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In this Special Issue published on HAL's 75th Anniversary, Vayu looks back – and forward – with a series of articles, highlighted by an exclusive interview with HAL's present Chairman, supported by on-the-spot reports filed by Vayu's editorial team which specially visited various Complexes and Divisions of HAL in various geographical locations of India, to be continued in forthcoming issues.



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From the very first aircraft built in 1941, to the current series production of advanced jet trainers, HAL has been involved with manufacture as also design & development of training aircraft. This pictorial review brings out this aspect vividly.

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Beginning with direct import of Russian-built Sukhoi Su-30s in the late 1990s to licence-manufacture of the type by HAL at its Nasik Division from the early 2000s, this combat aircraft has dominated HAL's production lines and, indeed, frontline squadrons of the IAF for the past 15 years. With 222 such aircraft ordered by the Air Force from HAL, in several batches, the programme is continuing with the last such aircraft to be handed over in 2019-20 (unless a new batch is ordered).

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On the eve of Prime Minister Narendra Modi's visit to Russia in December 2015, Vayu was invited to interact with top aviation industry officials in Moscow. 'The more things change, the more they remain the same,' reports Angad Singh.

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The United States and India are on the cusp of realising their ambition to entrench meaningful defence cooperation despite the absence of a formal alliance. The author, Ashley J Tellis, reviews the promise of US-Indian Defence Ties.

113 Exercise 'Trident Juncture'



This biggest and most ambitious NATO Exercise was designed to test readiness of its Response Force (NRF) the Very High Readiness Joint Task Force (VJTF). Article by Remco Stalenhoef.

65 Indian Civil Aviation



The forthcoming 5th Edition of the India Aviation Exhibition at Hyderabad in mid-March 2016 will surely be forum for some lively discussions and debates on the draft National Civil Aviation Policy which was released in the closing months of 2015. Apart from studied initial reactions, Vayu looks at annual forecasts for new airliners over the next decade as also the increasing role of helicopters for remote area connectivity in India.



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Right way to arm the Forces

New Delhi has always struggled with competing policy aims when it comes to buying arms. Should the priority be to buy the best possible weapons for its men-in-arms, promote indigenous arms production, or avoid any charges of corruption? In theory, the answer should be: All of the above. In practice, these often contradict the other. Thus, direct government-to-government sales are the most transparent way to buy weapons. But they do not allow offsets and undermine indigenisation. The weakness of India's industrial base has meant that a 'Make in India' programme in the past has meant substandard weapons. It also fed a culture of delusion about the public sector defence firms who, effectively, imported knock-down kits from overseas, gave the assembled weapon a Sanskrit name and pretended they had been 'made in India'.

The best point of the latest defence policy reforms has been a recognition that Indian industry has minimal capacity for the precision machinery required for genuine indigenisation. This must be built up over time, especially within the private sector. This requires a less onerous offset policy. Another reform is recognising that awarding contracts to the lowest bidder is a poor way to buy weapons. It was common for companies to sell to India cheaply and then, once dependency was locked in, to price gouge on the spare parts. Given the complexity of modern weaponry it is dangerous to presume they can be bought in the same manner that the government procures teabags and chairs. There is also an expectation that New Delhi will also morph the existing policy of blacklisting arms makers guilty of corruption into fines and imprisonment. In an industry where there is often only one or two makers for a specific kind of weapon and where such arms could be crucial to the national defence, this policy was simply foolhardy.

At the heart of all this is a recognition that to produce world-class weapons at home requires a policy of gradual change. It took decades for India to develop the ecosystem of component subcontractors to allow it to make automobiles. It will take even longer for something more complicated, like a fighter jet. As the policy becomes more nuanced, the government must also work out a system that opens the procurement and offset policy to greater public scrutiny. As the transactions become more complicated, false accusations of corruption will become easier to level. Even if they come as they are sure to do, the government must ensure it does not tie itself and defence procurement reforms into knots as a consequence — and undo the good work that has been done so far.

From Hindustan Times

Defence Postures

Defence Minister Manohar Parrikar has announced the contours of the long-awaited new defence procurement procedure (DPP), which he had promised immediately after taking over as defence minister in November 2014. It will take another two months for the DPP to be notified, which will include all the annexures and appendices containing the details of the procedure. A crucial chapter, pertaining to selection of strategic partners in defence manufacturing, has not been finalised yet — the VK Aatre Committee, formed to recommend policy on this aspect, is expected to submit its report this week. The policy — critical for the business

development plans of India's top private defence manufacturers — will then be finalised after discussion at the defence ministry. The delay in its finalisation renders the current exercise incomplete in its ambit and scope.

In finalising the current DPP, the defence ministry has accepted 90 per cent of the recommendations made by the expert committee headed by the former home secretary, Dhirendra Singh. The two major highlights of the new DPP are the creation of a new category called "IDDM" or indigenously designed, developed and manufactured platforms, and the raising of the value of contracts for 30 per cent offsets from Rs 300 crore to Rs 2,000 crore. The IDDM category will get top priority while buying equipment and will be the first to be chosen for tenders. This is likely to incentivise indigenous design and production of defence equipment under Make in India. Read in consonance with the reimbursement of development funding up to 90 per cent of the cost, this will further encourage Indian private companies to do research and development. The issue of 30 per cent offsets, which are to be spent in India, by all foreign suppliers, has been a major grouse among Western suppliers. By raising the value of contracts for offsets to Rs 2,000 crore, the defence ministry has satisfied the foreign companies in all future contracts.

The defence minister was also expected to issue the policy on blacklisting of defence suppliers and authorised defence agents along with the DPP but those still await the light of day. Those policies are critical to creating a well-defined landscape for the operation of both Indian and foreign defence manufacturers. The earlier they are issued, the better. Good-intentioned, with a clear focus on the indigenisation of defence production, the test of the new DPP will be in its early finalisation and notification — and eventually, its execution.

From The Indian Express

After Pathankot

It has been reported that Prime Minister Narendra Modi has expressed his concern over the lax security at the Pathankot airbase. After all, the attack took place even though prior warning was received, and seven service men were killed as a result. But, it is also true that some others in the government have declared that the counter-terror operation was successful because the air planes in the secure area of the Pathankot base were not destroyed. That is, however, far too low a bar for success. Certainly, given the strategic implications of India's border installations, more is expected.

There are two questions that should form the backbone of any examination of the Pathankot operation. First, was the institutional process for dealing with such an event ignored, or was it inadequate? Second, what is the nature of individual responsibility for the decisions taken during the operation, and will there be accountability for those decisions? Both these questions must be answered satisfactorily. After all, the stability of the prime minister's courageous opening up to the Pakistani civilian establishment depends upon minimising the threat that anti-peace factions in Pakistan pose to Indian interests. Surely, when Mr Modi went to Lahore on Christmas Day, the government knew that some form of attack might well follow. Given that, it is not yet clear if the institutions that exist to deal with such an attack



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had swung smoothly into operation when intelligence about an impending attack on Pathankot was received. Forget about the Cabinet Committee on Security, it is reportedly the case that a Crisis Management Group, a body which would include the relevant senior Union government officials, did not meet. Vital co-ordination between the wings of the government may have been delayed thanks to this; such poor co-ordination has been noted in the past also when a CMG has not been the nodal body for security matters, such as during the 26/11 attacks in Mumbai seven years ago. Messaging also suffers when a CMG does not depute one of its members to brief the public. Another purpose of the CMG would surely have been to thrash out in advance vexed questions such as whether it was more suitable to use infantry with experience of infiltrator tactics, or the National Security Guard, with training in urban counter-terror. Unfortunately, Pathankot - given that it follows a pattern clearly evident from the past - will not be the last such attempt to derail Mr Modi's outreach to Islamabad. Given that, have lessons been learnt about the importance of institutional resilience in the face of security emergencies?

Had a CMG been the focal body for decision-making on Pathankot, questions of accountability and responsibility would have been easier to tackle. Decisions would have been on the record, and their reasons understood. Incorrect assumptions could have been corrected, and errors of judgment learned from. As it stands, assigning responsibility and enforcing accountability is a more difficult endeavour. But it is one that must be carried out. This need not happen with a blaze of publicity, but it is important that it be done. There is no substitute for beefing up institutional robustness and enforcing accountability.

From Business Standard

Warning or waffle?

Sending out seemingly-contradictory signals — or if clichéd metaphors are preferred, blowing hot and cold or brandishing an iron fist in a velvet glove — can be deemed legitimate diplomatic and security policy. Yet it loses authenticity when the man taking the aggressive line qualifies his comments as being personal: not the views of the government of which he is a key member. It was holding the defence portfolio that “qualified” Manohar Parrikar to address a military seminar, so there was little scope to articulate a personal viewpoint. Particularly since there was no way in which his argument that those who inflict pain must be made to suffer it too would not be interpreted in the context of Pathankot.

His clarifying his position lends itself to varying interpretation: does it suggest a degree of frustration at being unable to persuade his cabinet colleagues to endorse a bullet-for-bullet policy against terror-sponsoring Pakistan, or an even greater disappointment that the military machine he heads is not quite capable of mounting immediate surgical strikes in response to provocative action by the adversary? Or maybe the fact that his first attempt at a counter-strike-across the Myanmar border against militants who ambushed an army convoy in Manipur-was rapidly exposed as being far from what it had been cranked up to be.

To put it in a Pathankot-specific context: thus far the strongest Indian response has been a reiteration of the contention that talks and terror cannot go hand-in-hand, and its key “weapon” would

be scrapping the scheduled interaction of the foreign secretaries. A rather far cry from what Parrikar — not the defence establishment had — advocated. Hence it is unlikely to “scare” GHQ Rawalpindi into abandoning its terrorism-sponsoring strategy.

It is a skewed political proposition that a defence minister is required to take a belligerent line, speak *fauji* language to endear himself to and earn the admiration of the military. Particularly when his government has failed to address critical issues such as materials shortages, not given that requisite fillip to modernisation and re-equipment, or the much-hyped purchase of 36 Rafale jetfighters having not been signed and sealed — deliveries still a distant dream. To be fair, Parrikar is not the first minister to take a thrill in being bellicose — generally when speaking on Pakistan but cowering before the “dragon” — without having inflicted the pain he had in mind a day or two back. It was some 45 years ago that a defence minister lived up to an assertion that the next war would not be fought on Indian soil — but then even those ignorant of military matters would acknowledge that Babu Jagjivan Ram was a class apart.

From The Statesman

Chandigarh Airport

A politician worth his salt would never let an initiative pass without a fight. That is all that can be concluded from the battle over naming what could simply be Chandigarh International Airport. There is not a paisa's worth of merit in the feud that Punjab and Haryana have been indulging in now for a few years. Punjab, which is contributing 24.5 per cent to the cost of building the facility, wanted to name it after Mohali. Haryana, which also joined the project later with an equal stake, would have none of that. A compromise was found in agreement to name it after Shaheed Bhagat Singh. But Punjab still wanted to append the word Mohali to it. The battle for credit had started while the Congress ruled Haryana. With the advent of the BJP in the state came another name, that of an RSS leader, the late Mangal Sein.

The casual manner in which names for buildings and cities are thrown about for petty politics is more an insult to the personalities than an honour. Shaheed Bhagat Singh needs no transport facility to validate his sacrifice. Mohali itself has been unsuccessfully named Sahibzada Ajit Singh Nagar. Punjab and Haryana, however, are only keeping up a long tradition of naming airports, towns, roads and chowks after personalities historical and political. Between Indira Gandhi, Veer Savarkar, Jayaprakash Narayan, Babasaheb Ambedkar, and a host of others, just the airports in India cover the entire spectrum of political ideology. Kerala too wants to name an airport in Kochi after Congress leader K Karunakaran.

The Civil Aviation Ministry, which plays arbiter in the controversies, has recently made a sensible proposal: name airports only after the nearest city. Airports are as much a commercial venture as an infrastructure facility. Branding is important, and Chandigarh is a strong brand for an international airport. The modern city should be a good place to start a trend. India draws upon a rich diversity in its heritage. Bringing it all together has to be the goal, not introducing divisive ideology in every sphere of life.

From The Tribune

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Intelligence Challenges for the Coming Year

“To be forewarned is to be forearmed” is a universally accepted truism. But, regrettably and statistically speaking, intelligence agencies all over the world do appear to be under more stress and are reactive rather than proactive as recurring terrorist acts and major security failures have unmistakably shown. Even in those threatened, otherwise technologically advanced nations, known for their prowess in counter intelligence and counter terrorist operations, intelligence failures are more commonplace than generally accepted. In the last few months, terrorist acts in Paris, US, Afghanistan, Israel, Pakistan – and India – have proven that, despite the terror threat being omnipresent, violent acts directed against innocents have an uncanny propensity to occur.

India, which is situated in one of the most violent expanses of the world and with two of its major neighbours, China and Pakistan, congenitally anti-India not only in posing external threats, but also since years encouraging internal threats, makes the tasks for the security organs of the state, especially India’s intelligence agencies, more than formidable and exacting. Whether India’s intelligence institutions are equal to these myriad security challenges to the nation, needs periodic and serious introspection. Dishearteningly, the history of evolution of India’s intelligence institutions clearly displays that its growth has been more crisis-driven than future challenges-oriented.

The 1962 debacle in the frontier war with China had led to creation of the Directorate General of Security (DGS) within the Intelligence Bureau (IB). Following the abysmal performance of the IB in the 1965 operations against Pakistan, the government decided on the establishment of a new agency, the Research and Analysis Wing (R&AW), exclusively for external intelligence gathering shortly and linked the DGS and its Aviation Research Centre (ARC) with it. Subsequently, the

gross intelligence failures in 1999, across the board, when our security agencies failed to detect major Pakistani intrusions across the Line of Control in the Kargil sector led to a major review of India’s higher defence management and all its security institutions.

The Kargil Review Committee (KRC), formed after the Indian Army, assisted by the Indian Air Force, evicted Pakistani intruders from the Kargil heights, indeed in sterling manner, made major recommendations

of the three services, including satellite imagery and communications intelligence. Besides, the National Technical Facilities Organisation (NTFO) was raised and earmarked as the premier TECHINT agency, and later re-named as the National Technical Research Organisation (NTRO). The NTRO’s mandate did create some turf wars between it and its earlier avatar, the ARC and R&AW as some assigned responsibilities certainly overlapped.



Border areas remain a crucial area of focus for the national intelligence apparatus

regarding higher defence management in India. The KRC, led by the highly regarded security analyst, K Subramanyam, made major recommendations regards reforms in defence and the suggestions, after vetting by a high powered Group of Ministers (GOM) formed by the Vajpayee government, were accepted. Amongst the many reforms mandated by the government on streamlining higher defence management and creation of newer structures, the most notable ones were establishment of the tri services Defence Intelligence Agency (DIA) for coordinating functioning of the existing service intelligence directorates and controlling strategic intelligence assets

It was again, in aftermath of the blatant Pak-sponsored Mumbai terrorist attacks in November 2008 that additional restructuring of the nation’s intelligence apparatus was carried out. The IB was designated as the premier counter terror institution and tasked to establish a Multi Agency Centre (MAC) at Delhi and Subsidiary Multi Agency Centres (SMACs) at state levels to collate and process intelligence inputs from various sources. They also recommended a National Counter Terrorism Centre (NCTC), which failed to take off owing to differences in its charter and responsibilities between the Centre and the states.



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India's internal security environment continues to face numerous challenges from continuing serious cross-border terrorism, on-off-on indigenous insurgencies in some North East states, an escalating Maoist insurgency afflicting nearly one third of India, latent Islamic extremism including from the emerging ISIL terror outfit, communal and sectarian violence, illegal immigration, human and drug trafficking from some of our neighbouring nations and money laundering are the diverse threats to India's internal security. Regrettably, Pakistan continues with self destructive policies to foment unrest and stoke the fires of secessionism in J&K and now, once again, trying to revive the Khalistani movement in Punjab.

India also faces formidable threats to its external security from China whose exponential growth, economically and militarily, has made it increasingly assertive both along India's disputed northern land borders as also in the Asia-Pacific maritime domain. A terror-driven, nuclear-armed Pakistan, alone or in collusion with China, puts India's external intelligence gathering and analysis capabilities under severe stress.

In this new year, the still relatively new Modi government with its overwhelming mandate has a unique opportunity to streamline India's apex intelligence management without waiting for the next crisis to occur. A few reforms are the need of the hour to enable India, vast intelligence apparatus becoming adequately responsive to thwart the diverse security challenges confronting the nation.

There are now 14 intelligence agencies, civil and military, servicing the intelligence needs of the nation. First and foremost, the apex level intelligence management is virtually handled by the National Security Adviser (NSA) through the National Intelligence Board and the Joint Intelligence Committee (JIC). It is the considered opinion of many security experts that, apart from tasking and coordinating intelligence work at the macro level, there is far too much on the NSA's plate and thus India needs, on the lines of the US, an exclusive intelligence head who could be designated as the National Intelligence Coordinator. The latter would be able to provide comprehensive integrated intelligence assessments to the Cabinet Committee on Security and the NSA.

TECHINT, which constitutes signals cum communications intelligence, satellite

imagery, cyber security *et al* are a function of resources of the nation's technological advancements and we are doing well in this sphere. However, India's intelligence agencies suffer from inadequacy in HUMINT resources and the government must take necessary steps to attract the right human resources for this critical and onerous task including recruiting of personnel, including from the academia and having IT and linguistic skills. The DIA must also gear up for achieving expertise in HUMINT across the world albeit in military aspects.

Reportedly, after a promising start, the myriad talents and resources of the DIA appear to be under-utilised, an aspect which

Most importantly, the Modi government should consider bringing all Indian intelligence agencies under some form of Parliamentary oversight to make them better accountable. Incredibly, till now, only the National Investigative Agency (NIA) has been legally mandated by an Act of Parliament !

Intelligence agencies, the world over, have a history of internecine turf battles, 'one-upmanship', apart from lack of coordination with each other. This malaise could be tided over by enlightened leadership of various heads of intelligence outfits in the larger interests of the nation. Additionally, Indian intelligence agencies should reach out to the intelligence agencies of friendly



Better coordination among various intelligence agencies could prevent or at least mitigate the impact of attacks such as those in Gurdaspur and Pathankot recently

needs to be seriously examined, including by the three Service headquarters. Absence of the much awaited Chief of Defence Staff (CDS) has meant sub-optimal utilisation of this prestigious institution. The DIA has to be adequately prepared for intelligence gathering and analysis as regards activities by various powers inimical to India's interests, in the turbulent waters of the Indo-Pacific, coastal intelligence *et al*. Services HQ must impress upon the CCS/MOD to speedily authorise establishment of the Tri-Services Cyber Command.

The Government must speedily implement the many key recommendations of various Policy Reforms Commissions, which have been gathering dust, to strengthen policing and intelligence gathering at the grassroots level, especially in areas afflicted by Left Wing Extremism and indigenous insurgencies.

foreign countries and share information on terrorist outfits which pose common threats. Global problems require global solutions and thus intelligence agencies will have to work towards synergising their resources bearing in mind, of course, national interests and how much can be shared. Interpol represents a good example of intelligence sharing among the investigative agencies across the world.

India today stands on the threshold of becoming a reckonable global player and the 'art and science' of Intelligence will have a major role to play in the attainment future goals and thwarting challenges to its security. It is very much in India's interest to exploit Intelligence as an effective force multiplier.

(The author has been Deputy Chief of the Integrated Defence Staff and was the first Chief of the DIA raised after the KRC report was implemented).

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Admiral Arun Prakash on

India's Civil-Military Discord: Grave National Implications



India's Republic Day in January 2016 will be celebrated with traditional pageantry and the citizen gets a panoramic view of the country's military capability. Intelligence inputs warn that it will be yet another test for the national security apparatus. However, it provides an opportune occasion to objectively review how India has dealt with its complex security challenges. Regrettably in India's National Security 'Hall of Shame' we can now add, 'Pathankot 2016' after 'Kandahar 1999', 'Parakram 2002' and 'Mumbai 2008.'

Given that India is a nuclear weapon state, which fields one of the world's largest armed forces and spends upwards of \$40 billion annually on defence, one cringes at accounts of our seemingly inept handling of yet another terrorist attack. Equally disheartening is the fact that, eight years after 26/11, we lack the ability to deter the architects of this attack, and the will to punish its perpetrators.

It is a matter of sheer good fortune that the cross-border terrorists who managed to enter the Pathankot air base failed to target aircraft, helicopters and missiles as well

as the huge bomb-dump and fuel-storage facilities. We overlook the fact that some of our air bases, adjuncts to the nuclear deterrent, may also house nuclear warhead components. So, while cautioning the world about the dangers of Pakistani warheads falling into jihadist hands, we need to ensure that a similar fate does not befall our own.

The calibre of a nation's leadership is tested by a crisis. Whether it is floods, an aircraft hijacking or a terror strike, India's response to any crisis has followed a depressingly familiar sequence. Regardless of intelligence inputs, the onset of a crisis

finds multiple agencies pulling in different directions, lacking unitary leadership, coordination and, above all, a cohesive strategy. Ad-hoc and sequential damage-control measures eventually bring the situation under control, with loss of life and national self-esteem. After a free-wheeling blame-game, the state apparatus relapses into its comatose state - till the next disaster.

From the media discourse, it appears that this template was faithfully followed in the Pathankot episode. While the military has due processes for learning from its mistakes and dealing with incompetence, one is not sure about the rest of our security system.

Whether or not India-Pakistan peace talks are resumed, the Pakistani 'deep state' has many more 'Pathankots' in store for India. For Pakistan's Inter-Services Intelligence (ISI), cross-border terrorism is an inexpensive method of keeping India off-balance. The strategy of plausible deniability and threat of nuclear 'first-use' assures them of impunity from retribution. Such situations call for all components of India's national security, military, intelligence, bureaucracy, central and state police forces to work in the closest synergy and coordination. Regrettably, civil-military relations have, of late, been deeply vitiated and the resultant dissonance could have adverse consequences for the nation's security.

What is worse, civil-military recriminations, so far, confined within the walls of South Block, seem to be proliferating. Post-Pathankot, the constabulary has jumped into the fray and, if an intemperately-worded newspaper article by a serving Indian Police Service officer is an indicator, civil-military relations may be entering a downward spiral. This outburst should compel the political leadership to undertake a re-appraisal of the prevailing civil-military equation which contains many anomalies, one of them being the role of the police forces.

Worldwide, an unmistakable distinction is maintained between the appearance and functions of the military and civilian police, the latter being charged with the maintenance of law and order, crime prevention/investigation and traffic regulation et al. India's unique security compulsions have seen the Indian Police Service not only retaining the colonial legacy of sporting army rank badges and star



plates but also garnering unusual influence in national security matters over the years.

Many of our Central Armed Police Forces (CAPFs) have blurred the distinction between police and military; terming themselves 'para-militaries', with constables wearing military style combat fatigues and being addressed as 'jawans'. There are only three, duly constituted, para-military forces in India: the Coast Guard, Assam Rifles and the Special Frontier Force; all headed by armed forces officers. The five CAPFs, namely BSF, CRPF, ITBP, CISF and SSB - cumulatively over a million strong - are headed by IPS officers.

The deployment of CAPFs in border-guarding as well as counter-insurgency roles calls for military (read infantry) skills; for which neither the police constables nor officers receive adequate training. This lack of training and motivation as well as a leadership deficit has manifested itself in: (a) these forces repeatedly suffering heavy casualties (confined only to constables) in Maoist ambushes; and (b) recurring instances of infiltration taking place across borders guarded by CAPFs.

In the case of the anti-terrorist National Security Guard (NSG), its combat capability comes from the army; yet, by government mandate, it is headed by a police officer. The fact that this elite force has seen 28 directors general in 31 years makes one wonder if round holes are being filled by square pegs.

A second anomaly in the civil-military matrix pertains to the fact that the Government of India Rules of Business have

designated the civilian secretary heading the defence ministry as the functionary responsible "for the defence of India and for the armed forces". Since no military officer, including the three chiefs, finds mention in the Business Rules, the Service HQs are subaltern to a 100 percent civilian ministry. Every major decision - whether it pertains to finance, acquisition, manpower or organisation - requires a ministry nod which can take decades.

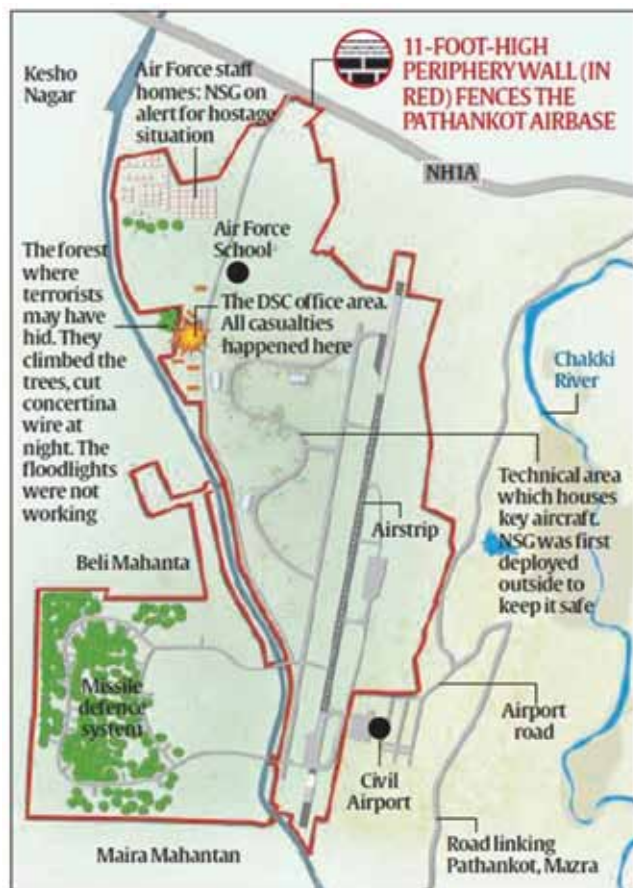
A false and dangerous belief prevails on Raisina Hill that civil-military relations constitute a zero-sum game in which 'civilian control' is best retained by boosting the bureaucracy and police at the expense of the military. Post-independence, the civil-military balance has been steadily skewed by pushing the military officer well below his civilian counterparts with the same years of service. This has caused deep resentment in the military, and the resultant hierarchical distortion could lead to a civil-military logjam - the last thing the nation needs at this juncture.

It is high time the Indian politician shed his traditional indifference to national security issues and took tangible measures to ensure a stable and equitable civil-military paradigm - one which ensures a say for the military in matters impinging on the nation's safety and security. Until that happens, the Republic Day parade will remain a vainglorious display of hardware and pageantry - and the nation's security in parlous straits.

Flashpoint: Air Force Station Pathankot, January 2016



Arguably the closest IAF air base to the international border with Pakistan, Pathankot which has always been prime target for India's western adversary (and was attacked both from the air and by paratropped commandos in September 1965) became headline news not only in the subcontinent but globally when heavily armed terrorists ('fidayeen') from across the border infiltrated into the high security area on New Year's Day 2016. 72 hours later, six of the intruders had been killed by security forces but not before seven of their own had lost their lives, mostly DSC personnel, but



Map not to scale

also an IAF Garud commando and a NSG officer, the latter by an IED explosion.

After action analysis has it that around 03.30 hrs. on 2 January 2016, some six heavily-armed persons wearing Indian Army uniforms breached the high-security perimeter of the airbase in Pathankot. The infiltrators possibly hid, using the elephant grass in the perimeter of the campus before making their strike. A nylon rope found over the 3.4-metre-high (11-foot) perimeter wall, looped from the ground up and then down again indicated the mode of entry, and there is speculation that one of the attackers climbed up an eucalyptus tree alongside the fence, bent it over with his weight to land on the wall. The floodlights in that stretch of the wall were apparently not working that night, which facilitated entry of the six attackers, carrying some 50 kilograms (110 pounds) of ammunition, 30 kg (70 lb) of grenades plus their automatic weapons.



Mi-35 over Pathankot airbase on search and destroy mission

These 'fidayeen', from the *Jaish-e-Mohammad* terrorist organisation, penetrated the living quarters of the air base, but were prevented from entering the technical area where "high-value assets" are housed, including MiG-21s and Mi-25/35s. A senior Punjab Police officer said that infiltrators "seemed to have jumped the wall and entered the base". The attackers were able to move 400 metres into the base through a forested area, before they were stopped by IAF's Garud commandos, some 700 metres away from the technical area. The attackers were carrying AK-47 rifles, grenades and launchers, 52 mm mortars and GPS devices. Objective of the attackers obviously was to destroy IAF aircraft and helicopters at the base.



Army Jawans in 'Operation Dhangu'

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According to intelligence reports, the attackers may have entered India on 31 December 2015 along the banks of the river Beas which meanders along and through the Indo-Pak border.



The strategic Pathankot–Jammu highway was sealed off immediately. The counter operation launched by the Indian Army to neutralise the attackers was named ‘Operation Dhangu’ or ‘Dhangu Suraksha’, after the place Dhangu where the air base is located. In his debrief, Lt General KJ Singh, GOC-in-C Western Command, the operations were “a complete success and an example of excellent synergy among the forces”. Employment of the NSG was essentially to prevent and tackle any hostage situation, particularly as there were a number of foreign air force trainees at Pathankot at the time.



Prime Minister Narendra Modi, the NSA Ajit Doval, COAS General Dalbir Singh and CAS Air Chief Marshal Arup Raha were briefed on counter-terrorist and combined operations at the Pathankot airbase on 9 January 2016.

Although the sensitive international border has numerous BSF posts, and the area is lit with high mast lights, but with more than 40 unfenced riverine stretches along the India-Pakistan frontier in this sensitive area, laser devices are reportedly being installed to further reinforce measures against infiltration of terrorists.

Rostec and HAL to implement Ka-226T project

During Indian PM Narendra Modi’s official visit to Moscow in December 2015, an agreement was signed between the Russian Federation and the Republic of India on cooperation in the field of helicopter manufacturing. “State Corporation Rostec will organise the production of at least 200 Kamov Ka-226T light helicopters, with 40 to be built in Russia and the remainder be assembled by HAL in India.” The agreement also provides for the maintenance, operation, repair and technical support of the helicopters.



“The production of Ka-226Ts in India is a big step forward in the development of business relations between the two countries,” said Russian Helicopters CEO Alexander Mikheyev. “Through the implementation of this ambitious project, we plan to strengthen the position of Russian Helicopters in the strategically important South Asian market. I am confident that the project will be successful and will open new prospects for cooperation between India and Russia.”

‘1200 Helicopters needed for Army, Air Force and Navy’

According to analysts, over 1200 helicopters of different types are needed by the Indian Army, Navy, Coast Guard and Air



HAL Chetak during Army Day Parade 2016 (photo: Angad Singh)

Force over next 10-15 years to replace aging fleets. The Armed Forces need 484 light utility helicopters to supplant obsolete Cheetah/Chetak fleets (Army 259, IAF 125, Navy 100), while a tender for the Navy's requirement of over 50 twin-engined light helicopters with foldable blades is yet to be issued.

Further, the Navy requires 147 multi-role and anti-submarine warfare helicopters, even as commercial negotiations have still to commence on initial procurement of 16 helicopters from Sikorsky, with another 8 under an option clause. The project for indigenous manufacture of 123 such helicopters is yet to get acceptance of necessity (AON).

LCA Mk.1A production planned



According to Dr S Christopher, Chief of DRDO, since the proposed LCA Mk.II with a GE F-414 engine and a lengthened fuselage will not be ready before 2024, an option could be production of the Tejas Mk.1A from 2017 for the IAF. He was "hopeful of an order for 100 Mk.1As before the end of the current financial year". Dr Christopher stated that the Mk.1A will address such requirements as provision of an AESA radar and ESM (Electronic Support Measures) the latter carried externally on a pod instead of within the fuselage, as also a mid-air refuelling system.

Sukhoi seeks JV in India

It has been reported that Sukhoi is exploring the possibility of investing in an Indian joint venture for maintenance and production of spares for its fighter aircraft, the objective being "to make India a hub for the Su-30 fighter fleet operating in the region including Malaysia, Indonesia and Vietnam". The Russian manufacturer is reportedly in discussions with Indian private sector companies, particularly Tata "which has necessary technical expertise." Valery V Chishchevov, marketing director of Sukhoi, said that the company intends to "create a unit in India for service and maintenance that can implement repair and overhauls of the aircraft and engine, jointly".

Such an approach becoming reality has been facilitated by the changes in the FDI policy of the government. Maintenance and servicing of the Su-30MKI in India could mean big business since,



according to an estimate, the IAF spends about Rs.3000 crore annually on its fleet, and orders could, additionally, flow in from other countries in the region operating the Su-30.

The viability of such a venture for repair and maintenance of the Su-30 becomes significant, considering that the Government of India is in process of signing an agreement with Russia for faster delivery of spare parts for the Su-30MKI fleet over the next five years.

Gripen offered for 'Make in India'

As part of the high level delegation from Sweden visiting New Delhi on 20 December 2015, Ulf Nilsson, head of Saab's Aeronautics Division, has stated that the Company is offering to manufacture the next generation Gripen multi-role combat aircraft "with comprehensive technology transfer to India." The offer includes setting up production facilities at a selected site in the country and thereafter collaborate in the development of futuristic programmes with Aeronautical Development Agency (ADA), which would "consolidate such capability for the next 100 years."



Mr. Nilsson offered 'real' technology transfer to India with "full system" and "full software". It is understood that Saab are already in process of identifying partners for collaboration on this Gripen-centric 'Make in India' project.

Combined Commanders Conference on board INS Vikramaditya



Prime Minister Narendra Modi being introduced to senior Army Commanders

On 15 December 2015, Prime Minister Narendra Modi chaired a Combined Commanders Conference on board INS Vikramaditya at sea off the coast of Kochi, the first time such Conference has been held on board an aircraft carrier.



Prime Minister Narendra Modi meeting senior Naval Commanders



Prime Minister Narendra Modi meeting senior Air Force Commanders

Later, the PM witnessed an operational demonstration of naval and maritime air capabilities, which included take-offs and landings of MiG-29K fighters from INS Vikramaditya, missile firing from a warship, flypast of helicopters and fighters, marine commando operations, concluded with a steam-past of warships, including INS Viraat.

DPP 2016 announced

On 11 January 2016, the Government approved major part of the changes which result in the new Defence Procurement Procedure (DPP) 2016 with some aspects yet to be finalised. Speaking at a specially convened Conference in New Delhi, Defence Minister Manohar Parrikar stated "We have finalised the DPP 2016. The major part of the changes have been approved today. What is now left is minor changes."



The new document - DPP 2016 - which will take some two months to be notified, allows government funds up to 90 per cent of development costs to private companies "to push research and innovation, with the objective of enhancing private sector participation and speed up procurement process." It has also brought down the Acceptance of Necessity (AoN) validity to six months from earlier one year, which means that the forces will have to issue tenders faster.

Mr Parrikar also said "We currently have signed offsets worth USD 5 billion and another USD 8 billion are in pipeline. We may not be able to absorb all of this. Moreover, offsets also increase the cost of the product by 14-18 per cent," Parrikar said explaining why the threshold has been increased.

The Future Infantry Combat Vehicle (FICV) programme

On 16 January 2016, the Ministry of Defence announced that nine private sector companies would compete to develop the future infantry combat vehicle (FICV) and that OFB (Ordnance Factory Board) would be nominated without competing as a third development agency. The FICV project is estimated to be worth around Rs 50,000 crore, given that some 2,600 FICVs are needed to replace the Army's ageing Russian-origin BMP-2 infantry combat vehicles.

The MoD's initial Expression of Interest (EoI), released in July 2015, invited ten companies to submit proposals to develop the FICV under the DPP's 'Make' clause, and specified that two development agencies would be chosen. The revised decision to include OFB came a day before the ten companies were to submit their responses to the EoI, forcing the MoD to extend the date of submission by a month, to 15 February.

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Indian Army BMP-2 manufactured by Ordnance Factory, Medak

The FICV bids assume that each company will spend approximately Rs 1,000 crore in developing prototypes, of which 80 per cent will be reimbursed to them by the MoD, according to the 'Make' procedure. By nominating OFB as a third development agency, the Ministry is therefore set to increase the development cost of the project by about Rs 800 crore.

DAC approvals, including for S-400

The Defence Acquisition Council (DAC) has reportedly cleared purchase of the Russian S-400 Triumf air defence system involving five units at an estimated cost of Rs 40,000-crore. These strategic systems are designed to neutralise hostile aircraft, missiles as also drones at a range of up to 400 km. The S-400 Triumf is also capable of taking out ballistic missiles and hypersonic targets.

The DAC also gave the "acceptance of necessity" to army's proposal for the purchase of six regiments of the Pinaka rocket system under the 'Make in India' category for Rs 14,600 crore. Each regiment of the Pinaka has 18 launchers with every launcher having the capability of firing 12 rockets at the same time.

The DAC has approved the Army's requirement for 571 light bullet-proof vehicles to be used in counter-insurgency and counter-terrorism operations, also cleared at a cost of Rs 310 crore and also go-ahead for the purchase of 120 trawls to be used on Russia-origin T-72 and T-90 tanks under 'Buy Global' category for Rs 450 crore.

CAG audit report in Parliament

Contents of the Comptroller & Auditor General of India (CAG) report tabled in Parliament on 18 December 2015 have been widely commented upon in various forum, as it refers to operational capabilities of the Indian Air Force and Army Aviation Corps, ranging from poor serviceability of Sukhoi Su-30MKIs, the A-50 AWACS and the virtually obsolete Cheetah/Chetak light helicopters.

As per CAG report, the AWACS were "high value national assets" that could be "a deciding factor" during conflicts, but there was "sub-optimal utilisation" of their operational capabilities in terms of "flying tasks" due to poor planning and serviceability. "On an average, there was a 43% shortfall against the established task of 1,500 flying hours per annum".

The CAG also reported the defence ministry's continuing failure to replace the Cheetah/Chetak fleets -129 of the 181 helicopters are over 30 years old – which the Army Aviation Corps (AAC) uses for reconnaissance and servicing forward areas like Siachen. "AAC is plagued with 32% deficiency in its authorized fleet strength... low level of helicopter serviceability further reduces the effective operational availability to 40% of authorisation".

The Sukhoi Su-30MKI fleet suffers from a "high rate of AOG (aircraft on ground since not airworthy)" due to lack of spares and non-availability of adequate repair facilities. The jets also suffer from "frequent snags" in their fly-by-wire systems and deficient radar warning receivers, among other things.

Platinum Jubilee at HAL Heritage Centre

Rao Inderjit Singh, Minister of State for Defence, inaugurated HAL's renovated Heritage Centre and unveiled a special Platinum Jubilee plaque on 12 December 2015. Speaking on the occasion, RV Deshpande, Karnataka Minister for Large and Medium Scale Industries and Tourism announced that the HAL Heritage Centre and Aerospace Museum would now be counted as one of Bangalore's tourism spots. HAL CMD T Suvarna Raju said that more aircraft would be added to the Museum, which has been extensively refurbished since it was established in 2001.



Rao Inderjit Singh, (fifth from right), RV Deshpande, (sixth from right), T Suvarna Raju, CMD, HAL (fourth from right) and others seen at the HAL Heritage Centre and Aerospace Museum

The MoS for Defence also digitally inaugurated HAL's upgraded Heritage Centres and Aerospace Museums at Koraput (Odisha), Korwa (UP) and Nasik (Maharashtra), along with a web portal, www.halmuseum.in

HAL's HTFE-25 turbofan engine

Inaugural run of HAL's 25 kN indigenous turbofan engine, or HTFE-25, was conducted in presence of Defence Minister Manohar Parrikar at HAL's Engine Division in Bangalore on 14 December 2015. The engine is being developed for basic, intermediate and advanced trainer aircraft, and also to power business jets and similar light general aviation aircraft. The Defence Minister also launched design and development of the 1,200 kW Hindustan Turbo Shaft Engine (HTSE-1200), being developed for helicopters.



Defence Minister Manohar Parrikar and HAL CMD T Suvarna Raju at inaugural run of the HTFE-25

Complimenting HAL Parrikar also said that concerted efforts should be made to achieve maximum success in the aeronautical sphere, with active participation of HAL and the private sector. The Defence Minister also referred to HAL's HTT-40 basic trainer programme, noting that the company is "almost there".

New HAL helicopter facility at Tumkur

On 3 January 2015 Prime Minister Narendra Modi laid the foundation stone for HAL's new Helicopter Manufacturing Facility at Tumakuru (Tumkur), some 100 km from Bangalore. "With this, the small village has come on the world-map as it would be manufacturing machines that would protect the country. It is no ordinary facility, as the world's attention would be focused on it. I expect the indigenous helicopter under 'Make in India' to fly out by 2018 ... [this] is a gift from Government of India to the people of



Karnataka, Tumakuru in particular. Nearly 4,000 families, directly or indirectly will benefit from this investment of Rs 5,000 crore."

The Prime Minister hoped that HAL would produce 600 helicopters in 15-year period and India's military would be the greatest beneficiary. "I want companies such as HAL to help the country reduce dependency on overseas suppliers," he said.

HAL's 'Centre for Aerospace Management Excellence & Leadership'

Defence Minister Manohar Parrikar inaugurated HAL's Centre for Aerospace Management Excellence & Leadership at Marathahalli on 15 December 2015. Addressing the gathering, he said that the new facility is the right step for training human resources to ensure the success of 'Make in India.' He hoped the new centre would become a focus of technology and management expertise in India.



The 16-acre campus is being built adjoining the ISRO campus and aims to promote design and engineering excellence with modern infrastructure. The HAL Management Academy (HMA) is involved in management and design training, and also provides learning and development opportunities for middle and senior level executives.

HAL seeks foreign partners for regional airliner

According to T Suvarna Raju, CMD HAL, the organisation is expected to float a tender by March 2016 inviting global aircraft manufacturers to partner it in the design and development of a 50-70 seat airliner. The project is estimated to cost Rs 7,000 crore including manufacture of three prototypes, testing and certification.

Some time back, National Aerospace Laboratories (NAL) and HAL had been cleared to set up a special purpose vehicle (SPV) for a regional transport aircraft project, the RTA-70, but this was not progressed. Since 2007, NAL have been conducting in-house design studies for a turboprop airliner but this never went beyond the drawing board. "There will be a requirement for 200 such aircraft in India over the next five years," said T Suvarna Raju.

Guideline document on HADR at IONS

The CNS Admiral RK Dhowan, attended the 5th Edition of the Indian Ocean Naval Symposium (IONS) in Bangladesh, where he presented a guideline document on Humanitarian Assistance and Disaster Relief (HADR). The theme of the Symposium this year was 'Fostering Partnership in IOR: Charting course for Maritime Cooperative Engagement.' 35 littoral states in the Indian Ocean Region (IOR) have been grouped into four sub-regions (South Asian, West Asian, East African and South East Asian littorals including Australia). IONS seeks to provide a regional forum through which the Chiefs-of-Navy (or equivalent maritime agency) of all the littoral states of the IOR periodically meet to constructively engage each other through the creation and promotion of regionally relevant mechanisms, events, and activities.

Indo-Japan Coast Guard Exercise Sahyog-Kaijin

Ships and aircraft of the Indian and Japan Coast Guards carried out joint training exercises as part of the 15th edition of the bilateral *Sahyog-Kaijin* joint exercise in the Bay of Bengal on 15

January. ICGS *Samudra Paheredar*, ICGS *Sarang*, ICGS *Vishwast*, ICGS *Rajtarang*, ICGS *Rajkamal*, a Dornier 228 and Chetak helicopters were from the Indian CG, while the Japan Coast Guard sent JCGS *Echigo* with its integral Sikorsky S-76 helicopter.

Vice Admiral HCS Bisht, DG ICG, said that the exercise was aimed at "fine-tuning the coordination between the forces", while Vice Admiral Hideyo Hanamizu, Vice Commandant of the JCG said he was "extremely satisfied" with the coordination of the forces and hoped that the exercise in the future would not only be wider but also deeper.

Indo-Russian Navy Exercise

8th edition of the joint Indo-Russian naval exercise '*Indra Navy*' was conducted in the Bay of Bengal 7-12 December 2015, primary aim of this being "to increase interoperability between the two navies and develop common understanding of procedures for maritime security operations". The Indian Navy deployed its stealth frigate INS *Sahyadri*, the guided missile destroyer INS *Ranvijay*, fleet support vessel INS *Shakti*, Kilo-class submarine INS *Sindhuvir*, Boeing P-8Is, Dornier 228s, Hawks and various helicopters. The Russian Navy detachment, led by Vice Admiral Andrey Ryabukhin, Deputy Commander of the Pacific Fleet, included the cruiser *Varyag*, the destroyer *Bystry*, rescue ship *Alatau*, and fleet tanker *Boris Butoma*.



ICG vessel and JCG helicopter during the exercise



US Pacific Fleet Commander visits India

Admiral Scott Swift, Commander, US Pacific Fleet visited New Delhi 7-9 January 2016, with an aim "to consolidate the growing defence relations between India and US and also to explore new avenues for naval cooperation".

Admiral Swift held bilateral discussions with CNS Admiral RK Dhowan on 8 January and also interacted with the DCNS and members of the Naval Maritime Foundation. "The on-going construction of the first Indigenous Aircraft Carrier (IAC-1) and planning for the second has seen cooperation in the field of aircraft carrier construction emerge as one of the major focus areas for the two Navies." Other issues discussed during the visit included



enhancement of scope and complexity of exercises, training exchanges, improving maritime domain awareness by sharing of 'white shipping' information.

CSL launches 19th FPV

Cochin Shipyard launched BY 519, the nineteenth of 20 *Aadesh*-class Fast Patrol Vessels (FPVs) being built for the Indian Coast Guard. The vessel will be named ICGS *Atulya* once it enters service with the Coast Guard. As of December 2015, 15 ships out of 20 have been delivered to the Indian Coast Guard, with an average delivery interval of 1.6 months against a contractual requirement of 3 months.

Delays in IAC project

Cost of the Indigenous Aircraft Carrier (IAC) under construction at Cochin Shipyards Limited (CSL) has escalated from Rs 3,261 crore to a massive Rs 19,341 crore. The Government, in its reply to a parliamentary question, has stated that the main reasons in time and cost overruns in the project were due to shortage of Russian steel and delays in receipt of critical pre-launch equipment such as gear box and 3MW diesel generators. Timely completion of IAC (INS *Vikrant*) is crucial to the operational capability of the Indian Navy, which will be left with INS *Vikramaditya* by mid-2016 after its other carrier INS *Viraat* retires.



According to Chairman of the Standing Committee "Over time, and with the experience of *Vikramaditya*, the 'form and fit' of the vessel has been finalised and many emerging technological advances/ new generation equipment incorporated in the IAC. Increased equipment costs, including of weapons and sensors, and AFC due to finalisation from generic to specific equipment has further added to the cost overrun and in case of INS *Vikramaditya*, there had been huge cost escalation due to repeated time extensions. These time and cost overruns in almost all the projects is a major cause of concern."

Fincantieri collaboration with MDL and GRSE for P-17A frigates

Fincantieri has signed a contract with Mazagon Dock Limited (MDL) to provide technical advice for the Indian Navy's Project-17A frigates, a follow on to the three *Shivalik*-class (Project 17) stealth frigates already in service and envisages construction of 7 stealth frigates at MDL, Garden Reach Shipbuilders and Engineers (GRSE). The agreement will be focused on development of detailed engineering aimed at integrated building in the two yards, design optimisation processes and modular construction, training, and ongoing technical assistance for every stage of design until delivery.

Project 17A frigates are planned with a displacement of around 6,400 tons, the first time modular construction across multiple shipyards is being explored in India.

Fifth LCU Mk.IV launched

L-55, the fifth vessel of the eight-ship LCU Mk.IV project was launched on 7 December 2015 at Garden Reach Shipbuilders



and Engineers (GRSE) in Kolkata. Vice Admiral AV Subhedar, Chief of Material and Rear Admiral AK Verma (ret), Chairman and Managing Director, GRSE were present, the former acknowledging GRSE's role as a partner in pursuing the national goal of 'Make in India' and stated that the Navy was looking forward to the induction of the LCU Mk.IV ships, which will be based at Port Blair.

IN conducts LR-SAM test firing



On 30 December 2015, the Indian Navy carried out test firing of the Indo-Israeli-developed Long Range Surface to Air Missile (LR-SAM) or Barak-8. Two missiles were fired by INS *Kolkata* off the western coast, and successfully intercepted high-speed aerial targets at extended ranges. This successful first test was jointly carried out by the Indian Navy, DRDO and Israel Aerospace Industries : the LR-SAM will be manufactured in India by Bharat Dynamics Limited (BDL). The system also includes the Israeli Multi Functional Surveillance and Threat Alert Radar (MF STAR) for detection, tracking and guidance of the missile.

The LR-SAM, or Barak-8, jointly developed by the Israel Ministry of Defence and DR&DO (Defence Research and Development Organisation) in India, is an advanced air and missile defence system, providing protection against a variety of aerial platforms, in both land and naval scenarios. The system is considered an essential project by the Israeli MoD and is led by Israel Aerospace Industries (IAI), as prime contractor, in collaboration with the Israeli MoD's Directorate of Defence Research and Development (DDR&D), IAI's Elta Systems subsidiary, Rafael Advanced Defence Systems, and other defence industries.

Indian Satellite Monitoring Station in Vietnam

India's strategic reach is extending to the South China Sea region with its new satellite monitoring station in Vietnam expected to be activated soon and linked to another existing facility in neighbouring Indonesia. The \$23 million Data Reception and Tracking and Telemetry Station has been set up near Ho Chi Minh City in southern Vietnam, and will link with a similar Indian station in Biakin, Indonesia. India has another satellite tracking station in Brunei.

IRNSS-1E launched by PSLV C31

ISRO successfully launched its fifth navigation satellite, IRNSS-1E, on board PSLV-C31 from Sriharikota on 13 January. After the satellite's injection into Geo-synchronous Transfer Orbit

(GTO), the two solar panels of IRNSS-1E were automatically deployed in quick succession.

IRNSS-1E is the fifth navigation satellite in the Indian Regional Navigation Satellite System (IRNSS) space system, which will comprise seven satellites once complete. IRNSS is envisaged to be a regional equivalent of the US-controlled GPS (Global Positioning System) once the full complement of spacecraft is launched. While four satellites are sufficient to start operations of the IRNSS system, the additional three make it "more accurate and efficient."



Fully integrated PSLV-C31 with IRNSS-1E at Second Launch Pad

PSLV launches six Singaporean satellites

On 16 December 2015, in its 32nd flight conducted from the Satish Dhawan Space Centre, Sriharikota, ISRO's Polar Satellite Launch Vehicle PSLV-C29 successfully launched six satellites from Singapore into a 549-km orbit. The 400 kg TeLEOS-1 was the primary satellite and the other five satellites were 'co-passenger' payloads launched as part of an agreement entered into between ST Electronics (Satcom & Sensor Systems), Singapore and Antrix Corporation Limited, ISRO's commercial arm. This was the eleventh flight of PSLV in 'core-alone' configuration (without the use of solid-fuel strap-on motors).



Army Day 2016



HAL Rudra over the parade ground : note gun turret and electro-optical sensor slewed to the right (photo: Angad Singh)



COAS General Dalbir Singh reviewing the parade (photo: Angad Singh)

6⁸th Army Day was marked with a ceremonial parade in Delhi Cantonment on 15 January 2016, where General Dalbir Singh, Chief of the Army Staff, reviewed the parade and awarded thirteen Unit Citations and fifteen Sena Medals (including five posthumously) for individual acts of gallantry.

The parade comprised seven mechanised contingents : T-90 MBT, BMP II ICV, Brahmos missile system, Akash missile system, BM-30 Smerch multiple barrel rocket launchers, Troop Level Radar (TLR), and Integrated Communication Electronic Warfare System, and nine marching contingents. The marching contingents included an Army Dog contingent for the first time in over two decades.

Another first at the 2016 parade was inclusion of HAL Rudra attack helicopters (weapon-integrated variants of the Dhruv ALH), now formally in Indian Army service with No.251 Army Aviation Squadron. A single Rudra was part of the opening flypast, while a pair of the all-black rotorcraft took part in the combat demonstration, swooping low over the parade ground, pylons bristling with dummy weapons. The combat demonstration also included ALH Mk.IIs and Mk.IIIIs, a pair of HAL Chetaks and two HAL Cheetahs, in addition to the usual mix of ICVs, tanks and artillery.



The indigenous Akash SAM system on parade (photo: Angad Singh)

Army Chief visits Sri Lanka

General Dalbir Singh, COAS, conducted a four-day goodwill visit to Sri Lanka from 30 November 2015, continuing a series of high-level bilateral exchanges with the Island country. During his visit, the COAS interacted with senior military officers as well as Ministry of Defence officials to discuss a wide range of issues and to enhance military cooperation.



Gen Dalbir Singh, COAS paying homage at the IPKF Memorial at Colombo

Sri Lanka is a key partner nation in the Indian Ocean Region (IOR) and defence and security cooperation between the two countries has been an important component of the bilateral relationship. This cooperation between the two countries has been characterised by joint training exercises, personnel exchanges at the functional level, maritime security collaboration and humanitarian assistance.

Women fighter pilots in IAF



File photo of IAF women pilots in the transport stream

The government has amended the hitherto rigid combat-exclusion policy for women prevalent since they began joining the armed forces in the 1990s. There are presently 94 women pilots in the IAF who fly helicopters and transport aircraft. According to Rao Inderjit Singh, Minister of State for Defence, the IAF will commission women as fighter pilots from June 2016 on an “experimental basis for five years”. Graduating from the Air Force Academy at Dundigal on 19 December, after Stage I flying on Pilatus PC-7s, three women pilots were selected for Stage II flying training at Hakimpet on Kiran Mk.IIs. subject to their clearing this phase, Stage III training would be on Hawks at Bidar.

‘Project Ghatak’

It has been reported that the Rs 2650 crore *Project Ghatak*, to develop a “futuristic Indian Unmanned Strike Air Vehicle”, will to be executed by DRDO in consultation with the IAF, is a sequel to AURA (autonomous unmanned research aircraft) programme sanctioned in 2009 to carry out a “conceptual and feasibility study”.

US armed drones for India?

Defence industry sources in Washington DC have indicated that India has sought some 100 unmanned aerial vehicles, both armed and surveillance versions. India has shown interest in acquisition of the latest Avenger unmanned combat air vehicle, as also the Predator XP, a surveillance platform to meet terrorist threats. It is understood the US has not made any firm commitment as yet.

US engines for AMCA ?

During Defence Minister Manohar Parrikar’s visit to the United States in December 2015, he was briefed on the possible co-development of a jet engine for India’s indigenous fifth-generation fighter Advanced Medium Combat Aircraft (AMCA). General Electric Aviation (GE) and DRDO have been engaged in uprating the F414-INS6 engine for the Tejas LCA Mk.II, in an effort to enhance the current engine’s max thrust to 110 kN. Mr Parrikar and Secretary Carter also discussed other programmes including Aircraft Launch and Recovery Equipment (ALRE) at the Joint Working Group on Aircraft Carrier Technology Cooperation (JWGACTC).

Reliance Defence acquires Pipavav stake

Swedish defence company Saab has sold its stake (approximately 3.3 per cent) in Pipavav Defence and Offshore Engineering Company Limited to Reliance Defence Systems Private Limited. “It is natural to act on the enquiry we got from Reliance Defence Systems to acquire our stake in Pipavav. We believe the cooperation between Saab and Pipavav now has the potential to get even better with the new owner,” said Jan Widerström, head of Saab India. “Saab works actively in support of India’s strategy to increase its national ability to produce defence material. Local partnerships are being fostered to meet the needs of the customer and the market conditions.”

Lockheed Martin sensors for Indian Apaches

The US Army has awarded Lockheed Martin a \$107.8 million foreign military sale (FMS) contract to provide Modernised Target Acquisition Designation Sight/Pilot Night Vision Sensor (M-TADS/PNVS) systems to the Government of India. The contract includes 23 M-TADS/PNVS systems and spares for India.



Operationalised in 2005, M-TADS/PNVS provides Apache pilots with long-range, precision engagement and pilotage capabilities for safe flight during day, night and adverse weather missions. The forward-looking infrared sensors' enhanced image resolution enable Apache aircrews to accurately identify targets and provide situational awareness to ground troops outside of detection ranges. Lockheed Martin has delivered more than 1,300 M-TADS/PNVS systems and spares to the US Army and international customers.

"Lacunae in Draft Aviation Policy"

Analysts have opined that the draft aviation policy, recently released by the Ministry of Civil Aviation, has some glaring omissions, the foremost relating to the future of Air India which absorbs most of the budget of the ministry, some Rs 6000 crore every year. "In fact, Rs 6000 crore is enough to set up three new airlines every year," feels an aviation analyst.

Similarly, the policy makes no mention of steps to reform the Directorate General of Civil Aviation (DGCA), to separate economic regulation from safety regulation, the two functions being performed by it, this separation recommended by the Naresh Chandra Committee report along with setting up a Civil Aviation Authority.

Further, there is lack of clarity in the proposal made in the draft-policy to charge a cess and build a corpus for subsidising connectivity to remote areas. The term 'remote area' has been left vague without a definition and hence it is subject to political influence. The network or the cities to be covered by the subsidy have not been specified.

Air India "not to oppose removal of 5/20 rule"

Air India will not oppose removal of the '5/20 rule', making it easier for the government to bring to an end this restrictive practice. As per reports, Air India CMD Ashwani Lohani has stated that the airline would not oppose the proposed scrapping of the



rule. Under the 5/20 rule, an airline should have operated for five years and have at least 20 aircraft in its fleet to fly international routes. Earlier, Air India had strongly expressed its reservation, stating it was not in the carrier's interest.

The draft civil aviation policy proposes abolishing of the rule and replacing it with a credit-based system Civil Aviation Minister Ashok Gajapathy Raju and minister of State Mahesh Sharma, have reportedly Stated that in their 'personal opinion', the rule should be scrapped.

Abolition of the rule will be a game changer for Indian skies, hugely benefitting new entrants such as Vistara and Air Asia. Older private airlines such as IndiGo, Jet Airways, Spice Jet, which have already fulfilled the criteria are also not in favour of scrapping of the regulation. The Federation of Indian Airlines (FIA), a lobby group which counts the above airlines among its members, had earlier written to Prime Minister Narendra Modi saying scrapping the rule would give foreign airline-controlled entrants an advantage.

IndiGo inducts 100th Airbus A320

In December 2015, IndiGo included the 100th Airbus A320 airliner in its fleet. IndiGo currently operates 653 daily flights connecting 39 destinations, with a Technical Dispatch Reliability of 99.91%, is among the fastest growing airlines in India, and has flown over 95 million passengers to date.



IndiGo plan flights to Doha

IndiGo plans to launch Delhi-Doha services in 2016, the Qatari capital expected to be IndiGo's sixth overseas destination and its third in the Gulf after Dubai and Muscat. The choice of Doha is significant, as Indian carriers have underutilised traffic rights to Qatar. At present, Air India Express and Jet Airways fly to Doha while Qatar Airways flies to 13 cities in India and has been seeking additional flights to the country.



Go Air explores international services to Kuwait, Tehran

GoAir is evaluating destinations such as Kuwait, Male (Maldives) and Tehran for its planned international services in 2016, when it inducts its 20th aircraft.

At present, GoAir has 19 Airbus A320 aircraft, but has ordered 72 A320neo, which will be added to the fleet when deliveries start next year. The airline has had the slowest fleet growth among its peers with an average addition of two airliners a year and has been unable to launch international flights till now because the 5/20 rule



require airlines to be in operation for five years and to possess 20 aircraft in their fleet for overseas flights.

At present, Air India and SpiceJet fly to Maldives and Air India and Jet Airways to Kuwait, but no Indian carrier flies to Tehran, although Iranian carriers fly to Delhi and Mumbai. Similarly, Kuwait and Maldives are connected with India with airlines from both sides.

SpiceJet in major expansion

SpiceJet's CMD Ajay Singh is directing a major expansion of the airline including a complete change of fleet. Both Airbus and Boeing have sent their proposals for the A320neo and B-737 Max, respectively. According to him "Today we are a relatively small airline and can therefore have a mixed fleet ... when we place a large aircraft order, we will have either an all 320neo or 737 Max fleet. If Airbus is able to make a better offer than Boeing, I will change my fleet to all A320s and if Boeing makes a better deal, I will have all B-737s," he clarified.

"We will have only one type of regional aircraft ... all aircraft manufacturers have told us that they will find new homes for our existing fleet if we choose their aircraft. I am ready to begin with a clean slate with the aim of having lowest possible cost structure



that, along with revenue generation, leads to a consistently profitable growth for the next 10 to 15 years."

HAL receives Raksha Mantri Awards

Hindustan Aeronautics (HAL) was conferred with a number of 'Raksha Mantri Awards,' presented by Defence Minister Manohar Parrikar at a function in New Delhi on 27 January. The award for 'Excellence in Performance, Innovation and Indigenisation' was received by HAL CMD T Suvarna Raju, who said that the event was "a recognition of the faith reposed on HAL by its customers. HAL is a leader amongst Defence PSUs in the field of high-end technology and the Government trusts the Company as a flag bearer in the 'Make in India' campaign."



The Defence Minister presenting a trophy to T Suvarna Raju at the ceremony

The award for 'Excellence in Performance under institutional category for the year 2012-13' was bestowed upon HAL "in recognition of significant improvements in organisational performance, excellence through R&D, improved production and financial performance, export promotion, technology upgrades, focus on customer service, adoption of quality management systems and human resource management initiatives."

HAL's Avionics Division, Hyderabad, received the award for 'Best Performing Division of Defence PSUs for the year 2013-14,' while the Strategic Electronic R&D Centre (SLRDC), also in Hyderabad, bagged the 'Excellence Award' for successful re-engineering and indigenisation of the Floating Deck High Voltage (FDHV) module of the PAR 2080C ground radar that guides landing aircraft.

The award for 'Excellence in the Innovation category for the year 2012-13' was jointly presented to HAL's Transport Aircraft Division (TAD), Kanpur, and Avionics Division, Korwa. TAD Kanpur received the award for 'Electro Plasticity Assisted Incremental Foaming (EPAIF)', a process that produces high strength and difficult to deform aerospace materials, while Avionics Division Korwa got the award for their new 'Deployable Flight Data Recorder System,' a new generation 'black box' that separates from an aircraft so as to be easily located in the event of a mishap.

Air Marshal SBP Sinha is AOC-in-Central Air Command

Air Marshal SBP Sinha took over as Officer Commanding-in-Chief of Central Air Command at Allahabad, on 1 January 2016, he was commissioned in the fighter stream of the IAF on



15 June 1980, has flown the Hunter, MiG-21, Mirage 2000 and Su-30MKI and has over 3700 flying hours. Being a 'Cat A' Flying Instructor, Instrument Rating Instructor and Examiner, and a graduate of the Defence Services Staff College, he has undergone 'Operational Electronic Warfare Course' in France and 'Executive Course on Security Studies' in USA. He is also the Commodore Commandant of No.7 Squadron ('Battle Axes').

Vice Admiral AB Singh is DCIC SFC

Vice Admiral AB Singh has assumed the duties of Deputy Commander-in-Chief of the Strategic Forces Command at New Delhi. A specialist in Navigation and Aircraft Direction, the officer has served in a large number of operational naval ships. He has also been an Instructor at NDA, Khadakwasla, Navigation & Direction School, Kochi and Directing Staff at DSSC Wellington. Vice Admiral Singh has served at Naval Headquarters as Deputy Director and Principal Director at the Directorate of Naval Plans. He also set up the Directorate of Strategy, Concepts and Transformation as Principal Director.



Air Marshal Bhadauria is DCAS

Air Marshal Rakesh Kumar Singh Bhadauria took over as Deputy Chief of the Air Staff, on 1 January 2016, prior to which he was Senior Air Staff Officer at Central Air Command.

An Experimental Test Pilot, Cat 'A' Qualified Flying Instructor and Pilot Attack Instructor with over 4200 hours of experience on over twenty five types of fighter and transport aircraft. Air Marshal Bhadauria is an alumnus of the National Defence Academy, and was commissioned as a fighter pilot in June 1980. During his 35-year operational career in the IAF, Air Marshal Bhadauria has commanded a Jaguar Squadron and a premier Air Force base in the South Western Sector. He commanded the Flight Test Squadron at Aircraft & Systems Establishment, was Chief Pilot and Project Director of National Flight Test Centre on the LCA programme, Air Attache at Moscow and Assistant Chief of the Air Staff (Projects).



Alistair Castle is Vice President and GM BAE Systems India

BAE Systems has announced the appointment of Alistair Castle as Vice-President and General Manager of its India operations, with effect from 1 January 2016. Castle moves from Kuala Lumpur, Malaysia where he was the Regional Vice President responsible for Group Business Development in South East Asia. He succeeds Mark Simpkins who concludes his second tenure in India and takes up new responsibilities based in the Middle East. Castle will continue to report to John Brosnan, BAE Systems' Regional Managing Director, India & South East Asia.

Castle takes charge at a time when BAE has proposed a state-of-the-art Assembly, Integration & Testing (AIT) facility in India with an Indian industrial partner for the delivery of M777 ultra-light howitzers. BAE Systems is also negotiating a 20-aircraft contract with HAL to build Hawk advanced jet trainers for the IAF's *Surya Kiran* aerobatic team.



Tejas LCA's international debut at Bahrain



The Tejas Light Combat Aircraft (LCA) made its first foreign appearance at the Bahrain International Air Show held between 21-23 January 2015 at Sakhir Air Base. Two 'Limited Series Production' (LSP-4 and LSP-7) aircraft, along with test pilots and support crews, deployed to Bahrain via Jamnagar and Muscat earlier in the month. The Tejas programme only recently completed testing that clears the LCA for aerodynamic loads up to 8 times the force of gravity (8g).

The two LCAs were joined at the show by the IAF's Sarang helicopter display team, flying the HAL Dhruv ALH.

More than 200 Dhruv helicopters have been produced so far, cumulatively clocking around 142,000 flight hours. Notwithstanding issues with Dhruvs exported to Ecuador, HAL remains keen to ensure this platform achieves as much success on the foreign market as it has at home. A Sarang display at a foreign air

show is expected to engender interest from prospective customers.

Apart from flying displays, HAL highlighted various activities, with particular focus on the HAL Rudra (Weapon System Integrated ALH) and Light Combat Helicopter (LCH). It is understood that upon the Indian contingent's return from Bahrain, the Tejas programme will commence BVR missile trials with the Rafael Derby BVR missile off the coast of Goa.

IGA signed on Rafales for IAF

Flying directly to Chandigarh, capital of the Punjab from France on 24 January 2016, French President Francois Hollande began his three-day official visit to India asserting that the deal for 36 Rafales was “on the right track”, although technicalities obviously would take time. He continued that Indo-French cooperation in defence “is part of our strategic partnership. It is based on trust, a very strong trust between both our countries”.



The next day at New Delhi, the inter government agreement (IGA) was formally signed by the two nations in presence of Prime Minister Narendra Modi and President Francois Hollande. “We are very happy that we have formed an agreement for purchase of 36 Rafale aircraft with France,” Modi said at a joint address with French President Francois Hollande after 13 agreements including that on the Rafale were signed. “We will resolve the financial aspects soon,” Mr Modi stated.

On 26 January 2016, President Francois Hollande was Chief Guest at the Republic Day Parade where a French Army contingent also took part, symbolising Indo-French cooperation in defence matters.

Airbus Helicopters and Mahindra agreement on JV

Following their MoU signed in July 2015 (*see Vayu IV/2015*), Airbus and Mahindra have made “significant progress” toward forming a joint venture to produce military helicopters in India. Representatives of both companies signed a Statement of Intent on 24 January, in the presence of Indian Prime Minister Narendra Modi and the visiting French President François Hollande at Chandigarh.

Mahindra Defence and Airbus Helicopters have already initiated an industrial relationship to produce helicopter parts locally and are defining additional work packages to be industrialised in India, which would facilitate the required rapid ramp-up in the case of a programme award to the joint venture. Simultaneously, both sides are evaluating potential industrial sites and are screening the existing local supply chain, while moving ahead with the setting up of the Joint Venture. The companies are proposing to set-up a final assembly line in India, develop tier-1 and tier-2 suppliers and



make extensive transfer of technology, with the intent to ultimately achieve 50% indigenous content. The JV formation itself will be subject to the customary regulatory approvals.

“Through this partnership, we target building several of our globally leading helicopter models in India. This will lead to the transfer of state-of-the-art technologies, development of manufacturing activities and creation of high-skilled jobs in India,” said Guillaume Faury, Airbus Helicopters President & CEO.

“We have made significant progress in setting up the joint venture and together the companies are creating a world class advanced helicopter production facility in India,” said SP Shukla, Group President, Aerospace and Defence, Mahindra & Mahindra Ltd.

INS Vikramaditya visits Sri Lanka

Indian Naval Ships *Vikramaditya* and *Mysore* made an official visit to Colombo from 21 to 23 January 2016, while transiting from the west coast to Visakhapatnam for the International Fleet Review to be held in February. On 23 January, Sri Lankan President Maithripala Sirisena, visited INS *Vikramaditya*, becoming the first foreign Head of State to do so, and was received by Rear Admiral Ravneet Singh, FOC Western Fleet and Captain Krishna Swaminathan, CO of the carrier. YK Sinha, High Commissioner of India to Sri Lanka, and Vice Admiral Ravindra C Wijegunaratne, Commander of the Sri Lankan Navy, accompanied the President.

On departure from Colombo, the ships participated in a Passage Exercise with the Sri Lankan Navy.





Vayu and HAL : Keeping the Pace

First prototype of the HAL-assembled Avro 748 on its maiden flight at Kanpur, 1 November 1961

For over four decades, since its maiden issue was formally released by the then Defence Minister and Chief of the Air Staff at New Delhi in November 1974, *Vayu* has maintained continuous relationship with HAL, becoming a virtual purveyor of its times, recording and analysing progress and successes – as also some problems. In this Special issue published on HAL's 75th Anniversary, *Vayu* looks back – and forward – with a series of articles, highlighted by an exclusive interview with HAL's present Chairman, supported by on-the-spot reports filed by *Vayu's* editorial team which specially visited various Complexes and Divisions of HAL in various geographical locations of India, to be continued in forthcoming issues.

In its very first issue, *Vayu* looked at HAL's performance and reviewed status of various programmes during the Financial Year 1973-74. It is fascinating to look back at HAL four decades earlier, and is reported here without comment to preserve the atmosphere !

The break up of sales that year amongst the different units of HAL was revealing: Bangalore Complex Rs 37.37 Crore ; MiG Complex Rs 42.47 Crore; Kanpur Division Rs 3.67 Crore; Lucknow Division Rs 1.51 Crore making a total of Rs 85.02 Crore, an overall increase of 15.2% over the previous year.

As admitted in the annual report, a major contributing factor for the shortfall in Bangalore Complex was a "serious setback in production at its Engine Division which in turn affected the performance of the



After maiden flight of the first HAL assembled MiG-21FL : Test pilot Brijesh Jayal with Air Commodore M Bhaskaran, General Manager MiG-Division



The HA-31 Mk.II Basant ("Spring") agricultural aircraft was designed, developed and built by HAL in 15 months, its first prototype flying on 30 April 1972.

Helicopter Division during the year". As a result of several remedial and corrective measures, the deficiencies were being rectified "and the 1974-75 target would be attained".

Still, for the third successive year, the Kanpur Division suffered a serious setback in production on account of "certain technical problems". The report on HS 748 suitability by Dr Satish Dhawan, appointed by the Government of India to evaluate all aspects of this transport aircraft with special reference to safety under varying operating conditions with Indian Airlines, had yet to be submitted. Meanwhile, seven HS 748s, the final batch for Indian Airlines lay uncollected at HAL Kanpur, even as the 69th, and last, aircraft for the Indian Air Force was to be delivered in 1975.

Plans for production of the freighter version (30 HS 748Ms) and development of a maritime reconnaissance variant have had to be held in abeyance as this was opposed by the IAF, which resulted in an inevitable break in production and idle capacity at Kanpur "causing serious concern and the matter is being pursued with the Government for an expeditious final decision". If a "successor" to the HS 748 is meanwhile identified, this will also be produced at Kanpur.

Main activity at HAL Kanpur, however, was expected to revolve around the HA-31



HAL-built Cheetah (licence-built Aerospatiale Lama)

Mk.II Basant agricultural aircraft, production lines for would be transferred to Kanpur from Bangalore. 100 Basants are on order by the Ministry of Agriculture with a second batch of 100 Basants on the cards. Preliminary work on conversion of the SA 315B *Cheetah* Helicopter for the agricultural role has been carried out, the *Cheetah* considered ideal for aerial top dressing in hilly areas of North and NE India.

The Accessories Division at Lucknow commenced partial manufacture of

components for Dunlop, Dowty and Garrett projects. An increased range of accessories for the MiG-21M and Alouette III/*Cheetah* were to be manufactured at Lucknow and project reports approved by the GOI.

A significant development was the setting up of a Design Organisation in HAL headed by a whole time Director responsible for planning and co-ordinating all design & development activities of the Company. Its first head was SC Das appointed as Director, Design and



HF-24 Maruts under production at HAL's Aircraft Division in Bangalore

Development, under whose charge HAL's Design Bureau instituted a preliminary study on the development of a scaled-down version of the proposed HAC-33 twin turboprop transport aircraft, for which the Indian Air Force indicated a requirement for some 60 aircraft. HAL have also received 30 "enquiries" for such an aircraft from State Governments and large Corporations, both Government and Private Sector and a report is to be submitted by end-December 1974 by the *Study Group on Small Passenger Aircraft*.

A piston-engined successor to the HT-2 primary trainer was being developed by HAL's Design Bureau. Designated HPT-32, the side-seating trainer would have a fixed tri-cycle landing gear and powered by a 260 hp Lycoming engine.

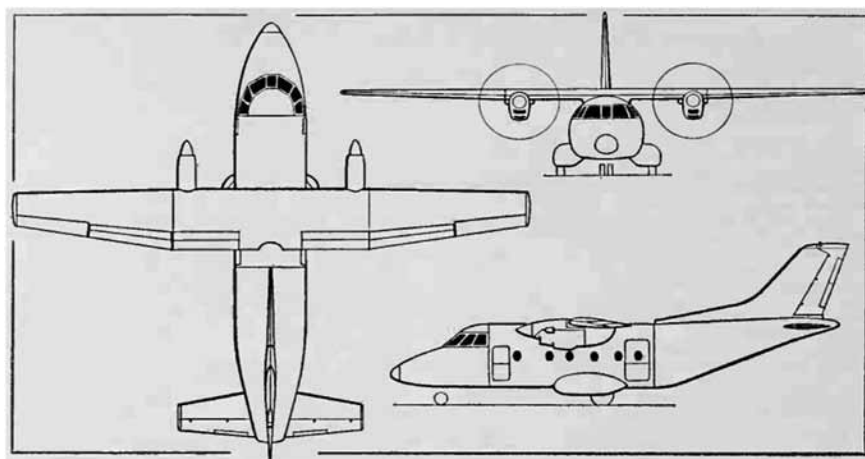
Butt-firing trials with the Armed-Kiran development were underway, the first prototype modified with two strong points, one under each wing, for the carriage of 50 gallon drop tanks, gun pods, 500lb bombs, or SNEB 122-1 rocket pods. "The Armed-Kiran will be suitable for light attack tasks, the COIN role and armament training".

Travails of the HF-24 Marut continued, with the HF-24 Mk.II proposal virtually rejected as the Indian Air Force did not confirm its interest in the afterburning Orpheus 703. HAL then submitted firm proposals for the Mark III, or HF-73, and this aircraft would reportedly exhaust growth potential of the HF-24. The

HF-73 would have maximum hardware commonality with the HF-24 and if Government sanction is received within 1974, the aircraft is envisaged as entering squadron service in 1981-82. Meanwhile, the first of the production Marut trainers on order were to be delivered to the IAF by late November 1974, the Mk. IT prototypes having completed all flight testing required (over 300 test flights).

Development work on the Ajeet light fighter continued satisfactorily and the first prototype would be flying in November 1974 followed a few months later by the second prototype. First production deliveries were scheduled for March 1976.

The new Helicopter Factory at Bangalore was now producing entire Alouette IIIs and SA 315Bs; but however awaited Government approval for its proposed indigenous Armed Light Helicopter (ALH) with preliminary studies and designs having been submitted early in 1974.



Three view drawing of the proposed HAC-33 turboprop light transport aircraft, which did not go beyond the D&D department in the mid-1970s, but became the basis for joint development of the Dornier 228



The Ajeet was a derivative of the Gnat light fighter which was adopted by the IAF in the early sixties

Chalees Saal Baad

Fast forward 40 years, to 2013-2014 wherein HAL recorded “an all time high” turnover of Rs 15,128 Crore, which is a staggering 17,600 % higher than that of 1973-74 [notwithstanding factors of inflation, exchange rates and so on].

During Financial Year 2013-2014, HAL produced 60 aircraft and helicopters along with engines and accessories, including

year, when 78 aircraft were delivered, including 25 Su-30MKIs, 15 Hawks, 4 Dornier 228s, 3 Tejas LCAs and 2 HJT-36 IJTs. As for rotorcraft, HAL delivered 23 Dhruv ALHs and 6 Chetak / Cheetahs.

2013-14 also recorded some “very important milestones achieved for major projects”, beginning with the Tejas LCA where Initial Operated Clearance (IOC)

on 30 October 2013 and 14 flights were carried out. “The Company has launched the series production of the LCA”.

Preliminary design activities of Fifth Generation Fighter Aircraft (FGFA), under joint development with Sukhoi Design Bureau, Russia and that of the Multirole Transport Aircraft (MTA) “have been completed”, with preliminary



HAL-Dornier 228 light transport aircraft built at Kanpur, with well over 100 produced for the Indian Air Force, Coast Guard, Navy and other operators (photo : Angad Singh)

Su-30MKIs, Hawks AJTs, Dornier 228s, Dhruv and Cheetal helicopters plus Pilotless Target Aircraft (PTA).

However, it was some years earlier, in 2010-2011 that HAL had produced the largest number of aircraft in one financial

year, when 78 aircraft were delivered, including 25 Su-30MKIs, 15 Hawks, 4 Dornier 228s, 3 Tejas LCAs and 2 HJT-36 IJTs. As for rotorcraft, HAL delivered 23 Dhruv ALHs and 6 Chetak / Cheetahs. 2013-14 also recorded some “very important milestones achieved for major projects”, beginning with the Tejas LCA where Initial Operated Clearance (IOC)

was achieved on 20 December 2013 which “has paved the way for induction of the LCA into operational service with IAF”, 503 flights of the LCA, having been carried out, the highest ever flying effort in a year. Test flights of the Naval variant of LCA resumed

design activities completed and technical configuration of the aircraft “finalised”. The Government mandated HAL and National Aerospace Laboratory (NAL) for jointly taking up design, development and manufacture of 70-100 seater Regional



Large numbers of the Sukhoi Su-30MKI are being produced by HAL at Nasik



The Tejas light combat aircraft, developed at Bangalore by the Aeronautical Development Agency (ADA), with considerable HAL design input, is sought to be produced in numbers for the IAF (photo: Angad Singh)

Transport Aircraft through a Special Purpose Vehicle (SPV).

HAL has taken new initiatives, including setting up of 'Green Field' facilities for manufacture of the Light Utility Helicopter (LUH) and Naval Multi-role Helicopter (NMRH), for which the Government of Karnataka has allotted 610 acres in Tumkur District.

With Suvarna Raju as head of HAL's Design & Development (present Chairman and MD of HAL) the Company has

developed "new products and product enhancements". The total R&D expenditure of HAL was Rs 1083.26 Cr in the Financial Year which worked out to 7.2% of the financial turnover : some 111 technology projects were identified in the area of design, manufacturing, avionics and material to support indigenisation.

HAL re-organised and strengthened its R&D set up, wherein a high level Design Policy Committee guided the R&D effort, sanctioned and reviewed various

projects to be undertaken. "HAL has also implemented a scheme wherein designers with experience in critical areas are retained after superannuation for a further period of two to five years, not only to maintain continuity but also to ensure knowledge transfer to the next generation designers".

HAL has developed capabilities in the design & development of aircraft, helicopters, engines and niche technology areas like Software Defined Radios (SDRs), Active Electronically Scanned Array (AESA) Radar, Aero Engines, UAVs and others either through indigenous effort or through collaborations. With respect to Aero Engines, HAL has taken up design & development of an aero engine with thrust of 25 kN.

Design & Development of the HJT-36 Intermediate Jet Trainer ("Sitara") progressed towards achieving IOC, with 1004 flights completed by the FY 2014-15, with anti-spin parachute system (ASPS) mod fitted and full flight test completed, the aircraft carrying out stall testing. In addition, high altitude and night flying trials, drop tank full envelope carriage trials, flight testing to +7g and -2.5g were also completed

IOC for wheeled variant of the ALH was received on 11 March 2014, while documents for IOC of the Weapon Integrated variant of the ALH for the IAF were submitted to RCMA after completion of all flight tests.

Design & Development of the Light Combat Helicopter (LCH) progressed and during the year, 163 flights were carried out with the TD-1 and TD-2. The second phase of sea level trials were carried out at Chennai to validate design improvements after initial sea level trials 2012.

Concerning the Light Utility Helicopter (LUH), HAL completed review of the detailed Design & Analysis milestone, equipping of Ground Test Vehicle (GTV) was completed and structure of the prototype (PT-1) launched.

With T Suvarna Raju taking over as Chairman, HAL recorded its highest ever turnover of Rs 15,480 crores for FY 2014-15 with forecasts of even higher turnover during FY 2015-16. Su-30MKIs are being steadily built and delivered from Nasik, as also Hawk AJTs from Bangalore and Dornier 228s from Kanpur, HAL having received an additional order for 14 of the latter aircraft from the IAF.



HAL's light combat helicopter (LCH) is nearing IOC and is required by the Indian Army for service in high altitude areas (photo : Angad Singh)

“Flag Bearer of India’s Aerospace Industry”



**On the 75th Anniversary of
Hindustan Aeronautics Limited,**

VAYU Interviews

**Chairman and
Managing Director (CMD),
Mr. T Suvarna Raju**



VAYU: *In celebrating its 75th anniversary, HAL has come a long way in meeting the aircraft and systems requirements of the Indian Air Force, Army and the Navy. Yet as some analysts tend to believe, HAL has not reached a stage of performance where it could be compared with some leading manufacturers of aircraft, especially in the USA and Europe. Please share your views on this reality and your vision for the near future.*

CMD: Over the past 75 years, since its inception, HAL has been the flag bearer of aerospace industry in the country, meeting the requirements of defence services, which are our prime customers. It may be recalled that HAL was established in India when not even an automobile manufacturing company existed in the country and over the years we have transformed into a mammoth organisation with 15 flying platforms to our credit including fighters, trainers and helicopters. The only aero engine developed in the country so far is also by HAL. The Company has not left any area untouched in the domain of aeronautics and today HAL is one of the largest DPSUs and a Navratna Company.

Our flagship product, the Advanced Light Helicopter (ALH) Dhruv, and Light

Combat Aircraft (LCA) Tejas are unique in their class. Further, our upcoming products like the Light Combat Helicopter (LCH), Light Utility Helicopter (LUH), Hindustan Turboprop Trainer (HTT-40), Unmanned Aerial Vehicles (UAVs) as well as engine programmes like the 25 kN turbofan engine HTFE-25 and the 1200 kW turbo shaft engine HTSE-1200 are expected to have export potential. The co-development of FGFA and MTA with Russia has also been taken up.

In addition to dedicating maximum resources to service Indian Defence Services, HAL also has business collaborations with all the major aerospace companies of the world like Boeing, Airbus, BAE Systems, Turbomeca, Rolls Royce etc. HAL has been supplying passenger doors for Airbus A320 aircraft over the last two decades, and there is a lifetime contract for the same. Similarly, HAL is participating in work packages like gun bay door, weapons bay door, landing gear uplock box, IFF system etc for Boeing programmes. A number of castings and forgings are being supplied for Rolls Royce too. HAL has joint ventures with Rolls Royce and Snecma, which are state of the art manufacturing facilities functioning as Export Oriented Units (EOUs). HAL’s

long-term partnerships with aerospace majors are a testimony to our company’s performance.

VAYU: *The higher management structure of HAL has been revamped from April 2015 to improve the operational efficiency and management control. Kindly enumerate on the key differences from the past structure.*

CMD: The Board of Directors of HAL has been reconstituted with effect from April 1, 2015. The Chairman is now re-designated as Chairman and Managing Director (CMD). The revised structure consists of five full time directors, including the CMD, two government nominees and seven independent directors. The re-constitution is done considering the growth of the Company in the next two decades, to ensure required delegation and to strengthen the management system. The posts of Managing Directors of Production Complexes have been discontinued. The Company now has four Chief Executive Officers namely, CEO (Helicopter Complex), CEO (Bangalore Complex), CEO (MiG Complex) and CEO (Accessories Complex).

VAYU: *Of late, the Government of India has been pursuing the policy of*



HAL's reconstituted board of directors (photo: HAL)

encouraging private sector companies to undertake production of aircraft in the country. Does HAL see this as a challenge and will this impact HAL adversely in terms of undertaking new projects?

CMD: HAL believes in inclusive growth. HAL has been instrumental in nurturing private industries and HAL alone has developed an aerospace industry ecosystem by hand-holding more than 2,300 business partners across India. We see the availability of a strong private industry base in the country as an opportunity in terms of better outsource partners, faster turnaround time and collaborators for new product development initiatives thus adding additional thrust to the growth of the company. As a strategic initiative, HAL is focusing on developing Tier-1 and Tier-2 vendors and outsourcing through the tiered level of supplier base, with the involvement of more private industries.

With increase in the FDI cap and 'Make in India' campaign, more private players are expected to enter into the defence manufacturing sector. HAL is strategising to reap the most out of this changed market scenario by increasing its indigenous portfolio of products and concentrating on R&D as the thrust area.

VAYU: *As an example, the case for manufacture of 56 transport aircraft to*

replace the Avro in IAF service has been considered by the Government that these be manufactured by Indian private sector companies with ventures. Does HAL propose to put in a bid as well?

CMD: HAL could not participate in the programme, as the bid was not open to HAL. As HAL's Transport Aircraft Division, Kanpur has all the infrastructure available to undertake such programme, HAL expressed its concern to the appropriate government authorities for denying an opportunity to participate in the programme. However, HAL is of the opinion that there is enough demand in the sector for both public and private sector to co-exist.

VAYU: *There have been some critical references to slippages in aircraft production and delivery rates by HAL, with two particular programmes specified, being the ALH and Su-30MKI. Kindly enumerate on HAL's 'Batch Mode of Production' pattern, which is different to the 'Mass Production' approach. Please explain the constraints on HAL.*

CMD: Production of Su-30MKI did face difficulties due to technology transfer related issues pertaining to manufacturing from the raw materials phase. Having now got the transfer of technologies completely, HAL is currently manufacturing the aircraft as per the rated capacity. We have



Su-30MKI during a flying display at an air show (photo: Angad Singh)

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WHEN RESULTS MATTER

already mastered the technologies for manufacturing of about 700 LRUs.

In case of ALH there was a delay in getting certification of Shakti engine from the OEM and a few integration issues with new systems introduced in Mk.III and Mk.IV helicopters. All the technical issues have been resolved and HAL will complete the delivery requirements in consultation with the customer.

VAYU: *The Hawk AJT programme is the only fixed wing programme currently underway at Bangalore Complex. Having absorbed its technology “completely”, it is understood that HAL and BAE systems planned to develop a ‘Combat Hawk’ for the IAF. Kindly give an overview of this important development and the export potential for this type.*

CMD: HAL signed an MoU with BAE Systems in May 2015 for development of a ‘Combat Hawk’ for the export market. The proposed modified Hawk aircraft will be utilising new technologies to provide advanced operational capabilities, specifically that of offensive air support to ground forces, and will be manufactured by HAL. Principles of collaborative working environment between the companies have been worked out and a road map is being evolved.

VAYU: *The Dhruv ALH is considered as HAL’s ‘flagship project,’ with increasing numbers being supplied to the Indian Armed Forces as well as for export. However, with the unfortunate experiences in Ecuador, what are HAL’s*

plans for augmenting ALH maintenance and logistic support?

CMD: Dhruv ALH is a ‘Made in India’ helicopter from design, development, manufacturing and product support points of view. This effort of HAL has placed India as the sixth nation in the world to have such design and development capabilities. Dhruv is a proven platform, which has already clocked more than 140,000 flying hours. It is a matter of pride to recall the important role played by this helicopter in the earthquake rescue and relief operations in Nepal early this year. The platform has also proved its mettle in various other rescue missions like *Operation Raahat* (Jammu & Kashmir floods), 2004 tsunami relief

measures etc, and is operational with export customers in Nepal, Mauritius and Maldives in addition to serving in all branches of the Indian Armed Forces.

HAL had supplied seven helicopters from 2009 to 2011 to the Ecuadorian Air Force against a contract dated August 2008. Dhruv helicopters in Ecuador alone have cumulatively flown more than 6,300 hours. Although Ecuador has served a notice for unilateral termination of the contract, it does not indicate any technical or mechanical snag as the reason. The incident however is part of the risk any company in business is prone to and with the proven product in hand, HAL is confident of resolving the same.



Indian Army Dhruv during a combat demonstration (photo: Angad Singh)



Hawks now equip the IAF's Surya Kiran aerobatic display team (photo: Angad Singh)



SU-30MKI

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HAL has an exclusive product support division, the Helicopter MRO Division located at Bangalore, with necessary skill sets and infrastructure to provide continuous support to its customers. Augmentation of the skill sets and its facilities are being done to manage the increasing fleet strength. HAL will continue all efforts and pursue every avenue to support Dhruv helicopters at Indian and overseas customer locations.

VAYU: *'Hot and high' flight trials for HAL's Light Combat Helicopter (LCH) have been successfully completed and firing trials are reportedly planned for mid-2016. This important programme is vital for operations in high altitude areas. When is the IOC expected and when will series production take place?*

CMD: HAL has completed performance trials of Light Combat Helicopter (LCH) paving the way for finalisation of basic configuration and a letter of completion has been handed over by CEMILAC on 16 October 2015 in the presence of the Defence Minister. The platform has completed more than 600 test flights with four prototype helicopters presently flying. LCH is the first attack helicopter to land and take off from the Forward Landing Base (4.8 km altitude) at Siachen with payload of 400 kg. Depending upon customer requirement, integration of weapon systems will be taken up.

VAYU: *The Su-30MKI ROH facility has been inaugurated recently at HAL Nasik. This is essential for enhancing maintenance*

support to increase serviceability of the IAF's Su-30MKI fleet. Your views on this important aspect!

CMD: Fleet support in terms of maintenance, supply of spares, training etc is always a prime focus at HAL to ensure serviceability of the aircraft with the customers.-

Repair and Overhaul (ROH) facilities were set up by HAL at Nasik for airframes, at Koraput for engines, at Hyderabad and Korwa for radar and avionics and at Lucknow for accessories, to ensure serviceability of the aircraft for its full operational life of the aircraft. HAL handed over the first overhauled Su-30MKI aircraft to the Indian Air Force through the Defence Minister on 9 January 2015.

The Su-30MKI overhaul facility at HAL Nasik is the only one of its kind in the world and has export prospects, since around 10 countries are flying Su-30s. As a result of the establishment of ROH facilities, the serviceability levels of Su-30MKI fleet will enhance, resulting in strengthening of Indian Air Defence capabilities.

LRU MRO facilities have also been established. The aircraft MRO capacity is 15 aircraft per annum. We are planning to increase it further and plan to set up another line at Nasik.

VAYU: *HAL's Koraput division is augmenting its capacity for manufacture and overhaul of larger numbers of AL-31FP engines, and overhaul of RD-33MK*



AL-31FP engine for the Su-30MKI



The third LCH prototype in flight over Bangalore (photo: Angad Singh)

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HAL & SAMTEL: A truly remarkable indigenisation journey

**MFDs BY
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INDUCTED ON
SU-30 MKI**



130 sets (910 units) of MFD already inducted

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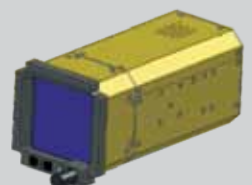


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engines, and is also in the process of establishing manufacturing facilities for AL-55I engines. What are the plans to make this Division the 'aero engine capital of India' as suggested by the Air Chief?

CMD: HAL's Engine Division at Koraput was established in 1964 to manufacture Russian origin engines starting with the manufacture of engines for MiG-21 aircraft. The state-of-the-art Centre has been set up in a remote village and we now have the technology wherewithal to manufacture very high thrust engines from the raw material phase.

The Division is also augmenting its capacity to ramp up the production rates for manufacturing and overhaul of AL-31FP engines. In addition the Division is in the process of implementing a modernisation plan by replacing the old production facilities with state-of-the-art machines, which are more versatile, flexible and faster. HAL Koraput Division has some cutting edge technologies and facilities available, which include single crystal blade casting, hot iso-static pressing, electron beam welding, ion-nitriding, manned (argon) chamber welding, isothermal forming, pneumo-thermo forming, and non-contact CMM etc. In addition, facilities are being planned for manufacturing AL-55I engines for the IJT aircraft and ROH of RD-33MK engines for MiG-29K aircraft for the Indian Navy.

The Koraput Division is the only setup in the country wherein all the required facilities for manufacturing an advanced aero engine, including single crystal blades and thermal barrier coatings, are available under one roof.

HAL's Engine Division based in Bangalore has also grown tremendously over the years and is engaged in manufacture of 14 types of engines. It has world-class facilities for heat treatment, chemical processing, surface enhancement, non-destructive testing, welding and non-conventional machining.

VAYU: *HAL-Dornier 228 production continues steadily at the Transport Aircraft Division. What are the main aspects of the type's modernisation to make it more competitive, also in the international market?*

CMD: Do 228 is a highly fuel efficient, rugged, reliable twin-turboprop light transport aircraft with low operating costs. The aircraft is adaptable for a wide variety of roles including commuter, air taxi, utility, corporate/executive transport, air ambulance, aircrew training, Search and Rescue (SAR), pollution control,



Dornier 228 under overhaul at HAL's Transport Aircraft Division in Kanpur (photo: Angad Singh)



AL-55 engine for the eventual HJT-36

troop transport, maritime surveillance etc. More than 100 aircraft are in service with different customers, with operators including Coast Guard, Navy and Indian Air Force, which operate the platform in a number of diverse roles. In addition, the aircraft has also been exported by HAL to Mauritius and Seychelles. HAL has been awarded the Production Organisation Approval (POA), CAR-21G by DGCA for manufacture of a civil variant of the Do 228 and it is anticipated that this successful and proven platform has substantial future sales potential both in India and abroad in the coming years.

In-house Research and Design has been very instrumental in keeping HAL manufactured Do 228 aircraft up to date with latest avionics and instrumentation on board in spite of almost non-existent OEM support. HAL provides various customer-specific equipment and systems such as surveillance radar, electro optical



HAL-built Dornier 228 of the Indian Navy, with a range of role-specific equipment clearly visible (photo: Angad Singh)

and infrared cameras, Electronic Support Measures (ESM) systems, Satellite Communication (SATCOM) equipment, Automatic Identification System (AIS), and Mobile Satellite System (MSS). With such state-of-the-art equipment on board, HAL-built Do 228 aircraft have been a proven platform for maritime surveillance.

Recently, Do 228 aircraft have been integrated with a digital autopilot system in place of the conventional autopilot, providing maximum reliability with greater smoothness and accuracy over the previous system. Another major upgrade effort currently in progress is integration of a glass cockpit for increased reliability, situational awareness, and reduced crew workload with comfortable viewing and decision-making. Possibility of integration of more fuel-efficient engines and noise-efficient composite propellers is also being explored to make it even more competitive in its class of aircraft.

VAYU: *The Indo-Russian FGFA project has become protracted, with differences between the two countries yet to be resolved. Please comment on the status and HAL's envisaged role in the circumstances.*

CMD: The Fifth Generation Fighter Aircraft (FGFA) is a joint collaboration

between India and Russia. The project is being executed in two stages namely Preliminary Design Phase (PDP) and Detailed Design and Development Phase (R&D Phase). The Preliminary Design (PD) Contract was signed in December 2010 and on completion of the contract milestones, the PD Contract was closed in June 2013. Presently commercial negotiations by an MoD Committee are under progress for the R&D phase.

VAYU: *On the Tejas Light Combat Aircraft: there have been concerns about the various delays in induction of the LCA*

in the IAF, some related to production at HAL. Kindly review the steps taken to increase production rates even as the aircraft is to be fitted with new AESA radar, in flight refueling and other steps to improve maintainability.

CMD: Aeronautical Development Authority (ADA) is the nodal agency and programme manager for Design and Development of the LCA and HAL is the principal partner. The LCA Mk.I has achieved Initial Operation Clearance in December 2013. After IOC, HAL started activities on Series Production (SP) aircraft and the first Series Production aircraft of



Tejas SP-1 seen shortly before it was handed over to the IAF

LCA Mk.I was handed over to IAF on 17 January 2015.

A separate division named 'LCA Tejas' has been created for dedicated manufacture of LCA. HAL is engaging many private and public sector industries for work share to enhance capacity. HAL has already roped in over 60 suppliers for manufacturing of detail parts. In addition, outsourcing of bigger structural modules has also been taken up.

HAL has set up a highly sophisticated hangar and all jigs and fixtures are established, calibrated with a highly accurate laser tracker system and our quality is of the highest standard. We are planning to invest Rs 1,250 crore and are committed to increase the aircraft production rate to 16 per year.

VAYU: *The HJT-36 Intermediate Jet Trainer programme has faced several problems in achieving IOC. How have these been addressed and what is the present status?*

CMD: IJT aircraft development has successfully completed all the crucial developmental tests except the spin testing. Certain modifications were done on the aircraft to obtain satisfactory spin characteristics and recovery from spin. Initial phase of spin tests has commenced. During aggravation of control input testing, aircraft entered spin and recovered promptly in one turn. This behaviour was observed consistently in later flights, which indicated significant progress, boosting confidence in HAL's efforts to complete this final milestone for certification of IJT. Due to the high-risk nature of spin testing,

a very cautious approach is being adopted by HAL and we are confident that the spin test will be completed successfully to achieve operational clearance.

VAYU: *As per a HAL statement, "detailed design, jig fabrication and commission have been completed for HAL's Basic Turboprop Trainer (HTT-40) and assembly activities initiated." What are the next steps before first flight is made?*

CMD: The HTT-40 is an ab-initio basic/primary aerobatic trainer aircraft being developed by HAL to meet the Stage-I training needs of IAF pilots. This project, started with initial funding by HAL is awaiting government sanction. The HTT-40 has already completed the Detailed Design Phase, assembly and presently aircraft is being equipped. System checks, ground run and flight trials are

being planned to take this aircraft to the skies shortly.

VAYU: *Congratulations on receiving the CEO of the Year Award by IIMM. References were made to your calling for strengthening of supply chain system from the planning to delivery stage. Could you elaborate on this approach as it impacts on HAL for the future?*

CMD: Thank you very much. Indeed it is a proud moment for me and my company to receive this prestigious award, which is a definite recognition of the efforts put forth by 'Team HAL' for strengthening the supply chain system of the organisation by realigning vendor relationship to the next level of engagement in terms of actual business partners for inclusive growth.

Strengthening of supply chain system from the planning to delivery stage



essentially indicates HAL's intent to take suppliers as risk sharing partners in programmes starting from the initial planning phase through the final delivery stage of identified work packages rather than from a mere buyer-seller perspective. HAL believes in growing together and has been instrumental in nurturing the private industries across India.

As a strategic initiative, HAL is focusing on developing Tier-1 and Tier-2 vendors. With the involvement of more private industries, outsourcing through the tiered level of supplier base is the driver for future programmes in HAL that would shift the role of the company to a prime integrator of the flying platforms and the focus on manufacturing would be shifting to HAL's tiered suppliers in the private sector.



The Sukhoi Story

Managing the Numbers

The Sukhoi story in India actually began with ‘rumours’ emanating from South Block in the early months of 1994 that the Su-30 (*nee* Su-27) was being considered for procurement by the country. Rumour turned to fact when, in 1996, the Governments of India and Russia formalised the contract for this combat aircraft which had never figured till then in the IAF’s long term planning.

As recorded by *Vayu*, after two years of evaluation and negotiations, on 30 November 1996 the Government of India signed a US\$1.462 billion deal with Sukhoi for 50 Russian-produced Su-30s, to be delivered in five batches. The first batch were to be eight Su-30Ks, the basic version of the type. The second batch were to be 10 Su-30MKs with French and Israeli avionics. The third batch were to be 10 Su-30MKIs featuring canard foreplanes. The fourth batch of 12 Su-30MKIs and final batch of 10 Su-30MKIs would have the AL-31FP thrust-vectoring turbofans.

The two countries also agreed for technology transfer of the Sukhoi Su-30

during Russian President Vladimir Putin’s India visit in October 2000, when Defence Minister George Fernandes and Russian Deputy Prime Minister Iliya Klebanov signed the MoU. That India would be

given a “comprehensive” licence, which provided for indigenous production of all the components of the Su-30MKI over a period of 20 years including its AL-31FP thrust-vectoring engines, was a given.



Indian Defence Minister George Fernandes with Russian Deputy Prime Minister Iliya Klebanov (HAL Chairman Dr Krishnadas Nair seen at the centre)



time, the Sukhoi Design Bureau (OKB) expressed its willingness to jointly develop a “fifth generation fighter” with India for the Russian and Indian Air Forces, “if the political leadership of the two countries so decided.”

By November 2000, the Irkutsk Aviation Plant (IAPO) had commenced test flights of the ‘fourth-plus’ generation multi-role fighter Sukhoi Su-30MKI with “full range of Indian, Russian, French and Israeli avionics” before starting its serial production. Russia was to deliver the first Su-30MKI “specially developed for the IAF” in 2001.

The first batch of 10 aircraft were described as ‘Su-30MKI Stage I’, and two more stages were envisaged, Stages II and III aimed at integrating new weapons and perfecting the flight control system (FCS).

In October 2000 a Memorandum of Understanding (MoU) was signed for licence-production of 140 Su-30MKIs by HAL and in December 2000, the contract was sealed with the Irkutsk Aircraft Production Organisation (IAPO) in Siberia. The first Nasik-built Su-30MKIs were to be delivered by 2004, with phased production to be completed in 2017–18 but in November 2002, the delivery schedule was expedited under directions of the Minister of Defence, who directed that HAL complete production by 2015.

Similarly, as for its powerplant, 920 Saturn AL-31FP turbofans were to be manufactured at HAL's Koraput Division, and specific accessories manufactured at HAL's Lucknow and Hyderabad Divisions. Final integration and test flights of the aircraft would be carried out at HAL's Nasik Division, which had produced MiG-21 variants for decades followed by the MiG-27ML. As was standard, four manufacturing phases were outlined with progressively increasing Indian content: In Phase I, HAL would manufacture Su-30MKIs from knocked-down kits, transitioning to semi knocked-down kits in Phase II and III; in Phase IV, HAL would produce aircraft from raw materials, from 2013 onwards.

The Indian team was led by Dharendra Singh, Additional Secretary for Defence Production and HAL Chairman Dr Krishnadas Nair, the deal providing for production of 140 Su-30MKIs “which has taken such defence cooperation far beyond a buyer-seller relationship”. Also at this



A spanking clean production hangar at HAL's Nasik Division



Production of Su-30MKIs at HAL Nasik has been continuous since the past decade

“Sue Numerology”



Tail numbers can be misleading as production phases have been mixed up

Even as the Company celebrated its 75th Anniversary, HAL's Aircraft Division at Nasik (still fondly referred to as the 'MiG Division'), was busy producing one Sukhoi Su-30MKI per month for the Indian Air Force. However, considering the manner in which the aircraft were originally ordered, re-ordered and timelines shortened, this inevitably resulted in leap frogging from Phase to Phase.

According to the original schedule for 140 Su-30MKIs to be progressively built by HAL, Phase I comprised 3 aircraft, followed by 5 in Phase II, 18 in Phase III and 114 in Phase IV, euphemistically described as the 'Raw Material' stage. Following the Defence Minister's diktat for 'compressed delivery', the numbers were juggled

to become 7+27+46+60, still totaling 140 but with the 'Phases' mixed up. Compounding the pattern, the new batch of 40 ordered were all in Phase I and II configuration as were the next 42, the total now adding up to 222.

By March 2015, 162 Su-30MKIs had been delivered by HAL to be IAF but of the 60 remaining, 36 are from the original order for 140 while 24 are from the last order for 42. Producing an average of 12 Su-30MKIs a year, HAL would deliver the last such aircraft in 2019-20.

Watch this Space !

However, it is learnt from 'reliable' sources in South Block that during Prime Minister Modi's official visit to Russia in December 2015, yet another batch of 40 Su-30s are likely to be ordered for the IAF which is steadily phasing out MiG-21s and MiG-27s over the next two years. HAL's Nasik Division, which had anticipated involvement in the Indo-Russian fifth generation fighter aircraft (FGFA) would then continue to produce Su-30s till 2023-24.

Work was also underway done on improving the thrust vectoring-NPO Saturn AL-31FP engines, to be installed on the Su-30MKIs.

The first two HAL assembled Su-30MKIs were delivered to the IAF in 2004-

05, HAL steadily increasing production every year, this going up annually to 6, 13, 13, 17, 23, 25 and so on till 149 aircraft had been delivered by 2013-14. Continuing this pace, the last of 222 Su-30 MKIs built

at HAL Nasik would be delivered to the IAF by 2018-19 or two years beyond the schedule which was initially set.

In 2007, an order for another 40 Su-30MKIs was placed. In 2008, Samtel HAL



Equipping of a Su-30MKI at the final assembly hangar



Su-30MKI after take off (photo : Angad Singh)



Su-30MKI being modified at the final assembly hangar

Display Systems (SHDS), a joint venture between Samtel Display Systems and HAL, were given a contract to develop and manufacture multi-function avionics displays for the MKI. A helmet mounted display, Topsight-I, based on technology from Thales and developed by SHDS was sought to be integrated on the Su-30MKI in the next upgrade.

In March 2010, *Vayu* reported that India and Russia were discussing a contract for 42 more Su-30MKIs and in June 2010, the Cabinet Committee on Security cleared the Rs15000 crore (US\$2.2 billion) deal with Rosoboronexport, the additional aircraft taking the total number of Su-30MKIs ordered for the IAF to 272. These

additional aircraft would be delivered as “technical kits’ to HAL for their assembly in India.

As the Chairman then stated :“HAL’s responsibility for this supersonic multirole aircraft has now gone up to 222. “One hundred fifty seven Indian vendors are involved in providing 13,350 components of the aircraft while another 19,450 components are manufactured at HAL’s Nasik and Koraput Divisions. The Su-30MKI project provides solid platform to indigenous manufacturing and technical competence creating hundreds of direct and indirect jobs.”



Su-30MKI at the flight hangar complex where ground tests are carried out and aircraft prepared for test flights

HAL-Samtel: Partners in indigenisation

HAL has been in the lead when it comes to indigenisation of technology in the domain of military aerospace, being the pioneer in building a strong aerospace eco-system in India with a thrust on outsourcing. It was some years ago that HAL launched the indigenisation drive to substitute imported systems, LRUs and other items, identifying private vendors to increase indigenous content in various platforms. One of the critical steps in this indigenisation journey was the creation of the HAL-Samtel JV.

India's premier navratna PSU, Hindustan Aeronautics Limited formed the joint venture company with Samtel in 2007, named Samtel HAL Display Systems Ltd. (SHDS) with 40:60 partnership of HAL and Samtel, to address the avionics requirements of HAL, especially cockpit displays of all kinds. Samtel HAL Display Systems are responsible for system design, development, manufacturing, MRO and obsolescence management of display systems and test equipment for all Indian platforms, both fixed and rotary wing and have the unique distinction of being the first public-private partnership in defence avionics space in India.

The genesis goes back to 2004, when Samtel signed the contract with DARE (DRDO) for ab initio technology development of Su-30 Multifunction Displays (MFDs) which included development of technology to have rugged LCDs to withstand harsh avionics environment, while maintaining a high level of optical and functional performance during operations. After 5-6 years of sustained efforts, such technology was fully developed and the MFDs flight tested successfully on the Su-30 under supervision of IAF test pilots. The HAL-Samtel JV was to be the only company to receive CEMILAC Type Approval for MFDs in India. As on date, the HAL-Samtel JV has delivered 130 aircraft sets (910 units) of Su-30 MFDs as form, fit and functional replacement to the foreign OEM.

Besides Su-30 MFDs, the HAL-Samtel JV has also supplied ATEs (Automated Test

Equipment) to the Indian Air Force, and are now developing MFDs for the Light Combat Helicopter (LCH), Integrated Standalone Instrument Systems (ISIS) for HTT-40, and cockpit display unit (3ATI) for Tarang Radar Warning Receiver (RWR).

Through this sustained effort SHDS has achieved the singular status of being the only company in India which indigenously offers a complete LCD ruggedisation package, electronic hardware designing, development of embedded systems and associated software, mechanical packaging and thermal management under one roof, so to speak.

The production facility of Samtel HAL Display Systems in Delhi/NCR is now poised to indigenise next-generation developments in the field of avionics displays such as LED backlighting, fanless design, touchscreen capability etc. Through this, the JV is now working towards building a centre of excellence for state-of-the-art cockpit displays which would give India self reliance in this domain.

This achievement holds considerable significance for India's defence as it substantiates the investment made for self-reliance by having an important technology available in country, thus reducing the dependence on overseas based players. What is even more relevant is that the technology developed over an exigent five-year long development and qualification journey, is not product specific, and can be laterally deployed on any fixed or rotary platform. It now opens up avenues for deployment in other upcoming programs and platforms by suitable augmentation. With support and encouragement from HAL, the JV is now in the process of providing displays on all important platforms.

This successful indigenisation has reaped major benefits; which include :

- Production Unit prices cheaper by 25-30% vis-à-vis foreign source.
- Turn Around Time reduced to just 2 months as compared to 8-9 months of foreign source.



- Significantly lower life cycle cost.
- Improved repairing and defect investigation analysis level of the system.

The HAL-Samtel joint venture is a prime example of how DPSUs can successfully partner with the private sector to leverage strengths of both companies to support indigenous production. It is only recently that the government has begun laying thrust upon the public sector to tie up with private players to boost indigenisation, while HAL and Samtel had a headstart on this for many years.

The HAL-Samtel JV is also in line with the PM's 'Make in India' campaign, which is aimed at improving and strengthening design/ development and manufacturing capabilities in India. The primary aim of this initiative is its thrust on self-reliance, something that the Indian defence industry has constantly strived for. The proposed changes in the new DPP recently announced by the defence minister are also a concrete step in giving impetus to indigenous defence manufacturers. Once the new DPP is implemented, it will provide much-needed encouragement for the private sector to make further inroads into the defence domain.

As the Indian defence industry attains another level of maturity, the HAL-Samtel JV is positioning itself as an active participant in this revolution for indigenisation.

Courtesy: Samtel



Harlow to Hawk

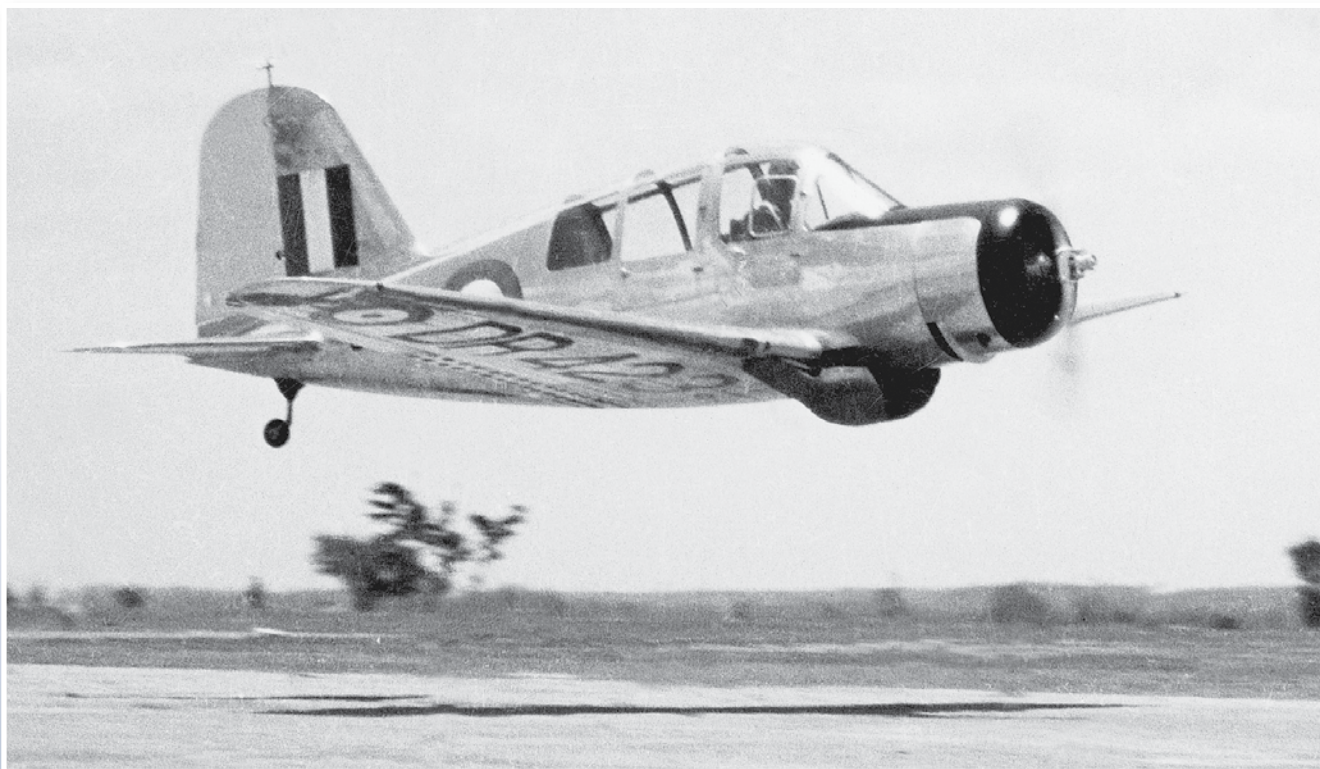
Training Aircraft from HAL

The American-designed Harlow PC-5A tandem seating trainer was the first aircraft type to be assembled by HAL (then Hindustan Aircraft) at Bangalore. The first such aircraft flew on 29 July 1941 and

was to be followed by another 29 numbers, curiously meant for the Nationalist Chinese Government which had also ordered 48 Curtiss 75A-5P Hawk fighters and 74 Vultee V-12D attack bombers.

The background for this fascinating story needs an entire book to record but sets the pattern concerning training aircraft which HAL has followed over the past 75 years.







First flight of the HAL designed HT-2 primary trainer took place on 5 August 1951

Post World War II and the Independence of India, the Percival P.40 Prentice T.3 basic trainer was to be the first aircraft licence-built by HAL, offering HAL a stepping stone to hone its manufacturing skills. India's first home-designed aircraft was the Hindustan Trainer No.2 (HT-2) which first flew on 5 August 1951, was followed by series production and this unpretentious type became the first flying mount of fledgling Indian pilots till it was supplanted by the HPT-32 basic piston-engined trainer from the mid-1980s.

The series production line was established at HAL Kanpur Division which was engaged in manufacture of the Dornier 228 light transport aircraft from which new production techniques

The HPT-32 basic piston-engined trainer replaced the ageing HT-2 from the mid-1980s





The HJT-16 Kiran basic jet trainer was developed by HAL for Stage II training and its Mk.II variant also equipped the IAF's Surya Kiran formation aerobatic team



The HJT-36 intermediate jet trainer is being developed as a successor to the HJT-16 Kiran

and technologies were imbibed, including re-designed wing with integral fuel tanks. Other modifications were incorporated, trebling fatigue life but the aircraft had its share of controversies.

Although the HPT-32 was used by the IAF as the basic ab-initio trainer for some three decades and a turboprop variant (HTT-34) was proposed, recurring problems particularly with the engine fuel system, led to premature grounding of the entire fleet. HAL since has been engaged in the design and development of a new turboprop basic trainer (HTT-40), but delays have resulted in the IAF importing equivalent aircraft from abroad.

The HTT-40 is to be powered by the Honeywell TPE 331-12B turboprop engine and will have a glass cockpit, the pilots seated on Martin Baker 16U light weight ejection seats. The prototype was scheduled to make its maiden flight in 2015 but this has been delayed.

The first jet trainer assembled by HAL was the de Havilland Vampire T.55, this versatile side-seating, twin-boomed aircraft being operated for Stage III training for several decades before being replaced by the indigenously-designed HJT-16 Kiran. First flight of the HJT-16 prototype was in September 1964 and the initial Mk.I was followed by an armed Mk.IA and



eventually by the Kiran Mk.II, which had a more powerful engine giving the aircraft additional power and capability for underwing stores.

The Kiran Mk.II was selected as mount for the IAF's Surya Kiran formation aerobatic team which performed excellently as such for several decades before being stood down as aircraft numbers were needed for Stage II flying training owing to delays in the successor programme.

The HJT-36 'Sitara' intermediate jet trainer, as successor to the HJT-16 Kiran, was a major R&D initiative of HAL which also introduced a new approach in not only forecasting the customer's requirement for such a trainer but proactively beginning production activities. The first prototype

made its maiden flight on 7 March 2003, just 42 months from 'go ahead' but there have been some issues concerning completion of test flights for certification. Once these are resolved, the IAF/IN's requirement for some 200 of these aircraft will be underway.

Many observers rue the fact that the HF-24 Mk.II tandem seating operational conversion trainer was not adopted in large numbers by the IAF as this aircraft could well have met the need for Stage III flying training, obviating the need to import advanced jet trainers.

The 'search' for an AJT took near two decades till eventually the BAE Hawk Mk.132 was selected and the contract signed in 2004. Following direct import of

24 aircraft from the UK, HAL was tasked to initially produce a further 42 Hawks in phased manner from 2008 onwards. An additional 57 Hawks were ordered some years later, 40 for the IAF and 17 for the Indian Navy. As of 2016, a total of 123 Hawks have been ordered by the Indian Air Force and the Indian Navy with orders for an additional 20 Hawks in process, the aircraft dedicated for the resurrected *Surya Kiran* formation aerobatic team.

In mid-2015, an announcement was made of HAL and BAE Systems studying the development of a 'Combat Hawk' which could be ordered in considerable numbers to meet the IAF's need for close air support as also possible export to 'friendly foreign countries'.





Working with 'the new India'

The Fifth Generation Fighter Aircraft (FGFA) programme is symbolic of the opportunities and challenges of Indo-Russian collaboration in aviation (photo: Alex Beltyukov)

On the eve of Prime Minister Narendra Modi's visit to Russia in December 2015, Vayu was invited to interact with top aviation industry officials in Moscow.

'The more things change, the more they remain the same,' reports Angad Singh.

In a warm conference room in Moscow, RAC MiG's CEO Sergei Korotkov noted that his firm has been working with India for over fifty of its 76 years in existence. A day earlier, Yuri Slyusar, President of Russia's state-controlled United Aircraft Corporation, the umbrella organisation for almost all aviation-related activities in the country, proudly stated that "the cooperation between Russia and India... in aviation is unique; we don't have any other country with such a broad and deep scale of cooperation."

The nature of this relationship has been constantly evolving, and never more so than in the recent past, with New Delhi growing increasingly closer to Washington under the UPA regime, a shift that has only gathered momentum under the NDA government that took charge in May 2014. The Narendra

Modi-led NDA government also hopes to usher in an era of increased industrial prosperity in the country, with military modernisation and energy security (through nuclear power) as key focus areas. While the PM has been lobbying a host of foreign countries, including many Western powers, for increased industrial participation in India, Russia remains confident that broader landscape remains unchanged, or indeed even improved. Although past collaboration between the countries has taken place between state-owned companies through inter-governmental arrangements, Slyusar welcomed the increasing participation of the private sector in Indian defence manufacturing and R&D, saying that with the inclusion of the private sector "the angle of view is wider and the opportunities are more."



UAC president Yuri Slyusar in conversation with Vayu and other visiting Indian media persons. (photo: Angad Singh)

Even when pressed on joint programmes that appear to be facing hurdles, the UAC Chief remains optimistic. While he urged

Indian officials to expeditiously make a formal commitment on the detailed design phase of the Fifth Generation Fighter Aircraft (FGFA) programme, he stressed that the process would continue to move and that “there are no stumbling blocks that cannot be resolved.” He also confirmed that the first two initial production (equivalent to ‘Limited Series Production’ – LSP) PAK-FA fighters would be delivered to the Russian Air Force in 2017, and that the IAF’s longstanding demands to flight-test the T-50 prototypes would be met once a formal joint development agreement is in place.

On the Medium Transport Aircraft (MTA) project, whose specific issues relating to engine selection are well known and in the public domain (*see Vayu II/2015*), Slyusar insisted he was still “hopeful that the Indian side can accept the design and move forward.” He admitted that the Aviadvigatel/Perm PS90 engine envisaged to power the aircraft does not have “full-fledged FADEC” (Full Authority Digital Engine Control) but also noted that this was never part of the IAF’s initial specification. The requirement for a FADEC has apparently been added midway through the programme, and although UAC has made investigations, they have not found a suitable replacement engine. The preliminary design for the programme “has been finished for over a year,” according to Slyusar, and if the engine issues are resolved, he is confident that detailed design and prototype rollout will proceed rapidly. He pointed out that the engine in question has been extensively used across civilian and military platforms across Russia, including the Russian Presidential aircraft, so there is little question of performance or reliability shortcomings.

Down to Business

A long time bugbear of the Indian Air Force has been low combat aircraft availability, particularly affecting its extensive inventory of Russian-origin aircraft. Complicating matters is the convoluted and bureaucratically encumbered process of ordering spares and sending aggregates for repairs or overhaul. Sukhoi Marketing Director Valery V Chishchevoy revealed that a long-term spares arrangement for the Su-30MKI fleet is in the works and due to be signed “shortly.” This arrangement will bypass the export licences, customs duties, bank guarantees

and other procedural issues that typically delay existing spares and servicing orders. “Under this arrangement, the spare part will be delivered to the Air Force within 4-6 months of receiving a request, depending on the time it takes to manufacture the part,” said Viacheslav Lozan, Director at Sukhoi’s After Sales Centre. At present, it takes an average of 12 months to complete a similar order.

Chishchevoy also revealed that a similar long-term contract, in operation since 2012, is already in place for repairs of Su-30MKI aggregates. The IAF, he said, has “expressed satisfaction” with the arrangement, which has dramatically reduced turnaround times for parts that need to be repaired in Russia. In the past, parts would take between 8 and 15 months just to reach Russia, but the new contract has seen that time shortened



Indian Air Force Su-30MKI in flight at an airshow (photo: Angad Singh)

to an average of 30 days, with a contract-mandated maximum of 60 days.

Liberalised FDI norms in India have also led Sukhoi to consider collaborating with an Indian firm, either public or private sector, to manufacture Su-30MKI parts in India. Such a Joint Venture (JV) would probably also be able to support other Su-30 operators in the region, said Chishchevoy. While he acknowledged that the bulk of aerospace manufacturing expertise in India rests with Hindustan Aeronautics, he also specifically mentioned Tata as one of the private sector companies with the requisite capabilities to carry out spares production.

Recently, Defence Minister Manohar Parrikar informed Parliament that serviceability of the IAF's Su-30MKI fleet had risen from around 50% to nearly 57%. The officials at Sukhoi believe these long-term arrangements and localised spares production could help the Air Force finally reach the Minister's much-touted 75% figure.

Meanwhile, Sukhoi's sister concern, MiG, was keen to highlight the merits of on-going as well as potential future cooperation with India with the MiG-29 family of fighters. MiG CEO Sergei Korotkov noted that although the MiG-29K/KUB is built in Russia, it incorporates a large amount of customer-selected and customer-furnished equipment, and that the technical centres being established for support of the Indian Navy's MiG-29K/KUB fleet will not only make maintenance and support of the aircraft simpler, they will also provide opportunities for employment and technology transfer over the life span of the aircraft (estimated at 30-odd years). In fact, Korotkov revealed that a large amount of work modifying the MiG-29K to the Navy's requirements is already being carried out in India itself. Modifications and refinements are executed under supplemental contracts, with Russian and Indian specialists working side by side, along with Russian and Indian test pilots. Examples of this supplemental work include

software upgrades for various subsystems, integration of the D-29 electronic warfare system, and integration of various new munitions and sensors.

With four additional MiG-29Ks ready for shipment to India in early December 2015, a total of 39 aircraft will have been supplied by the end of the year. Korotkov indicated that the remainder of the contract (for a total of 45 fighters) would be complete by the end of 2016, and is hopeful for more orders given that the Navy will be commissioning the first indigenous aircraft carrier (IAC-1), INS *Vishal*, a few years hence, and the design of IAC-2 has not yet been frozen.

He also said that he was proud that INS *Vikramaditya* and her complement of MiG-29K fighters would be *the pièce de résistance* at the International Fleet Review in February 2016.

As for the land-based MiG-29s, Korotkov said he appreciated the work done by the IAF's 11 BRD at Nasik, which handles all maintenance, repair, overhaul



An IAF MiG-29UPG, still wearing Russian test registration, on a test flight over Russia

and upgrade work for the MiG-29UPG fleet. The specialists at 11 BRD have been trained in Moscow at a MiG facility, and have completed upgrade of 4 aircraft in India so far, with two more being worked on and likely to be delivered for flight testing by end-2015. Russian involvement is now limited to supply of upgrade kits, and presence of Russian specialists at Nasik to provide technical assistance as needed.

MiG-35 as the MMRCA

Notwithstanding the success of the MiG-29UPG programme and PM Modi's April 2015 commitment to procure 36 Dassault Rafale fighters, Korotkov said that India still needs large numbers of modern fighters and that the MiG-35 remains well placed to meet this need. He emphasised that the MiG-35 was compliant with the MMRCA programme's technical requirements, and said it was likely that political considerations had "influenced the eventual shortlisting of the Rafale and Eurofighter Typhoon." He also confirmed that MiG had not been debriefed by either the IAF or the MoD on the reasons for the MiG-35's elimination from the competition. Even though no formal discussions have taken place, either by MiG or the Russian Government,

Korotkov said that the Indian Air Force would need to effect minimal training, infrastructure and logistics changes if it were to adopt the MiG-35, as it already operates a large fleet of MiG-29s, from which type the -35 is derived.

The Civil Sector

Even though the bulk of current Indo-Russian aviation collaboration is related to the military, the Russians are keen to pursue business in civil aviation as well, especially now that one Russian civil aviation programme (the Sukhoi Superjet) is going strong and the foundations for the next (the MC-21 narrowbody airliner) are being laid. Deputy Minister Andrey Boginskiy of the Russian Ministry of Industry and Trade hinted to *Vayu* that civil aviation joint ventures may prove easier to execute as they would be unencumbered by strict controls on defence-related technology that exist in both Russia and in India. Russian civil aviation firms, such as Sukhoi Civil Aviation Company (SCAC) do not have to deal with complicated government bodies such as the India-Russia Inter Governmental Commission for Military-Technical Cooperation (IRIGC-MTC) and therefore would be able to be flexible and responsive when dealing with Indian firms, including

those of the newly empowered private sector. This was confirmed by Alexander Dolotovskiy, Deputy Chief Designer at SCAC, who disclosed that his firm has already held detailed discussions with Tata to produce parts for the Superjet. The MC-21 programme, which has yet to roll out the first prototype, offers an even greater opportunity for collaboration and absorption of a range of advanced composite manufacturing techniques. During *Vayu's* tour of the AeroComposit facilities in Ulyanovsk, it was apparent that the technology leveraged for the MC-21 programme was at par with or ahead of anything else in the world. But for the Cyrillic signage, one may well have been in a Boeing or Airbus plant! UAC President Yuri Slyusar said that a summit for Russian and Indian business leaders would take place during PM Modi's visit, where the MC-21 would be high on the agenda.

Boginskiy also stressed on cooperation in areas outside of pure airframe and aero-engine technology. For instance, he said that Russian electronics companies can design components at the 22-28 nanometre scale, but Russian semiconductor foundries are unable to mass produce chips at such a small size. If India possessed the ability to produce 22-28 nm chips "Russia would be very interested," he declared.



Superjet production facility at KnAAPO in the Russian Far East (photo: SuperJet International)



Back to First Principles

The United States and India are on the cusp of realising their ambition to entrench meaningful defence cooperation despite the absence of a formal alliance.

Without a doubt, deepening defence relations have led the transformation in bilateral ties between the United States and India during the last fifteen-odd years. Whether one examines military-to-military exchanges, defence trade, cooperative development of defence technologies, or defence industrial investment, the picture in 2016 is so far removed from where things stood in 2001 as to defy comparison. Obviously, the record of achievement is more dramatic in some fields than in others, but on balance, both countries today are more deeply engaged in diverse forms of defence cooperation, the highest manifestation of friendship in high

politics, than is common for states that do not share a formal alliance.

The meetings on 10 December 2015 between the US Secretary of Defence Ashton Carter and Indian Minister of Defence Manohar Parrikar will be counted as successful if they provide new direction to this already-burgeoning partnership. In particular, if the US aim of accelerating India's rise in power is to be accomplished rapidly in a way that benefits both nations, then the practical ends of bilateral defence cooperation must transcend interoperability and enable India to secure a lasting operational advantage over its local competitors. To the degree

that US-Indian defence cooperation evolves in this direction, it will have had a positive and durable impact on the strategic fortunes of both democracies as they navigate the evolving geopolitical challenges in Asia.

The Long and Winding Road

For all its recent achievements, the functional objective of expanded US-Indian defence cooperation has thus far been rather modest. During the 1990s, when bilateral defence ties were gradually developing during then US president Bill Clinton's administration, the aim of closer engagement was largely like "getting to know you." In aftermath of the Cold War,

the dissolution of bipolarity removed one significant structural reason for continued US-Indian estrangement. US policymakers, then, recognising the benefits of reaching out to an emerging power, conceived of closer defence ties mainly as advancing the objective of increasing familiarity with the large and capable armed services of a hitherto neglected, but now important, fellow democracy. Consistent with this vision, military-to-military exchanges received greatest priority, with modestly increased Indian access to discrete pieces of US military equipment following distantly.

In the first decade of the new century, when then president George W Bush's administration embarked on a decisive transformation of US-Indian relations, defence cooperation was conceived of far more ambitiously because India was viewed as a unique geopolitical partner of the United States. Washington, in fact, took upon itself the obligation of assisting India's rise because its ascendancy was judged to foster the stable balance of power that might thwart any possible Chinese domination of Asia. At the same time, such US support was expected to deepen fraternal bonds with a major non-Western democracy whose

comprehensive success would contribute to a thriving liberal international order.

These goals justified the revitalisation of defence cooperation in ways that went beyond mere military-to-military exchanges and occasional defence sales. Rather, they included efforts at positioning the United States as a major supplier of defence goods to India, increasing defence industrial cooperation, and beginning the first efforts at collaborative defence research and development.

Although some of these initiatives did not bear much fruit in the face of historical US technology transfer restrictions, Indian fears of vulnerability to possible US sanctions in a crisis, and the enormous commitment of political energy on both sides to consummating their civilian nuclear deal, the Bush era ended on a fecund note as far as defence cooperation was concerned. For a nation that had long been suspicious of India and its legacy of non-alignment, the United States was resolved to build a relationship with India that, despite the latter's commitment to strategic autonomy, would permit both sides to pursue the goal of interoperability. This objective implied that the United States and India

would pursue the long-term ambition of developing those military capabilities that would enable them to engage in combined operations, should such operations be required to defend common national interests. As Senator John McCain would reiterate in 2010, after President Bush had left office, the United States views "the enhancement of India's defence capabilities and its increasing interoperability with US forces as... positive. Now, I realise that many in India are sceptical of such a proposal, viewing it as limiting India's autonomy and eroding its sovereignty. In fact, the opposite is true. The decision about whether to cooperate with the United States will always rest with India's democratic leaders; greater interoperability simply creates more options for how to cooperate if India chooses to do so."

On this one issue, President Barack Obama has actually doubled down on the policies of his predecessor. Treating the expansion of the US-Indian relationship as a strategic priority for the United States, in fact, articulating its importance in instructions to his entire administration, he pursued the comprehensive expansion of defence cooperation with New Delhi long



Specialist aircraft such as the P-8I are expected to help establish India as the dominant power in the Indian Ocean, in line with US aspirations for this crucial region (photo: Angad Singh)

before it was patently obvious that China would pursue various assertive policies in Asia and with respect to the larger international order. Under Obama, even those elements of bilateral defence cooperation that were previously flagging, namely cooperative research and development and defence industrial collaboration, received a fillip. And those components that had already demonstrated progress, such as military-to-military exchanges and defence trade, scaled new heights that had been simply unimaginable when bilateral ties were at their nadir in the aftermath of India's 1998 nuclear tests.

Further, and to the surprise of many, the Obama administration also articulated clearly its vision of, and support for, Indian leadership throughout the Indian Ocean basin. In 2001, in his confirmation hearings, Bush's secretary of state designate, Colin Powell, gingerly suggested that "India has the potential to help keep the peace in the vast Indian Ocean area and its periphery," concluding that "we need to work harder and more consistently to assist India in this endeavour." Barely eight years later, Obama's secretary of defence, Robert Gates, would forthrightly declare, "In coming years, we look to India to be a partner and net provider of security in the Indian Ocean and beyond."

A Bolder Step Forward

From the hesitant beginnings of the 1990s when the United States and India were cautiously feeling each other out, to the second decade of the twenty-first century with both nations comfortable and confident enough to promulgate a *Joint Strategic Vision for the Asia-Pacific and Indian Ocean Region*, the transformation in bilateral defence cooperation is visible for all to see. The election of Narendra Modi as prime minister of India in 2014 only intensified the imperatives for bolder collaboration. Unlike his predecessor, Manmohan Singh, who also ardently sought a strategic partnership with the United States but was prevented from consummating it by pressures from within his own party, Modi neither has the patience for the traditional Indian shibboleths about nonalignment and strategic autonomy nor is he diffident about cementing stronger ties with Washington because of its value for India's vital interests.

Given this evolution in Indian leadership attitudes toward collaborating with the

United States, the goal of bilateral defence cooperation thus far, interoperability, must also undergo a metamorphosis. Unquestionably, both nations should continue to work toward enabling their military forces to synergise their activities in the field when required, and to that end should shape their planning, procurement, training, and exercises as appropriate, with the full understanding that unilateral employment will likely remain the primary means of exercising coercive power. Yet, the importance of strengthening India's pivotal role as a force for stability in the Indo-Pacific region in the years ahead demands that the prevailing goal of interoperability be eclipsed by a newer ambition, namely that of enabling India to maintain a competitive operational advantage over its regional adversaries.

India's capacity to acquire and sustain a persistent operational edge over its immediate rivals, Pakistan and China, remains in American interests as the Asian geopolitical system continues its evolution, especially in the face of chronic instability in Pakistan and the continuing expansion of Chinese military power. Assisting New Delhi to overcome the challenges posed by both of these threats, which will persist for a long time to come, is not only the logical predicate of the now-conventional US strategic objective of aiding India's rise. It is also essential to advancing Washington's aims of constructing an Asian power balance that limits China's ability to intimidate its neighbours, containing Pakistan's capacity for self-destructive behaviours, and providing India with the requisite surplus of military power that satisfies its immediate defence needs while still permitting the appropriate excess necessary to underwrite its role as a net provider of public goods in the wider Indo-Pacific region.

Enabling New Delhi to sustain a competitive operational advantage over Islamabad and Beijing in military terms should therefore become the new functional objective of US-Indian defence cooperation. This aim comports with larger US grand strategy and would breathe new life into and offer new direction for security cooperation more generally.

Realising this objective is easier where Pakistan is concerned, because India is already the stronger power in this dyad. But it would require Washington to be more cognizant of when its own military

assistance to Pakistan, which is likely to continue indefinitely, turns out to undermine the larger functional aims of defence cooperation with India. On occasion, the tensions in these competing policies may not lend themselves to conclusive resolution, but they ought to at least be recognised and actively managed in ways that do not weaken the partnership with India because of its importance to larger US strategic interests in Asia.

A similar problem is unlikely to materialise in the case of China, since US policymakers, recognising the threats posed by an ever more powerful Beijing, are unlikely to strengthen Chinese military capabilities in ways that were contemplated prior to 1989. Yet the Chinese challenge will be even more daunting than the Pakistani one because the current Sino-Indian power balance substantially disadvantages India and hence will require greater US assistance if New Delhi is to preserve its traditional military advantage along the Chinese border while acquiring the capacity to neutralise the emerging Chinese threat in the wider Indian Ocean.

New Directions

If the goal of nurturing India's operational advantage is to be achieved in these circumstances, US-Indian defence cooperation must evolve further in three promising directions.



Joint Army exercises such as the annual India-US Yudh Abhyas series facilitate building of personnel-level camaraderie (photo: Angad Singh)



The IAF's small fleet of C-130Js, earmarked for 'special operations,' could benefit from greater engagement with, the USAF Special Operations Command (AFSOC), which also operates variants of the type (photo: Angad Singh)

First, the United States must make conscious decisions to provide India with preferential access to advanced, high-leverage military technologies that would enable New Delhi to gain battlefield superiority in its geographic areas of interest. This will require US policymakers to review current restrictions on the transfer of several next-generation combat systems and, wherever possible, accommodate the current Indian desire to co-produce or manufacture them in India. So long as American military superiority, or the security of US treaty allies, is not compromised by more liberal military technology access for India, Washington should consider many of the current Indian requests for advanced weapons favourably.

India, for its part, needs to help the process along. It should quickly conclude the outstanding agreements intended to protect either critical technologies or vital intangibles. By doing so, Indian policymakers can shore up the confidence of their American counterparts with respect to the protections that must be afforded to all puissant systems that could be transferred.

Second, bilateral defence cooperation must expand to offering India advanced military training in critical functional specialties. In recent years, New Delhi has, after concerted efforts, acquired new warfighting capabilities such as airborne warning and control systems, high-altitude air antisubmarine warfare platforms,

and unmanned aerial vehicles. New combat capabilities on the anvil include conventional take-off and landing aircraft carriers, nuclear-powered submarines, and long-range air and missile defence systems. A central element of increasing India's operational advantage in the field will be enabling its warfighters to use these advanced systems to their technological limits.

Given the US proficiency in operating such weapons, permitting India access to US training schools, and transferring intangible knowledge in the form of shared tactics, techniques, and procedures, would make an enormous difference to India's ability to use its new capabilities effectively. This would require the United States to reconfigure both the opportunities currently offered to India under the International Military Education and Training programme, as well as to offer to post Indian officers at the relevant combatant commands in order to strengthen liaison and coordination at the operational level. Given the obvious benefits for India, it is unfortunate that Indian policymakers have still not responded positively to current US offers on the latter, all the more because these proposals were precipitated by New Delhi's interest in the first instance.

Complex Military Exercises

Third, the United States and India must develop an ambitious programme of

complex military exercises in all warfighting domains and supplement these with combined operations wherever possible. The secret to developing operational proficiency and, by implication, securing an operational advantage on the battlefield lies in constant and diverse training.

The Indian military already has a well-developed schedule of year-round exercises for all components of its combat forces. Yet nothing hones competence like the ability to practice with one's international peers, especially those that deploy advanced military capabilities not in one's own inventory. US-Indian military exercises are indeed frequent and diverse. But those joint exercises are for the most part still relatively simple and oftentimes overly scripted. If the aim of ensuring India's competitive operational advantage over its adversaries is to be realised in the near term, bilateral military exercises must become more complex and more routine, and they should involve the best combatant capabilities on both sides—expanding to regularly include other friendly partners as well. Providing access to each other's major training ranges would also be a valuable evolution in this process.

There have been significant improvements in the bilateral exercise programme to date, but the potential for improvement here, especially in the areas of antisubmarine warfare, large-force air employment, specialised land



Exercise Malabar 2015 saw the first participation of an Indian Kilo-class submarine, highlighting the increased trust between the Indian and US Navies (photo: USN/Mass Comm Specialist Seaman Chad M Trudeau)

warfare operations, missile defence, and cybersecurity operations, is enormous and will only redound to mutual advantage. Taking the gains from familiarisation and common tactics, techniques, and procedures and applying them in combined operations represents the acme of defence cooperation. Without prejudice to the national interests of both nations, there are already remarkable opportunities for such activities in the Indian Ocean. It would therefore behoove India, which stands to gain tremendously, to examine seriously the US proposals in this regard that are already on the table.

Think Expansively

After almost two decades of efforts at building a new strategic partnership, the United States and India now stand on the cusp of realising their ambition to entrench meaningful defence cooperation despite the absence of any formal alliance. If the US goal of aiding India's rise as a means of protecting an Asian power balance that is favourable to American interests is to be accomplished, the functional objective of US-Indian defence cooperation will have to expand beyond interoperability to furnishing India with an operational military advantage over its immediate rivals. Only such a condition would permit India to play the role that limits both the

pathologies arising from Pakistan's weakness as well as the wilfulness emerging from Chinese strength.

Because aiding India's rise comports perfectly with American interests, Washington ought to be ambitious with regard to future defence cooperation with New Delhi. Policymakers in the United States should think expansively about increasing India's access to advanced military technologies, providing the Indian armed forces with new opportunities for training with their American counterparts, and pursuing ever more complex military exercises with India that hone common skills in ways that would advantage both nations in the wider Indo-Pacific.

India's government (including its military leadership), for its part, ought to seize the opportunities offered by Prime Minister Modi's bold overtures toward the United States and conclude the outstanding agreements whose absence has precluded the transfer of advanced military technologies. Meanwhile, the government should move unflinchingly to accept the US offers of joint military operations that would only benefit India at a time when it faces serious and growing external threats.

If both Washington and New Delhi can thus move complementarily to cement their growing defence ties in ways that were

inconceivable barely two decades ago, the first principle underlying the transformation of the US-Indian relationship, assisting India's ascendancy as a means of preserving the balance of power that favours freedom in Asia, will have been amply justified to the lasting benefit of both partners. If Defence Minister Parrikar's visit to the United States yields further progress in this direction, it will have been an important investment in realising the promise of US-Indian defence ties.



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India Aviation 2016 in wake of

The new Civil Aviation Policy

Preceding the 5th Edition of the biennial International Exhibition & Conference on Civil Aviation at Begumpet Airport at Hyderabad in March 2016, the Ministry of Civil Aviation has released the long awaited Civil Aviation Policy, albeit in draft form, in late October 2015.

Civil Aviation Minister Ashok Gajapathi Raju, his deputy Mahesh Sharma and aviation secretary RN Choubey have long been engaged in reviewing the policy in its various aspects including norms on the 20/5 issue which has been in suspense since 2013. According to Aviation Secretary RN Choubey, "The draft policy is in line with the Prime Minister's directive that the policy should promote aviation in a big way and take flying to the masses". He said that one of the most important initiatives proposed is the Regional Connectivity Scheme (RCS)

to boost air travel in smaller towns, under which scheme the government will work towards revival of un-served airports, build no-frills airports and also give incentives and subsidies to stakeholders. The 2 per cent levy from air tickets will also go into these funds. The revised policy has floated the concept of Scheduled Commuter Airlines (SCAs), which would have relaxed norms and those entities would not be liable to pay airport charges for operations under the RCS.

However, the most important aspect of the new policy concerns the 5/20 rule which stipulates that an Indian airline will only be

allowed to operate services internationally if it has five years of domestic flying experience and at least 20 aircraft in its fleet. "There are definitely going to be checks and balances such as airlines being asked to deploy certain capacity, say 40 per cent or more, on domestic routes. This would restrict them from diverting a larger of the capacity to international routes (which are more lucrative) at the cost of domestic connectivity", stated a ministry official.

This development assumes significance in view of the fact that new player AirAsia India has demanded scrapping of the 5/20 norm wherein another startup airline Vistara deferred its plans to induct more aircraft in its fleet, after the government failed to take a decision on the issue last year. Co-incidentally, both Vistara and AirAsia India have investments from the Tata Group.

The established airlines including Jet Airways, IndiGo, SpiceJet and GoAir - under the umbrella of Federation of Indian Airlines (FIA)-however, and expectedly, opposed any tweaking or scrapping of the earlier rule.



Key role of Helicopters

An important policy matter concerns the operation of helicopters which, to quote the document “play a key role in remote area connectivity, intra-city movement, tourism, law enforcement, disaster relief, search and rescue, emergency medical evacuation”. The Policy document rues that there are less than 300 civilian helicopters registered in India while Brazil, as an example, has over 1300.

Therefore separate regulations for helicopters will be notified by DGCA after due stakeholder consultation and four heli-hubs will be initially established across the country to promote regional connectivity. The ministry of Civil Aviation will coordinate with MoF, MHA, NHAI, Indian Railways, insurance companies, hospitals, Pawan Hans and helicopter operators to facilitate rapid medical evacuation. “Helicopters will be free to fly from point to point without prior ATC clearance in airspace below 5000 feet and areas other than prohibited and restricted ones, after filing the flight plan with the nearest ATC office.”

The government will promote the use of seaplanes for growth of tourism and regional connectivity along India’s 7500 km coastline.

Other Highlights of the Policy :

➔ All options are open on international flying norms (the ‘5/20 rule’). Three options stated in the draft policy are to continue the present norms, completely abolish them from immediate effect and have as replacement a credit-based system.

➔ The government will not discontinue the route dispersal guidelines which mandate airlines to fly to ‘remote areas’. More routes will be added in the Category I (metro) routes as destinations more than 700 km away domestically with annual traffic of 500,000 passengers also become part of it. Presently, airlines will need to deploy at least 10% of capacity on the routes to North Eastern region, Jammu & Kashmir, Andaman & Nicobar Islands and the Lakshadweep (Category-II routes). Airlines will need to take permission of the civil aviation ministry to withdraw existing operations in “north east region, the offshore Islands and Ladakh.”



Pawan Hans Dauphin is operated largely for offshore logistic support



Bell 429 twin-engine helicopter in private operation (photo: Angad Singh)



HAL's Dhruv ALH is largely operated by the Indian Armed Forces with a handful in civilian markings (photo: Angad Singh)

➔ The Government has cleared routes to destinations 5,000 km away from New Delhi thereby assisting European, Australian and West Asian carriers among others to operate flights to and from India without any restriction on the number of flights and seats.

➔ The government will give foreign airlines traffic rights to key destinations within seven hours of flying away from India (Gulf region, Middle East and South East Asia) through auction as one option. At present, countries sign an agreement to decide the flights or seats per week that



The single-engine Cessna 208 nine seater (above), with floats, has operated in the A&N Islands but could well be supplanted by the 14-seat, twin-engine Dornier Seastar (below)



can be flown to each other's country. "For countries within 5,000 km where domestic airlines have not fully utilised their quota, additional seats above existing rights would be allotted by bidding for a three year period," according to the draft policy.

➔ The government will "consider" opening skies for short-haul destinations from 1 April 2020. "If the government decides to go for open skies", there will be an increase in FDI in airlines from 49% at present to above 50%.

➔ A regional connectivity scheme, coming into effect from 1 April 2016, has been framed wherein airfares for a one-hour flight will be capped at Rs 2,500. This will happen through revival of un-served or under-served airstrips. According to the scheme, 'a regional connectivity fund' will be formed by charging 2% cess on air tickets on international and domestic routes excluding the intra-remote areas. The Centre will provide viability gap funding on air tickets from 80% of the regional connectivity fund and the rest will come from the state.

➔ The concerned state government will identify potential airstrips from which low-cost airports can be developed. It will have to provide a slew of incentives such as free land, concessional power, water and other tariffs, reduce value added tax (VAT) on aviation fuel to 1% or less on these airports.



Releasing the Policy Document

Additionally, the Centre will exempt service tax on air tickets under this scheme and the aviation fuel exempt from excise duty.

➔ The government endeavours to make India a Maintenance, Repair and Overhaul (MRO) hub in Asia. The service tax on output services of MRO will be zero, aircraft maintenance tools will be exempted from custom duty, tax-free storage period of spare parts imported by MROs will be extended for three years and procedure for custom clearance will be simplified. MRO, ground handling, cargo and ATF at the airport will get the benefit of 'infrastructure' sector.

➔ Indian carriers will be free to enter into code-share agreements with foreign carriers for any destination within the country on a reciprocal basis. No prior approval of the ministry will be required and the airlines only have to inform the ministry 30 days prior to starting the code-share flights.

➔ Airlines may be allowed to self handle services at airports, which include check-in, luggage handling, aircraft cleaning and servicing, loading and unloading of food and beverages. The present rule states only permanent employees handle ground operations but private airlines actually either hire contract workers or use external agencies.



IATA Air Passenger Forecast

“Dip in long-term demand”

The International Air Transport Association (IATA) in its updated passenger growth forecast, projects that passenger numbers are expected to reach 7 billion by 2034 with a 3.8% average annual growth in demand (2014 baseline year). That is more than double the 3.3 billion who flew in 2014 and exactly twice as many as the 3.5 billion expected in 2015. Previously, IATA forecast 7.4 billion passengers in 2034 based on a 4.1% average annual growth rate. The revised result reflects negative developments in the global economy that are expected to dampen demand for air transport, especially slower economic growth projections for China.

The five fastest-increasing markets in terms of additional passengers per year over the forecast period will be China (758 million new passengers for a total of 1.196 billion), the USA (523 million new passengers for a total of 1.156 billion), India (275 million new passengers for a total of 378 million), Indonesia (132 million new passengers for a total of 219 million) and Brazil (104 million new passengers for a total of 202 million).

Seven of the ten fastest-growing markets in percentage terms will be in Africa. The top ten will be: Malawi, Rwanda, Sierra Leone, Central African Republic, Serbia, Tanzania, Uganda, Papua New Guinea, Ethiopia and Vietnam. Each of these markets is expected to grow by 7-8% each year on average over the next 20 years, doubling in size each decade.

In terms of routes, Asian, South American and African destinations will see the fastest growth, reflecting economic and demographic growth in those markets. Indonesia-East Timor will be the fastest growing route, at 13.9%, followed by India-Hong Kong (10.4%), within Honduras (10.3%), within Pakistan (9.9%) and UAE-Ethiopia (9.5%)

“The demand for air transport continues to grow. There is much work to be done to prepare for the 7 billion passengers expected to take the skies in 2034,” observed Tony Tyler, IATA’s Director General and CEO.

“Economic and political events over the last year have impacted some of the fundamentals for growth. As a result, we expect some 400 million fewer people to

be traveling in 2034 than we did at this time last year. Air transport is a critical part of the global economy. And policy-makers should take note of its sensitivity. The economic impact of 400 million fewer travelers is significant. Each is a lost opportunity to explore, create social and cultural value, and generate economic and employment opportunities. It is important that we don’t create additional headwinds with excessive taxation, onerous regulation or infrastructure deficiencies,” said Tyler.

Divergence among the BRIC Nations

A sizable gulf has opened up between the performance of air passenger markets in the BRIC economies (Brazil, Russia, India and China). China and India are growing fast, with annual growth this year-to-date of 12.5% and 16.5% respectively. India has bounced back from a subdued 2014, and is seeing a strong increase in domestic frequencies. Although China’s growth rate has moderated, it is still on course to add an additional 230 million passenger journeys between 2014 and 2019. This is more than



Airbus A320 of Vistara

double the other three BRIC nations put together. Brazil and Russia, by contrast, are struggling. Falling oil and other commodity prices are partly to blame. Economic sanctions have also affected the Russian economy. It is notable that airlines in Brazil pay some of the highest fuel charges in the world, bringing the country's fuel policy in line with global standards would certainly be a boost for air transport.

“Exciting prospects for Iran and Cuba”

The prospects for more open travel between the rest of the world and Cuba and Iran offer exciting possibilities for business, tourism and development as diplomatic relations warm up. Of the two markets, Iran offers the greater potential. Although Cuba is the largest Caribbean country by population, passenger growth would be from a low base of 5 million passengers today to around 13 million by 2034, in the best-case scenario. Iran, by contrast, already has a market of 12 million passengers, mostly domestic flyers. If strong GDP growth is accompanied with a full normalisation of international relations and the end to sanctions, the total size of the Iran market could be 43.6 million passengers by 2034.

“There is a great deal of scope for economic development in Cuba and Iran, and air transport can play an enormous role in that. Relative to their economic development, the people of Iran and Cuba fly less than the global average. In Iran, full integration in the global economy could mean a difference in passenger growth of around 13 million extra travelers a year,” said Tyler.

World's 10 largest markets

China is expected to overtake the United States as the world's largest passenger market (defined by traffic to, from and within) by 2029. In 2034, China will account for some 1.19 billion passengers, 758 million more than 2014 with an average annual growth rate of 5.2%. Traffic to, from and within the US is expected to grow at an average annual growth rate of 3.1% that will see 1.16 billion passengers by 2034 (523 million more than 2014). India will displace the United Kingdom as the third-largest market in 2026, with Indonesia rising to number 5 in the world. Japan, Spain, Germany and France fall relative to their competitors, Italy falls out of the top 10, while Brazil moves from 10th place to 7th.

Regional growth highlights

- Routes to, from and within Asia-Pacific will see an extra 1.8 billion annual passengers by 2034, for an overall market size of 2.9 billion. In relative terms it will increase its size compared to other regions to 42% of global passenger traffic, and its annual average growth rate, 4.9%, will be the joint-highest with the Middle East.
- The North American region will grow by 3.3% annually and in 2034 will carry a total of 1.4 billion passengers, an additional 649 million passengers a year.
- Europe will have the slowest growth rate, 2.7%, but will still cater for an additional 591 million passengers a year. The total market will be 1.4 billion passengers.

- Latin American markets will grow by 4.7%, serving a total of 605 million passengers, an additional 363 million passengers annually compared to today.
- The Middle East will grow strongly (4.9%) and will see an extra 237 million passengers a year on routes to, from and within the region by 2034. The UAE, Qatar and Saudi Arabia will all enjoy strong growth of 5.6%, 4.8%, and 4.6% respectively. The total market size will be 383 million passengers.
- Africa will grow by 4.7%. By 2034 it will see an extra 177 million passengers a year for a total market of 294 million passengers.

Economic prosperity – and environmental responsibility

At present, aviation helps sustain 58 million jobs and \$2.4 trillion in economic activity. In 20 years' time, aviation is expected to support around 105 million jobs and \$6 trillion in GDP. The aviation industry, however, also recognises that air travel has an environmental impact. It is committed to reducing its carbon footprint. In 2009, the industry agreed three targets which will ensure that aviation plays its part in ensuring a sustainable future.

- 1.5% annual fuel efficiency improvement to 2020
- Capping net emissions through carbon-neutral growth from 2020
- A 50% cut in net emissions by 2050, compared to 2005.

“Aviation is determined to achieve carbon neutral growth from 2020. But we need governments to help by agreeing a global market-based measure, to be implemented from 2020. We believe that a global carbon offsetting scheme would be the best option, but the decision rests with the 191 member states represented at the International Civil Aviation Organization, who will meet in late 2016. We urge all governments to agree a global solution and help air transport meet its goals for a sustainable future,” said Tyler.



China, China, China

Airbus forecasts that China will need over 5,300 new passenger aircraft and freighters in the next 20 years with a total market value of US\$ 820 billion which represents 17 per cent of the world total demand for over 31,000 new aircraft in the next 20 years. According to Airbus' Global Market Forecast, new deliveries of passenger

and freight aircraft for China will be 5,363 over the next 20 years, including 3,567 single aisle aircraft, 1,477 twin-aisles and 319 very large aircraft. China will become the leading country for passenger air traffic, for both domestic and international markets as the passenger traffic in China will grow well above the world average.

Domestic air traffic in China will become the world's number one within 10 years. China will overtake the United States of America in 2023, in terms of the number of passengers and in 2027, in terms of RPK (Revenue Passenger Kilometre). In the next 20 years, the forecast average annual growth rate for the domestic Chinese market is 7.1 per cent but will grow even faster over the next 10 years at 8.3 per cent on average per year. By 2033, the domestic Chinese market will remain the largest flow, representing 11.9 per cent of world traffic in terms of RPK.

During the period, the average annual growth rate for international traffic from/to mainland China will be 8.1 per cent. Four out of the 20 largest flows (RPK) will be from/to PRC. The average annual growth rate for markets between emerging Asian countries and PRC is 7.5 per cent, for routes between PRC and the USA it is 6.6 per cent, while the routes between Western Europe and PRC is 5.6 per cent.

Drivers of China's dynamic air transport growth include the country's long-term economic development. The average annual economic growth in China is forecast at 7.4 per cent between 2013 and 2023. China will become the world's biggest economy in 2023, with its GDP accounting for 19 per cent of the world's total.

"Airbus has the most complete product line from 100 to over 500 seats and we will contribute to the long-term sustainable development of China's air transportation by providing Chinese airlines with the right aircraft at the right moment and the strongest support," Leahy stated.

IAI's JV in China deepens its ties in China's civil aviation market

Israel Aerospace Industries (IAI) has formed a Joint Venture to cooperate with Lingyun (Yichang) Science and Technology Group Co., Ltd., to establish its first local Chinese maintenance, repair and overhaul (MRO) enterprise in Hubei Province. This joint venture will be dedicated to expanding civil maintenance services and cargo conversion, as well as laying the groundwork for additional business. IAI is a world leader in the

provision of maintenance services for aircraft, engines and components, including heavy maintenance, modifications, upgrades, conversions and development programmes. With IAI's extensive experience as a centre of excellence in the MRO arena, the company will work hand-in-hand with Lingyun (Yichang). Cooperation between the two companies has received strong support from the Chinese People's

Association for Friendship with Foreign Countries (CPAFFC), as well as from local municipal and provincial governments.

Yosi Melamed, VP of IAI's Bedek Aviation Group, said: "This is IAI's first MRO JV in China and is part of IAI's strategy to extend our business into the growing Chinese civil aviation sector. This agreement will lead to substantial cooperation between our two companies for the mutual benefit of both parties."

The Airbus Forecast:

“32,600 new aircraft worth nearly US\$5 trillion in the next 20 years”



Airbus A350XWB

From the world's first commercial flight in 1914, to today's 32 million flights annually, aviation has become part and parcel of our everyday lives. With some three billion air passengers, and 50 million tonnes of freight carried every year by aircraft, it is estimated that aviation contributes US\$2.4 trillion annually to global GDP.

In the next 20 years (2015-2034), according to Airbus' Global Market Forecast, global passenger traffic will grow at an average 4.6% a year, driving a need for some 32,600 new aircraft above 100 seats (31,800 passenger and 800 freighters greater than 10 tonnes) worth US\$4.9 trillion. By 2034, passenger and freighter fleets will more than double from today's 19,000 aircraft to 38,500. Some 13,100 passenger and freighter aircraft will be replaced with more fuel efficient types.

Emerging economies which collectively account for six billion people, are the real engines of worldwide traffic growth. They will grow at 5.8% per year compared to more advanced economies, like those in Western Europe or North America, that are forecast to grow collectively at 3.8%. Emerging economies also account for 31% of worldwide private consumption which will rise to 43% by 2034. Economic growth rates in emerging economies such as China, India, Middle East, Africa and Latin America will exceed the world average. A knock on effect is that middle classes will double to almost 5 billion people.

The tendency to travel by air is increasing. In today's emerging economies, 25% of the population take one trip per year, and this will increase sharply to 74% by 2034. In advanced economies, such as North America, the tendency to travel will exceed two trips per year.

“Asia-Pacific will lead in world traffic by 2034 and China will be the world's biggest aviation market within 10 years, and clearly Asia and emerging markets are the catalyst for strong air traffic growth,” said John Leahy, Airbus Chief Operating Officer, Customers. “Today, we are ramping up production of the A350 XWB and we are studying further production rate increases beyond 50 for single aisle aircraft to meet the increasing demand for air transportation.”

Long-haul traffic will increasingly be to, from or between aviation mega-cities, rising from 90% (0.9 million passengers a day) today to 95% (2.3 million passengers a day) by 2034. Aviation mega-cities are centres of urbanisation and wealth creation and will increase from 47 to 91 cities by 2034 with 35% of World GDP centred there. These mega cities are already served well by air transportation and the existing route network will accommodate 70% of all traffic growth between now and 2034.

In the widebody market, Airbus forecasts a trend towards higher capacity aircraft on long-haul and an increasingly wide range of regional and domestic sectors. As a result, Airbus forecasts a requirement

for some 9,600 widebody passenger and freighter aircraft over the next 20 years, valued at some US\$2.7 trillion. This represents 30% of all new aircraft deliveries and 55% by value. Airbus will be especially well placed to win a leading share of the widebody market, with the A330, A350 and A380 representing the most modern and comprehensive product line available today from 200 to over 500 seats.

In the single aisle market, where the A320 Family and the latest generation A320neo Family are firmly established as the global market leaders, the latest Airbus forecast sees a requirement for nearly 23,000 new aircraft worth US\$2.2 trillion over the next 20 years, an increase of nearly 1,000 aircraft compared to the previous forecast, representing 70% of all new units and 45% of the value of all deliveries.

Globally traffic growth has led to average aircraft size 'growing' by 46% since the 1980s with airlines selecting larger aircraft or up-sizing existing backlogs. Larger aircraft like the A380 combined with higher load factors make the most efficient use of limited slots at airports and contribute to rising passenger numbers without additional flights as confirmed by London's Heathrow Airport. A focus on sustainable growth has enabled fuel burn and noise reductions of at least 70 per cent in the last 40 years and this trend continues with innovations like the A320neo, the A330neo, the A380 and the A350 XWB.

Airbus exceeds targets in 2015

Airbus has exceeded its targets for 2015, achieving a new record of 635 aircraft deliveries for 85 customers, of which 10 are new. These deliveries comprise: 491 A320 Family aircraft; 103 A330s; 27 A380s; and 14 A350 XWBs. This production achievement means that Airbus' aircraft deliveries in 2015 were up for the 13th year in a row, surpassing the previous year-end delivery record of 629 aircraft set in 2014.

Airbus also achieved 1,036 net orders from 53 customers (of which eight are new), comprising 897 single-aisle aircraft and 139 widebodies. At 2015 year-end the overall backlog had climbed to a new industry record of 6,787 aircraft valued at US\$996.3 billion at list prices.

Fabrice Brégier, Airbus President and CEO said: "This commercial and industrial performance unequivocally proves that global demand for our aircraft has remained resilient." He adds: "In 2015 Airbus has also laid firm foundations for the future, increasing the capability and variety of the aircraft which we can offer to our customers."

Overall, 2015 has been a year of wide-ranging Airbus accomplishments. For example, the A320neo was certified by the aviation authorities on both sides of the Atlantic just five years after its launch.



The A380 at Paris Air Show 2015

In addition, Airbus delivered 14 A350s and important progress was also made on the A350 programme's next variant, the A350-1000 – whose major components and structures are now taking shape across various production sites. Likewise, parts are now in production for the first A330neo – with the machining of its first engine pylon and centre wing-box components. In addition, there has been good news for the flagship A380, 10 years after its first flight, with the programme breaking-even for the first time.

Another notable highlight was of course last September's official opening of the first Airbus factory in the US, at Mobile on Alabama's Gulf Coast, where

between 40 and 50 A320 Family aircraft will be produced annually by 2018. On the other side of the globe in China, additional orders for the A330 not only complement plans for a new A330 completion and delivery centre in Tianjin, but also helps to smooth the transition towards the A330neo. Furthermore, in 2015, Airbus launched three new incremental aircraft developments which include: the Long-Range version of the A321neo which will offer true transatlantic operation; the Regional version of the A330 which is optimised to seat up to 400 passengers on missions up to 3,000nm; and the Ultra-Long-Range version of the A350-900, capable of 19-hour flights.



Hot weather testing in Al Ain was part of Airbus' certification programme for the A320neo jetliner with Pratt & Whitney Pure Power PW1100G-JM engines

The Boeing Forecast:

"38,050 new aircraft worth \$5.6 trillion"

Boeing projects a demand for 38,050 new aircraft over the next 20 years and estimating the total value of those new aircraft at \$5.6 trillion. "The commercial aircraft market continues to be strong and resilient," stated Randy Tinseth, vice president of Marketing, Boeing Commercial Airplanes. "As we look forward, we expect the market to continue to grow and the demand for new aircraft to be robust."

Passenger traffic will continue to grow at about a 4.9 percent annual pace, near the historic trend line of 5 percent. More than 7 billion passengers will fly by the end of the forecast period. Cargo traffic will grow at about 4.7 percent per year. The single-aisle market continues to be the fastest-growing, largest overall segment, requiring 26,730 airplanes over the coming two decades. These aircraft are the foundation of the world's airline fleet, carrying up to 75 percent of passengers on more than 70 percent of the world's commercial aviation routes. This sector is fueled by growth in low-cost carriers and airlines in developing and emerging markets. "At the heart of the single-aisle market are the Boeing 737-800 and the future 737 MAX 8," said Tinseth. "These airplanes offer customers the most fuel efficiency, reliability and capability in this class."

About 35 percent of the single-aisle market will go to low-cost carriers, Tinseth noted. "Low-cost carriers will require air liners that combine the best economics with



the most revenue potential. With 20 percent lower fuel use, the 737 MAX 200 will be the ideal machine for them."

Boeing forecasts that the widebody segment will require 8,830 new aircraft, led by small widebody aircraft in the 200- to 300-seat range such as the 787-8 and 787-9 Dreamliner. This forecast reflects a continued shift in demand from very large aircraft to efficient new twin-engine products such as the 787 and new 777X. While airline growth still accounts for the majority of new demand, a large and growing number of aging aircraft will require replacement. About 2 to 3 percent of the installed fleet will require replacement each year. "The 737 MAX, 777 and 787 are perfectly positioned to capture this important wave of replacement," Tinseth observed.

Then, the air cargo market continues to strengthen, and will drive demand of some 920 new airplanes over the 20-year forecast. "We've seen two years of solid growth in the air cargo market and we expect that growth to continue," Tinseth said. "That's great news for our line of production freighters, including the 747-8, 767 and 777."

Elbit Systems to enhance air safety

Elbit has a lot to offer in the commercial aviation sector. First is *Clearvision*, which is a complete, Enhanced Flight Vision System (EFVS), that covers the full flight envelope and overcomes extreme weather conditions and low visibility situations, both day and night. *Clearvision* allows for intuitive head-up flying, minimising the dependency on airport and helipads instruments, and is designed to reduce landing minima and providing takeoff credit. The *Clearvision* display fuses conformal flight guidance symbology with synthetic vision



Skylens

presentation and high-resolution EVS video on a head mounted display. ClearVision EVS allows the pilot to carry on operating, takeoff and land in low visibility conditions. ClearVision receives information from several sensors, all neatly packed into a single unit, covering different spectral bands, optimised for penetrating poor visibility and providing a fused picture that overcomes the reliance on heat generating objects.

Skylens, another solution, is packed in a lightweight, easy-to-install device, as intuitive as a pair of sunglasses, is a revolutionary approach for today's aviators challenges. Operational in all weather conditions, day and night, it provides head-

up information and minimises dependency on airport instrumentation. Skylens is part of the Clearvision Enhanced Flight Vision EFVS family, displaying high-resolution information, images and video on a high transparency visor, providing superior see-through transmission.

SkyVis, another Elbit product, is a new system combining the proven Helmet-Mounted Display (HMD) with commercially certifiable Line-Of-Sight (LOS) technology and daytime Head-Up Display (HUD) capabilities. SkyVis day or night system offers enhanced situational awareness and enables 'Eyes Out' operations, with or without night visions goggles (NVG), during all phases of flight, in marginal weather conditions without compromising safety. Adverse weather can prevent an air rescue team from executing their life saving missions, searching for and rescuing survivors. SkyVis

enables flight in limited visibility conditions, increasing the total number of rescue missions that can be safely executed and potentially saving more lives.

Finally, Clearvision HUD is an electro-optic device that presents aircraft data over a transparent glass (Combiner), located in front of the pilot. The presented data is collimated to infinity, enabling the pilot to operate the aircraft using out-the window view during critical phases of flight. With eyes focused out in front of the aircraft viewing on the HUD, the aircraft flight path vector, aircraft attitude, visual glideslope angle and the runway aim point, pilots can achieve greater precision and situational awareness at all times while increasing safety. In addition, modern HUDs such as Clearvision can present external video such as EVS video and benefit from lower landing minimas.

Boeing's record commercial aircraft deliveries in 2015



Boeing delivered 762 commercial airplanes in 2015, 39 more than the previous year and the most ever for the company as it enters its centennial year. "The Boeing team has worked hard to achieve strong performance," said Boeing Commercial Airplanes President and CEO Ray Conner. "Our team did a fantastic job achieving higher deliveries and getting our

products to our customers as quickly and efficiently as possible. This will continue to be our focus."

In 2015, Boeing recorded 768 net orders, valued at \$112.4 billion at current list prices. At year end, Boeing held 5,795 unfilled orders from customers worldwide. "We had a solid year of orders in 2015, maintaining a strong, balanced

backlog that will help ensure a steady stream of deliveries for years to come," said Conner.

Worldwide demand for air travel has continued to be robust, said Randy Tinseth, Vice President, Marketing, Boeing Commercial Airplanes. "Global passenger traffic in most key regions is increasing," said Tinseth. "Our customers continue to perform well in the marketplace and we'll continue to support them with the industry's best products and services."

In addition to the orders and deliveries, the company marked a number of other milestones in 2015:

- Five customers received their first 787 Dreamliners.
- The 747 team delivered the 100th 747-8
- The 767 programme received its largest single order ever from FedEx
- The first 737 MAX rolled out of the factory in December
- The 787-10 team completed detailed design of the newest member of the 787 family
- The 777X reached firm configuration



The Bombardier Forecast

Bombardier Commercial Aircraft has released its annual 20-year market forecast. With a more profitable airline industry, the need for new aircraft is expected to rise, in spite of a slower than anticipated world economic recovery. Replacement demand in established markets, such as Europe and North America, and growth potential in emerging markets, such as Greater China and South Asia, are forecasted to drive the increase in deliveries. Operators will remain focused on finding more efficient and sustainable solutions in the context of volatile fuel prices and mounting environmental concerns.

“We have a clear goal at Bombardier to provide a portfolio of aircraft that will enable our customers to differentiate themselves and generate value,” stated Fred Cromer, President, Bombardier Commercial Aircraft. “Our continued innovation in our Q Series, CRJ Series and C Series families of aircraft allows us to leverage current trends to offer optimal

solutions for all airline business models. We are committed to building winning partnerships and determined to strengthen our market leadership.”

Over the next 20 years, Bombardier forecasts demand for 12,700 aircraft deliveries in the 60- to 150-seat segment, valued at \$650 billion.

The 60-to 100-seat segment will continue to be one of the most dynamic in commercial aviation. It is anticipated that the fleet in this segment will more than double in size, generating demand for 5,700 new aircraft. Deliveries will be split roughly equally between regional jets and turboprops, with lower forecasted fuel prices favouring the regional jet share.

The 100- to 150-seat segment, which has not been the focus of aircraft development for at least the past two decades, will witness a major fleet transformation with the entry-into-service of new clean-sheet aircraft designs. This segment is expected to generate 7,000 aircraft deliveries from 2015 to 2034.

As a mature aviation market undergoing fleet renewal, North America is expected to lead the way in 60- to 150-seat commercial aircraft deliveries. Over the forecast period, the region is expected to take 3,600 new aircraft, followed by Greater China with 2,450, Europe with 2,100, Latin America with 1,150, Asia Pacific with 1,100, South Asia with 700, the Commonwealth of Independent States (CIS) with 600, Africa with 550, and Middle East with 450. The airline industries in emerging regions are at various stages in their development, but all will require aircraft with various seat capacities and competitive operating economics to match seat capacity to passenger demand.

“With its Q Series turboprops, CRJ Series regional jets and C Series aircraft family, Bombardier offers a full range of fuel-efficient and sustainable products that will drive our customers’ growth. Bombardier is uniquely positioned to capture a substantial share of the forecasted deliveries in its markets over the next 20 years.”

Irkut's "Airliner of the 21st Century"



Developed as "Airliner of the 21st Century" the Irkut MC-21 is a series of three twin-engined Russian civil airliners under development, intended to cover short-to-medium-range applications with capacities ranging between 150 and 212 passengers. Development and production is being undertaken by Irkut Corporation and Yakovlev Design Bureau, both subsidiaries of the United Aircraft Corporation (UAC). The MC-21 programme is reportedly an evolution of the never-realised twin-engine Yakovlev Yak-242 twin-engine narrowbody development dating back to the early 1990s, and the MC-21 will apparently carry the Yak-242 moniker once it enters series production. The aircraft is meant to replace large numbers of Tupolev Tu-154s and Tu-204/214s that are presently in operation in the Russian Federation.

The baseline MC-21-300 is designed around 180 passengers in a standard single-class configuration and will be followed by a shorter 153-seat MC-21-200 variant with basic and extended-range models, plus a longer-range MC-21-200LR. A larger 212-seat MC-21-400 version is also under consideration, along with cargo and business jet variants. Each passenger variant will also be offered with high-density and multi-class seating layouts.

The initial design includes a high degree of composite materials — up to 40-45% including a composite wing. In addition, the programme has significant Western involvement. Irkut has selected the Pratt & Whitney PW1400G geared turbofan engine as one of two options to power the MC-21 (the Russian option is the Aviadvigatel PD-14). UTC has further involvement in the project through its subsidiaries Goodrich and Hamilton Sundstrand, providing a number of sub-systems for the airliners. Rockwell Collins and its Russian partner Avionika are to supply the MC-21's avionics, while interior furnishings will come from Zodiac Aerospace.

In addition to the low structural weight resulting from the use of composites and lightweight alloys, efficiency gains have also been realised through aerodynamics, in collaboration with the Russian Central

Aero Hydrodynamic Institute (TsAGI). As a "clean-sheet design," the MC-21 is not tied to any legacy dimensions and as such features a cabin that is wider than that of an A320 by 12 cm and a Boeing 737 by 28 cm. The MC-21 family will also be compliant with future environmental requirements relating to noise as well as emissions.

Russian analysts assert that the MC-21 will be 10-15% more efficient than Airbus and Boeing narrowbody aircraft in the same class, with a 15% structural weight efficiency advantage, 20% lower operating costs, and 15% lower fuel consumption than the Airbus A320.

The MC-21 was in the pre-design phase as of 2009, with projected completion of the first prototype in 2013, first flight in 2014 and deliveries commencing in 2016. By June 2011 the pre-design phase of development had been completed, giving way to the working design phase, which was estimated to reach completion some time in mid-2012. However, in February 2012, Dmitry Rogozin, Deputy Prime Minister of Russia, in charge of the country's defence and aerospace industry, announced that first flight and initial deliveries of the new airliner would be delayed to 2016 and 2017 respectively.



Mock up of the MC-21's wide cabin in a 2-class layout

Sayan Majumdar

Honeywell's business aviation forecast



Dassault's Falcon Family

With a slow growth economic environment the business aviation sector is not immune to its impact. In its 24th annual Global Business Aviation Outlook, Honeywell Aerospace forecast some 9,200 new business jet deliveries worth \$270 billion from 2015 to 2025, which is a 3-5 percent reduction over the value noted in the 2014 forecast. "While emerging markets like Brazil continue to be a bright spot for business aviation over the medium term, we have seen weaker demand across other key growth markets, which may affect near-term order and delivery levels," said Brian Sill, president, Business and General Aviation, Honeywell Aerospace. "And while the sluggish economic growth and political tensions are driving a more reserved approach to purchasing, we are seeing operators invest in retrofits and upgrades for their existing aircraft, especially around connectivity, boosting aftermarket opportunities."

Key global findings in the 2015 outlook include:

- Deliveries of some 675-725 new jets in 2015, a single-digit percentage growth year over year. The improvement in deliveries expected in 2015 is largely due to new model introductions and

an increase in fractional-usage type of aircraft deliveries.

- 2016 deliveries are projected to be slightly lower reflecting weaker emerging market demand partially offset by deliveries to fractional operators.
- Operators surveyed plan to make new jet purchases equivalent to about 22 percent of their fleets over the next five years as replacements or additions to their current fleet.
- Of the total new business jet purchase plans, 19 percent are intended to occur by the end of 2016, while 17 and 20 percent are scheduled for 2017 and 2018, respectively.
- Operators continue to focus on larger-cabin aircraft classes, ranging from super mid-size through ultra long-range and business liner, which are expected to account for more than 80 percent of all expenditures on new business jets in the near term.
- The longer-range forecast through 2025 projects a 3 percent average annual growth rate despite the relatively flat near-term outlook as new models and improved economic performance contribute to industry growth.

Growth in the BRIC countries has lost momentum, reaching just over 21 percent.

Brazil remained a bright spot by recording the strongest new aircraft purchase plans in the survey, though overall buying plans fell year over year. The combined BRIC countries retain a very strong near-term demand profile with 48 percent of intended new jet purchases scheduled for the next two years.

Operators in Asia Pacific report new jet acquisition plans for 14 percent of their fleet, up 2 percent from 2014. Despite the below-average level, the improved purchase plans yield about a 4 percent share of global demand over the next five years for Asia Pacific. Nearly 40 percent of respondents are scheduling their new purchases within the first two years of the five-year horizon.

The share of projected five-year global demand attributed to the Middle East and Africa remained below its historical range of 4 to 7 percent again this year. In the Middle East and Africa, 16 percent of respondents said they will replace or add to their fleet with a new jet purchase, down from 18 percent last year.

Twenty-nine percent of the Latin America sample fleet expects to be replaced or added to with new jet purchases, which is 1 point higher than last year's survey. Nearly 48 percent of this region's projected purchases are timed to happen between



Bombardier's Global Family of executive jets

2015 and 2017. Because of the current purchase plan levels, Latin America's 18 percent share of total projected demand grew slightly compared with a year ago.

An estimated 61 percent of projected demand comes from North American operators, up 2 points from the 2014 survey. New jet purchase plan levels slipped less than 1 point in North America, the industry's largest market, and stand just under the world average of 22 percent. Current plan levels are somewhat below the averages of the 2008–2012 period. Though buying plan levels are moderate, the fleet and operator base have expanded, supporting demand levels despite a slightly smaller purchase plan rate.

Europe's purchase expectations retreated this year to 24 percent. The European share of estimated global five-year demand also receded compared with historical norms and is now at 14 percent in the 2015 survey. A comparison of the planned timing

for European purchases indicates uneven proportions of demand in the next three years of the five-year window, with about 17 percent allocated through 2016 followed by a dip to 10 percent in 2017 and a strong rebound to over 26 percent in 2018.

Used Jets and Flight Activity

Turning to used jets and flight activity, over the course of the past year the pace of flight activity recovery has weakened somewhat. Ground lost by operators during the 2009 recession still remains to be recaptured. With respect to the used jet market: Just under 10 percent of today's fleet is up for resale, down from a high of nearly 16 percent in 2009. Current levels are normal in light of the past decade's history; meanwhile, asking prices continue to drift lower. In 2015, the total number of recent model jets (less than 10 years old) listed for resale has risen moderately to around 640 aircraft. However, in proportion to

the decline in overall listings, the share of recent model jets for sale has crept up more noticeably. Operator respondents increased their used jet acquisition plans by about 4 points, equating to 32 percent of their fleets in the next five years. All regions' used jet purchase plans rose except the Middle East and Africa, which was flat. Strong used aircraft purchase plans boost potential cockpit and cabin upgrades.

This annual outlook reflects topical operator concerns but also identifies longer-cycle trends that Honeywell uses in its own product decision process. The survey has helped bring about investments such as designing and developing flight efficiency upgrades, optimised propulsion offerings, innovative safety products, and enhanced aircraft connectivity offerings. It also contributes to Honeywell's business pursuit strategy and helps position Honeywell consistently on high-value platforms in growth sectors.



Pilatus Enhances PC-12 NG for 2016

PC-12 NG

Pilatus claims that its single turboprop PC-12 NG offers greater speed, better takeoff and climb performance, more cabin comfort, greater range, and a quieter cabin with no increase in fuel burn or operating cost. The 2016 Pilatus PC-12 NG cruises at a new maximum top-speed of 285 knots (528 km/h) thanks to an aerodynamic optimisation effort which analysed every square inch of the exterior of the PC-12 NG to come up with a number of enhancements to reduce drag. Several subtle, but important changes contribute to the increased speed with no additional power. The underwing flap actuator fairings for example were redesigned for smoother airflow around them and the cabin entry door handle was

changed to a flush fitting design. Gaps and joints around the flaps were sealed, and several antennas were repositioned to align with localised air flow patterns.

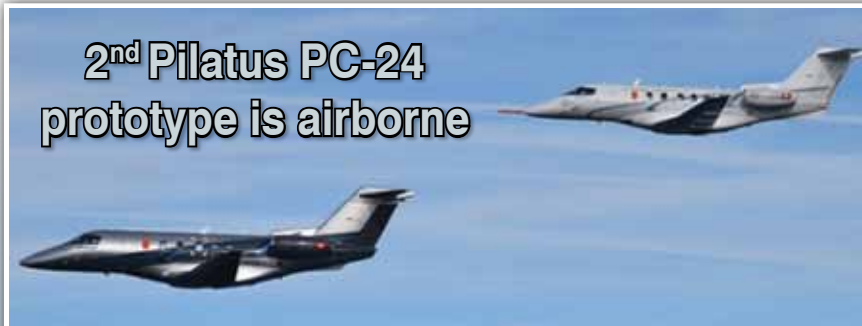
The most noticeable change to the 2016 PC-12 NG is the standard five blade graphite composite propeller. Designed specifically for the PC-12 NG by Hartzell, this new propeller reduces cabin noise levels, improves takeoff and climb performance, reduces life cycle maintenance costs, and is easily repairable in the field. With cleaner aerodynamics and the new five blade propeller, takeoff, climb, and cruise performance are also improved. The 2016 PC-12 NG features a takeoff distance over 50 feet of only 2,600 feet (793 m). At

maximum gross takeoff weight, it can climb to a cruise altitude of 28,000 feet (8'535 m) 10 percent quicker, and maximum range has been extended to 1,840 nm (3407 km) with four passengers and VFR fuel reserves.

Enhancing the exterior styling of the 2016 PC-12 NG are six new exterior paint schemes designed by BMW Designworks. Pilatus and BMW have worked jointly for more than a decade to come up with stylish new exterior and interior designs which our customers enjoy and take pride in showing their distinct personality. For 2016, there are now six unique BMW designed executive interiors for customers to choose from, and Pilatus continues to offer full customisation services for those who desire something even more unique.

Build 10 of the avionics software enhances the flying experience with new features such as temperature compensation for Baro VNAV approaches, a route flight log to show airways SIDs and STARS in the flight plan, a Vertical Direct-To task menu option, pilot-entered waypoints on the iNav map, an option for orbital search patterns, and a multitude of additional refinements requested by PC-12 NG pilots around the world. In addition, flight plan loading directly into the Flight Management System is made even easier with Pilatus' pioneering wireless gateway.

2nd Pilatus PC-24 prototype is airborne



Following on from the maiden flight of the first PC-24 prototype (P01) in May 2015, this first flight by P02 marks another major step forward in the Pilatus PC-24 development programme. P02 is the second PC-24 to join the test flight programme comprising a total of around 2,300 hours in the air. After completing initial test flights in Switzerland, P02 will be deployed mainly in the USA and in Canada, where it will undergo various systems tests and certification flights in partnership with the systems suppliers. Special scrutiny will be accorded to the avionics systems

and the autopilot, but the programme will also include cold weather trials and icing tests.

Flights with the first prototype, the P01, have gone as planned thus far. The aircraft has completed a total of 143 hours in 87 flights since May 2015. Capable of flying in and out of very short runways and unmade strips, the PC-24 is the world's first ever business jet to come equipped with a cargo door as standard. The jet also features an extremely spacious cabin whose interior can be tailored to the customer's personal requirements. Certification and delivery of the first series production aircraft to customers is planned from the third quarter of 2017.

Saab's Integrated Air Traffic Management (ATM) solutions



More often than not passengers and operators (be it airlines, ground handling companies, airports operators or Air Navigation Service Providers) end up facing delays, owing to either low visibility conditions or lack of proper information sharing. Air Traffic Controllers (ATCOs) often do not have access to a streamlined set of automation tools to manage traffic flow in a safe and efficient manner.

The weather conditions are not in one's control. However, technology goes a long way in mitigating some of the limitations that adverse weather conditions impose. Within this context, Saab was recently selected by the Airports Authority of India (AAI) to deploy Advanced – Surface Movement Guidance & Control Systems (A-SMGCS), multilateration (MLAT) and the SR-3 Surface Movement Radar (SMR) at five airports (Ahmedabad, Amritsar, Guwahati, Jaipur, and Lucknow). By fusing MLAT and SMR surveillance data to provide air traffic control operators (ATCO) precise surveillance of the airports' runways and taxiways, the Saab A3000 A-SMGCS will enhance situational awareness and runway safety. The systems will feature Safety Logic runway incursion detection and alerting algorithms to provide controllers with advanced warnings of potential runway incursions. The A-SMGCS will also include functionality for Airport-Collaborative Decision Making (A-CDM) initiatives.

The SR-3 SMR, a recent addition to the Saab portfolio, is a solid-state, third generation ground movement radar system optimised for a low life-cycle cost. The solid-state design greatly increases reliability and ease of maintenance. Thus, in combination with Saab's multilateration technology, a cooperative surveillance solution that relies on aircraft or vehicle transponders to emit a signal, a very reliable solution is obtained; reliable because multilateration solutions are not affected by weather. Furthermore, the solution is easily extensible and flexible to meet future growth scenarios in India's growing skies.

The Integrated Tower (i-TWR) is Saab's approach to an integrated workplace for ATCOs. Saab offers a complete set of tools integrated into a single working solution. At the core of the i-TWR solution is the A3000 A-SMGCS, focusing on surface and approach surveillance and safety nets. Saab's e-Strip, an electronic flight strip system that supports information sharing, integrates easily, as do information data processors (IDP) for control and monitoring of airport systems such as lighting systems, NAVAIDS and weather data handling systems like Saab's AWOS7. Saab's flow management tool Aerobahn and Saab's Departure Manager (DMAN) integrate easily as well, leading to increased efficiency through information sharing.

There are 454 airports and airstrips, in India of which 16 are designated as International Airports. While the Airports Authority of India owns and operates only 125 of the 251 operational airports, a report by the Centre for Asia Pacific Aviation states that the Civil Aviation Ministry aims to increase the number of operational airports to 500 within the next decade. With such large gaps to fill, there is an urgent need to address not only the surveillance coverage but the operational logistics of airports in India. Saab's Wide Area Multilateration (WAM) is a cost-effective solution to many en-route and terminal airspace needs; the sensors do not have any moving parts and can use solar power, easing operations at airports in remote and geographically disconnected regions.

To further compound the situation, in the case of airports catering to only a few flights a day, operational costs are phenomenal and retaining skilled air traffic controllers in such locations can be a nightmare. With Saab's Remote Tower (r-TWR) Air Traffic Control System, air traffic can now be managed and controlled remotely. This is a unique technological breakthrough that allows a single air traffic management system to control more than one airport at a time – truly a paradigm shift in air traffic control systems. When cost-effectiveness puts high demands on airport operations, Saab's Remote Tower concept is the solution that small and medium-sized airports need in order to be competitive.

The Remote Tower concept enables a more effective staffing for aerodrome control service, and heavily reduces the costs related to refurbishment of control towers. The r-TWR provides enhanced situational awareness, even in low visibility conditions, through features such as on-screen object tracking and alerting, infra-red vision and image enhancement. Data from cameras at the airport provides a 360-degree real-time view of the airport at the Remote Tower Center while the controller working position is equipped with the same controls as in a normal tower.

Rotorcraft Forecast

The global helicopter scenario

In its annual *Turbine-Powered Civil Helicopter Purchasing Outlook*, Honeywell Aerospace expects that 4,750-5,250 civilian-use helicopters will be delivered during 2015-2019. Overall, the five-year demand for turbine-powered, civil helicopters remains steady versus the 2014 five-year forecast, with moderate improvement in new helicopter purchase plans reported, offsetting the short-term uncertainty of large-fleet operators in the face of lower energy prices and fluctuating market currencies.

The forecast estimates the five-year share of demand from the US and Canada at 34 percent, up nearly eight points on stronger North American buying plans. When combined with Latin America, the Western Hemisphere represents 53

percent of the five-year global demand. Europe's share comes to 24 percent, with the Asia-Oceania region accounting for 14 percent, and Africa and the Middle East contributing 9 percent.

Operators who intend to purchase a helicopter within the next five years noted that the age of their current aircraft (which includes factors such as maintenance costs, performance erosion and safety concerns), contracted replacement cycle and warranty expiration were key reasons for their decision. For those surveyed, the make and model choices for their new aircraft are strongly influenced by range, cabin size, performance technology upgrades and brand experience.

"Near-term demand appears stable despite a pullback in 2014 deliveries and

ongoing concerns with the energy sector," said Mike Madson, President, Defence and Space, Honeywell Aerospace. "Purchase interest for helicopters in training, tourism, fire fighting and law enforcement categories is trending up, influenced by increased utilisation rates and helicopter replacement cycles. Interest across these mission sectors is helping to sustain near-term demand. Looking ahead, several new platforms are scheduled to enter service over the next few years, also bolstering overall helicopter demand."

Based on the relative sizes and directions of new purchase-rate changes, demand estimates increased modestly compared with 2014. Purchase rates in three of five regions tracked an increase to various degrees, while two regions experienced moderate

Airbus Helicopters launch X6 concept phase

The concept phase start-up for a new European helicopter, Airbus Helicopters' X6, was announced at the Paris Air Show 2015, initiating a two-year definition period on this next-generation heavy-lift rotorcraft that will be tailored for the civil market. X6 will initially target oil and gas missions and will also be perfectly suited for Search and Rescue, VIP and other applications. Major marketing, architecture and design choices for the twin-engine aircraft will be assessed to meet customer operational requirements during the concept phase, supported by a significant dialog with customers worldwide to validate the X6's value creation for their operations. The X6 is the newest arrival in Airbus Helicopters' H generation, continuing on from the success of the recently unveiled H160. "X6 will be for the heavy segment in the next decade what the H160 is today for the mediums. It will set new standards in the industry not only for

design, but for its production strategy as well, as we will rely on the industrial capacities of our core countries, including the upcoming pillar in Poland," explained Guillaume Faury, President & CEO of Airbus Helicopters. "Our objective is to bring to the market the most efficient helicopter solutions adapted for how our customers' needs and the industry itself will evolve in the future."

One of the major innovations to be integrated on X6 is the Fly-by-Wire flight control system. X6 entry into service is anticipated to be in the 2020s.



declines in new helicopter purchase rates planned for the next five years. However, large fleet or 'mega' operator requirements not included in the survey offset some of the improved purchase planning results provided by survey respondents. The tumultuous changes in the energy sector, as well as emerging regional growth and political issues, have affected fleet expansion plans in select areas and are restraining some of the near-term expansion that was expected a year ago. As a result, total projected demand in the 2015 outlook remains roughly in line with 2014.

"With near-term demand for new helicopters running close to recent

volumes, and aircraft lasting longer through replacement cycles, Honeywell is ready to support both new installations and fleet upgrades worldwide," Madsen offered. "Our propulsion, safety, navigation, communications and flight services can help aircraft stay efficient, powerful, reliable and safe throughout their entire time in the air."

North American purchase expectations rose seven points in this year's survey and provided a strong base of demand for light single and twin-engine platforms. Planned improvement in North American purchases is a significant finding of the 2015 survey and helps support overall industry demand projections by virtue of the large fleet active in North America.

European purchase plans also increased despite ongoing weakness in reported Russian buying plans. The sample of

Russian operators responding in 2014 fell to very low levels, which continues to add some uncertainty to the overall European results. European purchase intentions currently tend to favour light single-engine and medium twin-engine models.

Latin America continues to have strong fleet replacement and growth expectations, well above the world average, but 2015 results were a few points lower than the previous year. In terms of projected regional demand for new helicopters, Latin America is contributing the third highest demand among the regions tracked, trailing North America and Europe by a modest margin. Latin American respondents currently favor light single-engine models and a balance of light and medium twin-engine platforms.

The Middle East and Africa leads all regions in new purchase rates, with up to 32 percent of respondent fleets slated for turnover with a new helicopter replacement or addition.

However, demand in BRIC countries (Brazil, Russia, India and China) continues to ebb and flow with stronger results recorded for India in the 2015 survey, while planned Brazilian and Chinese purchase rates slipped moderately, reflecting near-term slower economic growth prospects. In both cases, new helicopter purchase-plan rates still exceed the world average.

Operator Preferences

- ◆ Light single-engine helicopters continue to be the most popular helicopter class, garnering almost half the new purchase interest in the 2015 survey. The Airbus EC130/AS350 series, Bell 407, Bell 505 and Robinson R66 were the most frequently mentioned models.
- ◆ Intermediate and medium twin-engine helicopters are the second most popular product class, with approximately 31 percent of total survey participants planning to buy a new model of this type. The most frequently mentioned models were the AW139, AW169, Bell 412, EC145T2 and Sikorsky S-76 series. Emerging super-medium-class helicopters such as the AW189, Bell 525 and EC175 rely on large fleet operators in the energy, natural resource, and search and rescue sectors for substantial portions of their demand, and may be under represented in the current

Bell Helicopter introduces the Bell 407GXP



Bell Helicopter has introduced the new Bell 407GXP, which incorporates reliability and advanced technology of the Bell 407GX platform, and introduces performance improvement, payload increase and pilot workload reduction. Derived from the Bell 407GX platform, the Bell 407GXP has an additional 50 lbs (22.5 kg) of payload capability, coupled with the new Rolls-Royce M250 engine that improves performance and fuel efficiency delivering class leading hot and high performance. The aircraft is also equipped with new avionics features such as a hover performance calculator improvement, as well as a transmission TBO extension of +500 hours that will lower maintenance costs.

AgustaWestland initiates production of AW609



The Finmeccanica–AgustaWestland AW609 TiltRotor programme has achieved key milestones, initiating production phase in anticipation of the first customer deliveries. The company has expanded the AW609 TiltRotor programme to include the AgustaWestland Philadelphia facility through its designation as the first final assembly line for the only civil tiltrotor in development extant. A second final assembly line is expected to be established at AgustaWestland's Vergiate facility in Italy at a later date. AgustaWestland currently has two prototypes undergoing flight testing with a third in final assembly. The first prototype aircraft will continue flying at the AgustaWestland facility in Arlington, Texas in parallel with FAA Certification support work at AgustaWestland's Philadelphia facility. The fourth prototype will be assembled in Philadelphia in 2016.

survey sample. Near-term interest may be volatile based on conditions in the energy markets.

◆ The light twin helicopter class earned between 18-19 percent of total operator purchase plans in the 2015 survey, with

the EC135, Bell 429 and AW109 series helicopters noted most frequently.

◆ Heavy multi-engine helicopters, such as the EC225, AW101 and S-92, registered small but steady levels of new helicopter purchase plans in the 2015 survey; however, demand from large oil and gas fleet operators not included in the survey continues to support volume in the heavy class even though some near-term replacement activity may be deferred. Mi-8/17 purchase plans are not fully represented due to limited response from Russian operators in the 2015 survey.

Satisfaction

Again in this year's survey, respondents were asked to indicate their current satisfaction over the past year with each model of aircraft they operated. For models that received more than 25 responses, the make and models with the highest net scores are the AW139, Robinson R66, Bell 407, Bell 429, Bell 412, Bell 206L, EC135, EC145, AS350B series and Sikorsky S-76C.

These helicopter types account for over 70 percent of all survey make and model mentions and can be considered the top current production helicopters in terms of recent customer satisfaction attitudes and likelihood to promote. Many other makes and models currently in production also received excellent scores that did not make the top 10 list.

Airbus Helicopters' militarised H145M receives certification

Airbus Helicopters' H145M has been certified by the European EASA (European Aviation Safety Agency) airworthiness authority, clearing the way for the military type approval and initial two deliveries of this multi-role twin-engine military rotorcraft took place end 2015. Its first customer is the *Bundeswehr* (German Armed Forces), which has ordered 15 rotorcraft to be operated by the German Air Force. First deliveries for the second H145M customer, the Royal Thai Navy, will begin later in 2016. The H145M is based on Airbus Helicopters' enhanced H145 civilian and parapublic rotorcraft (previously designated the EC145 T2). It has an increased maximum take-off weight of 3.7 metric tonnes and can be equipped with mission equipment that includes a pintle-mounted door gun and an ability to carry weapons on external pylons; electro optical/infrared sensors with targeting capability; as well as military avionics for communications, navigation and flight management.



According to *Forecast International*, rotorcraft manufacturers throughout the world will build 208 light military helicopters in 2016, but that production level will fall to only 55 light military helicopters by 2028. The light military helicopter market will see annual production generally head downward during the next 15 years, as manufacturers will build 165 light military helicopters in 2014 and 166 in 2015. A total of 1,495 light military aircraft will be produced from 2014 through 2028, worth \$23.6 billion, analysts say. *Forecast International* defines a military helicopter as "light" when it has a maximum gross weight of less than 15,000 pounds.

The military scene

Among the reasons for the anticipated drop in military light helicopter manufacturing is reduced defence spending for many nations around the world. "Ongoing rotorcraft procurement programmes are being stretched out, reduced in size and scope, or even canceled altogether," says Raymond Jaworowski, senior aerospace analyst at *Forecast International*. "At the same time, very few new-start programmes have emerged that would help keep production rates up."

North America and Europe are the two largest geographic markets for light military helicopters. Niche opportunities

for light military helicopter sales over the next 15 years will exist in the Middle East, Latin America, and much of Asia, analysts say. Europe's Airbus Helicopters in Marignane, France, will be the leading light military helicopter manufacturer during the 2014-2028 forecast period. Airbus Helicopters is projected to produce 431 such helicopters, worth \$7.4 billion, during the period.

Hindustan Aeronautics Ltd (HAL) in Bangalore, India, is projected to build 278 units during the timeframe, while Bell Helicopter in Fort Worth, Texas, is expected to produce 269 units.

Russian Helicopters' Ansat and Ka-226T enter the Russian commercial market

Ka-226T



Ansat



The new light commercial Ansat and Ka-226T helicopters, developed by Russian Helicopters (part of State Corporation Rostec) are now available on the Russian commercial aircraft market. Both received the required Interstate Aviation Committee Aviation Register certificates, and can be operated commercially. Earlier modifications of these helicopters have been used by the Ministry of Defence, Emergencies Ministry, Interior Ministry, Federal Security Service (FSB) and other Russian state agencies. Built as per traditional (Ansat) and coaxial (Ka-226T) designs, each has their own advantages and can be used for cargo and passenger transport, and also for medevac missions.

15 AWs for Abu Dhabi Aviation

Abu Dhabi Aviation (ADA) will acquire 15 helicopters from the AgustaWestland Family, comprising the AW169 light intermediate, AW139 intermediate and AW189 super medium twin types. The aircraft are scheduled to be delivered from 2016 through to 2019 and will be used for a variety of missions, including offshore transport. ADA currently owns 16 AW139 intermediate twin-engine helicopters that are primarily used for offshore transport missions.



Sikorsky S-97 Raider in flight

Successful first flight of the Sikorsky S-97 Raider helicopter, a rigid coaxial rotor prototype designed to demonstrate a 'game-changing' combination of maneuverability, hover ability, range, speed, endurance and survivability was conducted at Sikorsky's Development Flight Centre (DFC) where the two-prototype Raider helicopter test programme is based.

Sikorsky launched the S-97 Raider helicopter programme in September 2010, with objectives of maturing the X2 rotorcraft configuration and demonstrating a helicopter that meets current US Army special operations and armed reconnaissance needs, while maturing technologies for Future Vertical Lift (FVL). The programme is 100 percent industry-funded by Sikorsky Aircraft and its 53 industry partners. Based on the X2 coaxial rotor design, the helicopter is capable of being developed into a unique multi-mission configuration that is able to carry six troops and external weapons. The coaxial counter-rotating main rotors and pusher propeller are expected to provide cruise speeds up to 240 knots (276 mph). The Company is now part of Lockheed Martin.

S-92 deliveries to Bristow completed

Sikorsky has fulfilled its contract to deliver seven S-92 helicopters to Bristow Helicopters Ltd. for UK Search and Rescue. There are now 11 S-92 helicopters available for use by this Maritime and Coastguard Agency for the UK SAR mission; four began operations as part of the UK

Gap SAR contract in June 2013. To date, Sikorsky has delivered more than 250 S-92 helicopters throughout the world. In 2014, Sikorsky celebrated the 10-year anniversary of the S-92 helicopter, which was first delivered in 2004. The fleet has achieved more than 800,000 flight hours, with over 90 percent of

those hours providing offshore oil and gas worker transportation. In addition to SAR and offshore oil and gas, S-92 helicopters perform heads of state missions and a variety of transportation missions for utility tasks and passenger transportation.

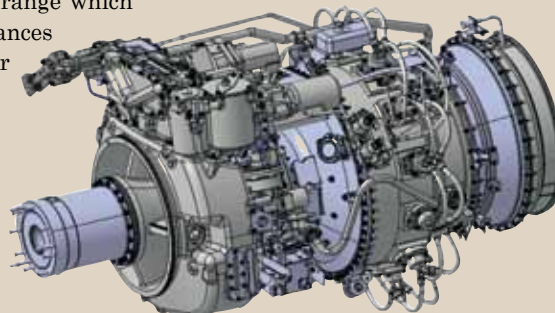


Bel Air's AW189: fleet leader for the type

The first Finmeccanica-AgustaWestland AW189 super medium twin engine helicopter operated by Bel Air of Denmark has become the global fleet leading type exceeding 600 flight hours in just six months of operation while demonstrating 'exceptional availability and mission effectiveness'. A total of 16 AW189s have been delivered to customers in Europe, Middle East and Asia and the fleet has now flown more than 3500 flight hours. The AW189 is also expected to soon enter service in Africa and North America. Bel Air has two AW189s in service performing long range offshore transport missions in the North Sea, and in October 2014 signed a contract for a third aircraft.

Turbomeca in heavy helicopter engine innovations

Turbomeca (Safran) is investigating new technologies to address the need for greater performance and reduced environmental footprint of new-generation heavy rotorcraft. The TECH3000 demonstrator is a key technological basis of a new family of engines in the 3,000 shp range which will enable Turbomeca to validate the design and core performances of such new high power engines, aimed at the heavy helicopter market. Since the beginning of 2015, Turbomeca has been running extensive tests on TECH3000 components and modules. Key technologies of the compressor have already been validated and tests of combustion chamber and turbine are underway. Engine tests integrating these new technologies will start at the end of 2015. The TECH3000 and its serial derivatives will deliver a 25 % improvement in fuel efficiency compared to the state-of-the-art engines available in the market in this segment.



Sikorsky delivers 6 CH-148 Cyclones to Canada



These six helicopters represent the first of 28 Cyclone aircraft that Sikorsky will deliver to the Canadian Armed Forces to perform a full range of anti-submarine and anti-surface warfare, search and rescue, and utility missions in various environments. Sikorsky will introduce increased capabilities that will be phased in while the Royal Canadian Air Force determines operational strategy and more personnel are trained to fly and maintain the aircraft. Completion of all deliveries and capability upgrades will enable replacement of the venerable Sea King fleet, also provided by Sikorsky, beginning in 2018.

Turbomeca marks 100 million flight hours

Turbomeca (Safran) has celebrated a major achievement: 100 million hours flown by its engine family : “A Turbomeca-powered helicopter takes off every nine seconds, somewhere in the world.” The first flight of a Turbomeca turboshaft took place in 1949. Since then, Turbomeca has produced over 72,000 more and is now the leading helicopter engine manufacturer in the world, with 18,200 Turbomeca engines in service. “Through powering new generation rotorcraft like the Airbus Helicopter H160 and the Bell 505 Jet Ranger X, the Safran’s subsidiary remains at the leading edge of innovation, being committed to remaining the first-choice engine provider of the helicopter industry” stated company officials. Turbomeca’s history has been marked by numerous records. Its Artouste II powered the Alouette II, the first serially-

produced turbine-powered helicopter in the world. The helicopter’s flight altitude record was also set using a Turbomeca engine.



Rolls-Royce: Turboprop to turbofan

Two of the most significant engines in Rolls-Royce history, the Dart and RB211, began life in a manner over-burdened with problems but both soon proved their merits in the marketplace worldwide.

By April 1945, when World War Two was nearly at an end, the prime driving force behind the successful development by Rolls-Royce of jet engines revolutionised the performance of allied warplanes. This was the time for Rolls-Royce to focus on ways to bring benefits of the jet engine to commercial aviation.

RAF decided to revert to piston power for its proposed new trainer aircraft, leaving the struggling Dart with no immediate market and Rolls-Royce with a crisis on their drawing boards.

However rather than abandon the project the company pressed ahead with a major redesign programme, overseen by an eminent senior engineer, David Huddie. Powerful support for the Dart also came from Sir George Edwards of Vickers-Armstrong, a vibrant UK aircraft company that wanted the Dart for its promising new Viscount turboprop airliner project.



On 25 April that year, in a bare-brick-walled office in Derby, designers began to define the basic shape of the RB53, a turboprop destined initially for a new Royal Air Force trainer but with clear potential for new commercial aircraft. But there were a daunting series of setbacks.

The new engine, named the Dart, was grossly overweight at birth – a problem seriously compounded during initial test-bed runs when maximum power reached just 600 shaft horsepower (shp), woefully short of its target 1,000shp. And then the

Huddie's emergency action-plan brought impressive technical results, culminating in an official type test at 1,400shp early in 1951. By now the increasingly lean and fuel-efficient Dart engine had also gained extensive flight development experience in a series of aircraft including, in 1948, first flight of the Viscount.

Production

Setbacks of the early Dart days seemed a distant past when, in April 1953, the



Vintage Dart advert

Viscount 700 production version, powered by four Dart Mk 505s, took off from London bound for Cyprus, becoming the world's first gas turbine-powered aircraft to operate a fully scheduled passenger service.

This flight marked the start of the jet revolution for commercial air travel. Passengers loved the smooth, quiet and comfortably pressurised Viscount with its panoramic windows. Airlines clamoured for orders from the Vickers production lines. With its fuel-efficient Dart, the Viscount proved one of the most successful and profitable of all post-war transport aircraft, eventually logging 445 sales to a range of global customers including, innovatively, key operators in North America and China.

The Dart's reputation with the Viscount also inspired its application in a series of new aircraft while the engine's inbuilt suitability for ongoing development – thanks to the foresight of its 1940s design team and Huddie's recovery programme – ensured that it took on board an enduring programme of technological enhancements right up to the mid-1980s. Eventually over 6,000 Darts were built for commercial and military operators worldwide and many remain in service today.



The RB 211 has been an unprecedented success !

The aerospace industry, however, never stands still and the global success of the Viscount in the 1950s served to spur intense competition, particularly from US commercial airframe and engine manufacturers with their burgeoning domestic market. By the late 1950s, the UK's post-war lead in commercial aviation had given way to new US generation of larger, faster turbojet-powered airliners. By the mid-1960s proposals began to emerge for even larger aircraft, initially to meet requirements from American Airlines and Eastern Airlines, with novel designs that would focus on low-cost-per-seat operations – the first wide-bodied airliners.

With its Dart already a world leader in the medium turboprop market, Rolls-Royce had not been waiting either. Sir David Huddie, the man behind the Dart's remarkable recovery and now managing director of the company's aero division, with senior engineer Geoffrey Wilde strongly supported development of new three-shaft engine designs, realising the potential to create engines shorter and lighter than equivalent two-shaft rivals – and provide better performance retention in airline service.

Orders

Rolls-Royce was also convinced that the three-shaft design would prove the simplest, lowest-cost solution to the problem of gaining significantly lower fuel consumption and lower noise output than two-shaft competitors.

With US companies Lockheed and Douglas offering new three-engined wide-

bodies, such as the L-1011 TriStar and DC-10 respectively, Rolls-Royce offered its new RB211 design to both. In 1968, Lockheed, announcing orders for 94 TriStars, placed an order for 150 sets of RB211-22 engines. Such a massive order was an unprecedented breakthrough for a UK company into the big-league US commercial aviation business.

But now Rolls-Royce faced a daunting technical and commercial challenge: to develop a large, complex and radically advanced big-fan engine within a severely tight timeframe. Early engines mirrored the setbacks of the early Dart days : insufficient thrust, too much weight and overly high fuel consumption.

And then, to compound these problem, came failure of the RB211's promising new lightweight carbon-fibre fan blades in crucial bird-ingestion tests. Costs of correcting these wrongs rapidly spiralled upwards and by late 1970 the project was deep crisis. Rolls-Royce's insolvency followed in January 1971, with the company nationalised the following month.

From such adversity sprang opportunity for a 63-year-old mathematician who had retired from Rolls-Royce three years earlier. Dr Stanley Hooker, a key figure in developing the supercharger that boosted the Merlin piston engine to wartime dominance in the sky and in turning the jet engine from crude prototype into the power of the future, came out of retirement and, working with senior engineers and fellow retirees, rapidly assessed and addressed the RB211's problems.

Progress came quickly. On 21 April 1972, on England's patron saint's day, pride

rode high as RB 211 - 22 formally entered airline service with Eastern Airlines. Still, Hooker, now restored to his pre-retirement role of Technical Director and senior colleagues clearly saw the looming reality: to become a true winner, the RB211 needed a bigger market than the L-1011 TriStar alone could provide. So Hooker and his colleagues soon defined a second-generation RB211 with higher thrust and better efficiency. Enter the RB211-524, the engine that pulled Rolls-Royce from the brink of extinction and began a new era of technical and commercial success!

The 50,000lb thrust RB211-524 offered major performance and efficiency gains over the Pratt & Whitney JT9D in the Boeing 747 and in 1973 Boeing agreed to offer the UK engine on the 747-200. British Airways led the order-book and other top-division operators soon followed suit, with Qantas, Cathay Pacific and South African Airways among them. Successive -524 enhancements, up to 60,600lb thrust, continue today to deliver profit-driving benefits for airlines worldwide and the engine also gained ground on Boeing 767s. Successful land- and sea-based derivatives were developed for power generation and for the oil and gas industry.

Boeing underscored the RB211's ability when it selected the new 535 version to launch its new 757. Soon the 535 cemented its lead position on the 757 with a new wide-chord fan version, the 535-E4. With world-leading performance retention, reliability and availability, the 535-E4 became the template for the next generation of Rolls-Royce three-shaft turbofans: the Trent family.

Today, with RR Trents clearly the engines of choice of airlines for current wide-body aircraft, Rolls-Royce leads as the world's number one in this ultra-competitive marketplace. The role of the RB211 in this transformation, and of the people who strove so hard and effectively to turn around its fortunes and deliver its enormous potential, is pivotal.

As with the Dart before it, unstinting attention to engineering excellence ensured long-term success.

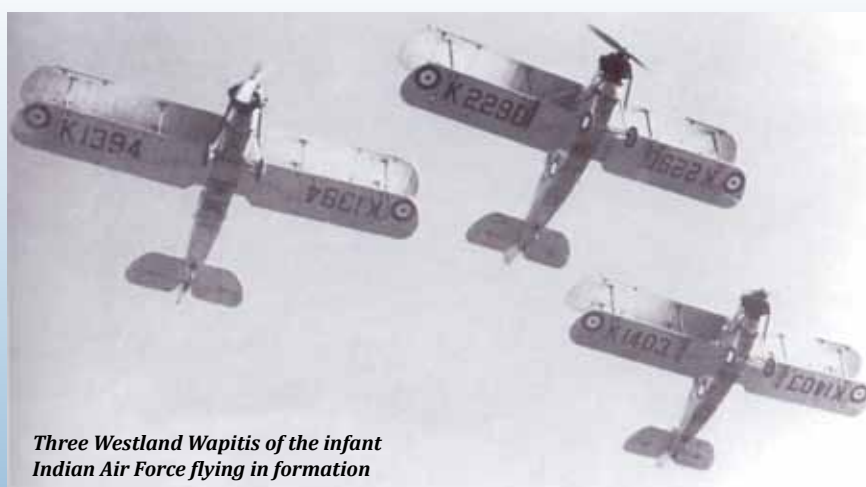
John Hutchinson
*Chief of Service Engineering at
 Rolls-Royce Plc.*

The Yeovil Connection

AgustaWestland celebrates 100 Years



Finmeccanica-AgustaWestland, has celebrated centenary of the establishment of Westland Aircraft Works in Yeovil and the many aeronautical achievements that have been made during 100 years of continuous aircraft manufacturing on the site. Established in 1915, Westland has produced many famous fixed wing aircraft designs such as the Whirlwind, Welkin, Wapiti, and Lysander before focusing on helicopter production and later its own designs such as the Lynx and AW101. In 2001 AgustaWestland was formed with the bringing together of two great entities in aviation and since 2004 has been wholly owned by Finmeccanica. In



Three Westland Wapitis of the infant Indian Air Force flying in formation



The Beginnings

In April 1915, the Petter brothers who had a thriving engineering business in Yeovil, made the decision to offer their company's manufacturing re-sources to the Government to help in the war effort. The Admiralty contracted them to build Short 184 seaplanes under licence with work starting immediately. Thus 'Westland Aircraft Works' was officially formed as a branch of Petters Ltd, beginning their one hundred years of aviation history.

Designed by Short Brothers Ltd as a torpedo-carrying seaplane, the Short 184 was the first aircraft to be built at Westland Aircraft Works in Yeovil. The aircraft's structure was typical of the period : a wire-braced, wooden box frame with the fuselage and wings covered in fabric. Production of the Short 184 began in July 1915 and the first aircraft was completed in December 1915. It was dismantled and taken by horse and cart to Yeovil Junction from where it went by rail to the River Hamble for testing. By the end of the First World War production had included types such as the DH9A light-bomber and the Vickers Vimy twin-engined heavy bomber.

Interwar and Experimental Age

The demand for military aircraft sharply decreased after the war, so Westland began to design civil aircraft. Flying was still a dangerous activity, as the war had hastened aircraft development by necessity. Designers and engineers could now focus on improving the safety and airworthiness of their aircraft. Civil luxury was sought after in the aircraft of the interwar period, advancing the designs of enclosed cockpits, passenger cabins and pushing aircraft to look sleeker, fly higher and go faster. Many fixed wing aircraft types were designed and built during the interwar period included the Widgeon, Wessex, Wapiti and Pterodactyl.

In 1933 a Westland aircraft became the first to fly over Mount Everest. The Houston Mount Everest Expedition aimed to prove that a British aircraft with a British crew could fly over the highest point on earth and use the opportunity to contribute to scientific knowledge by

2007 Agusta celebrated its centenary and in 2015 Westland has achieved the same historic aviation milestone.

Today, 100 years after building the first Short Type 184 seaplane, the Yeovil factory is at the forefront of rotorcraft technology, designing, developing and manufacturing the latest generation of rotorcraft for military and commercial applications. Yeovil is currently home to final assembly lines for the Super Lynx 300, AW159 and AW101 helicopters as well as the new generation AW189 civil helicopter. It is also the main provider of helicopters to the UK Ministry of Defence (MoD) and delivers Integrated Operational Support (IOS) and

training services for the MoD's Apache AH Mk.1, the Merlin, Sea King and AW159 Wildcat helicopter fleets.

Finmeccanica-Agusta Westland certainly makes significant contribution to the UK economy with more than 3,200 employees at its Yeovil site which in turn support a further 6,800 jobs in the supply chain. It also is an award-winning employer that actively supports education and skills development in schools and colleges and offers an exciting range of graduate, undergraduate and apprentice opportunities for those wanting to be part of the company's future aeronautical achievements.



AgustaWestland's new AW189 in flight

photographing inaccessible and dangerous terrain. Two extensively modified Wapitis, known as the PV.3 Houston-Westland and PV.6 Houston-Wallace, were altered to cope with the severe conditions. The first flight successfully achieved the summit and a second flight, against orders, achieved the Expedition's scientific goals. *The Times* called this "a magnificent piece of insubordination" and the pilots were reprimanded by the Royal Air Force for their breach of conduct but were then awarded the Air Force Cross!

Wartime Production

During World War II, Westland and its dispersal sites were wholly concerned with aircraft production, unlike the previous war in which munitions had also been manufactured. The Supermarine factory at Southampton was destroyed by the Luftwaffe in 1940, crippling production of the Spitfire leading to Westland becoming a major centre for Spitfire and Seafire manufacture and repair, with over 2000 of these aircraft passing along the production lines and many more being repaired.

Another famous aircraft design produced by Westland during the war was the Lysander, which gained fame for its use by the Special Operations Executive to drop off and retrieve agents or stranded allied aircrew in France. The Westland Whirlwind and Welkin fighters were also produced and Westland's last fixed wing aeroplane, the Wyvern, saw service with the Royal Navy after the war.

From Fixed Wing to Helicopters

In 1946 the Westland Board made the decision to focus entirely on helicopters. That bold decision was not taken lightly given helicopters at that time were rare and had very limited capabilities. Westland initially produced Sikorsky designs under licence, benefiting from the US technological lead instead of following the fledgling industry in Britain, but soon developed in-house design expertise. Later, the British aerospace industry was encouraged to rationalise by Government policy and Westland acquired the aircraft manufacturing interests of Fairey Aviation Ltd and the helicopter divisions of the Bristol Aeroplane Company and

Saunders-Roe. The early helicopter types built such as the Dragonfly and Whirlwind saw service with the UK armed forces and export customers and were followed by the larger and more capable Wessex and Sea King helicopters.

In 1971 the Westland Lynx took to the skies and in 2015 the much updated Super Lynx 300 remains in production. In 1986 a specially modified Lynx, serial G-LYNX, took the Helicopter World Speed Record with a speed of 249.10 mph/ 400.87 km/h over a course on the Somerset levels. Nearly 30 years on this record remains unbroken despite several attempts by other manufacturers.

Collaboration between Westland and Agusta in the 1980s produced the EH101, a world leader in its class, it is currently in service in diverse roles from SAR to Head of State/Government Transport with customers around the world. Today, the EH101 has evolved into the AW101, which incorporates the latest technology and integrated mission equipment.

In 2006 a contract was signed with the UK Ministry of Defence for the

development and manufacture of Future Lynx, which was later renamed the AW159 Wildcat. It was the first fully digitally designed helicopter to be produced by AgustaWestland and first flew in November 2009. Coincidentally the very first aircraft to be handed over at the Yeovil site in 2015 was an AW159 Wildcat to the Royal Navy, one hundred years after the Royal Navy accepted the very first aircraft built by Westland in 1915.

AgustaWestland in the UK Today

In recent years the Yeovil site has expanded its involvement in commercial helicopter programmes, in particular with the AW Family of new generation helicopters which comprise the AW139, AW169 and AW189. The AW189 is the first civil aircraft to be built in Yeovil since the mid-1980s, whilst rotor blades and transmission systems are manufactured for all three members of the AW Family of helicopters.

Today, Finmeccanica-AgustaWestland's Yeovil site continues at the very forefront of the rotorcraft industry and at the heart of UK advanced manufacturing, building some of the world's most advanced military and commercial helicopters for customers around the world. AgustaWestland in Yeovil is the home to several 'centres of excellence' that are designing and manufacturing the very latest rotorcraft rotor and transmission systems and integrating complex avionic and mission systems.

Courtesy: AgustaWestland

Five Mi-171Shs for Bangladesh



Russian Helicopters has delivered a batch of five military transport Mi-171Sh helicopters to Bangladesh's Ministry of Defence. In addition to regular cargo transportation operations and border security provision, the new Mi-171Sh will be used in UN humanitarian missions and in regions facing complex crime problems. Bangladesh received the Mi-171Sh helicopters under state credit for the purchase of Russian military goods. The contract was concluded by Rosoboronexport in late 2013. The Mi-171Sh helicopters delivered are equipped with the latest avionics, enabling them to land safely at any time of day or night in any weather conditions. The helicopters are equipped with additional fuel tanks to increase range and length of flight, as well as an external sling for large cargo transportation. They are equipped with armour and protection systems for operation in areas that see heightened activity by terrorist or organised crime groups.

Type certification for Mi-38



Russian Helicopters received type certification for the medium multirole Mi-38 transport helicopter, which confirms that the helicopter's standard design complies with Russian and international aviation requirements. In 2016, the Mi-38 will enter serial production and launch in the Russian market. The first fuselage for the serial-production model has already been assembled at Kazan Helicopters. All of the helicopter's main systems and components are Russian-produced. Flight certification testing of the Mi-38 involved two prototypes (the third and fourth) fitted with TV7-117V engines by Klimov; the engines themselves successfully achieved certification early in 2015. The fourth prototype closely approximates the future serially produced versions Mi-38, and incorporates all of the systems and components that will be used during serial production.

UK's Strategic Defence & Security Review

British Prime Minister David Cameron announced the UK's Strategic Defence & Security Review (SDSR) in November 2015. Accordingly, the defence budget will be increased in real terms every year of the current Parliament with plans to spend £178 billion over the next decade on equipment and equipment support. One of the major elements of the SDSR is the decision to purchase nine Boeing P-8 Poseidon maritime patrol aircraft, with three due to enter service before the end of the current parliamentary term in 2020. The type, which will also have an overland surveillance capability, will be based in Scotland, at RAF Lossiemouth.



Under the Joint Force 2025 (JF2025) concept, there will be a highly capable expeditionary force of around 50,000 personnel, who can be deployed quicker and including a maritime task group centred on a *Queen Elizabeth*-class aircraft carrier equipped with F-35B Lightning II combat aircraft; a land Division with three Brigades including a new Strike Force; an air group of combat, transport and surveillance aircraft and a Special Forces task group.



For the *Queen Elizabeth*-class carriers, which will enter service from 2018, the number of F-35Bs will be increased to 24 operating from the new carriers by 2023. Despite rumours of a cutback, the SDSR confirmed that Britain will buy 138 F-35s. The Typhoon's capability will be enhanced including for ground attack and fitment

of a new active electronically scanned array (AESA) radar, the type remaining in service until at least 2040, ten years longer than previously planned. Introduction of Storm Shadow and Brimstone missiles will take place as planned.

However, the RAF will continue to operate Tornado GR4s until replaced by the Typhoon, three GR4 squadrons being retained, two disbanding in 2018, followed by the third in 2019. As part of JF2025, a second F-35 squadron and two additional Typhoon squadrons will be established, making a total of seven frontline Typhoon squadrons, each with 12 aircraft. Of the current RAF transport aircraft, 14 C-130Js will be upgraded and go through a life-extension programme, enabling them to continue until 2030. The remaining ten will be retired by 2022. The fleet of Bae146 CC2 and C3 aircraft will be replaced as they reach the end of their life.

500 more Hellfire IIs for UK

The UK will receive a batch of 500 AGM-114R Hellfire II semi-active laser missiles, plus associated equipment, parts and logistical support to be taken from existing US Army stocks. The Hellfire is already in the UK armed forces inventory, equipping both the Army Air Corps Apache AH1 attack helicopter and the Royal Air Force MQ-9A Reaper.

PAC delivers 16 JF-17s in 2015

Indicative of the sustained series production rate at the Pakistan Aeronautical Complex (PAC) at Kamra, was handing over of the



sixteenth JF-17 Block II fighter to the PAF on 28 December 2015. The first JF-17 Block II aircraft had flown in February 2015. At the ceremony, Air Chief Marshal Sohail Aman, CAS PAF, expressed satisfaction with progress of the JF-17 programme and praised "the professional competence and commitment displayed by PAC personnel in meeting the milestones of the JF-17 programme". Minister for Defence Production Rana Tanveer Hussain appreciated "the vital role played by our time-tested Chinese friends for the success of the JF-17 programme."

The JF-17 now equips Nos. 2, 16, 26 Squadrons plus the Combat Commanders School (CCS), while future JF-17s will supplant the PAF's current Mirage III/5 and F-7s in service.

Algeria orders 14 more Su-30MKAs

An additional 14 Sukhoi Su-30MKAs have been ordered by the Algerian Air Force to supplement the 44 already in service. Sergei Chemezov, head of industrial group Rostec, has confirmed deliveries will begin in 2016 and all 14 are scheduled to be in service by the end of 2017.



More aircraft for Russian AF



A further batch of Su-34 ('Fullback') attack bombers have been handed over by Sukhoi at the VP Chkalov Novosibirsk Aircraft Plant to the Russian Ministry of Defence as part of the 2015 State Defence Order. Meanwhile, Aviastar SP delivered the first upgraded Ilyushin Il-76MD-90A to the Russian Air Force on 2 December at the factory in Ulyanovsk. The aircraft was the fourth production standard aircraft from the 39 being built for the Russian Defence Ministry and will join the 610th Combat Training and Aircrew Conversion Centre.

Norway's first F-35As



The first two Royal Norwegian Air Force (RNoAF) Lockheed Martin F-35A Lightning IIs have been delivered at Luke Air Force Base, Arizona. The first RNoAF F-35A had earlier been formally unveiled in the factory at Fort Worth, Texas, Norway being the second international partner to have F-35s delivered to Luke AFB for training, the first being Australia. Eight other nations will be training alongside the US on the new aircraft at Luke, the other partner nations joining the US, Norway and Australia in the F-35 training programme being Italy, the Netherlands and Turkey, in addition to Foreign Military Sales countries Israel, Japan and South Korea. Luke AFB currently has 32 F-35s on site and by 2024, is scheduled to have six fighter squadrons with 144 F-35s.

'Final' C-17A Globemaster III

Boeing has officially completed production of the C-17A Globemaster III at its Long Beach, California, plant, but will continue providing support, maintenance and upgrades to the worldwide C-17 fleet under the Globemaster III integrated Sustainment Programme (GISP), performance-based logistics agreement. The decision to end C-17 production had been announced by Boeing in September 2013, just a week before the 223rd and final USAF aircraft was delivered. The company reported that the few remaining export orders were insufficient for further viability in manufacture of the type.

Still, Boeing has stated that it would build 13 more C-17As as 'white tails' in anticipation of expected future sales, although this was subsequently cut to just ten aircraft. Five of the last ten C-17As are yet to be delivered, four of which are allocated for the Qatar Emiri Air Force. Of the others, two were sold to the Royal Australian Air Force, one to the Royal Canadian Air Force and two to the United Arab Emirates Air Force and Air Defence.



Final F-16C Block 52s for Egypt

Delivery of the final four Egyptian Air Force F-16C Block 52s has finally been completed, these being formally received on 29 October at Cairo West Air Base after being flown there by US Air Force pilots. A freeze on weapons deliveries to Egypt, imposed following the military-backed coup in the country, was lifted in March 2015. The embargo prevented delivery of the final 12 EAF F-16Cs, which remained in storage at the factory in Fort Worth, Texas. After the ban was eased, eight were delivered during the summer.

Third C295M for Ghana Air Force

Airbus Defence and Space have delivered a third C295M to the Ghana Air Force. The aircraft is seen here on the ramp outside the factory at Seville-San Pablo Airport, Spain, painted in Ghanaian markings. The previous two examples were delivered in November 2011 and April 2012.



UAE orders Global 6000 Erieyes

Saab has been awarded a \$1.27 billion UAE MOD contract that includes purchase of two new Bombardier Global 6000 Erieye multi-mission aircraft and upgrading of two existing Saab 340AEWs for the UAEAF&AD. The first of two Saab 340AEW Erieyes was



delivered to the UAEAF&AD in late August 2010, with the second aircraft following in April 2011. Both are based at Al Minhad in Abu Dhabi.

Saab's CEO, Håkan Bushke reiterated that the Swing Role Surveillance System (SRSS) would have increased endurance and a new suite of well-tested sensors compared to previous Erieye systems: "The sensor's capabilities will be a game changer for surveillance going forward." Updates may also be offered on Erieye systems currently fitted to three other platforms: the EMB 145 (Brazil, Greece, Mexico), Saab 2000 (Pakistan, Saudi Arabia) and Saab 340 (Sweden). First of the new aircraft will shortly arrive in Sweden for systems integration shortly.

Progression of China's FC-31

China's FC-31 new generation fighter aircraft was displayed in Cmodel form on the CATIC stand at Dubai Air Show, where this medium-sized multirole fifth-generation fighter was seen with several modifications increasing its air-to-ground capabilities. Apparent changes were to the vertical fins and horizontal stabilisers, while there is now an integrated cockpit canopy. Powerplant of the first prototype remains the Klimov RD-93, but production aircraft will use a Chinese-designed engine. The FC-31's designer, Lin Peng has said that each engine has a thrust of 88.29kN, stressing that the FC-31 would be a stealthy jet with "multi-spectrum, low



observability characteristics". The FC-31 will have secure datalinks and medium-range PL-9 and long-range SD-10 air-to-air missiles, apart from air-to-ground weapons but the FC-31 has six external hardpoints and an internal weapons bay. Ling Pen revealed that the fighter's maximum payload is 8 tonnes, with 2 tonnes carried internally. The FC-31 has a maximum take-off weight of 25 tonnes and a combat radius with internal weapons of 648 nautical miles (1,200 km) although this could be extended with air-to-air refueling.

CATIC has provided some projections on delivery timetable if a customer is found within the next year. First flight of a series production aircraft would be in 2019, initial operational clearance should follow in 2022 and full operational clearance in 2024. Speculatively, Pakistan is a clear candidate for the FC-31 as also Iran and perhaps Egypt.

UAE's JAC orders AW609s

UAE's Joint Aviation Command (JAC) has placed a tentative order for three AW609 tilt rotors with options for a further three, with delivery in the 2019 timeframe. Major General Abdullah Al Sayed Al Hashemi of the UAE Defence Ministry has said that these would significantly improve the service's search and rescue (SAR) capabilities, "will provide the flexibility of a rotary and fixed wing with its 275kt speed and 750 nm range, much faster than conventional helicopters".



The JAC was established in August 2012, with rotary wing and fixed wing aircraft transferred from the Land Forces, Navy and Search and Rescue (SAR). These included the AH-64D Apache, AS355 Fennec, AS555 Panther, AW139, Bell 407, Super Puma, UH-60 Blackhawk, CH-47D/F Chinook, Cessna 208 Caravan, IOMAX Archangel and Twin Otter and followed the lead taken by the UK's Joint Helicopter Command (JHC) to improve command and control as well as logistics support. The Twin Otter and Cessna Caravan are all former special ops aircraft while the helicopters came from Group 18/Presidential Guard, Group 10/Land Forces and the Naval Aviation Group. JAC personnel provide the first line maintenance but Global Aerospace Logistics (GAL) and AMMROC provides the rest.

Vipers for Pakistan

The Pakistan Army will receive its first three AH-1Zs in 2017, from a total batch of 15. The order of the first three was awarded to Bell on 25 August 2014, although at the time, the number involved was not announced.



Increased orders for C295s

The Egyptian Air Force has recently increased its order for Airbus Defence and Space (ADS) C295s from 4 to 24. Meanwhile, the Royal Jordanian Air Force has also increased its C295 requirement by two, thereby doubling its inventory earmarked for the gunship conversion programme. ADS has received an order for four winglet-equipped C295Ws from the Saudi Arabian Interior Ministry. Another West African customer is the Royal Air Force of Oman (RAFO), which ordered eight C295Ms on 21 May 2012, now comprising four tactical transports and an equal number of multi-role patrol aircraft. The latter is fitted with a Fully Integrated Tactical System (FITS) which includes an electronic support measure (ESM) mod above the cockpit.

Global Hawk for Japan

Foreign Military Sale to Japan of three Northrop Grumman RQ-4 Block 30 (I) Global Hawk remotely piloted aircraft has been approved by the US Defence Security Co-operation Agency (DSCA). Major Defence Equipment (MDE) would comprise three RQ-4 air vehicles, each to be fitted with an Enhanced Integrated Sensor Suite, plus eight Kearfott INS/GPS units (two per aircraft with two spares) and eight LN-251 INS/GPS units (two per aircraft with two spares).

Japan orders E-2D Advanced Hawkeye



Northrop Grumman has been awarded a \$151 million Foreign Military Sales contract by US Naval Air Systems Command covering four E-2D Advanced Hawkeyes for Japan. The JASDF will employ the aircraft for AEW&C situational awareness of air and naval activity in the Pacific region, augmenting the existing fleet of 13 E-2C Hawkeyes.

Indonesia to buy AW101s

The Indonesian Air Force (TNI-AU) plan to buy three AW101s for VVIP tasks which are included in the TNI-AU's five-year plan for 2014-2019. They would replace three NAS332L1 Super Pumas currently used in the VVIP role.

Thai Air Force's Sukhoi Superjets

Flight testing has begun of the first of three VVIP-configured Superjet 100-95LRs for the Royal Thai Air Force (RTAF). The aircraft made its maiden flight at Komsomolsk-on-Amur/Dzyemgion after being built on the Komsomolsk-on-Amur Aircrafts Production Association (KnAAPO) production line, ferried via Novosibirsk to Ulyanovsk, where it was painted in RTAF colours. It will undergo final acceptance testing at Zhukovsky before being outfitted with its VIP cabin prior to delivery to the RTAF, scheduled for September 2016.



Saab's Brazilian Gripen NG contracts

Saab has concluded a contract with the Brazilian Ministry of Defence, through the Aeronautics Command (COMAER), concerning acquisition of external stores for the next-generation Gripen multi-role fighter. The order includes deliveries of external stores by Saab and suppliers who have been selected by the customer for the Brazilian Gripen NG programme. The contract supplements the existing contract with Brazil concerning development and production of 36 Gripen NG, which was announced on 27 October 2014. Gripen NG deliveries to the Brazilian Air Force will commence in 2019.



Thai Gripens exercise with Chinese Su-27s

For the first time ever, Chinese Su-27s were deployed to Thailand to take part in Exercise 'Falcon Strike', hosted by the Royal Thai Air Force's (RTAF's) 1 Wing at Korat-Nakhon Ratchasima Air Base. Six Chinese Su-27s/J-11s (including two twin-seat Su-27UBKs) from the 2nd Fighter Division's 6th Regiment, based at Suixi in the Guangzhou Military Region flew to Korat for the exercise. Support was provided by a PLAAF II-76. The exercise "aimed to improve the performance of aircrew from both countries in tactical air operations and promote better learning and understanding between all levels of personnel from the two air arms." RTAF aircraft participation involved five JAS39C/D Gripens from 7 Wing/701 Squadron at Surat Thani Air Base, which deployed to Korat for the exercise.



FA-50PHs to Philippine Air Force

Delivery of the first two KAI FA-50PH lead-in fighter trainer/light attack aircraft to the Philippine Air Force was completed on 28 November, landing at Clark Air Base and received by Secretary of Defence Voltaire Gazmin and Armed Forces of the Philippines Chief of Staff General Hernando Iriberry.

They are the first of 12 FA-50PHs for which the Philippines signed a contract in March 2014. The next two are due to follow within 12 months and the remainder in 2017. These are the first supersonic combat aircraft operated by the PAF since it retired its F-5s in 2005. In related moves, it was revealed that President Benigno Aquino III had approved purchase of 44 billion pesos (\$932.74 million)-worth of military equipment to boost maritime security in the South China Sea. This will include orders for three anti-submarine helicopters, two long-range patrol aircraft and weapons for the FA-50PHs.



Singapore F-16 Upgrade contract

Lockheed Martin has been awarded a Foreign Military Sales contract by the US Air Force to upgrade Republic of Singapore Air Force (RSAF) F-16s. The work will be carried out at Fort Worth, Texas, expected to be completed by 30 June 2023. Plans for modernising the RSAF's 60 F-16C/D Block 52s had first been revealed by Defence Minister Ng Eng Hen and an announcement by Singapore's Ministry of Defence confirmed that the work will include a new active electronically scanned array radar, together with more capable precision weapons, including the Laser Joint Direct Attack Munition (Laser JDAM) and new advanced air-to-air weapons. A datalink capability and advanced helmet-mounted display will also be included.

JF-17s for Sri Lanka?

During Pakistan PM Nawaz Sharif's visit to Sri Lanka in early January 2016, it was reported that the SLAF would receive an initial eight JF-17 Thunders from Pakistan. However, this was not confirmed and within days, there were reports of stiff opposition from India which could delay, or even cancel the acquisition.



Amongst India's diplomatic missive to Colombo on why it should not buy the JF-17 Thunder, included a negative technical assessment of the aircraft, as also that Sri Lanka "did not need fighters". Still, the SLAF plans to replace its present ageing fleet of Israeli Kfir and Russian MiG-27s, and Pakistan has been promoting the sale of 10-12 JF-17s, each priced about \$35 million, with SLAF CAS Gagan Bulathsinhala visiting the PAC at Kamra last year.

Special force to guard Chinese workers at Gwadar

Pakistan has reportedly set up a special Marine Battalion to provide security to Chinese workers and experts at the Gwadar deep seaport working on the \$46 billion economic corridor project. The China-Pakistan Economic Corridor (CPEC) project was launched in 2015 to link western China to southern Pakistan through a network of roads and investment projects. Security of Chinese and the CPEC was focus of the new force for which a special Marine Battalion had been raised to provide security to Chinese engineers and delegates visiting the strategic Gwadar port.

Philippines offers bases to US

In a turnaround from the not-too-distant-past, the Government of Philippines has offered the United States eight locations where it can build facilities to store equipment and supplies under a new security deal amid rising tension with China over the South China Sea. In 2015, the Philippines and the United States signed the



Enhanced Defence Cooperation Agreement (EDCA) for increased military presence in the Philippines, rotating warships and aircraft "for humanitarian and maritime security operations".

Five military airfields, two naval bases and a jungle training camp were offered to the United States, three of them on the main island of Luzon, including Clark airfield, a former US Air Force base, with two on the western island of Palawan, near the South China Sea. The US is also seeking access to three civilian seaports and airfields on Luzon, including Subic Bay, a former US Navy base (*see picture*).

US Congress 'stalls' sale of F-16s to Pakistan



The US Congress has 'stalled' a planned sale of eight new F-16 fighter jets to Pakistan, reportedly owing to "concerns" over the end use of the F-16 fighter jets by Pakistan. The Obama administration has also received a "hold" notice from the Senate. However, the sale of F-16s has been put only on "hold" and it can still go through if the administration continues to push for it. Interestingly, this decision from the US coincides with the Obama administration asking Pakistan to "act fast" against the perpetrators of the Pathankot air base attack in India on 2 January 2016.

Re-organisation of the PLA

President Xi Jinping of China has instituted a major reform of the military, reorganising PLA's four military headquarters, staff, politics, logistics and armaments into 15 new agencies under the CMC. On 11 January, Xi directed China's 2.3 million-member



armed forces to strictly follow the orders of the ruling Communist Party and focus "on winning wars." President Xi, who is also the CPC chief beside being the chairman of the CMC which makes him the strongest Chinese leader in recent times, said military leaders must adhere to the Party spirit, obey political discipline, and "be politically intelligent," with firm political faith and right political stance. This is part of major reforms initiated by Xi to revamp the PLA, including reduction of the force by 300,000 troops to make the force "lean and mean".

As it embarks on major reforms, the Chinese military have stated that "winning wars should its top responsibility, as 'antagonist forces' unwilling to see China growing stronger are trying to contain the Communist state. The national security situation is facing new and profound changes with an increasing number of risks, challenges and interwoven conventional and unconventional security threats," state-run Xinhua news agency quoted.

Besides the strategic rivalry with US, China is entangled in maritime disputes in the South China Sea with Vietnam, Malaysia, Philippines, Brunei and Taiwan. China is also locked in a dispute with Japan over the uninhabited islands in the East China Sea, apart from the half-a-century-old India-China border dispute along the Indo-Tibetan frontier, which remains unresolved even though both countries have made efforts to improve relations and initiated several measures to keep the situation peaceful along the borders.

Additional Tiger HADs for French Army Aviation

The French Defence Procurement Agency (DGA) has ordered seven additional Tiger HAD attack helicopters, bringing to 67 the total number of Tigers that will eventually be operated by French Army Aviation. The additional Tigers will be delivered in 2017-2018.



Since July 2009, Tigers have been deployed continuously by the French Army in different areas, such as Afghanistan, Libya and Sahel. While deployments in Afghanistan and Libya have come to an end, Tigers are still supporting missions in Sahel where, despite the hostile operating conditions, the helicopter has shown very high level of availability and logged more than 2,000 flight hours since the start of deployment in January 2013.

PC-21 for Australian Defence Force



The Australian Defence Force have selected the Pilatus PC-21 turboprop trainer after a “thorough evaluation and contract negotiations.” As Oscar J. Schwenk, Chairman of Pilatus, commented: “We are delighted that after 28 years of Pilatus PC-9 operations the Commonwealth of Australia has chosen to endorse our reputation for providing world class Training Systems with this new contract.” The PC-21 has been in service with the Republic of Singapore Air Force at RAAF Base Pearce in Western Australia since 2008 and is also operated by the Air Forces of Switzerland, the UAE, Saudi-Arabia and Qatar. The PC-21s for Australia will be delivered commencing June 2017 and will form the backbone of future pilot training over the next 25 years.

2,500th C-130 Hercules

On 11 December 2015, Lockheed Martin delivered the 2,500th C-130 Hercules, an HC-130J Combat King II personnel recovery aircraft assigned to the US Air Force’s 71st Rescue Squadron, which is part of the 347th Rescue Group. The US Air Force is the world’s largest Hercules operator, which includes legacy C-130 and C-130J Super Hercules fleets. Additionally, the USAF operate MC-130J Commando IIs from Air Force Special Operations Command at Hurlburt Field, Florida and an HC-130J Combat King II is assigned to Air Combat Command at Moody Air Force Base, Georgia.



C-130s are operated from 68 nations and the global fleet has collectively logged more than 22 million flight hours. The current production model is the C-130J Super Hercules, “the airlifter of choice” for 16 nations and 19 different operators, including the Indian Air Force.

Swiss order Hermes 900 HFE UAVs

Elbit Systems is to supply Hermes 900 HFE (Heavy Fuel Engine) UAVs to Switzerland under a \$200 million contract. The deal also includes an advanced ground segment for command, control and communications.



PAC-3 missiles for US

The United States and allied military forces will upgrade their missile defence capabilities under a new \$1.1 billion contract for production and delivery of Lockheed Martin-built Patriot Advanced Capability-3 (PAC-3) missiles and PAC-3 Missile Segment Enhancement (PAC-3 MSE) missiles. The contract includes PAC-3 and PAC-3 MSE interceptor deliveries for the US Army and Foreign Military Sales of PAC-3 interceptors, Launcher Modification Kits, associated equipment and spares for the Kingdom of Saudi Arabia, the Republic of Korea and Qatar.



The PAC-3 Missile is a high-velocity interceptor that defends against incoming threats including tactical ballistic missiles, cruise missiles and aircraft and currently provides missile defence capabilities for six countries, including the US, the Netherlands, Germany, Japan, United Arab Emirates and Taiwan.

MX-10s for UK Police P68s

L-3 Wescam has received an order from Austrian-based Airborne Technologies for four MX-10 electro-optical/infra-red (EO/IR) imaging systems to be installed on the UK National Police Service's (NPAS) newly procured Vulcanair P68 aircraft. As prime contractor and integrator for the NPAS fixed-wing programme, Airborne Technologies will purchase and integrate L-3's MX-10 with displays, a moving map and a digital video recorder. The integrated solution will be downlinked with its own Airborne LINX mission system. Deliveries of the MX-10 sensors to Airborne Technologies will begin in March 2016.

New-generation Gripen in final assembly

Saab has reconfirmed that its Gripen NG programme is on track to deliver advanced capability to Sweden and first export customer Brazil. Ulf Nilsson, head of Saab's aeronautics business area, stated that the fighter's three main sections required only one minor adjustment before they could be joined. "We had less [production line] feedback on the first aircraft than we have on the running production of the [Gripen] C/D," he noted, attributing this to the new model's all-digital design.



Meanwhile, Saab has received an order worth SEK 360 million from the Swedish Defence Materiel Administration (FMV) to provide maintenance, operational support and continuing development work for Gripen operations during 2016. The order includes the operation of rigs, simulators and test aircraft for the verification and validation of the Gripen C/D and Gripen E fighter aircraft systems, plus operational support for Gripen C/D. The order is a call-up of options as part of the framework of a previously signed contract with FMV regarding Gripen development resources, which was announced on 20 December 2013.

Service life extension for RBS 97 ADS



Saab has signed a contract with the Swedish Defence Materiel Administration (FMV) for a service life extension of the RBS 97 air defence missile system, ensuring the continuing effectiveness of a missile system which is the backbone of Sweden's air defence battalions. The RBS 97 (Hawk) is a surface-to-air missile system that is part of Sweden's national defences, capable of destroying high-flying targets, in all weather conditions, at a range of up to 40 km. The service life extension will implement new capabilities for the system, making it better able to counter current and future airborne threats.

RBS 70 NG tested by Czech Army

Saab has participated in a live-fire exercise held near Cesky Krumlov, in the Czech Republic, where its RBS 70 NG system was integrated into an existing air defence system. The exercise, held at the Boletice Military Training Area in the Cesky Krumlov region, included several missile firings that successfully hit their airborne targets.



Charles de Gaulle deployed

The French Navy aircraft carrier *Charles de Gaulle* (R91) has joined the country's 'Opération Chammal' air strike campaign against the IS, the first strikes from the ship taking place on 23 November. 18 Rafale Marines, eight Super Étendard Modernisés, two E-2C Hawkeye 2000S, two AS365N3 Dauphins and one Alouette III are embarked on the carrier. Meanwhile, the French Air Force have deployed six Rafales, two Mirage 2000Ds and two Mirage 2000Ns from BA 104 at Al Dhafra in the UAE for air strikes against targets in Syria.



Emirates high-density A380s



The first Airbus A380 in a maximum configuration (615 passenger seats) has been received by Emirates. Dispensing with the First Class cabin, the new A380s will be employed on the airline's busiest routes including Dubai-Bangkok and Dubai-Copenhagen, and also Dubai-Kuala Lumpur and Dubai-Manchester from 1 January 2016. Two Emirates Airbus A380s have been painted in special scheme to support 'United for Wildlife', which unites the efforts of the world's leading wildlife charities in the fight against illegal wildlife trade.

Thales ballistic missile subcontract

Thales has signed a subcontract for verification of the North Atlantic Treaty Organisation (NATO) Ballistic Missile Defence (BMD) architecture on an Integrated Test Bed. The work is part of the contract awarded to prime contractor Leidos by NATO, with Thales performing the test and integration activities, the team responsible for the design, development and test of the interfaces with NATO's and national weapons and sensors. The Integrated Test Bed relies on Thales's vast experience with naval defence systems and knowledge of long-range sensor technology. The contract has a duration of four years with options for extension and is a follow-on to the Active Layer Theatre Ballistic Missile Defence contract.



Cathay's new Livery



Cathay Pacific Airways have introduced a new aircraft livery, the colour scheme showcased on one of the carrier's Boeing 777-300ERs during a special event at the airline's Hong Kong International Airport base. The new livery will be progressively introduced across its entire fleet over the next five years as each aircraft goes through its normal maintenance schedule, and more than 150 aircraft will eventually receive the new look. The new livery comprises three key design elements: the updated and streamlined 'brushwing' motif, which was launched in October 2014; a simplified colour palette to Cathay Pacific green, grey and white and more prominent use of the company's name and logo.

Eva Airways order B-787-10s

Eva Airways of Taiwan have finalised orders for 24 Boeing 787-10 Dreamliners plus two more 777-300ERs, the largest single commercial aircraft purchase in the nation's aviation history. This deal reinforces Eva's long-haul aircraft modernisation programme with plans to expand the fleet to 100-plus by 2010. The 787-10s will also expand Eva's new markets.

Philippine Airlines expansion

Philippine Airlines is to order at least six Airbus A350-900 HGW aircraft as part of its future expansion and fleet renewal plans, the decision to be finalised very shortly. Philippine Airlines would retire its six A340-300s and replace them with the high gross weight variant of the A350 making it possible to operate non-stop flights from Manila to New York.



Certification of Airbus A320neo

Airbus has received joint type certification from EASA and FAA for the Pratt & Whitney Pure Power PW1100G-JM-powered variant of the A320neo. The three P&W-powered flight test aircraft have accumulated more than 1,070 flight hours in 350 flights; of these, 300 hours were completed with the same aircraft in an airline-like environment to ensure operational maturity at entry into service. The A320neo is now cleared for first delivery and "ready to offer airlines its combination of unbeatable economics and outstanding cabin comfort", first of the A320neo Family to receive its type certificate. The CFM International LEAP-1A-powered variant will be certified in early 2016, with the A321neo and A319neo in both engine configurations to follow. An incredible number (4300 plus) of orders have been received for the A320neo from airlines worldwide.

Two Airbuses a day

Airbus plan to increase the production rate of its single-aisle family to 60 aircraft a month from mid-2019. Airbus is currently building 42 A320 Family aircraft a month, and has announced plans to increase production to 50 from the first quarter of 2017. With 60 aircraft a month, Airbus will extend the capacity of its Hamburg facility with the creation of a second final assembly line.

flydubai on 'labour routes'



The low-cost carrier flydubai will continue to operate a fleet of Boeing 737-800s with an all-economy configuration. The single-class aircraft will be used on the newly coined expression 'labour routes' where the demand for Business Class services is low. The carrier has 100 737 MAXs on order which will be used for growth and replacement. "We plan to fly our aircraft for around eight years before selling them on," according to its CEO.

A321s for VietJet Air

Vietnam's VietJet Air has placed a firm order for 30 Airbus A321s (nine A321ceos and 21 A321neos). The carrier started flights at the end of 2011 and now operates a fleet of 29 A320 Family aircraft, including three A321s on a network covering Vietnam and a growing number of destinations across Asia.



Meanwhile, VietJet Air has selected CFM International's CFM56-5B to power its Airbus A321 ceos and signed a long-term service agreement. Pegasus Airlines entered into an eight-year *Time & Materials Support* agreement with CFM International to cover a total of 90 shop visits for the CFM56-7Bs powering its fleet of 737-800s.

Engines ordered

GE Aviation and CFM International have secured several engine orders and long-term contracts valued at more than \$17 billion with carriers in the Middle East. Emirates signed its largest single engine Maintenance Repair and Overhaul (MRO) deal worth \$16 billion for the GE9X engines that will power its fleet of 150 Boeing 777Xs over a period of 12 years. The carrier also signed a 12-year GE OnPoint solution contract, covering the maintenance and inventory support for various avionics, electrical power and mechanical systems on all of its 777s in service as well as the 44 additional -300ERs it has on order. Etihad Airways signed an agreement for GE90-115Bs to power its two new 777 Freighters and a 12-year OnPoint solution agreement for GE90s valued at more than \$475 million (at list prices). Royal Air Maroc selected GE Aviation for a five-year exclusive OnPoint solution agreement to maintain, repair and overhaul its CF6-80C2s that power its four 767s.

Airbus A380neo "inevitable"

Airbus' Chief Operating Officer Customers, John Leahy has said that the launch of a re-engined, more economical A380neo is "inevitable" with an in-service date of around 2023. Also, conceiving a "stretch" of the A350, Leahy said the company would decide soon as any delay could reduce market share for that size of aircraft if Boeing secures more orders for the 777-9X. Any stretch would add around 40 to 50 seats to the A350-1000's capacity and put it in the 400-seat category currently being catered for by the 777-9X.

SSJs for Iran

Sukhoi Civil Aircraft Company (SCAC) are in discussion for the sale of some 100 Sukhoi SuperJet 100s to Iran. President Ilya Tarasenko has said the company is ready to include Iranian companies in the SSJ100 co-operation programme. Reportedly, SCAC is also negotiating with India's Tata Group for a deal that includes up to 50 aircraft for deliveries starting in 2018.



Interestingly, Kato Investment Company has ordered six Irkut MC-21s with four options for aircraft to be used by its charter subsidiary Cairo Aviation. The two firms may establish a regional MC-21 MRO centre at Al Alamain International Airport.

Il-96Ms for China

Russia has reportedly offered China joint participation in the production, and future development, of the Ilyushin Il-96-300 and Il-96M four-engined airliners. The proposal is currently the subject of government-to-government negotiations. Future joint developments would focus on a re-engined version of the Il-96M.

airBaltic launch operator for CS300

Latvian flag carrier airBaltic will be the CS300's launch operator while Swiss will be the first user of the aircraft's CS100 variant, which is due to be certified shortly. The Latvian flag carrier will take delivery of the first of 13 aircraft in the second half of 2016. Bombardier plans to deliver the first CS100 to Swiss in the first half of 2016 following certification and the larger CS300 will be certified six months after the CS100.

Ultra-long range A350s for SIA

Singapore Airline's first A350-900 was recently rolled-out from the Toulouse paint shop. SIA is the launch customer and has amended its existing order for 63 A350-900s so that seven will be delivered as A350-900ULRs. The airline also ordered four A350-900s, taking its total firm A350 orders to 67. The A350-900ULR will include a higher capacity fuel system within the existing fuel tanks, increasing capacity from 141,000 litres to 165,000 litres.



The option will also feature aerodynamic refinements and a higher maximum take-off weight of 280 tonnes, up from 268 tonnes of the standard aircraft. Deliveries of the A350-900ULRs to SIA are scheduled for 2018.

SIA intends to operate the A350-900ULRs on the 8,700nm (16,112km) route from Singapore to New York. According to SIA's CEO Goh Choon Phong, "Our customers have been asking us to re-start non-stop Singapore-US flights and we are pleased that Airbus was able to offer the right aircraft to do so in a commercially viable manner."

Etihad selects Thales HUD



Etihad have selected Thales for its dual configuration Head Up Displays for the first 12 aircraft of its new Airbus A350XWB fleet scheduled to be delivered from December 2017; some 62 A350XWBs have been ordered by Etihad. The dual-configuration (pilot/copilot) HUD is a newer development to the more traditional, pilot only HUD configuration. These are gaining traction in the commercial market as it improves situational awareness and efficiency of both pilot and copilot, by giving them the same level of eyes-out instrument visibility during critical phases of the flight, especially in low visibility and adverse weather conditions, thus improving flight safety.

Yeti Airlines Jetstream 41 support

BAE Systems Regional Aircraft has won a two-year extension to its long-running Rate-Per-Flying-Hour (RPFH) spares support contract with leading Nepalese regional operator, Yeti Airlines. The MACRO contract (Material and Components Repair and Overhaul) covers the airline's fleet of seven BAE Systems' Jetstream 41 turboprop airliners and covers some 240 separate part numbers. BAE Systems retains responsibility for managing the spares inventory, logistics and repairs, which facilitates the smooth operations by Yeti Airlines.



Embraer delivers 1,200th E-Jet to Azul

Embraer has delivered the 1,200th aircraft of the E-Jets family to Azul Linhas Aéreas Brasileiras SA, a Brazilian airline, in a ceremony held at the Company's headquarters, in São José dos Campos. The first delivery of an E-Jet to Azul occurred in December 2008, making it the first Brazilian airline to operate an aircraft



from this family of commercial jets. The initial agreement was for 36 firm orders: 31 E195 and five E190 jets. Presently, the airline has a total of 88 E-Jets in operation and in May 2015, Embraer and Azul signed a purchase agreement for 50 E195-E2 jets, with 30 firm orders and 20 additional purchase rights. The first delivery is scheduled for the second quarter of 2020.

Boeing debuts the 737 MAX 8

Boeing has completed final assembly of its first 737 MAX 8 in Renton, Washington. The aircraft will undergo pre-flight preparation in the factory before departing for Renton Field to



continue flight test readiness first flight is scheduled in early 2016. The 737 MAX incorporates the latest technology CFM International LEAP-1B engines, Boeing-designed Advanced Technology winglets and other improvements.

New-generation Il-78 tanker

During a December 2015 visit to the Aviastar-SP production facilities in Ulyanovsk, Russia, *Vayu* was briefed on the upcoming Il-78M-90A, a natural outgrowth of the Russian MoD's Il-76MD-90A (also known as Il-476) programme. The new tanker essentially leverages the changes and upgrades applied to the Il-76 in its new guise, and also importantly moves Il-78 production to Russia. In the past, all Il-78 aircraft were produced at the Tashkent Aircraft Production Association (TAPO) in Uzbekistan.



Il-78M-90A wing-fuselage mating at Aviastar-SP, Ulyanovsk (photo: Angad Singh)

Like the present generation Il-78 variants, the Il-78M-90A remains usable as a transport aircraft, retaining the Il-76 loading ramp and cargo handling equipment. Three hose-drogue type refueling pods will be installed, one at the rear fuselage and one under each wing. The tanker will be powered by the same PS-90A-76 engines as the Il-76MD-90A, improving payload, field performance and endurance. Aviastar is planning for the development prototype to make its maiden flight some time in 2016.

CityJet firms up options on six additional Superjets



Irish regional airline CityJet has exercised an option to take delivery of six more Sukhoi Superjet 100 regional airliners. In October 2015, CityJet had announced that a firm order for 15 Superjets, at a list price of over \$1bn. The six options will take the CityJet Superjet fleet to 21 aircraft. The airline retains further options on more SSJs and has indicated that it will decide on exercising those by Q3 2016.

CityJet presently operates a fleet of BAe 146 regional airliners, which are to be supplemented and eventually replaced by a mix of Sukhoi Superjets and Bombardier CRJ900s.

Second MC-21 prototype under construction

Fuselage panels and airframe components for the second MC-21 airliner prototype have been delivered from Aviastar-SP in Ulyanovsk, Russia, to the Irkutsk Aviation Plant. During a visit to the Aviastar plant in December 2015, *Vayu* was briefed on the programme and informed that the first prototype will be rolled out in mid-2016, with maiden flight and commencement of the flight test campaign later in the year. Fuselage panels for the third prototype are already under construction at Ulyanovsk, where a number of key MC-21 parts are produced. While Aviastar is responsible for conventional (i.e. non-composite) parts such as the APU compartment, tailcone, doors, and flight and control surfaces, the co-located AeroComposit plant is where the aircraft's carbon-fibre composite parts, including the entire CFRP 'black wing' are made.



MC-21 APU housing and tailcone under construction at Aviastar-SP in Ulyanovsk (photo: Angad Singh)

Russian state-owned parent company UAC has received 175 orders and commitments for the MC-21 to date, primarily from Russian carriers and Government bodies. However, UAC officials are confident that the aircraft will be able to challenge contemporary Western narrowbody airliners on merit, and expect flight-testing data and early service performance to generate more orders.

SpaceX makes historic Falcon 9 first stage landing

A SpaceX Falcon 9 rocket placed 11 Orbcomm satellites in orbit on 21 December 2015, while the first stage successfully landed back near the launch site at Cape Canaveral. The rocket lifted off on SpaceX Falcon 9 Flight 20 at 2029 h local time from Space Launch Complex 40 at Cape Canaveral Air Force Station, Florida. Deployment of the Orbcomm satellites started about 14 minutes after liftoff, and all 11 satellites were reported to be operational shortly afterward. Meanwhile, some 10 minutes after liftoff, the first stage touched down on a landing pad several kilometres south of the launch site and remained upright as its engines cut off.

The launch and landing represent several major milestones for SpaceX, marking the first Falcon 9 launch since a failure in June on a cargo mission to the International Space Station, the first launch of the upgraded Falcon 9 with increased thrust, an improved stage separation system and a stretched upper stage that can hold additional propellant, and of course, the historic first stage return landing after a number of failed attempts on previous launches. The successful return marks a significant milestone toward the company's goal of creating a reusable rocket system that would significantly reduce the space launch costs.



The Falcon 9 booster seen moments before touchdown (photo: SpaceX)

200th F-15 AESA radar from Raytheon

Raytheon has delivered the 200th APG-63(V)3 active Electronically scanned array (AESA) radar for the F-15 fighter operated by the US Air Force, Air National Guard and many coalition partners around the world. This all-weather,

multimode AESA radar provides superior situational awareness and interoperability to F-15 aircrew. Along with its increased capability, the radar is “three times more reliable than older mechanically scanned array radars, resulting in sustainment savings and increased availability.” With fire control radars designed for F-15, F-16, F/A-18 and B-2 aircraft, Raytheon has delivered more than 800 AESA radars since introducing the technology in 2000.

Sagem and AOI agreement on drones

Sagem (Safran) and Egyptian manufacturer AOI-Aircraft Factory have signed an exclusive commercial and industrial collaboration agreement concerning the Patroller surveillance drone system, to address the requirements of the Egyptian Ministry of Defence, wherein AOI-Aircraft Factory would handle final assembly of Patroller drones in its Egyptian facilities. The agreement also covers system support and commissioning. AOI-Aircraft Factory will develop a dedicated training centre in Egypt to train staff for the operation and maintenance of Sagem's drone systems. Developed in France by Sagem, the Patroller is a versatile long-endurance tactical drone system. It features an open, modular design to handle a broad spectrum of military and security missions, while carrying a multi-sensor payload of up to 250 kg, fuselage or pod-mounted.



First run of Rolls-Royce Trent 7000 demonstrator engine

A Rolls-Royce Trent 7000 demonstrator engine has successfully completed its initial power run, on a test bed in Derby, UK. The Trent 7000, the exclusive power plant for the Airbus A330neo, is seventh member of the Trent family which has become “engine of choice” in the wide body market over the last 20 years and scheduled to enter service in 2017. The 68-72,000lb thrust Trent 7000 will deliver significant performance benefits compared to the current version of the Trent 700 and will “improve specific fuel consumption by ten per cent, have twice the bypass ratio and halve the noise.”

Raytheon EKV in developmental flight test

A Raytheon Exoatmospheric Kill Vehicle (EKV) successfully completed a data-gathering mission during a Missile Defense Agency flight test. The mission's objective was to observe in-flight performance of redesigned components and gain valuable information on evolving threat classes. EKV's are designed to destroy incoming ballistic threats while they are still in space. As part of the MDA test of the Ground-based Midcourse Defence system, a ballistic missile target was launched and purposely not intercepted to demonstrate for maximum maneuvering and data collection. The testing was supported by Raytheon's sea-based X-band radar (SBX) and AN/TPY-2 radar – both play critical roles in supporting the Ground-based Midcourse Defence system. Raytheon is simultaneously managing four kill vehicle programmes – the EKV, Standard Missile-3 kinetic vehicle, Redesigned Kill Vehicle, and Multi-Object Kill Vehicle. The Raytheon kill vehicle family has a combined record of more than 30 successful space intercepts. Backed by decades of kill vehicle technology expertise, the Raytheon-made EKV is designed to destroy incoming ballistic missile threats by directly colliding with them, a concept often described as “hit to kill.”



associated Aster missile. The contract was notified by the French DGA (Direction Générale de l'Armement) to the EUROSAM consortium involving MBDA and Thales. This contract provides for the development of a new version of the Aster 30 Block 1 missile, referred to as Aster B1 NT with first deliveries to the French Air Force being expected in 2023. It also covers the modernisation of the current SAMP/T system to provide enhanced capabilities particularly against ballistic missiles. These evolutions will enable SAMP/T to further enhance its contribution towards NATO's anti-ballistic missile defence programme.



IAI Elta contract for Airborne SAR/GMTI System

ELTA Systems Ltd., a Subsidiary and Group of Israel Aerospace Industries (IAI), has been awarded a large contract for an advanced airborne SAR/GMTI (Synthetic Aperture Radar/ Ground Moving Target Indication) Imagery Intelligence (IMINT) system, designated ELM 2060P, “for a customer in Asia-Pacific.” The contract, to be performed together with Elbit Systems as prime contractor, will provide a complete multisensor tactical ISTAR solution. ELTA's SAR/GMTI podded system, carried by a fighter aircraft delivers long range stand-off all weather, SAR strip or spot imagery, with an option of Ground Moving Target Indication (GMTI) overlay. The imagery is transmitted in real time to a ground exploitation station, where a multisensor imagery information is translated into an intelligence report and disseminated to the relevant users.

ATR turnover at \$2 billion in 2015

ATR achieved a new record turnover in 2015, increasing to 2 billion dollars (2014: 1.8 billion). During the year, the aircraft



manufacturer also set a new record in terms of aircraft deliveries, with a total of 88 aircraft (2014: 83), an increase of 72% over the 51 deliveries made in 2010. Firm orders for 76 aircraft, along with 81 options (totaling 157 aircraft), were received in 2015 from clients on the five continents. ATR begins 2016 with a backlog of 260 aircraft, valued at some 6.6 billion dollars, which guarantees almost three years of production. Since the beginning of the program, ATR has received firm orders for 1,538 aircraft and has delivered 1,278.

France launches Aster Block 1 NT programme

The French Ministry of Defence has launched the Aster Block 1 NT (New Technology) programme aimed at modernising the SAMP/T ground based air defence system as well as its

Elbit's Airborne Electronic Warfare Systems for Israeli MoD

Elbit has been awarded a contract by the Directorate of Production and Procurement (“DoPP”) of the Israeli Ministry of Defence (IMOD) valued at approximately \$70 million for the supply of Electronic Warfare (EW) systems. The systems, developed and manufactured by Elbit Systems EW and SIGINT – Elisra Ltd., to be delivered over a 5-year period, will be installed on board all types of Israeli Air Force fighter jets. Bezahel (Butzi) Machlis, President and CEO of Elbit Systems, commented: “We are proud to provide the Israeli Air Force, recognised as one of the world's most advanced air forces, advanced EW systems, covering the full range of fighter jets, and we trust that this win will further enhance our position as one of the world's leading EW manufacturers. The modern global air combat arena is extremely challenging, and pilots are facing many new threats. Our systems provide a solution to a wide variety of current and future threats, and we hope that other customers will follow the IMOD and the Israeli Air Force and select our EW systems”.

Expanding World of Airbus

easyJet orders additional 36 A320 Family aircraft



easyJet will acquire a further 36 A320 Family aircraft taking its cumulative order for the type to 451. The agreement for six A320ceo and 30 A320neo makes easyJet one of the world's biggest airline customers for the A320ceo Family with 321 ordered and also for the A320neo with 130 on order. As with other recent deliveries to easyJet, the A320 is equipped with the latest technology and fuel-saving Sharklets.

TAM Airlines' first A350 XWB

TAM Airlines' first A350 XWB made its maiden flight at Toulouse on 1 December 2015 making it the first airline from the Americas to fly the A350 XWB and the fourth operator in the world. LATAM Airlines Group, comprising of LAN Airlines and TAM Airlines, has ordered 27 A350 XWB aircraft. The carrier will start operating the A350 XWB in January 2016 between Sao Paulo and Manaus, followed by international operations from Sao Paulo to Miami, to Madrid and to Orlando.



A321neos for Turkish Airlines

Turkish Airlines will acquire 20 additional A321neo aircraft, besides the 72 A321neo already on order to boost its expansion. "As one of the world's fastest growing airlines, our ambitious growth strategy needs to be fully supported by the most efficient, reliable and profitable aircraft," stated Dr Temel Kotil, CEO of Turkish Airlines. "This order for 20 more A321neo will help us achieve our expansion plans in a profitable and sustainable manner."



A330-900neo and 39 A320neos for TAP Portugal

TAP Portugal have ordered 53 Airbus wide-body and single aisle aircraft including 14 A330-900neo, and 39 A320neo Family aircraft (15 A320neos and 24 A321neos) to augment its fleet as part of its fleet renewal announced by the airline's new majority owner Atlantic Gateway. As part of the agreement, TAP Portugal is replacing its previous order of 12 A350-900s with the A330-900neo. TAP Portugal is an all Airbus customer, currently operating 43 A320 Family aircraft and 18 Widebody Family aircraft. The A330-800neo and the A330-900neo are two new members of the Airbus Widebody Family launched in July 2014 with first deliveries scheduled to start in Q4 2017.



A350-1000 Trent XWB-97 engine begins flight-test

The A350-1000's new engine, the Rolls-Royce Trent XWB-97 completed its maiden flight-test aboard Airbus' dedicated A380 "Flying-Test-Bed" aircraft. The aircraft flew from Airbus' facilities in Toulouse and performed a flight of 4 hours, 14 mins during which the engine covered a wide range of power settings at altitudes up to 35,000ft. The engine's operation and handling qualities were evaluated from low speeds to Mach 0.87. The Trent XWB-97 development engine was mounted on the A380's inner left engine pylon, replacing one of the aircraft's Trent 900 engines.



Commencing some nine months prior to the A350-1000's first flight, this engine flight-test programme will include hot weather as well as icing condition testing campaigns. The specially enhanced Trent XWB engine produces 97,000lbs of thrust on take-off, making it the most powerful engine ever developed for an Airbus aircraft.

Asiana Airlines orders 25 A321neos



South Korea's Asiana Airlines will procure 25 Airbus A321neo aircraft, the contract signed at a special ceremony in Seoul by Kim Soo Cheon, President & CEO, Asiana Airlines and Fabrice Brégier, Airbus President and CEO. Asiana Airlines currently operates 33 Airbus single aisle aircraft, 15 widebody A330-300s and four double deck A380s. Meanwhile, Air Busan operates 10 A320 Family aircraft on its domestic and regional services. Following this order, the Asiana Group now has firm orders with Airbus for 57 aircraft, comprising two more A380s, 30 mid-size widebody A350 XWBs and 25 A321neo.

30 A321neos for Korean Air

Korean Air has contracted with Airbus for purchase of 30 A321neo aircraft plus 20 options, becoming a new customer for the A320 Family. The purchase agreement finalises a commitment announced earlier in 2015 and was signed in Seoul by Walter Cho Won Tae, Korean Air Executive Vice President and Fabrice Brégier, Airbus President and CEO.



IAG confirms A330s and A320neo orders



The Board of the International Airlines Group (IAG) has firmed orders for 19 additional wide-body and single aisle aircraft (2 A330-200s, 2 A330-300s and 15 A320neos taking their cumulative Airbus orders to a total of nearly 470 aircraft. The two A330-200s will be assigned to Iberia and the two A330-300s operated by Aer Lingus. The 15 A320neos will be assigned within the group.

Elbit DIRCM Systems tested on Airbus C295

Elbit Systems' MUSIC family of Directed Infrared Countermeasure (DIRCM) systems, integrated with the advanced Passive Airborne Warning System (PAWS) IR based missile warning system, have been successfully demonstrated on an Airbus C295 aircraft. During the tests, conducted by a multi-national NATO team, a C295 aircraft with an operationally installed Elbit EW self-protection suite, consisting of the DIRCM system and the PAWS, successfully demonstrated the capability to detect, acquire, track and counter the trial test equipment on the ground, under extreme conditions. The initial assessment of the

results highlighted that the system has the capability to successfully MANPADS (infra-red, ground to air heat seeking Man-Portable Missiles) counter using generic NATO jam codes.

Airbus A330 MRTT tankers for France

Airbus Defence and Space has received a firm order from the French Defence Procurement Agency (DGA) for a further eight A330 MRTT Multi-Role Tanker Transport aircraft, comprising the second tranche of the multi-year contract for 12 A330 MRTTs signed by the French Ministry of Defence in November 2014 and bring the total orders to nine. The remaining three are scheduled to be confirmed in 2018, permitting deliveries of the 12 aircraft before 2025. The first A330 MRTT will be delivered to France in 2018, followed by the second in 2019, and the remainder at a rate of one or two per year. In French service the A330 MRTT will be powered by Rolls-Royce Trent 700 engines and equipped with a combination of the Airbus Refuelling Boom System and underwing hose-and-drogue refuelling pods.



Airbus C295W demonstrated in Bolivia

An Airbus C295W aircraft belonging to the Mexican Navy (SEMAR) and operated by a mixed crew from Airbus Defence and Space and SEMAR carried out demonstration flights in El Alto, La Paz, Bolivia, one of the airports with the most extreme hot and high conditions in the world. The C295W, which landed at El Alto International Airport, more than 4,000m above sea level, on 17 November, has also performed flights to the Cochabamba base and the unprepared runway of San Borja.



Airbus DS radars for Malaysian coastlines

Airbus Defence and Space will deliver five of its newest SPEXER 2000 Coastal radars to Malaysia for monitoring coastlines and prevent illicit intrusions, deliveries to be completed in 2016. SPEXER 2000 Coastal is optimised for the surveillance of coastal areas and maritime infrastructure such as harbours and oil fields. With an instrumented range of 133 nm (247 km), its high doppler and velocity resolution as well as its high sea clutter suppression is able to detect and track even very small and slowly moving objects such as swimmers and rubber dinghies, but also fast objects such as speed boats. The Command & Control system will be provided by Signalis/Bremen.



Airbus Helicopters first NH90 for Sweden



Airbus Helicopters has delivered the first Swedish NH90 in full Anti-submarine warfare (ASW) configuration to the Swedish Defence Materiel Administration FMV (*Försvarets Materielverk*). The fully-qualified rotorcraft has an entirely customised mission system including underwater sonar, tactical radar and high cabin for improved interior space.

Sweden has ordered 18 NH90s, 13 equipped for search-and-rescue missions (SAR) and five in ASW configuration. FMV and the manufacturer NH Industries have also signed a contract to modify four already delivered NH90 from SAR to ASW configuration, bringing the total Swedish NH90 fleet to nine ASW and nine SAR aircraft.

Airbus DS TRS-4D for Freedom-class LCS

Airbus Defence and Space, Inc. and its affiliate, Airbus Defence and Space GmbH have tested the TRS-4D naval radar scheduled to go aboard the US Navy's *Freedom-class* Littoral Combat Ship (LCS) starting with LCS-17. The TRS-4D radar for LCS is a rotating version of the Active Electronically Scanned Array (AESA) fixed panel TRS-4D radar currently aboard German F-125 frigates. Upon installation aboard LCS-17, the TRS 4D will be the first AESA rotating radar aboard a US Navy ship. This new radar combines mechanical and electronic azimuth scanning to achieve fast generation of target tracks.



Exercise Trident Juncture

Testing Readiness of NRF and VJTF forces

Exercise *Trident Juncture* (TRJE) 2015, held from October through early November, was the biggest and most ambitious NATO exercise in more than a decade. It was the culmination of a series of dynamic and demanding training events designed to exercise and test troops and commanders. NATO is enhancing its readiness and flexibility in response to a changed security environment and to challenges from the south and the east. The exercise also tested the functions of the new Very High Readiness Joint Task Force (VJTF) – or ‘Spearhead Force’ – ahead of it becoming fully operational in 2016.

NRF

NATO’s Response Force (NRF) is a high readiness and technologically advanced force comprising land, air, sea and special forces units capable of being deployed quickly on operations wherever needed. The purpose of the NRF is to provide a high quality quick reaction force to support NATO missions as required. The concept of NRF was first

endorsed with a declaration of NATO’s Heads of State at the Prague Summit on 22 November 2002. It was then approved by NATO Defence Ministers in June 2003, and

the first headquarters — NRF 1 in Italy — was created in October 2003 under control of the NATO Joint Force Command (JFC) in Brunssum, the Netherlands. Its rotation



Portuguese jumpers perform a HALO (High Altitude Low Opening) jump from a Canadian CC-130 (photo: Christian Timmig)

replacement was designated NRF 2 (2004) at the same time. Until now, units assigned to the NRF have been used on four occasions, namely the Olympic Games (Athens, 2004), Afghan presidential elections (2004), humanitarian assistance following Hurricane *Katrina* (USA, 2005) and the humanitarian relief following the earthquake in Pakistan in 2006. Since Russia's intervention in Ukraine last year, NATO officials have declared that the alliance must adapt to a changed security environment in Europe. During the past year, NATO has worked to heighten its state of readiness by doubling the size of its crisis-response force, now set to grow to 40,000 troops. In addition, after last year's Alliance

and air training. For the aviation element, TRJE used four main operating bases next to a handful of other bases, which only hosted small detachments. In Portugal, Beja air base was the temporarily home of all Scandinavian units (Norwegian F-16s, Swedish JAS-39 Gripens and Finnish F/A-18 Hornets), USAF F-16s of the 480th Fighter Squadron out of Spangdahlem air base, Germany and some patrol assets. Albacete and Zaragoza in Spain, and Trapani in Italy hosted the majority of the remaining assets. In Northern Spain, Base Area Zaragoza hosted the bulk of the rotary assets involved in TRJE, among them US Army helicopters (AH-64s, UH-60s

Scenario 'Sorotan'

The exercise was based on a fictitious training scenario named 'Sorotan,' developed by the Joint Warfare Centre in Norway and led by German Army Major General Reinhard Wolski, commander of the Centre. The Centre stated that the objective is to assess NATO's ability to meet projected operational challenges through 2020. The scenario simulates a "rising political instability, ethnic tension, and persisting socio-economic challenges in a certain country that are climaxed by a blatant invasion of one state's territory by another and results in a UN mandated NATO-led response in a region far from NATO's

US Paratroopers jump off during the live demonstration at the San Gregorio training area in Spain (photo: Edouard Bocquet)



summit in Wales, a new Very High Readiness Joint Task Force (VJTF) was created which is a rapid-reaction Spearhead Force capable of mobilising in 48 hours. One of the aims of *Trident Juncture* was to test the readiness of these 2016 NRF and VJTF forces.

Operating bases

Spread over the hosting countries of Portugal, Spain and Italy with 36,000 troops, 140+ aircraft and helicopters, 60+ ships, 7 submarines and over 230 land-based assets, TRJE brought together 28 member states and eight partner nations for land, sea

and CH-47s), Belgian Agusta A-109s, the Czech detachment of ALCA L-159 and Mil Mi-171 and a Ukrainian Il-76 which was used in the medevac role. Albacete in the south offered a home to the RAF detachment consisting of Tornado GR4s and Eurofighter Typhoons sharing the ramp with Turkish F-16s and Spanish EF-18Ms. The fourth main operating base was located at Sicily in Italy where local AMX, Eurofighter F-2000s and Tornados joined forces together with Polish and Greek F-16s. Other bases hosted small detachments of patrol, air-to-air refueling and airlift aircraft.

home territory" a region they call 'Cerasia.' Although the script for *Trident Juncture* was written two years ago it was altered by current world events as well as request made by participants. "New elements were added to the standard scenario by the planners," said French Air Force General Denis Mercier, Supreme Allied Commander for Transformation (SACT). "Compared to thirteen years ago when NATO held its last exercise of this magnitude, the world has been changing at a faster past. Look at NATO's Eastern border where Russia has [illegally] annexed the Crimea from Ukraine

and is now also involved in the Syrian war. At our Southern flank from Syria to Libya, failed and failing states have opened the door to extremist and terrorist groups who are eager to fill the vacuum that exists. Threats and surprises have accelerated so we have to be sure that we are flexible enough to integrate in our exercises these new concepts and to speed up the processes of developing new ideas.”

Interoperability

One of the key aspects during TRJE was interoperability and joint training. During the exercise many cross over training events were scheduled and executed. One example of such a training event was the deck landing practicing of a US Marines MV-22B Osprey of VMM-261 on the Dutch vessel HNMLS *Johan de Witt*. “This is a perfect opportunity to work together,” said MV-22B pilot Captain Rogers. “Although the deck of *de Witt* is smaller than that of our [US] ships it went really well.” The ship’s Commanding Officer, Captain Luyckx, was very enthusiastic about the Osprey aboard his ship: “This is the second time in history an Osprey landed on a Dutch ship. It is very special to witness this and a great example of NATO cooperation with great training values for the everyone involved.”

The detachment commander (DETCO) of the 351th Air Refueling Squadron of the United States Air Force Europe, Captain Joshua Fuller, whose unit was temporarily based at Son Juan air base at the Island of Mallorca for the exercise echoed these sentiments, saying: “For my men and women this exercise is a great experience to work at an austere location and to set up a full functioning detachment as could be happening anywhere in the world. We work closely with the German tanker crews who are also based here for the exercise and with our Spanish hosts, which proves that interoperability in such a large exercise is automatically generated. On a squadron level this exercise gives me the opportunity to evaluate two potential aircraft commanders in a dynamic environment so when we arrive back home they will be ready for their check ride.”

Non-NATO partners and NGOs

Overall during the exercise over 36,000 troops from over 30 nations took part, of which most were from NATO allies as well as eight partner nations. Those partner nations were Australia, Austria, Bosnia and



Portuguese F-16s and a Norwegian Fa20 EW aircraft at Beja, Portugal
(photo: Portuguese Air Force)

Herzegovina, Finland, Georgia, the former Yugoslav Republic of Macedonia, Sweden and Ukraine. Other confirmed participation came from the European Union, the African Union and international non-governmental organisations (NGOs) such as the Red Cross. The exercise demonstrated NATO’s ability to work with international organisations to deal with a crisis, in what is called ‘the comprehensive approach.’

During the initial press briefing, General Phil Jones, Chief of Staff Allied Command Transformation, stressed the importance about the role of the NGOs

and non-NATO partners during TRJE: “The integration of seven non-NATO forces into TRJE provided by partner nations is of huge mutual benefit. NATO partners have vast experience and considerable expertise. And our cooperative approach to shared security has been further developed in this exercise. The participation of a wide range of international organisations, NGOs and agencies has become standard in NATO’s training and exercising philosophy. The ability for us all to act together, to understand each other’s perspectives to communicate and interact is a key element of any crisis



Mixed Air Power for Exercise Trident Juncture 2015 at Beja, Portugal (photo: Portuguese Air Force)

response. There's no such thing as a purely military solution. And the presence of non-NATO military observers, including Russia, is part of the Alliance's commitment to transparency and openness in every respect." One interesting addition for TRJE was that defence firms were invited to observe and to formulate faster development of systems and weapons. This is a rare occurrence for an exercise of this scale.

'Real and Ready'

The exercise drew to a close on 6 November 2015, having tested the Allied forces' abilities to work together and with partner nations and organisations to meet a wide range of security challenges. After visiting a major land-heavy demonstration in Spain on 4 November, NATO Secretary General Jens Stoltenberg said, "Exercises like these show that NATO stands strong. *Trident Juncture* shows that NATO's capabilities are real and ready. While our aim is to train and exercise, we are also sending a clear message to our nations and to any potential adversary: NATO does not seek confrontation but we stand ready to defend all Allies."

JFC Brunssum is now officially certified to lead the NATO Response Force, if activated, throughout 2016. General Domröse, Commander of JFC Brunssum and the Commanding Officer for *Trident Juncture* concluded, "We set out to train forces from many nations so as to improve their interoperability and jointness. We achieved that and demonstrated the forces that will comprise NRF16 are more than ready to respond to any threat."

Remco Stalenhoef



Different assets of TRJE in formation during the opening ceremony of Trident Juncture at Trapani air base, Italy (photo: Remo Guidi)



Special Forces from four NATO nations fast-rope from a 352d Special Operations Wing CV-22 Osprey at Montijo air base, Portugal (photo: 1st Lt Chris Sullivan)



AIRLOOMS

Random Recollections of an Ancient Aviator

Air Vice Marshal Cecil Parker's book reviewed by KS Nair

The name Cecil V Parker should be immediately recognisable to those who remember the 1971 war. Air Vice Marshal Cecil Vivian Parker, MVC, VM, is one of less than twenty Indian Air Force personnel since Independence who have received the Maha Vir Chakra, India's second-highest gallantry decoration. For 28 years, he was the only MVC recipient from his home state, until Major Padmapani Acharya (the role played by actor Nagarjuna Akkineni, in the film *LOC Kargil*) posthumously received the same decoration in 1999.

AVM Parker's MVC was the mid-point of an IAF career with many distinctions. He remained active after leaving the IAF, in the private sector and in teaching. And gifted with an engaging writing style, he has written frequently, during and after his period of service. His articles have appeared in defence and aviation journals, (regularly in *Vayu*), general interest magazines, and in newspapers. *Airlooms*, the whimsically-titled book under review (Sanbun Publishers, 192 pages), is a collection of some sixty-odd of these pieces.

To be clear, *Airlooms* is certainly not AVM Parker's 'memoirs', much though Indian aviation aficionados would have appreciated that. The pieces making up this collection are mostly light recollections of escapades and situations from his life, sometimes harum-scarum, sometimes dramatic, but not necessarily of special historic or military significance. Many are tributes to colleagues. Most have a services flavour, but some are simple family stories, and a few are reflections on management or leadership challenges. They are cheerful in tone, always enjoyable, and often, thought-provoking.

The tone is sunny and self-deprecating; the humour is nothing so much as, this may be an odd word to use about a highly-decorated warrior, but it is appropriate, gentle. The tenor throughout is fatherly, and understanding of human foible. An armed forces career offers opportunities, indeed, demands, to exercise courage, certainly. But often it simply pitchforks a young officer into situations where he has to take some personal chastisement; and (if he grows appropriately) later, into situations where he has to dish some out. AVM Parker's stories demonstrate numerous lessons learned, and when his turn came, passed on.

There is, characteristically, nothing in this collection on the exploits of derring-do that earned AVM Parker his decorations. There is, and I think this is significant, just one short wartime piece. It recounts an unplanned attack on a train encountered in the wrong place. Then Wing Commander Parker realised, literally

just as he rolled his formation into the attack, that the train was carrying civilian passengers. As that realisation struck, this gunnery trophy winner, closely followed in this, as in much else, by his well-trained formation, without any fuss, altered his aiming point just a little, expending his ammunition



harmlessly over the target and into empty desert beyond. I would like to think this little story says something important about the ethos of the Indian armed forces.

At a time when much is made of how the 1990s and 2000s have greatly improved life in India, AVM Parker's stories are a sometimes salutary corrective. They convey a sense of an altogether more innocent period, a period when mid-seniority Indian armed

forces officers, like most of the middle class in those days, had very little in cash and consumer goods. Yet, they experienced a certain richness of life, in ways that seem to have been lost today. Squadron Leaders and Wing Commanders, in the India of that time, could and did encounter Presidents, Prime Ministers, and Governors, and interact with them meaningfully. They could invite such august personages to their messes, on the basis of a services connection and mutual respect, and have the invitation graciously accepted. There seems to have been much less of the determined intermediation that would probably be interposed today by a clucking bureaucracy.

The stories also convey something of the wonderful diversity of the armed forces, and indeed of India of the time. This was a period before Bollywood and cable television imposed their current superficial uniformity on the middle class, and some of the rich social variety of that period is nicely captured.



Manju Sharma, the first Indian lady to fly in a combat aircraft in a Hunter cockpit with then Wg Cdr CV Parker



The author commissioned by AVM Subroto Mukherjee at AF Begumpet on 30 August 1952

The reminiscences covered in *Airlooms* span a few decades, during which the author went through a number of interesting roles in the IAF, some of which are only hazily visible as background in these stories. The stories can all stand on their own, each by itself; but there does seem to have been some editing, to establish connections and cross-references between some of them. This prompts one of my few criticisms of the book: I might have asked for a few lines of connecting narrative, between pieces, conveying a little more of the background and stage of the author's progress in service: I believe this would only improve the book, for a wider audience. I might also have asked for a different cover picture. The current cover shows a stock image of the IAF's *Suryakirans* aerobatic team; an image of their immediate predecessors, the Thunderbolts, would have had a more direct connection to the author. The Thunderbolts were formed out of a squadron that the author commanded, and flew the Hawker Hunter, the aircraft type with which he is most identified.

... But even as I write these thoughts, they seem churlish, among so much else there is to enjoy in this most agreeable book. Definitely recommended, especially to those who remember those times!

Publisher : Sanbun, New Delhi
Pages : 192
Price : Rs. 225

25 Years Back

From Vayu Aerospace Review Issue I/1991

Indian Missile Programmes

Pressure has been intensified by concerned authorities that the Government proceed with the planned second test of the *Agni* intermediate range ballistic missile demonstrator, which has been pending for over a year. According to reports, the missile war in the Gulf has accelerated such pressure on the Government from the Army and the Air Force as India does not possess any surface-to-surface or air-to-surface missiles. As a first step the Government is likely to authorise acceleration of the *Prithvi* programme and two tests are expected soon of the *Prithvi* surface-to-surface missile from the Sriharikota range.

A320 court of inquiry

As per the report of Justice Shivshankar Bhat, whose court of inquiry examined the causes of the A320 accident near Bangalore airport on 14 February 1990, the probable cause has been identified as failure of the Indian Airlines pilots in not taking quick corrective actions and responding to the emerging situation. The court has ruled out any "sabotage or structural, engine or any aircraft system failure as the cause of the accident."

Civil Aviation Briefing

The Government has sanctioned Rs 210 crore, including a foreign exchange component of Rs 162 crore, for immediate modernisation of the existing air traffic and navigational facilities at the Bombay and Delhi airports. Civil Aviation Minister of State, Harmohan Dhawan, stated that when completed the modernisation will permit safe handling of 35 to 40 movements per hour against the present rate of 10 to 15 aircraft movements. The minister reiterated the Government's determination not to hike air fares except in situations where it becomes absolutely necessary in view of the Gulf crisis and its effect on the supplies of jet fuel.

Air India's Rs 200 crore loss

Air India will incur a revenue loss of about Rs 200 crore during the current financial year, primarily because of the Gulf crisis, said the Minister of State for Civil Aviation. He said the airline was incurring higher losses on account of fuel and insurance charges. It had also lost traffic on account of the curtailment of its operations in the Gulf countries. However, Air India had taken steps to rationalise its expenditure and also its route structure.

Tu-204 offered for co-production at HAL

The Soviet Union has offered India its new generation Tupolev Tu-204 jetliner. A high-level Soviet aviation delegation led by the aircraft industry minister Mr. Systsov, was in India to discuss

details for co-production of the Tu-204 by HAL. A team of Indian experts had reportedly already visited the Soviet Union to evaluate this aircraft for Indian Airlines. The Soviets have informed India that they plan to sell this jetliner worldwide and are prepared to let Hindustan Aeronautics Limited (HAL) produce major assemblies and certain sophisticated parts for this aircraft.

LCA progresses

The Light Combat Aircraft (LCA) now under development, will be ready for its first test-flight in 1995, according to Dr VS Arunachalam, Scientific Adviser to the Defence Minister and Director-General of the Defence Research and Development Organisation. "The aircraft will be ready for induction into the Air Force, on schedule, by 2000 AD". The LCA project was initiated in 1983 but several aviation and defence experts had last year expressed fears that the project may not be completed in time: "Some people have been saying that we have been talking about the LCA for the last three years, but where is it? To them my answer is that we may have to talk about it for 15 years."

"From 1983, when the project started, to 2000, when the aircraft will be ready for induction, it is actually 17 years," Dr. Arunachalam stressed that when the INSAT-1A was launched, the solar panel failed to open in space due to a snag and people would ask every few minutes whether it had opened or not "as if it was like Gavaskar hitting boundaries in a one-day cricket match."

Chinese, Pakistani arms for Sri Lanka

The Sri Lankan armed forces are to receive considerable new weaponry from China and Pakistan in order to expand and modernise the armed forces engaged in war-like operations against Tamil militants in the Island's north and east. From Pakistan, Sri Lanka is receiving jeep-mounted 106 mm RCL guns, small arms and ammunition, mortars and field artillery. The Sri Lanka Air Force (SLAF) is receiving combat aircraft from China. The SLAF which has relied upon a handful of Siai Marchetti SF.260 piston-engined trainers with machine gun pods and some rockets for close air support, will shortly induct the Nanchang A-5M strike fighter from China.

SLAF air and ground crew have completed conversion training in China and the first two aircraft are expected to arrive in Sri Lanka in March 1991, with another four to follow. More A-5Ms could be inducted as the SLAF infrastructure expands. The SLAF will also receive another three Harbin Y-12 light transport aircraft augmenting the fleet of Y-12s already in its inventory as also some more Bell 212s from the Asian Bell Corporation in Singapore.

Iraqi Su-7s for Bangladesh ?

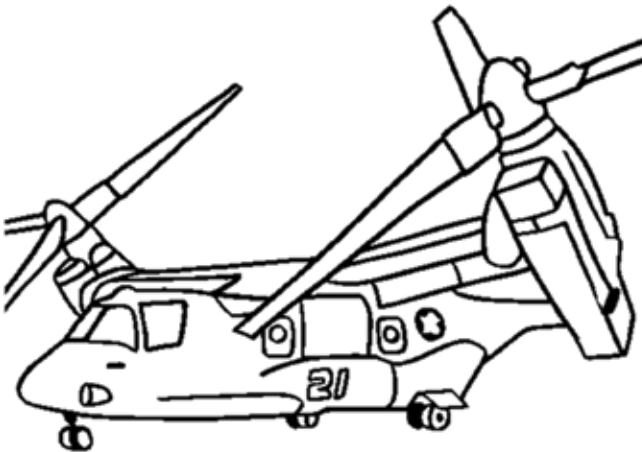
The Gulf War has prevented transfer of surplus Sukhoi Su-7s from Iraq to Bangladesh. Negotiations had reportedly been completed between the two countries for the transfer of 12 single-seat Su-7s and 3 two-seat Su-7s from Iraqi Air Force surplus stocks to the Air Wing of the Bangladesh Armed Forces, together with spares and ground support equipment.

We were here first !



IAF MiG-29s in formation fly past over Rajpath during Republic Day Parade, even as an Accipitridae flies the other way.

In Good Spirit !



It was hardly stage managed but what a party it must have been ! According to a news report, “Royal Marines from **Whiskey** Company, 45 Commando at Arbroath, **Scotland**” were whisked away in a US Osprey tiltrotor for a joint exercise. That would have been very stimulating indeed !

Tejas LCA replaces Gnat

The nation set out to develop an indigenous light combat aircraft to replace the Gnat light fighter in 1983. Three decades later, celebrating HAL’s 75th Anniversary, this has been achieved, albeit with a full scale mockup of the Tejas LCA, mounted on a pedestal in Bangalore’s Minsk Square, next to HAL’s Corporate Office, displacing the earlier Gnat light fighter displayed there.



Veggie is as Veggie does

From 1 January 2016, Air India will only serve vegetarian fare to its passengers on flights upto 90 minutes duration. A spokesman for the Government-owned airline defended the decision, not because



it saved money but because the meals have been “upgraded and improved”.

Former J&K Chief Minister tweeted his incomprehension on the move, “really struggling with the logic”. But then, *Mera Jahaz Mahan* !

Quest for India



When Pakistani-born singer Adnan Sami’s more-than-decade-long quest for Indian citizenship was granted on New Year’s Day, he responded with “Jai Hind” ! Adnan confessed he loves Indian culture and the vibes of Mumbai - which is wonderful indeed.

His father may have had mixed feelings as he was flying top cover in a PAF Sabre during the devastating attack on IAF’s Pathankot Air Force base in September 1965.

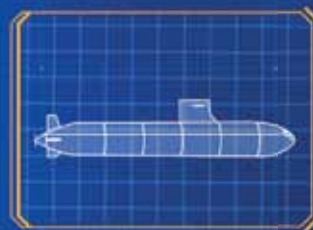
The son also rises !

Afterburner



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