It will be available on future applications of the company's Pro Line Fusion avionics system.

The touch-controlled interface is designed to make the cockpit user-friendly and keep the pilot's eyes focused up and forward instead of down at the centre console. A tap of the display brings up a context-sensitive menu that lets pilots change things such as the speed, altitude and heading of the aircraft with just a couple of taps. Through the icon-based graphical user interface, the pilot can manage aircraft systems, complete checklists, and review the flight plan on a scrollable map.

Through gesture controls, pilots can also redirect the aircraft to a graphically displayed waypoint or destination with a swipe of a finger instead of entering information on a console-mounted keypad. Other gestures control panning and zoom features, while a physical keyboard is retained for alphanu-

meric input rather than an onscreen virtual keyboard that was decided would cover up too much important information.

"These displays demonstrate our focus on empowering pilots with natural head-up, eyes-forward interfaces," says Colin Mahoney, Vice President of Sales and Marketing for Rockwell Collins. "Touch-controlled, icon-based controls on the main displays help keep pilots' attention focused up and forward for safer and more efficient flying."

"When programming the flight management system, instead of entering information on a console-mounted keypad, pilots can redirect to a graphically displayed waypoint or destination with the single swipe of a finger." **SP**

For more information and video, visit:
www.spsaviation.net/video



E-mail your comments to:
letters@spsaviation.net

HAWKER 4000. **THE ULTIMATE BUSINESS SPACE.**



THE WORLD'S MOST TECHNOLOGICALLY ADVANCED SUPER-MIDSIZE BUSINESS JET.



We know that the experience you'll have traveling on any one of our aircraft is just as important as how fast you'll get there. In the Hawker 4000—the world's most technologically advanced super-midsize business jet—we engineer our interiors with your need for productivity in mind. Hawker Beechcraft craftsmen bring superior workmanship to a spacious cabin that accommodates eight in stand-up, stretch-out comfort. With amenities and finishes that set the benchmark for business aviation, you and your team can maximize time spent traveling. Learn more HawkerBeechcraft.com

EUROPE, MIDDLE EAST & AFRICA **+44 (0)1244 523803**

UNITED STATES & THE AMERICAS **+1.316.676.0800**

ASIA-PACIFIC **+65 6423 0321**

©2011 HAWKER BEECHCRAFT CORPORATION. ALL RIGHTS RESERVED. HAWKER AND BEECHCRAFT ARE TRADEMARKS OF HAWKER BEECHCRAFT CORPORATION.





THE ROAD Less Travelled

The metros represent a better standard of infrastructure than the smaller airports, but privatisation of airports at Bengaluru, Delhi and Hyderabad and impending privatisation of others, pose their own problems in terms of exorbitant and escalating cost of operation for aircraft operators

PHOTOGRAPHS: CESSNA, FERENC HAMORI & MIKE FUCHSLOCHER

THE ASCENDANT MARCH OF the Indian economy is inexorable and irreversible; experts predict that it would be the sixth largest in the world by 2020. There are visible portents of the ongoing growth all around us and the disparity between India and the developed nations we compare ourselves with is gradually diminishing. One jarring note in India's growth story, however, remains the government's apathy towards aviation in general

By **A.K. Sachdev**

and corporate aviation in particular. The contributive potential of corporate aviation to the growth of national economy remains largely incomprehensible to the establishment. As a result, the regulatory mechanism in respect of corporate aviation is indifferent; the tax burden prohibitive; and there is total lack of focus on dedicated infrastructure required to support corporate aviation.

The foremost impediment to any corporate ambition

towards owning and operating an aircraft is its purchase. All aircraft, fixed or rotary wing, that catch the attention of a potential owner are produced outside India, as indigenous capability to do so is practically non-existent. Barring a few cases of transfer of ownership of business aircraft within the country, purchase of new or pre-owned aircraft from abroad involves import. The regulatory mechanism that governs the import process is so elaborate and complex that it could take up to a year from the time one decides to buy an aircraft to its arrival in the country. It may be stated in the defence of the Ministry of Civil Aviation (MoCA) and the Directorate General of Civil Aviation (DGCA) that the checks and balances put into place perhaps are necessary and appropriate to our overall corporate/national culture and security concerns. However, what is indefensible is the slumberous approach to paperwork. Since the exposure of the pilot's-licence-for-money scam, the overbearing and intrusive presence of multiple investigating agencies has currently reduced the staff at DGCA responsible for paperwork to a paralytic state. Even otherwise, paperwork was agonisingly slow, under-the-table lubricants notwithstanding.

To add to the pain of prolonged wait is the sting of a hefty customs duty on an aircraft being imported. The duty is 18 per cent for corporate or private use and three per cent for use by an aircraft operator holding a non-scheduled operator permit (NSOP). The logic favouring NSOP is that its operations are for public use. Considering the fact that aircraft cost millions, an aircraft buyer ends up paying a large amount of money as customs duty. However, there is a simple circumlocutory duty-saving arrangement, import the aircraft under the NSOP category, a method which some corporate houses adopt to save on customs duty. A cursory glance at the list of 132 registered NSOP holders on DGCA website would indicate that many of those listed are associated with corporate houses not engaged with the aviation industry per se. Some of the aircraft registered under NSOP category available for charter, belong to big corporate houses whose main business is related to real estate, textiles, hotels, etc. Thus the dividing line between corporate aviation and NSOP is blurred. The number of aircraft registered under the corporate category is so few that the DGCA does not find it worthwhile to list.

Let us move on to the main pillar of aviation infrastructure, the Airports Authority of India (AAI) constituted by an Act of Parliament on April 1, 1995, by merging the National Airports Authority and International Airports Authority of India. The AAI is responsible for creation, upgradation and maintenance of civil aviation infrastructure in the country. However, privatisation of airports is now on the increase with Kochi having led the way. The total number of airports in India, large and small, is about 500, but the list of licensed

Corporate aviation is especially at the mercy of the monopolistic regimes on account of the avaricious desire of the airport operators for the highest return on their investments



ones numbers only 44 in the public category and 16 in the private one. Incidentally, a remarkable manifestation of the establishment's indifferent approach towards aviation infrastructure is the fact that it is almost impossible to obtain an authentic list of airports in India. DGCA, which frequently forays into areas not directly defined in its scope of work (airline ticketing, for example), has not yet been able to draw up a directory for airports in India. A document of this nature is an urgent necessity so that authentic information on airfield data such as coordinates' of airfield location, runway dimensions, aprons, navigational aids, watch hours and contact details, etc is available to aircraft operators. Scheduled airlines operate largely from and to metros, and when commencing operations to a new airport, go through a formal diligence process before sending by the first revenue flight. However, corporate aviation tends to be need-based and unstructured in terms of the airports visited. Thus, when a requirement arises to fly to an airport not visited for some time in the recent past, especially a small airport, there is a flurry of desperate activity amongst the operational staff and the crew to obtain the latest information on it. Occasionally, the source of information is another corporate (or NSOP) crew who may have visited that airport lately. This arrangement understandably is far from perfect and no substitute for authentic, updated database which can ensure safe flights if correct, and serve as evidence to facilitate investigation, if inaccurate. A corporate aviation pilot is unlikely to refuse to fly to a small or remote airport for non-availability of complete and updated database. However, if that lack of information were to lead to a mishap, he would almost certainly be blamed by the very agency that is responsible for documenting airport information for the benefit of all aircraft operators but has not been able to do so.

Regulation and strict diligence by DGCA is restricted largely to the larger airports primarily due to shortage of manpower. Thus inspections of smaller airports are few and far between and their fitness for operations is left largely to the discretion of the operators. Corporate flying is all about saving time (time is money) and quite often the passenger who is invariably a 'big shot' in the company if not the employer of the crew himself, is inclined to influence 'go' or 'no go' decisions. On occasions, the crew is compelled to land at airfields against their professional judgement, lest they are shown the door. While many privately owned or operated airports, some owned by corporate houses, are in excellent state, inability on the part of DGCA and AAI to ensure minimum standards of safety at all our airports across the board, remains sad and lamentable.

The metros represent a better standard of infrastructure than the smaller airports, but privatisation of airports at Bengaluru, Delhi and Hyderabad and impending privatisation of others, pose their own problems in terms of ex-



CORPORATE AVIATION:
AIRCRAFT OPERATORS ARE
LEARNING TO LIVE WITH A
SINGLE GROUND HANDLING
REGIMES

orbitant and escalating cost of operation for aircraft operators. Corporate aviation is especially at the mercy of the monopolistic regimes on account of the avaricious desire of the airport operators for the highest return on their investments. At Delhi, for example, all corporate flights, whether they like it or not, have to use the general aviation lounge, get their flight handled by the sole ground handling agency permitted to do so and pay huge amounts of money for this forced hospitality. At Mumbai, the parking apron earmarked for corporate and other general aviation aircraft, is overcrowded with aircraft parked wing-tip over wing-tip. The implication is that any corporate aircraft seeking overnight parking at Mumbai is an unwelcome guest even though it represents revenue for the airport operator. The overcrowding on the ground is complemented by congestion in the air over all metros. Steps initiated by the DGCA to reduce congestion, such as rationalisation of network schedules and introduction of departure slots, has only been partially successful.

The concept of fixed base operators (FBOs) is non-existent in India. In the past, Delhi airport did toy with the idea of an FBO located in the erstwhile Terminal 1B. However, the idea was shelved after initial negotiations with the eight contenders that had responded to the tender. Terminal 1B was subsequently demolished. However, cynics aver that the FBO concept could, in all probability, be monopolistic in nature and hence distasteful for the general aviation fraternity at large.

Problems confronting corporate entities owning helicopters are no less daunting. There appears to be an insurmountable mindset against dedicated facilities for helicopters. There are no heliports in India and operations over and into urban areas are frowned upon. There is only one rooftop helipad that has DGCA approval. These figures are in stark contrast to those from the US and Europe. As a result of woefully inadequate attention to rotary wing oriented infrastructure, the potential of these versatile machines remains

largely unexploited by corporate aviation. One silver lining apparent in the recent past has been the introduction of a regulation that permits helicopter pilots to land at a suitable place away from an established airport or helipad, in case of inclement weather, preventing adherence to flight plan.

Ground handling is another problem area for the corporate world and indeed for civil aviation in India. Starting with the metros, the malaise of monopolistic ground handling regimes has engulfed even Tier II and III airports. Corporate aircraft operators are learning to live with a single ground handling service provider at increasing number of airports. The problem therein is the high and arbitrary cost of service which is not limited to private airports only but prevails at several AAI-operated airports as well. No amount of protest has been registered by the establishment so far. The institution of the Airports Economic Regulatory Authority (AERA) is yet to make its presence felt in this area, as the defined scope of the AERA does not include majority of the airports patronised by corporate aviation aircraft. Constant refrain about the monopolistic regimes permitted for ground handling being bad in law, a suitable response from the AERA or the DGCA is yet to come.

One of the reasons for the legitimate concerns of corporate aviation being ignored by the establishment is the absence of a mechanism for their voices to be heard by responsible functionaries. The DGCA has no officer specially designated for affairs related to corporate aviation. Regulations drafted primarily for scheduled operators are imposed on corporate aviation. There is lack of unity amongst owners of corporate aviation aircraft, each relying on their own clout to push specific agendas. Two associations were formed in the past with the laudable objective of representing collective issues plaguing general aviation which includes corporate aviation, but without noticeable results. Recently, these have merged and a third entity called the Business Aircraft Operators' Association has come up. This association is yet to stabilise and it remains to be seen whether it can serve the interest of corporate aviation to make it safer and more efficient through a quantum change in the quality of infrastructure. SP

Regulatory SNAGS

There is a need to increase the number of business aviation airfields and FBOs in place and to ease the restrictions on when aircraft can land



By Trevor Esling

THE INDIAN ECONOMY IS growing strongly. India is important to Cessna and the expanding economy should soon support a robust business aircraft fleet and infrastructure. The Indian market has readily accepted both the Citation CJ2+ and the Citation XLS+ as particularly strong aircraft for the sub-continent, alongside the Citation Sovereign. These aircraft offer excellent short-field capability in hot climates and non-stop capability anywhere within India, so are well-suited to the market.

"There are currently 20 Cessna Citation aircraft operating in India, part of a total fleet of around 100 business jets. I would expect to see a total business jet fleet of 200-250 aircraft in India in 10 years' time.

"There are nonetheless bureaucratic and regulatory issues that are not very favourable for the business jet market in India, such as high import taxes and the difficulty of transferring money into and out of the country. These issues are certainly

inhibitors to the fast acquisition of aircraft. Furthermore, the limited business aviation infrastructure is currently an impediment to the development of the Indian business jet market.

"There is a need to increase the number of business aviation airfields and fixed base operators (FBOs) in place, and to ease the restrictions on when aircraft can land. Airports tend to prevent business jets from landing at peak times and without fixed base operators, business jet passengers need to be processed through the same terminal facilities, such as security, as all other passengers. Furthermore, a larger supply of professional aircraft management companies and indigenous pilots will be a key ingredient for further growth.

"By 2025, I would expect India to be in the top 10 individual countries for business jet ownership outside the US." SP

—The author is the Vice President, International Sales, Cessna Aircraft Company

SUITABLE FOR INDIA:
CITATION XLS+



PHOTOGRAPH: CESSNA

Are We Ready?



By Rohit Kapur

While much is said about infrastructure requirements for commercial airlines to stay in the growth path, surprisingly there is little or no mention of the infrastructure requirements to support the growth of general and business aviation.



INDIA AND CHINA WILL continue to be the most favoured destination for all general and business aviation (GBA) aircraft manufacturers in the coming decade. With the recession and slowdown in western economies, GBA in India is expected to grow at a compound annual growth rate (CAGR) of 20-25 per cent over the next decade. By moderate estimates, India is expected to have approximately 2,000 GBA aircraft (both fixed and rotary wing) from the present number of 650 or so. This implies that about 1,300 GBA aircraft will be added over the next nine years, which translates into 125 aircraft every year or one aircraft every three days. These projections can keep the adrenaline pumping for any GBA aircraft manufacturer in the world.

But let's take a pause and see whether we are ready to achieve this growth. The biggest challenge to the growth of GBA in India today is the lack of infrastructure and the lack of infrastructure planning. Infrastructure will only happen if we plan for it. Sadly, we haven't even reached that stage yet. While much is said about infrastructure requirements for

commercial airlines to stay in the growth path, surprisingly there is little or no mention of the infrastructure requirements to support the growth of GBA, which has some peculiar needs.

FBOs: Fixed base operator (FBO) is defined in Wikipedia as "a commercial business granted the right by the airport sponsor to operate and provide aeronautical services such as fuelling, hangarage, tie-down and parking, aircraft rental, aircraft maintenance, flight planning, etc and is primarily a service provided to general and business aviation." FBOs are essential to the growth of GBA, as it provides the flexibility and standards business aviation is expected to operate. FBOs also provide crew rest facilities, lounges/conference rooms for passengers, custom and immigration services and maintenance facilities. It enables its users to transit smoothly without the delays of passenger terminals and all the hassles associated with it. FBOs normally operate out of

SLOW GROWTH:
THERE IS A CRAVING NEED
FOR MRO AND FBO SERVICES
FOR GENERAL AND BUSINESS
AVIATION IN INDIA

airports dedicated to GBA, such as Teterboro in New York, Seletar in Singapore, and Luton in London, etc. In the least, even if operating out of regular airports, they have a totally separate access away from the regular passenger traffic.

Sadly, FBO planning and development in India is still at a very nascent stage. With the possible exception of Chhatrapati Shivaji International Airport (CSIA), Mumbai, which operates a facility closest to being a FBO, there are no other FBOs in India which are either operational, or even in the process of being developed. The airport developers are still busy getting their act on commercial aviation together and don't seem to have much idea or plans for FBO to development in the country. Ideally, international airports should have more than one FBO while regional airports which cater to GBA movements should have at least one FBO. Until this happens, GBA will not be able to grow in the manner it should.

Heliports: Helicopters the world over, fly from heliports



which are normally located in the heart of the city. In cities like New York, helicopters transfer passengers from Newark and John F. Kennedy (JFK) international airport to and from the New York City heliport in the heart of Manhattan. In Sao Paulo, majority of the helicopters operate out of rooftop helipads, including single-engine helicopters. In India, the only functional heliport is Juhu in Mumbai, which has its own problems. Rohini Heliport in New Delhi, which was announced some time ago, is being developed by Pawan Hans Helicopters Ltd (PHHL). However, the plans are still to be shared with the industry, especially the terms and charges for its use by non-PHHL helicopters, which I suspect may not be commercially viable for them. Meanwhile, helicopters continue to operate out of international airports, adding to the congestion. The overzealous security concerns do not allow ideal places like Safdarjang Airport to be used as a heliport, wherein there is a case to find ways to utilise it by establishing helicopter corridors which prohibit flying over no fly zones. Rules and regulations are restrictive and restrict the use of roof-top helipads.

Till the time heliports and city helipads are developed in India, the right utilisation of helicopters in roles such as emergency medical services (EMS), traffic control, disaster management, law enforcement, electronic news gathering, etc will remain a dream, and helicopters will continue to fly for passenger carrying from airport to airport.

MROs: There is a special need for maintenance repair overhaul (MROs) dedicated to GBA, which are different from MROs catering to commercial airlines. GBA MROs have peculiar requirement since they cater to a vast variety of aircraft and most of the flying is non-predictive, unlike airlines, thereby making maintenance and spares planning more difficult. GBA aircraft are also more sensitive to environment and need covered parking unlike the robust airliners, and therefore, there is a need to hangar them when parking for extended periods.

The present policy for GBA MROs (if any) leaves a lot to be desired. The airport developers have not yet revealed their

plans about allocating space for hangars/MROs at their airports. The present premises being used by some GBA MROs in Delhi and Mumbai are under notice for being vacated, without any viable alternative plans in place. The duties and tax regime make it unviable for these MROs to stock spares in the country. In the absence of maintenance support, most GBA aircraft go to international destinations for heavy maintenance, thereby increasing

General and business aviation is a tool for expanding the reach of business across the length and breadth of the country, thereby adding to GDP

the cost manifold and thus leading to loss of foreign exchange for the nation. This needs to be looked at urgently.

The list goes on. General aviation needs smaller airports to be developed near urban cities to encourage the sports and hobby flying activities. This segment is totally being ignored in our country. In the US, business aviation has grown on the strength of hobby and sports flying, which gave a strong foundation to the booming GBA industry of the country.

In our growing economy, general and business aviation need to grow along with commercial aviation. It is a tool for growth and for expanding the reach of business across the length and breadth of the country in remote areas, not well connected by commercial airlines, thereby adding to growth of gross domestic product (GDP). Unless we plan for it now, our projections will remain what they are—mere numbers to be used in seminars and conferences. SP

—The writer is the Managing Director, Arrow Aircraft Sales and Charters Private Ltd and the President of Business Aircraft Operators' Association (BAOA)

DREAMLINER LANDS



THUMPS UP:
DREAMLINER LANDING AT T3; BOEING INDIA
PRESIDENT DINESH KESKAR IN THE COCKPIT
(BELOW LEFT); INSIDE THE AIRCRAFT (BELOW)



PHOTOGRAPHS: AMIT BHARDWAJ / SP GUIDE PUBNS

The Boeing 787 Dreamliner made its India debut landing at the Terminal 3 of the New Delhi International Airport on July 13. "Indian air carriers have recognised the tremendous value the Boeing 787 offers airlines," said Dinesh Keskar, President, Boeing India. Air India is one of the early customers and has ordered 27 787s. Jet Airways has also ordered 10 Dreamliners. The 787 offers the potential to enhance the revenues of customers due to its passenger appeal and reduction in maintenance costs and fuel burn. "We look forward to the airplane's introduction into the fleets of our valued customers in India," Keskar added.

Air India which placed the order in 2005 will get its first aircraft in October this year, followed by two in November and one more in December.

The 787 Dreamliner is built by an international team and will provide airlines around the globe with a new level of efficiency in operations, with a 20 per cent reduction in fuel use when compared to similar-sized airplanes. The 787 also brings a new level of passenger comfort to travellers including bigger windows and more personal space as well as an environment designed to help them arrive at their destinations feeling refreshed. SP



Networking INDIA

The passenger traffic has grown tremendously, registering more than 250 per cent growth over a decade. And enthused by the increasing traffic, the government has embarked upon developing non-metro airports to spur regional aviation which is growing at a healthy pace.

IN THE LAST FOUR years, the number of operational airports in India has increased from 50 to almost 90, indicative of the rapid growth of the economy in general and the aviation sector in particular. The fact that new destinations are getting networked augurs well for the overall development of the country. "Airports are also catalysts of economic growth, being the very gateway to the nation. The Ministry through the Airports Authority of India (AAI) has embarked upon developing 60 airports, covering most of the states," the Union Minister for Civil Aviation, Vayalar Ravi has said.

Enthused by the passenger traffic, the government has embarked upon developing non-metro airports to spur regional aviation which is growing at a healthy pace. During

By **R. Chandrakanth**

the last five years, aircraft movement at Indian airports increased at a CAGR of 15.4 per cent between 2004-05 and 2009-10. The passenger traffic has grown tremendously, registering more than 250 per cent growth over a decade, reaching 58 million in 2009-10,

a substantial chunk contributed by non-metro sectors. The main factors contributing to this phenomenon include economic growth; new airport destinations; reasonable fares and increasing capacities of domestic private airlines.

HEALTHY PASSENGER MOVEMENT

As per AAI statistics for May 2011, the total passenger traffic during the month increased by 13.9 per cent as compared to May 2010. The Airports Economic Regulatory Authority of India (AERA) has determined 12 airports as 'major airports'

NO-FRILL AIRPORTS:

AIRPORTS BEING DEVELOPED IN
(L-R) KANNUR, TIRUCHIRAPALLI,
COOCH BEHAR AND MYSORE



based on traffic and they include Ahmedabad, Bengaluru, Chennai, Calicut, Dabolim, Delhi, Hyderabad, Kochi, Kolkata, Mumbai, Pune and Thiruvananthapuram.

In 2010, domestic airlines in India flew about 44 million passengers of which 17 million were on the high-density city pairs of the top seven cities. The rest of the passenger movement has been from low-to-medium density markets.

The growth rates of traffic handled by different categories of airports:

There are 89 domestic and 16 international airports in the country. With the encouraging growth of low cost carriers in India, secondary and tertiary airports are to get increasingly active in the years to come.

And as and when the Civil Aviation Ministry's proposal for setting up regional airlines materialises, there will be added momentum. Regional airlines have been defined as carriers with aircraft having less than 80 seats and which will operate exclusively on regional routes from any one metropolitan airport such as Delhi, Mumbai, Chennai, Kolkata, Bengaluru and Hyderabad.

To encourage regional airlines, the Ministry has suggest-

ed that the first airline to connect cities that are not linked by air should be exempt from all airport and navigation charges at both airports for the first year of operation. For regional airlines, navigation and landing charges often constitute up to 10 per cent of the overall costs.

There is a growing demand for no-frill and low-cost airports. At a recent seminar, a SpiceJet executive said, "We don't need a Taj Mahal of an airport. What we need is basic infrastructure in place and with reasonable costs." The high airport costs in some of the airports have been squeezing the airline finances and a few of the airlines are contemplating moving back to Terminal 1D in New Delhi as they find the costs too high at Terminal 3.

In a bid to encourage regional airlines and provide air links to small cities and towns, nearly 25 Greenfield airport projects (no-frill airports) have been identified for development by various states. This is besides the development of the 35 non-metro airports. A no-frill airport is built at a minimum cost and allows operation of small jets as well as slightly bigger aircraft like Boeing's B737 or Airbus' A320. The investment in such an airport could range from ₹40



RANCHI AIRPORT:
THIS AIRPORT HAS SEEN
A MAJOR INCREASE IN
PASSENGER TRAFFIC

MAJOR INCREASES (IN PER CENT)			
Goa	14.7	Indore	20.1
Guwahati	23.5	Visakhapatnam	19.0
Srinagar	34.5	Jammu	69.9
Delhi (DIAL)	20.5	Vadodara	17.0
Hyderabad (GHIAL)	14.7	Agartala	29.4
Nagpur (MIPL)	16.5	Chandigarh	15.9
Lucknow	36.0	Raipur	59.4
Trichy	18.6	Madurai	33.8
Patna	42.6	Ranchi	40.4
Varanasi	37.5	Leh	73.0
Bhubaneswar	51.6	Aurangabad	61.5



crore to ₹100 crore. The places identified for the purpose include Hassan, Shimoga, Gulbarga, Bidar, Mysore (all in Karnataka), Shirdi, Jalgaon, Solapur, Akola (all in Maharashtra), Kannur (Kerala), Madurai, Tiruchirapalli (Tamil Nadu), Rupsi (Assam), Ajmer, Mount Abu, Kailashar (Rajasthan), Behala, Cooch Behar, Malda (West Bengal), Jharsuguda (Orissa), Muzaffarpur (Bihar), Kamalpur (Tripura) and Passighat (Arunachal Pradesh).

AMENDMENTS IN POLICY SOUGHT

Currently, some private regional airports are losing money, such as five in Maharashtra set up by the Reliance Group and the reason is obvious. There is not enough traffic movement as the operating costs are high. As airport operators start looking at aeronautical revenues to begin with, the pressure is felt on airlines. The need to increase revenues from the non-aeronautical component has been emphasised, but then it is a chicken and egg syndrome.

Several airlines fly smaller aircraft on trunk routes as they have substantial advantage. Kingfisher has 27 ATR; Jet Airways 20; and Air India 7 which they ply on trunk routes as well as some Tier-II cities. The smaller aircraft have the potential to connect newer destinations where the passenger growth is just picking up. The grounded airline Paramount had an Embraer fleet.

At a seminar, the CEO of Reliance Airports, Vidya Basarkod had made a case for support to airport infrastructure development at smaller airports if they had to act as catalysts of growth. The small airports were constrained currently as there was limited traffic, high operating costs and growing need for airport security. For the non-aeronautical revenues to flow in, first aeronautical revenues have to exist.

AERA has suggested single-till model for airport charges while the airport operators are seeking double-till model. In the single-till model, all airport activities (aeronautical and non-aeronautical) are taken into account

to determine the level of airport charges. In the double-till model, only aeronautical are considered and airlines prefer the single-till model. The battle continues. Currently, most Indian airports do not earn significant commercial income.

“We have tentatively taken a stand that single-till is suitable in the Indian context. We have sought comments and views from the industry stakeholders. The final decision would be taken shortly,” AERA Chairman Yashwant S. Bhavne had said at the seminar.

The Directorate General of Civil Aviation has liberalised certain policies. Now, a company planning to start regional air services will need to reach a fleet size of three aircraft within two years instead of the earlier stipulated one year. Only by the end of five years would the carrier be required to operate five aircraft against the earlier deadline of two years.

PRIVATE REGIONAL AIRPORT

Meanwhile, Regional Airport-Holdings International Limited (RAHI), a private airport developer, has announced that 15 airports along with city side infrastructure would be developed in the next five years with an investment of ₹3,000 crore. RAHI is a joint venture between IL & FS Transportation Networks Limited (ITNL) and Comet Infra-Developments Private Limited (CIDPL). The joint venture is currently developing airports in Shimoga and Gulbarga in Karnataka under the public-private partnership model, both of which will be operational by mid-2012. The concession period for both projects is 30 years, extendable by another 30 years.

The founder Chairman of RAHI, Umesh Kumar Baveja has said that the company would follow a three-pronged strategy for regional aviation in Tier-II and Tier-III cities. “We will not only develop airports and associated infrastructure but also have our own regional airline that will serve Tier-II and Tier-III cities.” The company expects to get its regional airline going by mid-2012, by which time at least two airports would have been developed. SP

There is a
growing
demand for no-
frill and low-
cost airports

\$65 MILLION ONLY



Dave Scott is the Director, F-35 International Business Development, Lockheed Martin who works closely with the US Government to ensure the required coordination between international and domestic governments. In a brief interview with *SP's Aviation*, Scott clarified why and how the fifth generation fighter F-35 is highly affordable.

SP's Aviation (SP's): The price of F-35 has been an issue of debate. What is the list price of the F-35? The usual perception has been that the price is close to about \$125 million.

Dave Scott (Scott): The F-35 is built in three versions. The conventional take-off and landing (CTOL) version is the version that will likely have the broadest international appeal. The CTOL F-35 is projected to have an average unit recurring flyaway price of \$65 million in 2010 dollars. It is important to note that this price includes all the sensors, the electronic warfare system and weapons launching equipment that must be purchased separately for current generation fighters.

SP's: Can we have a little background as to how the price is considerably cheaper than \$100 million?

Scott: The F-35 is designed to provide fifth generation capabilities in a highly affordable aircraft allowing the US Air Force (USAF), US Navy (USN), US Marine Corps (USMC) and eight partner nations to cost-effectively recapitalise their ag-

ing fighter fleets. All three F-35 variants have a high degree of commonality enabling the aircraft to be built on a single production line, with common parts and at a high production rate providing affordable fifth generation capabilities.

SP's: How is the international partnership progressing for this fifth generation fighter programme?

Scott: The F-35 international partnership remains strong and is a model for international co-development and cooperative production. Nearly ten years ago, eight nations joined together with the USAF, USN, and USMC to co-develop the F-35. Today those eight nations—United Kingdom, Netherlands, Italy, Norway, Australia, Canada, US and Denmark—all remain committed partners in the development programme and all intend to acquire and operate the F-35. Till date, initial F-35 production aircraft orders have been received from the UK, Netherlands, Italy and Australia. In addition to the eight partner nations, Israel has placed the first foreign military sale (FMS) aircraft order, and Singapore and Spain are receiving F-35 information from the US Government. SP



Dave Scott assists international countries in developing their fighter aircraft requirements and provides information concerning the capabilities and value of the F-35. His responsibilities include both F-35 partner nations and Foreign Military Sales (FMS) nations.

Previously, Scott was the F-22 Business Development lead responsible for developing F-22 new production, modernisation and sustainment business opportunities. Prior to this assignment he was the Director of Market Development for Asia Pacific, responsible for developing markets for all Lockheed Martin aircraft products. He worked extensively in Australia, South Korea, Singapore, Japan and Thailand developing sales for the F-16, C-130J, F-35 and other Lockheed Martin aircraft programmes.

He joined the legacy Lockheed Martin Company, General Dynamics/Fort Worth as an avionics engineer and has since held positions of increasing responsibility in Engineering, Advanced Programmes and Business Development.

Scott graduated from Ohio State University in 1981 with a B.S. in electrical engineering and from Southern Methodist University in 1986 with a M.S. in electrical engineering. •



With a century of special mission experience, Bombardier knows and understands your needs. We recognize the situations and the challenges you face and we understand the solutions you require. Because chances are, we've been there before. We are the third largest civil aircraft manufacturer in the world. That's why you should choose Bombardier, because we have a lifetime of knowledge that helps us understand every need and ensures every mission is a success.

Bombardier Specialized Aircraft. Experience you can count on.

For more information: www.specialmission.bombardier.com

Bombardier and Bombardier aircraft model names are trademarks of Bombardier Inc. or its subsidiaries.
© 2011 Bombardier Inc. All rights reserved.

BOMBARDIER

KEEPING A CLOSE WATCH

There is a great need to integrate all radars, military and civil, to be brought together in a seamless network for the IAF to discharge its responsibility in an adequate manner



AEROSTAT LONG-RANGE MULTI-LEVEL
AIR DEFENCE RADAR



AN IAF GARUD
IN ACTION



INDIAN NAVY'S
HERON 1

HAVING FOUGHT FOUR WARS in six decades since independence—a short span in a nation's history—India is no stranger to external military threats. But what is most consternating is the never-ending cross-border terrorism thrust on the nation either directly from external sources or home-grown but aided and abetted in whole or substantially by the same sources to create mayhem in the country. Whether it was the tribal insurgency in the Northeast (still ongoing in some form or the other), the extinguished insurgency in Punjab, the dissidence and proxy war in Jammu and Kashmir, the burgeoning Naxalite violence and the jihadi terrorism unleashed by its unscrupulous western neighbour, threats to India's homeland security have been multi-faceted and multi-directional.

Considered to be a soft nation with one of the highest levels of tolerance-quotients, India has been repeatedly subjected to humiliating terror activities without adequate response. Couple this with short public memory and a government lacking in political will and resoluteness in tackling the menace of terror, the nation continually faces the ignominy of being subjected to repeated terrorist activities at regular intervals. To cite an example, other than perhaps the Indian Air Force (IAF), how many Indian citizens remember the fateful evening of December 17, 1995, when a Ukrainian-built An-26, on a flight from Karachi in Pakistan to Dhaka

By Air Marshal (Retd)
V.K. Bhatia



in Bangladesh, laden with a cargo of illegal arms and ammunition dropped the entire lethal load clandestinely in Purulia, a remote district in the Indian state of West Bengal, by hoodwinking the civilian radar/air traffic controllers at Kolkata and escaping to Thailand.

Was it not for an alarm sounded by an alert IAF corporal at the Chennai Flight Information Centre (FIC), which started a chain reaction ordering the aircraft to return to Mumbai, the audacious crew and the villainous arms dealer on board would have managed to again escape from the Indian airspace on their return journey from Bangkok to Karachi. Paradrropping of such a large cache of weapons (later used for unlawful/terrorist activities) over the Indian territory with total impunity by a foreign aircraft represented severe public embarrassment for New Delhi. While its subsequent apprehension did save the blushes for the Indian Government, it also brought to light gaping deficiencies in India's air surveillance capabilities, severely impinging on its homeland security mechanism.

The failure however paled in comparison to the maritime intrusion perpetrated by a bunch of Inter-Services Intelligence (ISI)-trained Pakistani terrorists in 2008. On November 26, a mere 10 km from the Mumbai shore, where the night waves from the Arabian Sea routinely splash against the bustling Marine Drive, popularly known as the 'Queen's Necklace', lay an Indian registered trawler, Kuber, hijacked by the Pak terrorists off the Gujarat coast,

the craft's sole legal occupant, the skipper, lay slain with his throat slit from ear to ear, al-jehadi style. Two inflatable rubber boats, with 10 men and substantial quantities of arms and ammunition, detached themselves from the trawler and raced towards Mumbai, their navigation made easy by the hand-held GPSs. What followed was a blatant and brutal assault on the Indian soil carried out with military precision. The planners in Pakistan had selected the targets for the human carnage with a sinister focus to also include affluent segments of society as also high-value citizens from abroad. The terrorist act not only brutalised Mumbai with a senseless death toll reaching 180 and a much bigger figure for the wounded, it traumatised and left a permanent scar on the very psyche of the financial capital of the country, an otherwise vibrant, dynamic and a world city. The terrorist attack once again laid bare the porosity of the Indian borders—this time adding the maritime frontier to the many times exposed land borders and airspace domains of the country.

US RESPONSE TO TERRORISM

Why is it that India continues to be subjected to repeated terrorist activities while the other most vulnerable democratic country, the USA, has succeeded in preventing such occurrences since the gruesome 9/11 attacks? The main reason is that the US, starting from its President downwards swore to do their utmost to protect the country—never to be subjected to such an atrocity again—and went methodically to achieve the aim. In less than a month after the attacks, the then President George W. Bush established the Office of Homeland Security within the White House on October 8, 2001, and gave it their first task of producing a comprehensive 'National Strategy for Homeland Security' which was prepared within eight months. In a proactive move, he also unleashed a war against global terrorism (GWOT) during the same period, which is still continuing. To counter the most horrendous challenges of terrorism, the US Congress considered the most extensive reorganisational mechanism by creating a Department of Homeland Security at the national level and integrating all concerned agencies, including federal and local, into a seamless network, imbued with across the board 'unity of purpose' for greater accountability over critical homeland security missions. Vastly improved intelligence gathering mechanisms and networked to and fro dissemination has ensured that timely actions can be taken to thwart terrorist activities by nipping them in the bud. While constant vigil is maintained to prevent any in-house activity, special efforts have also been made to insulate



DSEI
Defence & Security Equipment International
13 - 16 September 2011
ExCeL London dsei.co.uk

NEW FOR 2011

MORE
Visiting Naval Ships than the 2009 show

NEW
Waterborne Demonstrations

NEW
Security Focused Exhibitors

NEW
Security Demonstrations & Showcase

NEW
Static Vehicle Display for Land, Air & Naval Sectors

NEW
Innovation Showcase

NEW
Increased Air Capabilities

NEW
Robotics & Unmanned Systems Showcase



Image Copyright of BAE Systems
Image Copyright of Force Protection Europe
Image Copyright of Smith Detection
Image Copyright of Lockheed Martin Corporation

Infinite opportunities. One world-leading event.

With 1,300 exhibitors and a host of exciting features, DSEI is the world's leading Defence & Security exhibition, allowing you to meet the whole supply chain in four productive days; **13-16 September 2011, ExCeL London.**

REGISTER AT WWW.DSEI.CO.UK/EARLY FOR EARLY BIRD DISCOUNT

Platinum Sponsors

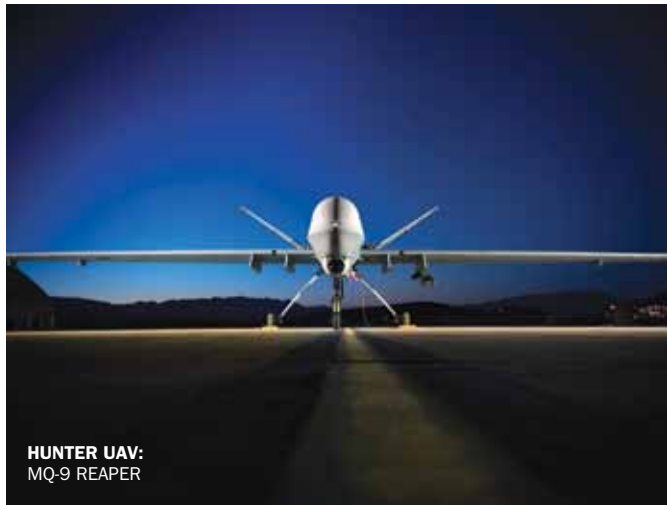




the continental US (CONUS) from unwanted ingress, in any form or from anywhere—be it land, air, sea or space—to prevent terror attacks on the US homeland. That the concerted efforts taken at each level of the US homeland security apparatus have paid off is evident from the fact that no repeat terrorist attacks have been allowed to take place in CONUS for almost a decade since 9/11.

THE INDIAN SCENARIO

Stung by public outrage and political opposition in the aftermath of Mumbai 26/11 attacks, a slew of long-awaited measures were initiated by the Indian Government to prevent such attacks in the future. But three years have passed since the Mumbai carnage with a responsive, effective and accountable mechanism to prevent/counter such activities still eluding the nation. In the wake of Mumbai attacks, public outcry has been for punitive action against Pakistan which ranges from total war to hot pursuit. But saner thinking, geopolitical realities and ensuring the continuing transfor-



HUNTER UAV:
MQ-9 REAPER

mation of India as a global economic powerhouse—which in the long run would be in its strategic interests—it would perhaps be imprudent at this stage to take recourse to a proactive military action against India's errant western neighbour. The need of the hour is to ensure that preventive measures are in place which includes integrated command and control for greater accountability, actionable intelligence and its across the board availability for prompt and timely action and credible reaction force(s).

In the above context, insulating the land, air and maritime frontiers to safeguard the country and its population against cross-border terrorism ought to be India's one of the most vital goals. Reacting to the Mumbai attacks, Defence Minister A.K. Antony had announced a comprehensive package to counter the threat from the sea. Most important part of the package was to designate the Indian Navy as the authority responsible for overall maritime security and integrating all the concerned agencies both military and civil such as Coast

Guard, marine police, etc—to name a few—for the coastal defence of the nation. The other measures include setting up of Joint Operations Centres (JOCs), creation of 1,000 personnel-strong Sagar Prahari Bal, acquisition of fast interception crafts (FICs) and setting up of a coastal radar chain and a comprehensive network of automatic identification system along the entire Indian coast as well as island territories. But much needs to be done on the implementation front, both in the area of jointness as well as augmentation of equipment and personnel, to achieve the desired capabilities. A stark reminder has been sent to the Indian establishment in the form of the abandoned Panama-flagged ship MV Pavit—which ran aground at Juhu Beach at Mumbai after drifting 800 km undetected in the Arabian Sea—that India's maritime security is still leagues away from being leak-proof.

AIR ASPECTS

Unlike its sister services, Army and the Navy, which share the task of securing their respective land and maritime borders with other paramilitary and Central Police Forces (CPF), etc, the task of the Indian Air Force (IAF) has been well cut out with the Union War Book clearly pinning the responsibility of securing/defending the country's skies squarely on the shoulders of the IAF. Therefore, there is least confusion on this aspect. But the key to comprehensive air defence lies in the IAF's ability to provide seamless, round-the-clock radar cover for the entire airspace over the national territory and beyond, at least up to the limits of extended air defence identification zones (ADIZs). However, due to paucity of financial resources in the past, the IAF has been only partially successful in providing the required cover. There is a great need to integrate all radars—military and civil—to be brought together in a seamless network for the IAF to discharge its responsibility in an adequate manner, at least at medium- and high-altitudes. For low level cover, while the IAF is constantly trying to improve its capabilities by acquiring additional low looking radars, there is little possibility of filling the deficiencies because of the huge requirement. One option for the IAF would be to acquire additional aerostats, which deployed at their optimum tethered heights could provide much greater area coverage and therefore, in effect, be more economical. The IAF would need to augment its present holding of only two aerostats to a dozen or more, as also integrate other assets such as the Navy's proposed coastal radar chain to adequately cover the Indian airspace and areas of interest beyond its borders at low level.

The above capability caters to only the passive surveillance part of the entire gamut of requirements. The IAF would have to greatly improve its proactive surveillance capabilities by acquiring more capable and more persistent platforms both manned and unmanned aerial vehicles (UAVs) and space-based satellites of all types. In the counter-terrorism role for homeland security, the IAF would have to seriously consider the option of acquiring unmanned combat aerial vehicles (UCAVs) to augment its manned platforms. Flexibility of use being an inherent ability of aerial platforms, the IAF would then also be in a unique position to cater to the entire spectrum of air warfare including asymmetric scenarios and homeland security. **SP**



The upgradation of Mirage 2000 would usher in state-of-the-art technologies with modern radar, weapons and electronic warfare capabilities. But the way the contract is structured, it would take seven to eight years from now for its completion, which means it could be the end of 2018 by the time the 51st aircraft is configured into its new avatar.

COINCIDING WITH THE LITERALLY 'change of guard' for the top post of the Indian Air Force (IAF), the much awaited contract to upgrade its fleet of Mirage 2000 jet fighters was finally signed on July 29, 2011. After a tortuous period of financial duelling lasting more than two years, issues related to price negotiations between the two sides appear to have been resolved for the Indian Government to take the final step of inking the contract. The deal had been stuck for the past two years primarily due to differences over the price being offered by French original equipment manufacturer (OEM) Dassault and Thales. After going through the

By Air Marshal (Retd)
V.K. Bhatia



detailed list provided by the Indian side for the fighter's upgradation, the French companies had initially quoted an exorbitant price close to \$3 billion (₹13,500 crore). This amounted to about \$60 million (₹270 crore) per aircraft, which was coming close to the price of a brand-new fighter jet of the Mirage 2000 calibre. With the final price arrived at through not only hard negotiations but also carefully timed nudges at the highest political quarters; at ₹10,000 crore (\$2.22 billion) as the total cost of the project, per unit cost to upgrade 51 aircraft is still coming close to a hefty \$40 million (₹180 crore). However, the Indian Government has decided to ink the deal in view of the reasonable reduction in price and

agreeing with the IAF's plea that upgradation is crucial to help cope up at least to some extent with its never-ending problem of ageing fleets and diminishing numbers in combat force levels.

First inducted in 1985, the IAF had acquired a total of 51 aircraft (41 single-seat fighters and 10 twin-seat trainers) by 1988. At the time of the 1999 Kargil conflict, Mirage 2000, also known as the Vajra (Thunderbolt) was the frontline fighter of the IAF. The IAF went on to acquire an additional 10 aircraft in 2004 with somewhat improved avionics such as the RDM-7 radar, but the bulk of its Mirage fleet was indeed in need of a midlife upgrade. French manufacturer Dassault and its associated partners in the Mirage 2000 programme have continued to keep the aircraft on par with the latest models of the US F-16 fighters. By the late 1980s, Thomson-CSF had already begun work on a privately funded update of the Mirage 2000C to be renamed Mirage 2000-5, which first flew on October 24, 1990. The French Air Force had by 1993 decided to upgrade a major portion of its Mirage 2000 fleet to the 2000-5 specification as a stopgap arrangement before the induction of the Rafale, which at the time was still under development. The upgraded aircraft were re-designated Mirage 2000-5, and became operational in 2000. The improvements included the Thales thermal camera TV/CT CLDP laser designator pod as well as the Thales multimode radar doppler multi-target (RDY), which allows detection of up to 24 targets and the ability to simultaneously track eight threats while guiding four MICA missiles to different targets. Updates to defensive systems included the integrated countermeasures (ICMS) 2 countermeasures suite and the Samir Détecteur De Missile (DDM) missile warning system. ICMS 2 incorporated a receiver and associated signal processing system in the nose for detecting hostile missile command data links, which could be interfaced to a new programmable mission-planning and post-mission analysis ground system. Avionics were also updated, using a new night vision-compatible glass cockpit layout borrowed from the Rafale, a dual-linked wide-angle head-up display, and hands on throttle-and-stick (HOTAS) controls. The Mirage 2000-5 was enabled to carry the oversized drop tanks developed for the Mirage 2000N, greatly extending its range. And while the Rafale has entered operational service,

the French Air Force has taken a conscious decision to move one more step ahead to further upgrade its fleet of Mirages, at least for the aircraft with sufficient residual operational life to Mirage 2000-5 Mark 2 standards.

It may be mentioned that in response to the initial request for information (RFI) issued in 2001 for the IAF's ambitious 126-aircraft MMRC programme, the French manufacturer Dassault had offered Mirage 2000-5 to compete with the Russian Mikoyan MiG-35, the US Lockheed Martin F-16 Fighting Falcon and the Swedish SAAB JAS39 Gripen aircraft. The undue delays in progressing the programme to the next stage from the Indian side and the fact that two heavy-weight contenders Boeing's F/A-18 Super Hornet from the US and EADS Eurofighter Typhoon, had joined the competition, prompted Dassault to replace the Mirage 2000-5 with its own state-of-the-art twin-engine Rafale jet fighter by citing its inability to keep the Mirage 2000 assembly line open for an indefinite length of time. Simultaneously however, the French OEMs also offered to upgrade the IAF's Mirage 2000 fleet to '-5 standards'.

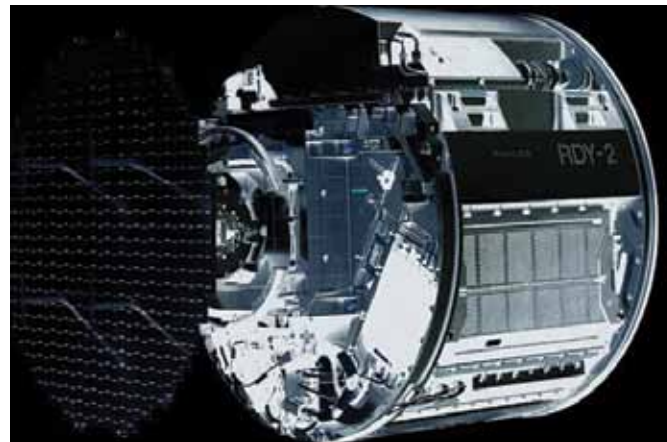
Interestingly, as the saga of India's most ambitious MMRC defence deal unfolded, Dassault and its Rafale, which at one time came very close to being knocked out of the race on technical/procedural grounds, not only survived the danger of elimination but creditably came to be selected as one of the only two shortlisted aircraft in the competition. That it stands tall along with the other contender—the Eurofighter Typhoon—and has at least a 50 per cent chance of winning the competition, its offer along with its other compatriot companies to upgrade the IAF Mirage 2000 fleet to Mirage-5 Mk 2 standards takes on altogether a different hue.

The Mk2 version of the Mirage 2000-5 incorporates further enhancements to offensive systems which include a data link for the targeting of MICA ER missiles, the addition of the Damocles FLIR targeting pod, and a newer, stealthier Thales RDY-2 all-weather synthetic aperture radar with moving target indicator capability, which also grants the aircraft improved air-to-ground capability. The avionics have been further updated with higher resolution colour displays, an optional top-sight helmet-mounted display and the addition of the modular data processing unit (MDPU) designed for the Rafale. A new Thales Totem 3000 inertial





WHAT'S MORE:
DAMOCLES FLIR AND
THALES RDY-2 RADAR
(RIGHT)



navigation system with ring laser gyroscope and global positioning system (GPS) capability has been added, providing much greater accuracy, higher reliability, and shorter alignment time than the older ULISS 52 navigation system which it replaces. The other upgradation includes the addition of an on-board oxygen generation system (OBOGS) for the pilot and an ICMS 3 digital countermeasures suite. Further planned upgrades include Thales AIDA visual identification pod, a GPS receiver, MIDS data link, new long-range sensors, and the top sight helmet-mounted display. Other technologies developed for the Rafale will also be integrated into the Mirage 2000, including infrared and optical sensors for identification friend and foe (IFF) and targeting.

Understandably, the IAF has not divulged the exact details of the upgrade, but keeping in view the financial outlays, it could be presumed that the IAF's Mirage 2000 fleet would indeed be upgraded to Mirage 2000-5 Mk 2 standards. The contract reportedly entails the first two aircraft to be upgraded in France which may take between 40 and 44 months. Thereafter, under a technology transfer programme, the next two aircraft would be upgraded in India under French supervision followed by the Hindustan Aeronautics Limited (HAL) undertaking the remaining aircraft at the rate of one a month. As most of the work entails upgradation of avionics, Thales is expected to have a major (2/3rd) share of the workload, while Dassault's contribution would amount to around 26 per cent of the upgrade programme. But the story does not end here. Apart from the ₹10,000 crore for the upgrade project, a sum of \$500 million (₹2,250 crore) would be needed to set up facilities at the HAL to be able to undertake the necessary work. In addition, acquisition of a plethora of state-of-the-art air-to-air and air-to-surface weapons with preci-

sion guidance and BVR/stand-off capabilities could cost the Indian exchequer close to \$1 billion (₹4,500 crore) or more. This would also bring into the act MBDA, the manufacturer of aerial weapons such as the AIM-132 ASRAAM short-range, Meteor long-range and dual-use MICA air-to-air missiles and Apache or its derivatives Storm Shadow/SCALP-EG, etc as a major supplier of arms to the IAF for its upgraded Mirage 2000 fleet. The entire package could well touch the \$4 billion (₹18,000 crore) mark in the end.

While agreeing with the critics to some extent, the high cost of the programme should be considered in view of the fact that the upgradation will transform the fleet into a fourth generation fighter in terms of operational capabilities. The

upgradation of Mirage 2000 would also usher in state-of-the-art technologies with modern radar, weapons and electronic warfare capabilities. The Mirage 2000 has indeed stood the test of time and post-upgradation would certainly soar to new heights of lethality and effectiveness. There is only one issue though, which could spoil the party and that is the time factor. The way the contract is structured, it would take seven to eight years from now for its completion, which means it could be the end of 2018 by the time the 51st aircraft is configured into its new avatar—that too, if the stated time frames are strictly adhered to. With the bulk of the aircraft inducted in and around 1985, by that time, Mirage 2000 fleet of the IAF would have already crossed the three-decade-old mark. To realise full amortisation of the high upgradation costs, ideally, the fleet would have to remain effective for at least two more decades, which brings to the fore, integrity factors of an airframe—older than half a century. Will the IAF be able to grapple with this problem successfully? Only time will tell. **SP**

The IAF has not divulged the exact details of the upgrade, but keeping in view the financial outlays, it could be presumed that the IAF's Mirage 2000 fleet would indeed be upgraded to Mirage 2000-5 Mk 2 standards

AGILE & DISTINCT

PHOTOGRAPHS: NEWS ADMIN.CH & DASSAULT RAFALE

The Dassault Rafale has the firm support of the French Government that has placed orders for 120 aircraft and has made a commitment for another 180. Apart from Dassault, technologies incorporated in the Rafale are the most advanced in the world and the programme is supported by the leading global aerospace and defence majors in Europe such as Snecma and Thales.

OF A MODERATE SIZE, yet extremely powerful, superbly agile and very discrete, the latest type of combat aircraft from Dassault Aviation does not only integrate the largest and most modern range of sensors, it also multiplies their efficiency with a technological breakthrough, the “multi-sensor data fusion”. In the Rafale, Dassault has designed and produced a combat platform which meets or even exceeds the defined parameters of each type of mission. The aircraft has exhibited remarkable survivability rate during the recent operations by the French Air Force and the French Navy, thanks to an optimised airframe and to a wide-range of smart and discrete sensors. Versatile and regarded as a true force multiplier, the Rafale is slated to be the prime combat aircraft for the French armed forces until 2040 at least. Apart from Dassault, technologies incorporated in the Rafale are the most advanced in the world and the programme is supported by the leading global aerospace and defence majors in Europe such as Snecma and Thales.

Meanwhile, engineering work is already being done to further extend the air-to-air and air-to-ground capabilities. The ongoing effort will ensure more robust detection, tracking and identification of emerging air-to-air threats and increase the aircraft’s survivability with new low observable modes and with the latest advances in electronic warfare systems. Air-to-surface capabilities could benefit from assisted target recognition and enhanced sensor resolution enabling the combat platform to attack ever more elusive targets. The Rafale was developed taking into account a joint requirement projected by the French Air Force and the French Navy for an omni-role combat aircraft that would replace the seven types of fighter aircraft in service at that time. When developed, the Rafale was expected to carry out a wide-range of missions as follows:

- Air defence
- Air superiority/air dominance
- Reconnaissance
- Close air support
- Air-to-ground precision strike
- Interdiction
- Anti-shipping strike
- Nuclear strike

OPERATIONAL DEPLOYMENT

Over the last few decades, air forces have always been the first military component engaged in all crises or conflicts

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

from the Falklands to the Gulf, from Bosnia to Kosovo, in Afghanistan and more recently in Libya.

Military aviation is undoubtedly the strategic weapon of choice today both in terms of combat effectiveness and of critical technologies incorporated in combat platforms. In modern

warfare, from day one, air dominance is a pre-requisite so that air-to-ground and air-to-sea operations can be conducted safely and efficiently. In the course of asymmetrical and counter-insurgency conflicts, the air arm also remains at the forefront of the military effort, its flexibility and fire-power helping to ensure that allied forces prevail. The 9/11 events have shown that in peacetime it is essential to secure the national airspace with easily deployable control and air defence assets. The decisive place of the air component in modern warfare is demonstrated by the defence strategies decided by those nations who want to keep a leading role on the world stage.

According to the French Air Force Adviser, General Herve Longuet, based on its deployment and performance in Afghanistan and Libya, the Rafale is ‘combat proven’. Since 2006, Rafale aircraft of the French Air Force and the French Navy have been engaged in countless combat missions in Afghanistan where they have demonstrated very high proficiency. The AASM precision-guided modular air-to-surface weapons systems, laser-guided bombs and the 30mm cannon have been successfully employed on many occasions scoring direct hits with remarkable precision. More recently, the Rafale fighters have been engaged in operations over Libya as part of the coalition forces. “During the Libyan campaign, the Rafale has proved its versatility. When some of our allies need two or three different planes for different missions, we can perform all missions with only one aircraft type,” added General Herve Longuet.

Lessons learned from the recent conflicts where air power was used can be summarised into four overarching expectations about weapon systems by political decision-makers:

- Versatility: The capability of the combat platform to perform different missions.
- Interoperability: The ability to undertake operations in coalition with the allies using common procedures and agreements, collaborating and communicating in real time with other systems.
- Flexibility: The ability to conduct different missions in the course of the same sortie. With this capability, it is possible to switch mission objectives instantly on demand from the political and military leadership.



COMBAT PROVEN:
IN THE RAFALE, DASSAULT HAS
DESIGNED AND PRODUCED A COMBAT
PLATFORM WHICH MEETS OR EVEN
EXCEEDS THE DEFINED PARAMETERS
OF EACH TYPE OF MISSION

- **Survivability:** The capability to survive in a dense and hostile threat environment owing to stealth features and/or advanced electronic warfare systems.

The Rafale combines all these attributes and is relevant against both traditional and asymmetrical threats. It addresses the emerging needs of the armed forces in a changing geopolitical context and remains at the forefront of technical innovation.

POWERING THE RAFALE AND LOGISTICS

The omni-role Rafale is powered by the M88-2 turbofan, a new-generation engine featuring state-of-the-art and advanced technologies such as integrally bladed compressor disks (blisks), non-polluting combustion chamber, single-crystal high pressure turbine blades, powder metallurgy disks, ceramic coatings, composite materials, etc. It also features the latest advances in technology to reduce electromagnetic and infrared signatures. The M88-2 offers high thrust-to-weight ratio with easy maintainability, high despatch reliability and lower operating costs. With thrust rating at 10,971lbs dry and 16,620 lbs with afterburner, the M88-2 is equipped with redundant full authority digital engine control (FADEC), which provides carefree engine handling anywhere in the flight envelope. The pilot has the freedom to slam throttle from idle to combat power and back to idle in less than three seconds.

The M88 was launched in 2008 and has been subjected to continuous improvement by Snecma, leading to the latest M88-4E version which builds on the total cost of ownership (TCO) programme initiated to further improve engine dura-

bility and bring support costs down. This version which has upgraded high-pressure compressor and the high pressure turbine of the M88-2 is now in the final qualification tests. Life expectancy between two overhauls has been considerably expanded for a number of modules, helping further to minimise the impact of planned maintenance on engine availability. Production deliveries are expected shortly and the Rafale delivered from 2012 onwards, will be powered by the M88-4E.

To meet stringent customer requirements, ease of support has driven Rafale design from the beginning, reducing significantly its logistic footprint for easy and speedy deployment. Innovative technologies have been developed and employed to boost reliability, accessibility and maintainability and reduce the need for manpower and elaborate infrastructure. Deployment at forward operating bases including austere airfields has been made easier by keeping the requirement of ground support equipment to a minimum.

SALES

The Rafale programme has the firm support of the French Government that has placed orders for 120 aircraft and has made a commitment for another 180. Apart from India that is considering the Rafale for the requirement of medium multi-role combat aircraft for the Indian Air Force, the United Arab Emirates (UAE) is looking at buying 60 fighter aircraft, Brazil 36 and Switzerland 22. The Rafale with its omni-role attributes is the right answer to the capability approach selected by an increasing number of governments. SP

Browne is the New Air Chief

AT 12 NOON ON JULY 31, Air Chief Marshal P.V. Naik handed over the reins of the Indian Air Force (IAF) to Air Chief Marshal N.A.K. Browne, who became the 23rd Chief to head the service. The handing over/taking over ceremony was conducted in the office of Chief of the Air Staff in Vayu Bhawan, New Delhi, in the presence of Air Officers Commanding-in-Chief of various commands from different parts of the country and the Principal Staff Officers (PSOs) from Air HQ.

Outlining his vision statement for the IAF—‘People first Mission Always’, the new Chief, while extolling his ‘men and women in blue’, also exhorted them to discharge their individual and collective responsibilities to the nation in a befitting manner. SP



EXCERPTS OF AIR CHIEF MARSHAL N.A.K. BROWNE'S ADDRESS

“The IAF is well poised on the path of transforming itself into a potent strategic force. While induction of the state-of-the-art equipment and systems would lead to a major upgradation of our combat potential, our biggest strength, ‘Our People’ must receive our highest attention. In whatever capacity you serve in the Indian Air Force, you remain our most valuable asset.”

“I firmly believe that each one of us has a duty to care and look after the people placed under our charge. It is a sacred calling, for all leaders, men and women, irrespective of the rank and position. Our endeavour should be to empower

our subordinates, by giving them required operating skills, through dedicated training and mentoring.”

“While change is the hallmark of growth and progress, the biggest challenge facing us in the coming years, is to manage this fast paced change effectively, without compromising on high operational standards. Operating across a broad spectrum of equipment vintage, would test our innovativeness and capabilities. The nation has reposed a high degree of trust and confidence in our capabilities. It is indeed an onerous asking, and I am confident that as capable men and women we will work shoulder to shoulder in discharging our responsibilities befittingly.” •

Enthusiasts' Delight



Not dominated by commercial competition or military thunder, it is a showcase of all things related to aviation—antique restorations and warbird formations, homebuilt completions and microlight aircraft, seaplanes and gyroplanes—each have its area and following. But there's no denying the marketing opportunity that the Oshkosh show presents, given its attendance of over half a million.

THERE ARE VERY FEW such massive influxes of like-minded people as the annual migration of aviation enthusiasts to Oshkosh, Wisconsin, located in the north-central US. Similar to a religious pilgrimage, with overtones of rock music festival, vintage car rally and military reenactment mixed in, it is, quite simply, an aviation extravaganza. Commonly written off as a sport aircraft gathering, the Experimental Aircraft Association's (EAA) mid-summer AirVenture event has evolved into a venue for all aspects of aviation.

For example, this year's AirVenture featured the first-ever public showing of Boeing's 787 Dreamliner. The new

By **LeRoy Cook**
Oshkosh, USA



composite-construction airliner landed at Oshkosh for a one-day stopover, allowing the assembled enthusiasts to troop aboard and engage in a walk-around. In the previous years, the show has been visited by the Airbus A380, Concorde SST, Guppy cargo haulers and various Boeing 747 iterations.

Military attractions have included the C-5B, An-124 and C-17 transports, SR-71 and U-2 spyplanes, and tankers, fighters, bombers and trainers of all types.

AirVenture remains, however, an enthusiast's show. Not dominated by commercial competition or military thunder, it is a showcase of all things related to aviation. Antique restorations and warbird formations, homebuilt completions and

microlight aircraft, seaplanes and gyroplanes—each have its area and following. But there's no denying the marketing opportunity that the Oshkosh show presents, given its attendance of over a half-million. That is precisely the reason many business aircraft makers take booth space on the grounds, to expose their wares to a large audience with hopes of finding a prospect. Not every AirVenture attendee is a mere light plane pilot and of those who are, some own business and company aircraft in addition to their personal plane.

NOTABLE EVENTS OF AIRVENTURE 2011

As usual, there were noteworthy happenings taking place at the air show. On day two, we witnessed the retirement announcement of Tom Poberezny, long-time President and Chairman of EAA and son of its founder, Paul Poberezny. Effective from August 1, he is handing over the chairmanship reins to Rod Hightower, currently the organisation's President. For the first time in the EAA's 60-year history, there will no longer be a Poberezny at its head.

By happenstance, well-known aviation publisher Dave Sclair died later the same day, fittingly succumbing to brain cancer at his home while the Oshkosh airshow was in full bloom, just as he would have wanted. It was Sclair who began the daily newspaper circulated at the show, seeing the need for a communication outlet at the event.

The 2011 show was favoured by benign weather conditions at its outset and at its conclusion, with some rainy spells at mid-week to enhance attendance at the interior exhibits. The temporary city constructed for AirVenture takes such minor difficulties in stride.

NOTEWORTHY AIRCRAFT SEEN

There are always significant aircraft making an appearance at Oshkosh. This year, the Farmers Insurance advertising dirigible, a Zeppelin NT, cast its 246-foot shadow over the show. Dirigible rides were offered, for those not satisfied with hops in the Ford TriMotors or

Everyone comes to Oshkosh, to see what can be done with innovation and enthusiasm

sightseeing from M*A*S*H-type helicopters. The Commemorative Air Force's Boeing B-29 bomber, Fifi, returned after a 16-year absence, given the new engines under the sponsorship of the Cavanaugh Flight Museum. As the only flyable World War II Superfortress in existence, it filled the Conoco-

Phillips Square apron with style.

A rare Mitsubishi Zero fighter, a full-scale faithful replica of a Focke-Wulf FW-190 fighter and the only flyable SB2C Curtiss Helldiver torpedo bomber attracted an appreciative warbird-lover crowd. In smaller scale, Supermarine Aircraft showed its 90 per cent scale Spitfire kit aircraft. The Vintage Wings of Canada museum brought its Fairey Swordfish biplane torpedo bomber from World War II. As 2011 marked the 100th Anniversary of the US Navy's entry into aviation, it was proclaimed that the airport would be called "Naval Air Station Oshkosh" for the week, and numerous events and aircraft centred on a nautical theme, including showings of practically every aircraft type in the Navy's inventory.

Sikorsky Innovations showed its 250-knot X-2 research helicopter, soon to be installed in a museum. Innovative home built aircraft designers receiving special honours this year included Zenith Aircraft's Chris Heintz and Scaled Composites' Burt Rutan, both of whom had many examples of their designs flown in by builders for display.

In the business aircraft arena, Kestrel Aircraft announced the selection of Honeywell's TPE331-14GR turboprop engine for the production version of Kestrel's single-engine composite aircraft, currently flying

OLD AND MODERN:
BOEING'S B-29 WAS ONE OF THE LARGEST
AIRCRAFT IN SERVICE DURING WORLD
WAR II; BURT RUTAN'S SCALED
COMPOSITES AIR AND
SPACE VEHICLES





AT THE SHOW:
SEAPLANES ON DISPLAY;
AROUND THE DISPLAY GROUND

in test-bed form with a Pratt & Whitney Canada PT-6A. Blackhawk Modifications proclaimed certification for its 850-shp XP42A conversion of the Cessna Caravan 208B, boosting horsepower by 175 to 250 shp and vastly improving high-and-hot, known icing and high-gross operation for Caravan operators. Meanwhile, Evektor Aircraft of the Czech Republic announced its twin-PT6A turboprop EV-55 Outback utility plane, and GripsAero division of Mahindra Aerospace announced the selection of the Rolls-Royce M250 turboprop engine for its GA10 utility single, an expanded version of the GripsAero GA8 piston-engine bushplane.

Also seen at the show were Bombardier's Learjet 65, Hawker Beechcraft's King Air 90GT, 250 and 350 models, the Hawker 200, Cessna's Mustang and Caravan, Piper's Altair single-engine jet and Cirrus Aircraft's Vision SJ50 jet. Embraer proudly showed its Phenom 100 and 300 light jets and announced record sales for the entire Embraer line. The reborn Total Eclipse twinjet was repeatedly flown and HondaJet demonstrated its over-wing-engines light business jet prototype and announced flights of the conforming certification test aircraft. Daher-Socata marked its 100th anniversary as a company, dating from the Morane Saulnier origins in 1911; strong demand for the TBM850 very fast turboprop fuels speculation of a follow-on NTx twin jet, perhaps based on the Grob SPn. Pilatus Aircraft, which always pursues a unique thematic for the Oshkosh event, presented its PC-12NG as the centerpiece at a retro-1950s "Pilatusville" bistro.

As always, many developmental aircraft were shown, including a fanjet-equipped conversion of an Aerostar piston twin shown by Aerostar Aircraft. Boosted to nearly 400 knots by Pratt & Whitney 615F-A engines of 1,460 pounds thrust, it fulfills designer Ted Smith's dream of an ultimate Aerostar. Quest Aircraft's well-established Kodiak utility turboprop will be available with an executive interior; was announced at the show.

Nearly all of the light sport aircraft (LSA) under production, mostly from Central Europe, were on display. The LSA arena

continues to hold promise for revitalising general aviation with simpler, less-costly aircraft. In addition to production of LSAs, many of the amateur-built experimental kit designs can fit into LSA requirements,

which allow flying suitable aircraft with (in the US) no medical certification and less training.

As always, a few mishaps marred the Oshkosh airshow's week. A Piper Cub went down in the adjacent Lake Winnebago, claiming two lives, and a Cessna pilot crossing the larger Lake Huron, farther to the east, suffered engine failure and had to tread water for 18 hours until rescued by a passing boat. A US Air Force F-16 Fighting Falcon over-ran the runway end on the fourth day and suffered a collapsed nosegear and damaged engine inlet. Considering the 10,000 aircraft and thousands of operations taking place during the event, the overall AirVenture safety record is quite good, thanks to the measures taken.

Even with a prolonged economic recession casting a pall, the AirVenture event defied the trend of doom-and-gloom and attracted a strong showing of 5,41,000 attendees, up by 1.3 per cent over 2010. Of the estimated 10,000 aircraft flown in, 2,522 were registered as "showplanes"; 974 home-builts, 899 vintage category, 367 warbirds, and so forth. There were 803 exhibitors taking part, up by 33 from 2010. The general mood of the show was one of survivorship and belief in aviation as a life-style.

A total of 2,098 international visitors were recorded, with many more no doubt arriving without visiting the official pavilion. While the greatest numbers came from Canada, Australia and Brazil, about 68 countries were represented. Even the Chinese People's Republic sent a delegation to observe and take notes, promising in carefully-couched terms to open airspace to private aviation in Red China. Other regions with a stronger record of developing aviation included India, Africa and Latin America. Eventually, everyone comes to Oshkosh, to see what can be done with innovation and enthusiasm.

The 60th anniversary AirVenture gathering will take place from July 23 to July 29, 2012. SP

FINAL LAUNCH:
SPACE SHUTTLE ATLANTIS SOARS
INTO THE SKY ON ITS FINAL JOURNEY

SALUTE THE SHUTTLE

During an eventful journey, Atlantis was the first shuttle to dock with the ISS; fittingly, it was also the last. It was also the final spaceship to visit the other iconic symbol of success in space: the Hubble Space Telescope. No space shuttle will ever fly again; the shuttle is history.

WAS IT A SPACE-CRAFT? It was launched like one. Was it an aircraft? It landed much like a conventional glider

on a runway. Was it a space passenger bus? It was certainly promised to be, but the cost worked out way too high and the US Government finally balked at paying the price. Was it a cargo truck? The space shuttle's enormous load carrying capacity was vital in building and replenishing the International Space Station (ISS) which might otherwise have taken decades to complete.

On July 8, almost a million people thronged the beaches around the Kennedy Space Center in Florida for a final glimpse of the majestic Atlantis as it raced skyward. This was the 135th and last mission of a shuttle—the pioneering craft that has defined the US space programme for 30 years. Only four astronauts were on board, since no shuttle was available to mount a rescue mission if Atlantis sustained damage—the stricken crew would have to be recovered aboard the smaller Russian Soyuz capsule. In the event, Atlantis landed safely on July 21, 42 years almost to the day after human beings first set foot on the moon. During an illustrious career, Atlantis was the first shuttle to dock with the ISS; fittingly, it was also the last. It was also the final spaceship to visit the other iconic symbol of success in space: the Hubble Space Telescope. No space shuttle will ever fly again; the shuttle is history.

HISTORY IN THE MAKING

Officially known as the Space Transportation System (STS), the shuttle programme was launched in 1972. The US space programme's manned flights had begun with the Mercury programme, followed by Gemini and Apollo. They were all single-use spaceships. The space shuttle was revolutionary because it was the first reusable spacecraft in history. Only six shuttles were built. STS-1 was launched on April 12, 1981 (twentieth anniversary of the first human spaceflight) with two crew

By **Joseph Noronha,**
Goa

members aboard Columbia. Enterprise never flew in space, Challenger exploded soon after lift-off in 1986, and Columbia disintegrated during its return to earth in 2003. Atlantis, Discovery and Endeavour are now in peaceful retirement.

The space shuttle was the most complex flying machine ever built. The stub-

by-winged device was mounted on a huge external fuel tank containing cryogenically stored liquid hydrogen and oxygen, strapped to two solid rocket boosters, which collectively became known as "the stack". In launch configuration, the entire assembly contained more than 3,500 subsystems and 2.5 million parts. Fully fuelled, it had the explosive potential of a small nuclear device. Launched vertically like a rocket and gliding back to earth like an aircraft, shuttles proved their worth in carrying astronauts, cargo, heavy machinery, satellites, even the Hubble Space Telescope. That versatility, however, meant higher construction and operating costs, because a crewed vehicle needs complex life-support systems, escape methods and high safety that an unmanned rocket can do without.

Through three decades of its operational history, 355 individuals (306 men and 49 women) flew 852 times on 135 shuttle missions. The astronauts were from 16 countries. They conducted more than 2,000 experiments in the fields of earth, biological and materials sciences and astronomy. Shuttles have docked with two space stations—nine missions flew to the Russian Mir station and 37 flights were to the ISS. Shuttles were responsible for the orbiting and repair of Hubble, just one of the 180 satellites and other spacecraft they successfully launched. Shuttles were critical in the construction and replenishment of the ISS, more than 12 years and 37 shuttle trips in the making. Construction of the space station began in 1998, and is planned for completion in 2012. It should remain operational till 2020.

COMPLEX AND COSTLY

In the early 1970s, the National Aeronautics and Space Administration (NASA) projected a rate of 48 shuttle flights

THE LAST LAP



STS-135 IS THE FINAL SHUTTLE MISSION TO THE ORBITAL LABORATORY.

THIS IMAGE OF THE INTERNATIONAL SPACE STATION WAS TAKEN BY ATLANTIS' STS-135 CREW DURING A FLY AROUND AS THE SHUTTLE DEPARTED THE STATION ON TUESDAY, JULY 19, 2011.

SPACE SHUTTLE ATLANTIS' BRIGHT-WHITE, ICONIC FRAME ILLUMINATES THE DARKNESS AS IT TOUCHES DOWN ON THE SHUTTLE



LANDING FACILITY'S RUNWAY 15 AT NASA'S KENNEDY SPACE CENTER IN FLORIDA FOR THE FINAL TIME. ON BOARD WERE STS-135 COMMANDER CHRIS FERGUSON, PILOT DOUG HURLEY, AND MISSION SPECIALISTS SANDRA MAGNUS AND REX WALHEIM.

THIS UNPRECEDENTED VIEW OF THE SPACE SHUTTLE ATLANTIS, APPEARING LIKE A BEAN SPROUT AGAINST CLOUDS AND CITY LIGHTS,



ON ITS WAY HOME, WAS PHOTOGRAPHED BY THE EXPEDITION 28 CREW OF THE INTERNATIONAL SPACE STATION. AIRGLOW OVER EARTH CAN BE SEEN IN THE BACKGROUND.

per year, at a cost per launch of around \$15 million (₹67.5 crore). In the event the programme averaged five launches per year. NASA claims that a single launch eventually worked out to about \$450 million (₹2,025 crore). But if the costs of development and operation over the duration of the programme are factored in, the total tab has been estimated at \$208 billion (₹9,36,000 crore) in 2010 dollars. For the tally of 135 missions, this works out to around \$1.5 billion (₹6,750 crore) per flight and perhaps \$250 million (₹1,125 crore) for each person going into space.

The space shuttle was conceptualised as a reusable launch system and orbital spacecraft. It was certainly an amazing machine. However, its designers had to make a host of compromises to meet the competing demands of various US civilian and defence agencies. Ultimately, the craft emerged fragile, complicated to operate and unsafe. Being large and aerodynamically unstable it needed sophisticated “fly by wire” systems that were still under development during the 1970s. The engineers also faced a huge challenge in building rocket engines sturdy enough to work repeatedly and flawlessly for over 50 missions. Before the shuttle, space rockets were like Diwali firecrackers—good only for a one-off burn. Shuttle maintenance and refurbishment was an expensive and time-consuming affair. Each time a shuttle touched base, it had to be tak-



DIFFERENT MISSIONS:
DRIFTING SMOKE PLUME FROM THE
LAUNCH OF THE SPACE SHUTTLE
ATLANTIS; DURING STS-125, ATLANTIS
ASTRONAUTS REPAIR THE HUBBLE
SPACE TELESCOPE

en apart, inspected, cleaned, many components replaced, and the whole craft reassembled for the next flight. The process took months, sometimes years. And the promised simplicity of a reusable spacecraft was invalidated by the need for a new external fuel tank for each mission. Florida's famously stormy weather did its bit to ensure that shuttle flights never became a routine, as had been hoped. Consequently, against the target life of 100 missions apiece, no shuttle exceeded 39 launches.

What really hurt, however, was the safety gap. NASA probably underestimated the risks shuttle astronauts faced. On January 28, 1986, Challenger disintegrated 73 seconds after launch due to the failure of the right solid-rocket booster, killing all seven astronauts on board. Columbia burned up on February 1, 2003, during re-entry into the earth's atmosphere, just 16 minutes from landing. The cause was later traced; it was because of the damage to the carbon-carbon leading edge of the wing during launch. The entire seven-member crew died. Notably, Columbia's fatal flight had been delayed 18 times over the course of two years before its actual launch date of January 16, 2003 (despite its designa-

AFTER COMPLETING THE STS-135 MISSION, SPACE SHUTTLE ATLANTIS IS ROLLED OVER TO THE ORBITER PROCESSING FACILITY



ATLANTIS AND THE STS-135 CREW COMPLETES A 13-DAY MISSION TO THE INTERNATIONAL SPACE STATION AND THE FINAL FLIGHT OF THE SPACE SHUTTLE PROGRAMME ON JULY 21, 2011, IN CAPE CANAVERAL, FLORIDA.

STS-135 CREW AND SPACE FLOWN TRIBUTE BANNER TO SPACE SHUTTLE WORKFORCE



SPACE SHUTTLES ENDEAVOUR AND DISCOVERY MEET IN A NOSE-TO-NOSE PHOTO OPPORTUNITY AS THE VEHICLES SWITCH LOCATIONS AUGUST 11 AT NASA'S KENNEDY SPACE CENTER, FLORIDA. NOW IN ORBITER PROCESSING FACILITY-1 (OPF-1), DISCOVERY WILL GO THROUGH MORE PREPARATIONS FOR PUBLIC DISPLAY AT THE SMITHSONIAN'S NATIONAL AIR AND SPACE MUSEUM STEVEN F. UDVAR-HAZY CENTER IN VIRGINIA NEXT SPRING. ENDEAVOUR WILL BE STORED IN THE VEHICLE ASSEMBLY BUILDING UNTIL OCTOBER, WHEN IT WILL BE MOVED INTO OPF-2 TO CONTINUE BEING READIED FOR DISPLAY AT THE CALIFORNIA SCIENCE CENTER IN LOS ANGELES NEXT SUMMER.



tion as the 107th mission, it was actually the 113th mission launched). After each shuttle accident, the remaining craft were grounded for two to three years. It has been calculated that the space shuttle was 138 times riskier than an airliner, based on deaths per million miles travelled.

WHAT NEXT?

With America's long-term fiscal outlook looking increasingly bleak, President Barack Obama's options in space are severely limited. He has shelved plans to build a powerful new spacecraft to return to the moon. Instead NASA's goal is to put Americans on an asteroid by 2025. To some, aiming to reach a giant rock floating in space doesn't quite seem an inspiring objective. But beyond that, there's destination Mars and its moons by the mid-2030s.

It is remarkable that just before Neil Armstrong's Apollo 11 spacecraft lifted off in July 1969, Vice President Spiro Agnew declared that America's next goal should be a manned landing on Mars by the end of the century. A presidential committee on post-Apollo strategy even said that the United States could send astronauts to Mars by the mid-1980s for not much more than the \$24 billion (₹1,08,000 crore) cost of the Apollo programme. However, 40 years later, human flights to Mars are still some decades away.

For now, NASA has decided to farm out much of the routine work of ferrying astronauts into low-earth orbit (especially to the ISS) to commercial firms. The first commercial cargo craft could demonstrate its docking capability with the ISS as early as December. And commercial "space taxis" could be ferrying American astronauts there as early as 2015. Although several corporations are in the race, Space Exploration Technologies Inc. (SpaceX) seems to be the frontrunner. According to company sources, its Falcon 9/Dragon combination has a tremendous advantage over others intended to carry astronauts, because SpaceX vehicles were designed from the start to take humans. Besides, they have already flown successfully. Another company, Orbital Sciences Corporation has a contract to ferry supplies to the ISS beginning next year. Till the private firms (with NASA's financial and technological backing) come up with something concrete, the US will rely on Russia for resupply of the ISS. For the next few years, the only way for the US astronauts to reach the ISS will be to board a Soyuz space capsule at a cost of \$51 million (₹230 crore) per person.

NASA is continuing work on a space vehicle capable of carrying human beings beyond the earth's orbit. Up to four astronauts may be able to survive for 21 days in this multipurpose crew vehicle (MPCV), a refinement of the abandoned Orion. The MPCV is designed to be 10 times safer than the space shuttle. Beyond that, there's the new Space Launch System (SLS) which will be based on Apollo and shuttle technology, although not much is known about it yet. And attracted by the \$30 million (₹135 crore) Google Lunar X-Prize, 29 privately-funded teams are competing to become the first to successfully launch, land, and move a robot across the surface of the moon. The

deadline is December 2015. Is the age of private space enterprise about to dawn?

THE END OF AN ERA

When Atlantis executed its flawless landing on July 21, it marked the final chapter in a 30-year saga of numerous triumphs and tragedies. Ultimately, the space shuttle left unfulfilled expectations. The greatest event for America so far happened on July 20, 1969, when Neil Armstrong stepped on the surface of the moon. It was also one of the supreme achievements of human history. The space shuttle did maintain America's leadership in space exploration, and many find it depressing to see that great nation seemingly abandon the final frontier.

Some experts believe that NASA's apparent retreat from human spaceflight could have far-reaching consequences for scientific discovery. Others feel that there will be a welcome switch to new areas of robotic exploration that have been missed due to preoccupation with costly human travel. However, although unmanned probes and space telescopes have indeed produced spectacular scientific progress, human spaceflight missions are still the most convincing proof of space prowess. Space explorers inspire us with their courage, determination and skill, and not the least by the fact that they face mortal risk unflinchingly.

Meanwhile, the space race has changed beyond recognition. Nine countries have now succeeded in placing spacecraft in orbit. Citizens of almost 40 countries have sampled spaceflight. China, India and others have ambitious programmes to explore space. For some years, Russia will have complete control of access to the International Space station (ISS). A statement from the Russian space agency Roskosmos after Atlantis landed said it all: "From today, the era of the Soyuz has started in manned space flight, the era of reliability." Indeed, following the shuttle's exit, the US will not have the ability to send astronauts into space until a new American launch vehicle materialises.

"It was a magnificent failure," says space historian Alex Roland summing up the shuttle. However, where it failed, was in attempting the impossible—being cheap, safe and reliable, all at once. There's no shame in that. Half a century after the first human being crossed the threshold of space, space travel is still a fairly risky and expensive affair. NASA's mission was to create a reusable, economical spaceship, but it discovered that creating a reusable craft was far more costly than conjectured. Still, the shuttle provided invaluable experience in managing complex, re-useable space systems; the development of advanced materials, tools and testing techniques; new life-support technologies, and extensive space-walk practice. The shuttle experience is a solid foundation for whatever comes next in space. When all the technological and scientific progress that shuttle flights achieve is balanced against the economic and human costs, the space shuttle programme will be seen as an important (if somewhat wearisome) journey on a necessary path to eventual success.

Was it a failure? As the space shuttle era comes to an end let us salute its indisputable magnificence. SP

Was it a failure? As the space shuttle era comes to an end let us salute its indisputable magnificence. SP

The shuttle experience is a solid foundation for whatever comes next in space



THE US SPACE SHUTTLE was one of the most spectacular symbols of technological achievement ever. For the hundreds of men and women who flew on board, the shuttle represented the fulfilment of a cherished dream. And yet twice during its 30-year operational history, the inspiring narrative faltered. Kalpana Chawla was one of 14 astronauts for whom the dream ended in disaster.

Kalpana was born on July 1, 1962, in Karnal, Haryana. The youngest of four children, she always longed to be an engineer. She earned an aeronautical engineering degree in Chandigarh in 1982. Bent on higher studies, she flew to the USA the same year. Her educational quest culminated in a PhD in aerospace engineering from the University of Colorado in 1988. Later that year, she began working with the National Aeronautics and Space Administration (NASA). She gained a Certificated Flight Instructor rating for airplanes and gliders and Commercial Pilot Licences for single and multi-engine airplanes, seaplanes and gliders. Intensely attracted by space, Kalpana volunteered for NASA astronaut training in March 1995 and was selected. She lifted off on her first mission on November 19, 1997, as part of the six-member crew that flew the space shuttle Columbia, STS-87. This made her the first Indian-born woman and the second Indian to fly in space (cosmonaut Rakesh Sharma who flew in 1984 was the first).

In 2000, Kalpana was chosen for her second flight aboard STS-107. Once again the craft was the space shuttle Columbia. The crew went into training for the scheduled launch date of January 11, 2001. However, due to a number of factors, including scheduling conflicts and technical problems (like the discovery of cracks in the shuttle engine flow liners) the mission was delayed 18 times before its actual launch date of January 16, 2003. So despite its official designation as STS-107, this was actually the 113th shuttle mission launched. As Mission Specialist, Kalpana's responsibilities included microgravity study, and the crew made over 80 experiments in earth and

space science, advanced technology development, and astronaut health and safety. As the mission came to an end it was time to return to earth. On February 1, 2003, Columbia commenced its re-entry sequence. On crossing California, the shuttle appeared to observers on the ground as a bright spot of light moving rapidly across the sky. Then

(reinforced carbon-carbon panels and thermal protection tiles) on the leading edge of the left wing of the shuttle. During re-entry, this allowed the hot gases to penetrate and weaken the wing structure, ultimately causing it to fail. The shuttle became uncontrollable and was destroyed by the extreme heat. Sadly, during the mission itself, ground engineers had requested high resolution images that may have provided an understanding of the extent of the damage, while a senior NASA engineer requested that astronauts on board Columbia be allowed to carry out a space walk to inspect the damage. However, NASA managers felt these measures were unwarranted. The report also delved into the underlying organisational and cultural issues that led to the accident. It was highly critical of NASA's decision-making and risk assessment processes. As with the doomed Challenger space shuttle in 1986, NASA seemed to have grown complacent following a string of successful missions. Its managers were prone to accept unusual phenomena since no serious consequences had resulted from similar episodes earlier. They failed to recognise the relevance of engineering concerns for safety.

Although America was Kalpana's adopted country (she married an American and became a US citizen in 1990) she never forgot her roots in India. During her tenure at NASA, she arranged for five students from her school to visit NASA every year to acquaint them with the space programme. Honours flowed in from both countries after she passed away. She was posthumously awarded the US Congressional Space Medal of Honour, the NASA Space Flight Medal and the NASA Distinguished Service Medal.

Later, the Accident Investigation Board determined the cause of the crash to be a piece of foam that broke off during launch and damaged the thermal protection system components



KALPANA CHAWLA
(1962–2003)

She was posthumously
awarded the US
Congressional Space
Medal of Honour, the
NASA Space Flight Medal
and the NASA Distinguished
Service Medal

the superheated air around it suddenly brightened, leaving a noticeable streak in its luminescent wake. It was the first sign of debris being shed. Four or five minutes later, Columbia disintegrated over Texas, killing its crew of seven. The accident occurred at about 9 a.m. (local time), 16 minutes prior to the planned touchdown at Kennedy Space Center.

Later, the Accident Investigation Board determined the cause of the crash to be a piece of foam that broke off during launch and damaged the thermal protection system components

—Group Captain (Retd)
Joseph Noronha, Goa

MILITARY

Asia-Pacific

Gripen operational in Royal Thai Air Force

During a ceremony on July 8, 2011 the Royal Thai Air Force (RTAF) officially declared its new air defence system consisting of the Gripen fighter and Saab 340 Erieye AEW operational. The ceremony took place at the Wing 7 base in Surat Thani. The new era for the RTAF began in 2008, when an agreement was signed between FMV, Sweden's Defence Materiel Administration and the RTAF, for the delivery of six Gripen C/D multi-role fighter aircraft to replace its outgoing F-5 aircraft. The order also included one Saab 340 Erieye AEW, a single Saab 340 for transport purposes and a ground-based Command and Control system. A further batch of six Gripen C fighters and another Saab 340 Erieye was ordered in 2010. Deliveries will be completed in 2013.

\$5.1 billion proposed for PAF F-16s

Recently, the US Defense Security Cooperation Agency (DSCA) had notified Congress via a series of releases of its intention to provide Pakistan with a \$5.1 billion foreign military sales package to upgrade the F-16s that serve as the PAF's top of the line fighters. Some of these items had been put on hold following the October 2005 earthquake in Pakistan & Kashmir, but the request for 36 new F-16 Block 50/52s is now going ahead, along with new weapons, engine modifications, and upgrade kits for Pakistan's older F-16 A/Bs. The buy went through, and was accompanied by the supply of 26 older F-16s from USAF surplus stocks.

Americas

Cobham awarded USAF KC-46 tanker subcontracts

Cobham has been awarded two subcontracts by Boeing related to the hose and drogue aerial refuelling system that will be used by the US Air Force's new KC-46

tanker aircraft. The contracts, valued in excess of \$73 million, relate to the Engineering and Manufacturing Development (EMD) phase of the programme, including development hardware.

Earlier this year, the United States Air Force (USAF) selected Boeing to provide the next generation strategic tanker, the KC-46. Shortly thereafter, it was announced that Boeing had selected Cobham to provide the hose and drogue refuelling systems. These systems will be manufactured by Cobham Mission Equipment at its air-to-air refuelling centre of excellence in Davenport, Iowa. Deliveries on the engineering phase begin in 2014, with low-rate initial production starting in 2015. The USAF plans to acquire 179 KC-46 tankers from Boeing. Cobham expects to equip each aircraft with a centerline drogue system. Approximately 30 tankers will also be provided with a pair of wing-mounted aerial refuelling pods.

Boeing P-8A Poseidon completes first flight



The first Boeing P-8A Poseidon production aircraft completed its first flight on July 7, taking off from Renton Field and landing three hours later at Boeing Field in Seattle. The P-8A is the first of six low-rate initial production (LRIP) aircraft Boeing is building for the U.S. Navy as part of a \$1.6 billion contract awarded in January. The successful flight marked LRIP-1's completion of final assembly in the company's Renton factory and transition to mission system installation and checkout in Seattle. Boeing will deliver LRIP-1 to the Navy next year in preparation for initial operational capability, which is planned for 2013. The Navy plans to purchase 117 of the Boeing

Next-Generation 737-based P-8A anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance aircraft to replace its P-3 fleet.

F-35 Jet Blast Deflector testing under way



F-35C Lightning II carrier variant aircraft CF-2 is performing Jet Blast Deflector (JBD) tests at Joint Base McGuire-Dix-Lakehurst in New Jersey. The JBD, located behind the catapults aboard aircraft carriers, deflects high energy exhaust from the engine to prevent damage and injury to other aircraft and personnel located in close proximity. JBD testing is one portion of the tests required to ensure the F-35C is compatible aboard the aircraft carrier. Testing continues with varying distances between the aircraft and JBD, and at power settings up to and including maximum afterburner power. CF-2 arrived at Lakehurst on June 25 for JBD tests.

Propane, anti-freeze, and other toxins in pilots' blood

First it was oxygen problems. Then there was treatment for "physiological symptoms." And now the news is that toxins are keeping the F-22s down. According to the US Air Force Times, blood tests of F-22 pilots showed a host of chemicals, including anti-freeze, propane and burned polyalphaolefin, a synthetic oil, after flights where they reported experiencing cognitive problems. These toxins, along with carbon monoxide, may be causing hypoxia, which is a lack of oxygen. Hypoxia can cause reduced brain function and memory loss. F-22 pilots reported being unable to remember how to change radio frequencies and scraping treetops when approaching the runway.

QuickRoundUp

AAI

- AAI Corporation has been awarded a \$18.7 million cost-plus-fixed-fee contract. The award will provide for the engineering services in support of the Shadow 200 unmanned aircraft system. Work will be completed by May 31, 2013.

AGUSTAWESTLAND

- "It was fantastic!" That was the verdict of highly-experienced Australian Defence Force pilots who took the controls of the GrandNew helicopter after it was demonstrated by AgustaWestland, CAE and BAE Systems team for AIR9000 Phase 7. The GrandNew is a new generation light twin-engine helicopter that is successfully operating worldwide. It is light enough for ab initio pilot training but large enough to perform air crew training for other helicopter missions.

AIRBUS

- Lufthansa has placed a firm order for 30 Airbus A320neo Family aircraft. This contract follows the selection by the Lufthansa Supervisory Board of the A320neo Family in March this year. The order comprises 25 A320neo and five A321neo aircraft which will be powered by new-generation Pratt & Whitney PW1100G turbofan engines.

ATK

- ATK has received a \$48 million major subcontractor award from Orbital Sciences Corporation to provide commercial solid rocket motors for the Missile Defense Agency intermediate range ballistic missile (IRBM) target rocket programme. With follow-on options, ATK believes that the contract has a potential value of up to \$90 million. Orbital is the prime contractor for the IRBM programme.

BAE SYSTEMS

- BAE Systems has completed a successful production readiness review (PRR) for manufacturing critical airframe components for the F-35 joint strike fighter (JSF) programme. The PRR was an important step for South Australia becoming a key supplier in the JSF programme's global supply chain.

APPOINTMENTS

INDIAN NAVY

Chief of the Naval Staff Admiral Nirmal Verma has taken over as the Chairman, Chiefs of Staff Committee (COSC). The baton was handed over to him by the outgoing Air Chief Marshal P.V. Naik prior to the latter's retirement on July 31.

INDIAN AIR FORCE

With Air Chief Marshal N.A.K. Browne having taken over as Chief of the Air Staff on July 31, the Indian Air Force (IAF) has witnessed a number of changes in its top hierarchy. Air Marshal K.K. Nohwar is now the Vice Chief of Air Staff; Air Marshal S. Varthaman is the Air Officer Commanding-in-Chief (AOC-in-C), Eastern Air Command; Air Marshal S.P. Singh is the AOC-in-C, Southern Air Command; Air Marshal M.K. Matheswaran is the Senior Air and Staff Officer (SASO), Eastern Air Command; Air Marshal P.S. Gill is the SASO, Central Air Command; and Air Vice Marshal J.S. Walia is the AOC Jammu & Kashmir.

BOEING

Boeing Company has announced the appointment of Dennis D. Swanson as the International Business Development Vice President for Boeing Defense, Space & Security in India.

EMBRAER

Embraer has named Paulo Penido Pinto Marques as the new Chief Financial Officer (CFO) to replace Cynthia Marcondes Ferreira Benedetto.

JET AVIATION

Jet Aviation has appointed Stephan Krenz as the Senior Vice President and General Manager of Jet Aviation Basel.

HONEYWELL

Honeywell has appointed Mike Lang as the company's Vice President and Chief Information Officer (CIO).

From the Air Force Times: "Part of the problem, at least for pilots flying from Joint Base Elmendorf-Richardson, Alaska, where many of the known incidents have occurred, may be the start-up procedures used in winter, one source said. "Because of the harsh climate, pilots often start their jet engines inside a hangar before taking off. That could allow exhaust gases to be trapped in the building, sucked back into the engines, and ingested into the bleed air intakes that are located within the engines' compressor sections that supply the OBOGS, sources said.

Boeing, BAE to develop directed energy weapon

On July 25, Boeing announced that its Directed Energy Systems (DES) division has signed a teaming agreement with BAE Systems to develop the Mk 38 Mod 2 Tactical Laser System for

defence of US Navy ships. The Navy awarded the BAE Systems team an initial contract in March to build a demonstrator unit of the system. Boeing is a subcontractor to BAE Systems under this contract. The Mk 38 Mod 2 Tactical Laser System couples a solid-state high-energy laser weapon module with the operational Mk 38 Machine Gun System. The addition of the laser weapon module brings high-precision accuracy against surface and air targets such as small boats and unmanned aerial vehicles. The system also provides the ability to deliver different levels of laser energy, depending on the target and mission objectives.

Europe

Rafale and AASM-Hammer, a dynamic duo

As witnessed throughout recorded history, each new

conflict seems to bring its own share of innovations. Recently, for example, the air strikes over Libya – Operation Harmattan for France, and Operation Unified Protector for NATO in the framework of the UN resolution 1973 – have spotlighted the unexpectedly powerful performance of a new French-made weapon, the AASM Hammer (Highly Agile Modular Munition Extended Range) air-to-ground modular weapon developed and produced by Sagem. The AASM Hammer is a medium-range guided weapon that can be used day or night and under all weather conditions – which is not the case of regular laser-guided bombs, which have to be launched in the vicinity of air defence systems. The AASM stands out because it's a modular weapon system, totally autonomous and jam-proof, flying resolutely towards its target once the coordinates have been manually loaded into the onboard computer by the pilot. The most advanced AASM models, like the Laser version now undergoing final tests, allow the modification of terminal guidance if needed to hit moving targets. In short, the AASM is a real "fire & forget" weapon.

Eurofighter Typhoon on Libya operations



At the 2011 Royal International Air Tattoo, in Fairford, UK, the Royal Air Force held a media briefing on operations in Libya. Some of the key points from the briefing have been summarised in the succeeding text. Typhoon's rapid deployment to Gioia del Colle air base in Italy, 72 hours from the initial UN mandate and subsequent first mission on Operation Odyssey Dawn 12 hours later, are testament to the deployability and rele-

QuickRoundUp

BELL TEXTRON

- Bell Helicopter Textron, Inc. has been awarded a \$550 million modification to a previously awarded advance acquisition contract for long lead materials and components associated with the manufacture and delivery of 19 Lot Eight UH-1Y new-build aircraft; eight AH-1Z remanufactured aircraft; and six Lot Eight AH-1Z new-build aircraft. Work is expected to be completed in February 2014.

BOEING

- The Boeing Corporation, St. Louis, has been awarded a \$32.15 million cost-plus-incentive-fee contract modification for an aircraft closure redesign; eight massive ordnance penetrator assets; 16 separation nuts; and eight MOP loading adapters. Boeing has been awarded a \$190 million contract for the modification of an existing contract to provide 16 AH-64D Apache aircraft and related support. Work is likely to be completed by February 28, 2014.

BOMBARDIER

- Bombardier Aerospace has announced that the letter of intent (LOI) from Korean Air signed at the 2011 Paris Air Show to acquire 10 CS300 airliners has now been converted into a firm order. The transaction also includes options on 10 CS300 aircraft and purchase rights for an additional 10 CS300 aircraft.

DENMARK

- Airbus and Satair A/S (Satair), a Danish company listed on the NASDAQ OMX Copenhagen, have entered into an agreement under which Airbus will offer the shareholders of Satair a price of DKK 580 (about \$112) in cash per share and the warrant holders in Satair a price of DKK 378.661 (about \$74) per warrant.

EMBRAER

- Embraer Defense and Security has selected BAE Systems to provide hardware, embedded software, system design and integration support of the flight control electronics for the KC-390 military transport jet. Under the contract, BAE Systems will supply flight control computers and actuator control electronics for the KC-390.

SHOW CALENDAR

16-21 August
MAKS 2011
 Zhukovsky, Moscow, Russia
www.aviasalon.com/en/static/page/welcome_to_MAKS_11.htm

13-16 September
DSEI - DEFENCE AND SECURITY EQUIPMENT INTERNATIONAL
 ExCeL, London, UK
www.dsei.co.uk

14-15 September
BUSINESS AIRCRAFT EUROPE - INCORPORATING 5TH ANNUAL LIGHT JETS EUROPE
 Biggin Hill, UK
www.miuevents.com/bae2011

14-16 September
JET-EXPO AIR SHOW 2011
 1 bld.3 Airport VNUKOV
 Moscow
www.2011.jetexpo.ru

21-24 September
AVIATION EXPO CHINA 2011
 China National Convention Center, Beijing, China
www.beijingaviation.com/en

15-18 September
CHINA HELICOPTER EXPOSITION
 Tianjin Airport Industrial Park, China
www.helicopter-china-expo.com/index.php/en

22-24 September
AOPA AVIATION SUMMIT
 Connecticut Convention Center, Hartford, Connecticut, USA
www.aopa.org/summit

27-29 September
MRO EUROPE 2011
 IFEMA, Madrid, Spain
www.aviationweek.com/events/current/meu/index.htm

24-26 October
AEROSPACE & DEFENSE PROGRAMS
 Arizona Biltmore, Phoenix, AZ, USA
www.aviationweek.com/events/current/ad/index.htm

26-27 October
FUTURE MRO & AGEING AIRCRAFT 2011
 Holiday Inn Bloomsbury, London, UK
www.smi-online.co.uk/mro-ageingaircraft19.asp

vance of this new generation aircraft. More impressive has been the re-rolling of Typhoon and its pilots from an air-to-air aircraft to an air-to-ground fighter bomber. From a pilot's perspective, the aircraft is spectacular. Despite spending on average 7 hours in the cockpit per mission one could not find a more comfortable aircraft to fly. The cockpit is large by fast-jet standards and the information from the radar, DASS and LINK-16 is displayed easily and accessibly. This allows you to function at 100 per cent capability throughout the sortie, not plagued by fatigue or a lack of situational awareness.

CIVIL AVIATION

Asia-Pacific

Boeing delivers first 777-300ER to Air China
 Boeing delivered in July the first 777-300ER (extended range) to Air China, the flag carrier of the People's Republic of China. The new airplane is the first of 19 777-300ERs Air China has on order with Boeing. With this new addition to its fleet, Air China becomes the first airline on the Chinese mainland to operate the new generation 777 family member. Boeing is scheduled to deliver an additional three 777-300ERs to Air China by the end of 2011. Air China will use the airplanes for route expansion including direct routes to Frankfurt, London and Paris, as well as for gradual replacement of the Boeing 747-400s currently serving North American routes.

Israeli carrier Israir receives its first ATR 72-500



The Israeli airline Israir has taken delivery of its first ATR 72-500, of a total order of

two. The aircraft, equipped with PW 127M engines, is configured to transport 72 passengers. It will be used to enhance the airline's domestic network, adding to its current fleet of three ATR 42-320 and two Airbus A320 aircraft. The second ATR 72-500 is scheduled for delivery at the end of July. The two ATR 72-500s will allow the airline to increase its capacity and the number of flights operating on its main route from Tel Aviv Sde Dov (City Airport) to Eilat (Red Sea Resort). The airline will also be able to increase the number of charter flights to other Mediterranean tourist destinations.

Americas

Gulfstream G150 sets speed record



Gulfstream Aerospace Corp.'s G150 demonstration aircraft recently set a world speed record between Gander, Newfoundland, Canada, and Geneva, Switzerland, beating the existing record by 37 minutes. The wide-cabin, high-speed aircraft travelled the 2,464 nautical miles (4,563 km) between the two cities in 5 hours and 6 minutes. Its average cruise speed was Mach 0.80. The aircraft, en route to the 2011 European Business Aviation Conference and Exhibition (EBACE), carried four passengers. The G150 has a range of 3,000 nautical miles (5,556 km) at its normal cruise speed of Mach 0.75.

Gulfstream renames G250
 Gulfstream has announced that it has renamed the super midsized Gulfstream G250 aircraft. The business jet is now called the Gulfstream G280. Gulfstream officials said that the move was prompted by the company's sensitivity to the varied cultures of its international

QuickRoundUp

GENERAL ELECTRIC

- General Electric Aircraft Engines has been awarded a \$71.5 million modification to a previously awarded firm-fixed-price contract to exercise an option for the supplemental engine requirement to procure (18) F414-GE-400 engines and (18) F414-GE-400 engine device kits. The F414-GE-400 engine powers the F/A-18E/F Super Hornet aircraft. Work is expected to be completed in July 2013.

IBERIA

- Iberia has selected GE's CF6-80E1 engines to power its fleet of eight firm Airbus A330 aircraft with an option for eight additional A330s. The engine order is valued at more than \$260 million list price.

IMMARSAT

- Inmarsat plc has announced that Inmarsat SA, one of its subsidiary companies, has signed a contract with International Launch Services for the launch of three Inmarsat-5 satellites. The launches, which are scheduled for 2013-14, will use the ILS Proton launch vehicle from the Baikonur Cosmodrome in Kazakhstan.

INDIAN AIR FORCE

- Encapsulating the rich legacy of a house whose illustrious residents have shaped the contours of the Indian Air Force (IAF), Marshal of the Air Force (MIAF) Arjan Singh released a coffee table book on Air House, the official residence of the Chief of Air Staff titled "Air House....Down the Years", at 23 Akbar Road, in New Delhi, on July 19, 2011.

IRAQ

- Prime Minister Nouri al-Maliki is attempting to use defence contracts as a means of ensuring some US troops remain past the withdrawal deadline. US officials remain wary of the ability of Iraqi Security Forces to maintain complete security over the country in the short-term and have pressed Baghdad for an extension to allow a sizeable residual force of US "trainers" to remain after the deadline. Thus Iraq is likely to double its order of F-16 jets.

customer base. "Since introducing the Gulfstream G250 in 2008 and presenting it to customers around the world, we determined that G280 is a more amenable number sequence in certain cultures," said Larry Flynn, Senior Vice President, Marketing and Sales, Gulfstream. The renaming will not affect any other in-production Gulfstream aircraft.

INDUSTRY

Asia-Pacific

GippsAERO selects Rolls-Royce M250 engine

On July 28 Rolls-Royce, the global power systems company, announced a development agreement with GippsAERO, a wholly owned subsidiary of Mahindra Aerospace. Under the agreement, Rolls-Royce will supply M250-B17F/2 turboprop engines for the GA10, a new 10-passenger fixed-wing plane that will deliver enhanced performance, fuel efficiency and reliability.

Eurocopter Mahindra sign MoU

On July 27, Mahindra Aerospace and Mahindra Satyam – representing the aerospace manufacturing and engineering capabilities of India's industrial house, the Mahindra Group signed a Memorandum of Understanding (MoU) for a trade partnership with the Eurocopter Group and its Indian subsidiary, Eurocopter India. This partnership will be focused on the manufacture of subassemblies, engineering and customisation of civil helicopters, and the joint development of specific market segments. The cooperation with Mahindra is aligned with Eurocopter's strategy to become a manufacturer in India through arrangements with local partners, thereby improving its knowledge of the market and adapting the company's products to the region's operational needs.

EADS broadens its technology licensing reach

Five agreements signed by EADS have extended the scope of the company's

technology licensing outreach with new industrial partners in India and Europe. These accords were inked during June 2011 Paris Air Show and involve a contract with Germany's Grenzebach Automation GmbH for metallic production technologies based on the friction stir welding solid-state joining process, along with four Letters of Intent (LoIs) with one German and three Indian companies for metallic and composite manufacturing processes.

Americas

Aeronautical Accessories to distribute TrueView EVS

Bell Helicopter has announced that it has formed a distributor partnership to sell products from TrueView Enhanced Vision Systems (EVS), LLC under its Aeronautical Accessories brand. TrueView EVS' infrared thermal imaging system improves flight safety in compromised flight conditions such as darkness or low light/low visibility conditions and virtually eliminates the chance of controlled flight into terrain (CFIT). Under the agreement, Aeronautical Accessories will distribute TrueView EVS infrared enhanced vision systems worldwide.

SPACE

Americas

Boeing selects Atlas V Rocket

On August 4, Boeing Company announced it has selected the United Launch Alliance (ULA) Atlas V rocket to launch the Boeing Crew Space Transportation (CST)-100 spacecraft from Florida's Space Coast. If NASA selects Boeing for a development contract with sufficient funding, ULA will provide launch services for an autonomous orbital flight, a transonic autonomous abort test launch, and a crewed launch, all in 2015. The Commercial Crew programme consists of developing, manufacturing, testing and evaluating, and demonstrating the CST-100 spacecraft, launch vehicle

and ground/mission operations – all part of Boeing's Commercial Crew Transportation System – for NASA's new Commercial Crew human spaceflight programme that will provide access to the International Space Station. The CST-100 is a reusable, capsule-shaped spacecraft that includes a crew module and a service module.

P&W Rocketdyne's Next Generation J-2X



Pratt & Whitney Rocketdyne has successfully completed a chill test and 1.9 second ignition test of NASA's J-2X engine at John C. Stennis Space Center. The J-2X upper-stage engine is in development to power NASA's next era of human spaceflight. The J-2X is based on a proven design that could provide a safe and reliable solution for NASA's future heavy-lift launch vehicles. The engine also leverages the investment taxpayers have already made in the Constellation programme and other programmes such as the space shuttle.

Europe

Thales Alenia Space contracts for Solar Orbiter

On July 19, Thales Alenia Space announced that it has won the Phase B contracts from Italian space agency ASI for the entire METIS (Multi Element Telescope for Imaging and Spectroscopy) instrument and the Data Processing Unit (DPU) on the Solar Wind Analyser (SWA), both part of the Solar Orbiter Mission in the European Space Agency's Cosmic Vision programme. The Solar Orbiter satellite will, for the first time, observe the Sun and its environment at a distance of just 0.28 Astronomical Units (i.e., 28 per cent of the mean distance between the Earth and the Sun). •

QuickRoundUp

LOCKHEED MARTIN

- Lockheed Martin and Raytheon Missile Systems are being awarded a \$475 million firm-fixed-price contract for Paveway II laser-guided bomb computer control groups (seekers) and GBU-12 air foil groups (tail kits).

Lockheed Martin's joint air-to-surface standoff missile (JASSM) has recently completed a successful product verification test at White Sands missile range. Released by a B-52 at an altitude of 25,000 feet and speed of Mach 0.76, JASSM navigated through a preplanned route before destroying its intended target, meeting all mission objectives. The test validated software upgrades for 158 Lot 8 JASSM missiles, which will begin delivery in the third quarter of 2011.

NAVMAR

- Navmar Applied Sciences Corporation has been awarded a \$75 million cost-plus-incentive-fee contract for a Phase III Small Business Innovation Research project for the development and use of the persistent surveillance unmanned aerial systems. Contract funds in the amount of \$30 million will expire at the end of the current fiscal year.

SINGAPORE TECHNOLOGIES

- Singapore Technologies Aerospace Ltd has concluded over S\$260 million (about \$216 million) worth of new maintenance contracts in the second quarter of 2011. Ranging from three to 12 months, these contracts for the aircraft maintenance and modification, component total support and engine total support businesses will be carried out at its facilities in America, Asia Pacific and Europe.

US

- Boeing, Embraer, and the Inter-American Development Bank (IDB) have announced that they will jointly fund a sustainability analysis of producing renewable jet fuel sourced from Brazilian sugarcane. The groundbreaking study will evaluate environmental and market conditions associated with the use of renewable jet fuel produced by Amyris. World Wildlife Fund will serve as an independent reviewer and advisor.

A Growing LIABILITY

It is abundantly clear that Air India's chances of survival as a state-owned airline is practically non-existent. The key to its survival undoubtedly lies in privatisation.

ONCE REGARDED AS A jewel in the crown of the nation and the pride of the airline industry, the state-owned Air India is now engaged in a desperate struggle for survival. The finances of the airline are in a monumental mess and today the carrier has an unmanageable debt of Rs 43,000 crore accompanied by a monthly interest burden of Rs 220 crore. The carrier has repeatedly defaulted on interest payment and each time has been able to clear dues only through dole from the government. The airline has not been able to pay even the basic salaries on time to its 31,000 strong workforce leave alone the various allowances that constitute the major portion of their emoluments. Given an option, the financiers would declare the airline as an non-performing asset. Efforts by the government over the last two years for revival of the airline through a comprehensive restructuring plan do not seem to have had any appreciable effect so far. The size of funds required for the airline to go through a revival plan escalates each time it is revised. The latest revival plan suggested by the SBI Capital Markets Limited calls for an equity infusion of ₹43,255 crore over the next decade. The airline would require 20 per cent of this figure immediately to clear outstanding dues of the Airports Authority of India—oil companies; refund of loan for acquisition of aircraft; and emoluments of employees.

The beginning of the downslide for Air India can be traced back to the mid-1980s. It was during the days of the Congress government when anyone in the political and bureaucratic establishments with the remotest connection with the airline began the era of subversion and reckless exploitation of the carrier. A golden opportunity to save Air India was lost when a move to privatise the carrier in the late 1990s by Tata in collaboration with Singapore Airlines was successfully thwarted by some powerful lobbies and vested interest groups. The situation for Air India took a noticeable turn for the worse in 2004, a point in time that marked the resurgence of airlines in the private sector pushing the intensity of competition to a new level. But it was the slew of strategic decisions by the Ministry of Civil Aviation (MoCA) since 2004 that proved to be far more debilitating than the fiercely competitive environment of the last decade. Orders were placed by the MoCA for as many as 111 aircraft valued at over ₹50,000 crore. The inordinately large or-

der included a combination of 68 Boeing aircraft including 27 Dreamliners for Air India and 43 Airbus aircraft for India. The total number of aircraft ordered which was regarded as being way beyond their optimum requirement, resulted in a colossal interest burden the airline was in no financial position to bear. No convincing justification by the MoCA for this bizarre decision unknown even to the Parliamentary Committee set up to examine the aircraft deal has been forthcoming. Suggestions by observers, both inside and outside the airline, on the size of the order range from mere juvenile indiscretion to intent bordering criminal conspiracy that warrants a high level probe.

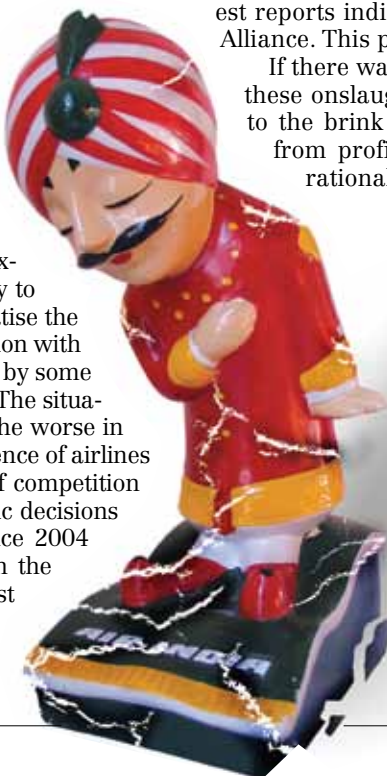
Another queer decision by the MoCA was to merge Air India and Indian into one entity called the National Aviation Company of India Limited, to be renamed subsequently as Air India. For a variety of reasons too numerous to dilate on, the merger has been a complete disaster. From a combined cumulative loss of ₹680 crore in 2007 prior to the merger, by 2010, the figure rose to ₹16,000 crore. While the decision in retrospect is being seen merely as ill-conceived by many, insiders do not buy the argument that the merger was undertaken to enable the combined entity to join Star Alliance. They once again point to intent behind this decision as being devious, meant to benefit rivals in the private sector. Latest reports indicate that in fact Air India is not joining Star Alliance. This perhaps is another subject for investigation.

If there was any chance for Air India to have withstood these onslaughts, what has ultimately pushed the airline to the brink of collapse was the systematic withdrawal from profit making routes under the guise of "route rationalisation". In 2009, the airline handed over

a large number of routes to the Middle East and South East Asia where the recorded load factors were high and the airline had a good chance of making profit. Once again these steps are being seen as designed to benefit Air India's competitors in the private sector as also some foreign carriers.

In the final analysis, it is abundantly clear that Air India's chances of survival as a state-owned airline is practically non-existent. The key to its survival undoubtedly lies in privatisation. SP

— **Air Marshal (Retd) B.K. Pandey**



TREASURE HOUSE

visit: www.spsmilitaryyearbook.com

WELCOME TO THE FUTURE^x

Slide into a Cessna Corvalis TT^x and you'll find the future of aviation has done more than make an early arrival, it's moved well past expectations.

The TT^x boasts the new Cessna IntrinziC™ flight deck powered by the Garmin G2000 – the first touchscreen-driven avionics ever designed for a piston aircraft. And with the fastest speed in its class, the TT^x leaves other piston aircraft lagging in its wake, literally and figuratively.

TO LOOK INTO THE FUTURE OF AVIATION:
000-800-100-3829 | AVIATOR.CESSNA.COM



CORVALIS TT^x

