VAYU

Aerospace & Defence Review

IV/2014

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India's Budget 2014

Global Helicopter Market

Threats in the IOR

Indian Army Artillery

Airshows : ILA, RIAT, FIA

The Airbus A350 XWB
(photo courtesy Airbus)

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Soaring high

The Polar Satellite Launch Vehicle (PSLV) has proved itself yet again to be a dependable workhorse of the Indian Space Research Organisation (ISRO). The latest launch put in space five satellites on behalf of foreign clients. Prime Minister Narendra Modi saw his first launch and used the occasion to spell out his vision before the scientists. The world is a family, he said and reiterated that India's space programme was focused not on a desire for power, but on service. Thus, India shared disaster management data with over 30 countries. He asked ISRO to develop a SAARC satellite which would provide various applications and services to India's neighbours, thereby extending his SAARC-centric vision that was first visible at his swearing-in ceremony.

ISRO has a long record of delivering excellence at a fraction of the cost as compared with the Western world. The PSLV has proved itself and powered the nation's space missions to the moon, and the one currently on way to the Mars. As it moves forward from the tried and tested PSLV to the temperamental Geosynchronous Satellite Launch Vehicle (GSLV) launch vehicles, which have much more potential, it will need the continued support of the government, which the Prime Minister's involvement indicated will be forthcoming. ISRO's original mission has been to provide the wherewithal to the country through which it can make and launch satellites that enhance its communication, broadcasting, remote sensing and disaster management capabilities. In this it has excelled and made the country proud.

Even as ISRO celebrates the success of the latest mission, it must now also focus on increasing the payload capacity that it can deliver, for which it needs to master the much more difficult cryogenic technology that the GSLV requires. ISRO has had a mixed record on the GSLV, though every mission has been a learning experience. It needs to ensure that the GSLV launches deliver the same consistency as the PSLV, even as it works on the satellite that the Prime Minister has suggested for SAARC nations.

From *The Tribune*

Pushing arms sales

Initially it would appear incongruous that one of the world's top importers of military equipment should seek to boost the export of its own products, yet the Prime Minister's emphasis on that has several positive facets. Like all seemingly "fresh" thinking it could run into difficulties, but who can deny that for some time now India has been looking to sell military stores abroad: with minimal success. Whether that was because of unclear political thinking, or just plain inefficiency and a *sarkari* inability to operate in a competitive market is difficult to determine. Mr Narendra Modi has been hitting several 'right' buttons, keeping them pressed is what ultimately counts. It will also have to be recognised that selling arms is no pristine business, the sanctimonious approach to defence deals will misfire. India will have to accept the role of agents even if deemed vermin in the import context. In reality, they still flourish despite the pious "no middlemen" promise from Rajiv Gandhi before the Bofors blow-back flattened him. Just how much exports will help 'balance' an import bill projected at $100 billion if the defence wish-list is granted is of small consequence (exports hover around the $ 10 million mark). The dividends could be political if there is an effective sales-push in developing countries, render them less prone to pressure from traditional suppliers in the west, China, South Korea etc. Diplomacy will have to chip in; it's time for those IFS superstars do some *dukandari* too, get their hands dirty, for their commercial track-record is dismal.

The 'profit' would accrue to the defence industry, particularly if the Modi government can foster a climate in which the private sector is not equated with a red-light area. A focus on exports would expand the market, attract investment, bring economies of scale into the equation: one reason why the private sector had been hesitant was the sales-volumes were too low to make commercially viable the huge investments required for defence-grade manufacture. Having to compete in a non-captive market could force the Ordnance Factories and Defence PSUs to shake off their lethargy, upgrade the quality of their goods, cut down unproductive expenditure. Maybe even the DRDO would get its act together. On paper there is potential for medium-technology weaponry and a host of other military stores. India boasts some 'historic' production centres, trouble is they were little modernised since they operated in monopoly conditions. Perhaps the biggest gains could come in attracting FDI in the defence sector - whether 100 per cent, or less is a matter for quibbling - for comparatively low labour rates and a re-export regime could prove alluring. Provided Modi means business.

From *The Statesman*

Still a secret

Last March, while in opposition, Arun Jaitley vehemently demanded declassification of the *Henderson Brooks-PS Bhagat Report* that has examined the Army's reverses suffered during the 1962 Sino-Indian war. Mr Jaitley voiced his demand - both verbally and in the form of an article - after former Australian journalist Neville Maxwell posted most of the report on the website. Now four months later, as Defence Minister, Mr Jaitley has done a U-turn by announcing in Parliament that the disclosure of any information related to this report "will not be in national interest".

The surprising turnaround raises two issues. One, politicians have a different voice when in opposition and can be both quick and unabashed to do a complete reversal when in government. Two, the fact that the government under every political dispensation in the last two-and-a-half decades has consistently stonewalled the release of the report reflects that either there is something serious to hide or the government is being obsessively secretive. Lt Gen Thomas Bryan Henderson Brooks, an Anglo-Indian officer in the Indian Army, along with Brig (later Lt. Gen) Premindra Singh Bhagat were assigned by the then Army Chief to conduct an 'Operations Review' soon after the war ended. The terms of references were confined to examining "training, equipment, system of command, physical fitness of the troops and the capacity of commanders at all levels to influence the men under their command". They were specifically asked not to review the functioning of both Army Headquarters and the Ministry of Defence.

Yet, the report continues to be classified even though 52 years have elapsed and the scenario has completely changed. Although the two countries continue to have a serious border dispute, India

MBDA

today is far more confident and powerful than it was in 1962. It has stronger economic relations with China as also bilateral agreements in place to prevent a flare-up on the borders. It is imperative that the government release the Henderson Brooks report and all other unpublished war histories and reports on military campaigns at the end of a reasonable time frame. Else, the adage that those who do not learn from history are condemned to repeat it could forever remain true for the Indian military establishment and policy-makers.

From *The Tribune*

A significant visit

French Foreign Minister Laurent Fabius has concluded a substantial India visit which can help lift some of the barriers that may be blocking the emergence of a full-blown strategic partnership between the two countries. Free from verbiage, Mr Fabius' visit had a hard-nosed businesslike feel to it. Cash-strapped France seemed focussed on trading some of the blue-chip kernels of its hi-tech industry. India, on its part, looking to bolster its military preparedness, energy security and international profile, was prepared to calibrate a hard bargain. The recognition by New Delhi and Paris that a win-win outcome was indeed possible seemed to have yielded significant progress during the visit towards clinching the multibillion dollar Rafale aircraft deal, and the stalled contract for two French nuclear reactors. With a capacity to generate 1,650 megawatts of power each, a breakthrough in the deal for the two reactors could clear the path for the establishment of four additional reactors of similar capacity at the Jaitapur site in Maharashtra. An installed capacity of nearly 10,000 megawatts would not only boost French nuclear commerce, but also make a vital contribution to satisfying India's energy hunger.

In dealing with the French, the Indian side has made it clear that it is not interested in a pure buyer-seller relationship with France in the hi-tech domain. As a result, complex negotiations are under way both on the Rafale and the European Pressurised Reactors (EPR), that would not only give India the final product, but also implant frontier technology within the country through transfers of state-of-the-art know-how. The induction of the 126 Rafale fighter jets would also help cement the air-dominance doctrine of the Indian Air Force, which has already benefited from the induction of the Russian Su-30 MKI multi-role planes and other advanced platforms. Mr Fabius' arrival in New Delhi has provided an opportunity to quickly finalise the Indo-French nuclear deal, which is possible if the two parties arrive at a formula that would lower the costs of atomic power generation at Jaitapur. During talks, India has demanded greater 'localisation,' which would expand involvement of domestic industry in the project, as well as provide greater scientific and technical exposure to Indian personnel to Light Water Reactor (LWR) technology that the French have mastered. At a political level, the Minister's visit has provided New Delhi an opportunity to advance its ties with continental Europe, which revolves around a Franco-German core. This is significant, as Europe, despite undergoing a rapid political and economic transition, would continue to remain a major player in a multipolar world, which India needs to engage vigorously.

From *The Hindu*

Building capacities

In ending the public sector's monopoly over aircraft production, the first meeting of the Defence Acquisition Council (DAC) under the new Union government turned out to be highly significant. The DAC, chaired by Defence Minister Arun Jaitley, cleared procurement proposals worth Rs 21,000 crore in one stroke, which included critical necessities such as the replacement of the air force's five-decade-old Avro transport aircraft fleet, auxiliary support ships and offshore patrol vessels for the navy, advanced light helicopters for the navy and the coast guard, as well as fast and offshore patrol vessels for the coast guard.

While these decisions signal the government's intention to accelerate the process of defence procurement, the two biggest takeaways are the programmes for military transport aircraft and naval fleet support vessels. These invite Indian private-sector firms to defence production and, in the longer term, should help develop a domestic military-industrial complex.

The Avro replacement project will see 16 aircraft procured from a foreign vendor, who in turn will choose an Indian partner for the manufacture of the remaining 40 of the 56 aircraft needed. Since this is a non-lethal platform, the foreign manufacturer and its Indian partner can sell the aircraft for commercial use too, expanding their market to the civil aviation sector. Although this programme had been approved by the erstwhile UPA government, it was frozen by then Defence Minister AK Antony following his colleague Praful Patel's objections to the exclusion of public-sector companies like HAL from the bidding process. With legal opinion upholding that bidding process, this move will now be an important step towards capacity-building of the Indian private sector in defence manufacture and in the aerospace industry.

The decision on auxiliary ships is tied up with the Navy operating three carrier battle-groups outside the Indian Ocean Region, signalling that the transformation of the Indian navy into a genuine blue-water force is on the MoD agenda again. Auxiliary ships feed carrier battle-groups. The invitation of the Indian private sector to this programme could see manufacturing move beyond Cochin, at present the only Indian yard capable of building large vessels like the under-construction INS *Vikrant* carrier.

The UPA's culture of instinctive banning and blacklisting of foreign suppliers at the hint of a scandal had led to a complete stalling of India's military modernisation. After raising the FDI cap in defence from 26 to 49 per cent in the budget, the NDA government has a chance now to fulfil its promise of providing the armed forces with the most advanced defence technologies. Inviting domestic private firms full-time for defence manufacture and making PSUs like HAL and BEML compete and collaborate with them, while making the process of foreign procurement transparent and accountable, can address the defence challenges that the new government has inherited.

From *The Indian Express*

Saab

VAYU 4 Aerospace

The Aerospace Media Dinner

2014 marks the 40th year of *Vayu* and these four decades have been appropriately matched by the enormous enthusiasm of readers, worldwide, for this journal. Recognising *Vayu's* excellence in aerospace journalism, have been numerous awards bestowed upon it at the international arena in the past – and this continues !

Alongside some of the world's most respected aerospace journals, including *Aviation Week, Jane's Defence Weekly, Air Transport World, Aviation International, Defence News and Military Technology,* all published in Europe and the United States, was the *Vayu Aerospace & Defence Review,* the only such professional publication from India, or for that matter, Asia.

The latest event was held at headquarters of the Royal Aeronautical Society in London on eve of Farnborough International Air Show 2014. *Vayu* was nominated for no less than four awards : that for the 'Best Young Journalist' (Angad Singh), 'Best Defence Publication', 'The Bill Gunston Technology Writer of the Year' (Sayan Majumdar) and 'Lifetime Achievement Award' (Pushpindar Singh).

As the Organising Director Peter Bradfield said in his welcome address "the Aerospace Media Awards are building a reputation for acknowledging the very best in aerospace

nominated for Media Awards

media. There were an incredible number of entries this year … the quality of entries was outstanding which means that once again we can recognise the very best in aerospace journalism and publishing."

After the superb dinner, the awards were given by the Chief Guest, Marc 'Turbo' Gruene, holder of the world record for spinning an aircraft. Even though most of the awards went to *Aviation Week*, published from Washington DC, the *Vayu* team were repeatedly applauded for their record nominations.

VIEWPOINT

Admiral Arun Prakash urges that we

"Unshackle the Military from the Bureaucracy"

As it savours the impressive mandate handed to it by India's multi-hued electorate, the new NDA government must remain mindful of the tremendous expectations it has raised amongst a sanguine public. Of the innumerable, often contradictory, demands that will be made on the time, energies and resources of the government, none is more critical than that of socio-economic development; with educational opportunities and job-creation for a burgeoning youth-population commanding utmost priority.

And yet, if there is one lesson we should have learnt during our 67 years as a sovereign republic, it is that security shortcomings, both internal and external, have repeatedly served to distract our attention and divert scarce resources away from the pursuit of development. The history of India's post-independence conflicts has conclusively proved that the 'guns vs butter' debate is futile. Development can take place only in a secure environment, and we must have *both* guns and butter.

The hawks amongst us loudly bemoan the steady decline in India's defence expenditure, which has hit a low of 1.74 percent of the GDP. The common man, on the other hand, wants to know whether the Rs. 224,000 crore ($38 billion) recently voted for defence is being spent wisely enough to buy us the security we need. He asks: are India's core national interests being safeguarded; are our borders and territories inviolate; and are our citizens protected from the threat of terror-strikes? These are all valid questions, given China's increasingly aggressive attitude and Pakistan's relentless use of cross-border terrorism as a low cost weapon.

The term heard most commonly in India's national security discourse is "surprise". It is used in the context of the 1947, 1962, 1965 and Kargil conflicts, as well as episodes such as the IC-814 hijacking and the 26/11 Mumbai terror strike and denotes repeated intelligence failures. A closely related phrase, heard only in whispers, is "lack of preparedness" of the armed forces. Public memory being short, we have forgotten many of our past blunders.

For example, in the bitter winter of 1962 we sent our troops to fight the Chinese, clad in summer uniforms and armed with WW-I bolt-action rifles. The Bangladesh war was won only because General Sam Manekshaw had the courage to seek a grace period of nine months to equip his troops. While celebrating Kargil's Vijay Divas we forget the army chief's 1999 lament: "We will fight with whatever weapons we have." But to continue ignoring dire warnings that emanate from South Block about the military's current lack of combat-readiness would be folly of the highest order.

A reality check will show the new government that the reassurance we derive from our large conventional forces and expensive nuclear arsenal is chimerical, for two reasons. First, the languid and wayward functioning of the Ministry of Defence (MoD) has, over the past decade, served to erode the qualitative and/or quantitative edge that the armed forces had over potential adversaries. Second, successive governments having refused to integrate the Service HQs with the MoD and to engender jointness amongst the three armed forces, our national security structure is not only flawed but badly outdated and likely to fail in the face of 21st century threats.

So far, India's political leadership, in an unfortunate display of indifference, has distanced itself from national security issues. At the same time, the armed forces have been deliberately excluded from a role in national security decision-making. The net result is a conundrum in which India has collected, at huge expense, the trappings of a major military power without having a real idea of how to leverage this in the national interest. Further evidence of strategic naiveté is to be found in the adoption of a

model - unique amongst democracies - in which the armed forces are placed under the total control of a civilian bureaucracy, with limited comprehension of recondite defence and security matters; especially those related to weapon-acquisition programmes.

As Prime Minister Modi contemplates the nomination of a suitable person to assume the full time, crucial post of Raksha Mantri (RM), he must also charge him with the conception of a national security vision, spanning - not just the customary 100 days but - a decade or two. Instead of looking at superficial symptoms, the vision should address the root of the malaise afflicting India's national security.

The RM's first priority must be to eliminate the paranoid suspicion of our patriotic and apolitical armed forces; a lingering Nehruvian legacy which has kept them outside the edifice of the Government of India (GoI). This would logically lead to the next important step of integrating the Service HQs with MoD and constituting a Chief of Defence Staff. This vital step, recommended by successive Standing Parliamentary Committees on Defence, as well as by government-constituted Task Forces, has remained stalled by lack of political will and bureaucratic resistance.

The new RM, Arun Jaitley, meeting Naval Commanders at South Block.

South Block

Concurrent with these measures, a review of the "1961 GoI Rules of Business" must be undertaken in order that the three service chiefs are nominated as functionaries of the GoI: responsible to the PM/RM for the defence of India's land, maritime and aerospace domains. The last but most important action-point for the RM would be the restructuring of our ineffective defence research and production organisations to lay the foundations of a dynamic indigenous arms industry. These measures, while reinforcing political control of the armed forces, will bring our higher defence structures at par with other major democracies and ensure that the defence budget translates into genuine security.

Lastly, one hopes that the new RM will have the stature and self-confidence to venture on an examination of the internal health of our armed forces. Events of the recent past, including misdemeanours at senior ranks, episodes of mass indiscipline and occurrence of serial mishaps have raised concerns amongst the public. Given synergy between the RM and the service chiefs, it should be possible to identify the systemic flaws that have crept into our military and to institute enduring solutions.

OPINION

Lt. Gen Kamal Davar believes that

"There is no Good Taliban"

The audacious terror strike on 8 June 2014 at Pakistan's Jinnah International Airport in Karachi, which killed 36 people, including 10 terrorists of the now Mullah Fazlullah-led Tehrik-e-Taliban Pakistan (TTP), who staged the assault, was perhaps the tipping point that propelled the Nawaz Sharif government to shed its reluctance to mount an all-out counter-offensive against one of Pakistan's major terror conglomerates. That Prime Minister Sharif conscientiously strove for peace talks with Pakistan's main terror 'tanzeem', the TTP considering that his political formation, the PML-N, allegedly had durable links, since a long time with some Pakistani extremists was understandable. That a majority of these fundamentalist elements, especially in Punjab, electorally assisted the PML-N in the last general elections is hardly a political secret.

On the other hand, the Pakistani Army and its notorious handmaiden, the Inter-Services Intelligence (ISI), themselves formidable practitioners of the art of exporting terror to neighbouring India and Afghanistan were persistently demanding strong action, exclusively against the TTP for it had been striking at will against army assets all across Pakistan, including the daring and devastating attack on the strategic naval air base PNS *Mehran*, (Karachi) in May 2011. Meanwhile, the Pakistan Army and the ISI, for decades, have conveniently disregarded other equally lethal extremists in anti-India terror groups, such as the Hafiz Saeed-led Lashkar-e-Toiba (LeT), Jaish-e-Mohammed and the Harkat-ul-Mujahideen, as also the Afghan Taliban, the Haqqani Network and al-Qaeda elements, which it considers its "strategic assets."

Till last year, the Pakistan Army had mounted only half-hearted attacks in the restive Federally Administered Tribal Areas (FATA), including the rugged Waziristan regions that have been a haven for terrorists of all hues, both indigenous Pakistanis and foreign militants operating in Afghanistan and Pakistan on both sides of the Durand Line. Most casualties inflicted on terrorists in the North and South Waziristan sanctuaries can be attributed to US drone strikes since 2008, which have caused many deaths among both extremists and civilians.

However, this year, so far, under pressure from the Pakistan government,

the US has resorted to only the odd strike. That Washington, with its planned draw-down in Afghanistan, has pressured the Pakistani military machine to up the ante against terror groups holed up in the Waziristan belt would be stating the obvious. Presumably, with Pakistan's economy in the doldrums, coupled with an alarmingly deteriorating internal security situation and generous financial doles promised by the US, the army would have agreed to bite the bullet at long last and resolutely go after the TTP and, ostensibly, other terror groups too.

In February this year, Pakistan formally unveiled its National Security Document that laid out, in some detail, Pakistan's anti-terror policy. Despite a few off and on peace talks and ceasefires between the unyielding TTP and the Pakistani establishment, PM Nawaz Sharif finally gave the green signal for the Pakistani armed forces to mount an all-out offensive against all terrorists in the North Waziristan belt. Thus Operation *Zarb-e-Azb* was launched with all ferocity on 15 June employing nearly 30,000 troops. The operation is significantly named after one of the Prophet's swords, *Azb*, which he had used in the battles of Badr.

With Pakistan Air Force F-16 fighters pounding militant hideouts in North Waziristan, Army tanks also rolled through the streets of Miranshah, North Waziristan's main town. Thousands of civilians of this town and the neighbouring villages have fled to safer areas to avoid the impending ground offensive. The army has also liberally employed lethal multi-barrel rocket launchers, heavy artillery and attack helicopters, unmindful of the collateral damage that could occur. Media reports point to over 200 militants having been killed in the first 36 hours of the offensive, including Uzbek terror kingpin Abu al-Manni, who reportedly had masterminded the Karachi airport attack.

Pakistan's army chief, General Raheel Sharif has vowed to destroy terrorist sanctuaries "without any discrimination", which is a reference to the selective anti-terror operations the Pakistan army has been accused of. Meanwhile, TTP spokesman Shahidullah Shahid immediately retaliated, saying : "By God, we will soon shake your palaces in Islamabad and Lahore and burn those to ashes." The Pakistani establishment, expecting violent retributive acts by the Taliban, has deployed large numbers of security personnel to guard sensitive assets across the country.

The otherwise delayed anti-terror offensive has closed ranks, perhaps for the first time in many years, among Pakistan's major political parties and civil society. Even Imran Khan of the Pakistan Tehreek-e-Insaf, the hitherto recalcitrant opponent of offensives against the TTP, has welcomed the government's decision as have other major parties, including the PPP and MQM. If Pakistan can truly discard terrorism as an extension of state policy— gainst both India and Afghanistan—and not be selective in combating terror groups, India will wish it all success in ridding itself of the scourge decimating its vitals.

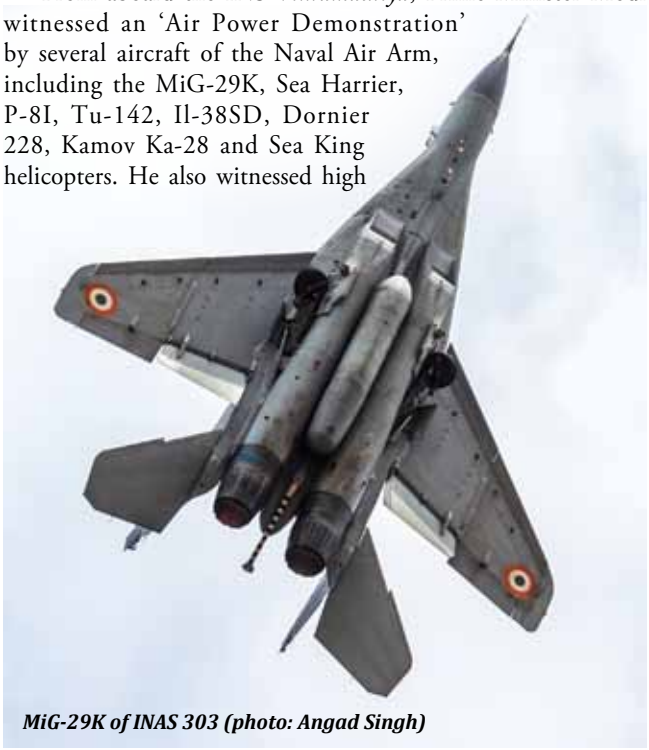
Pakistan today stands at the crossroads of its destiny. Only its sincerity of intent in endeavouring to eliminate terror in all its manifestations can help it.

Hearteningly, the Pakistan Army finally appears to be discarding its earlier policy of selective anti-terror operations. Pakistan's Army Chief, General Raheel Sharif, has vowed to destroy terrorist sanctuaries 'without any discrimination', a reference to the selective anti-terror operations Pakistan has been accused of.

New Prime Minister onboard INS *Vikramaditya*

Prime Minsiter Narendra Modi visited the Indian Navy's new aircraft carrier, INS *Vikramaditya* on 14 June 2014, his first visit to an operational Indian fighting unit. Arriving at INS *Hansa*, the Prime Minister was received by Admiral RK Dhowan, CNS and accorded a ceremonial Guard of Honour. Thereafter, he departed for the aircraft carrier by helicopter along with Chief Minister of Goa, Manohar Parrikar, the Minister of State for Defence Rao Inderjit Singh, the National Security Advisor Ajit Doval, the Chief of Naval Staff Admiral RK Dhowan and the Defence Secretary RK Mathur. He was received by the Commander-in-Chief, Western Naval Command, Vice Admiral Anil Chopra and Fleet Commander, Western Fleet, Rear Admiral AK Chawla.

From aboard the INS *Vikramaditya*, Prime Minister Modi witnessed an 'Air Power Demonstration' by several aircraft of the Naval Air Arm, including the MiG-29K, Sea Harrier, P-8I, Tu-142, Il-38SD, Dornier 228, Kamov Ka-28 and Sea King helicopters. He also witnessed high speed manoeuvres by Western Fleet ships including the other aircraft carrier INS *Viraat*, Delhi-class destroyers INS *Mysore* and INS *Mumbai*, stealth frigates INS *Tarkash*, INS *Talwar* and INS *Teg*, guided missile frigates INS *Betwa* and INS *Godavari* and fleet tanker INS *Deepak,* amongst others.



MiG-29K of INAS 303 (photo: Angad Singh)

"India will speed up defence purchases": Jaitley

Defence Minister Arun Jaitley has stressed that his government will "relook at the country's defence procurement policies, looking to speed up the acquisition process and cut red tape". Speaking at the Navy Commander's Conference in New Delhi on 24 June 2014, Mr Jaitley said that he was looking to "prune the layers through which defence proposals have to go through in the ministry." Regarding the work done by the previous administration under Defence Minister AK Antony, Mr Jaitley said that "their work would be taken as a starting point, as re-evaluation from scratch would severely delay programmes that the armed forces have deemed critical". The Army's long delayed requirement for 155mm howitzers as well as the Navy's request for additional conventional submarines were particularly mentioned.

Defence Minister Arun Jaitley with CNS Admiral Robin Dhowan

New Defence Minister "congratulates" Indian Navy

During the bi-annual Naval Commanders' Conference of 2014 in New Delhi held to "discuss issues of operational relevance, identify capability gaps and to review the future plans of the Indian Navy", Defence Minister Arun Jaitley inaugurated the conference and congratulated personnel of the Indian Navy for "discharging their duties with utmost diligence and professionalism".

Taking note of the capability shortfall of conventional submarines, ship-borne helicopters, mine counter measure vessels and other weapons and sensors in the Navy, he assured that all efforts would be made to ensure operational preparedness. Appreciating the indigenisation efforts of the Indian Navy, Mr Jaitley made a mention of the fact that all 44 naval ships and submarines under acquisition are being built in Indian shipyards. He stressed that these efforts need to be further strengthened for timely inductions of the platforms.

Defence Minister Arun Jaitley with Indian Navy Commanders at New Delhi.

Airbus Cassidian

Fourth P-8I for Indian Navy

Boeing has delivered the fourth P-8I maritime patrol aircraft to the Indian Navy "on schedule", fulfilling the first half of a contract for eight aircraft. The aircraft had departed from Boeing Field in Seattle and arrived on 21 May 2014 at Naval Air Station *Rajali*, where it joined an earlier three P-8Is. "This marks an important milestone, the halfway point for P-8I deliveries to India," said Dennis Swanson, BDS vice president in India. "The programme's success the past year is really a testament to the great work between Boeing, the Indian Navy and industry." Based on the company's Next-Generation 737 commercial airplane, the P-8I is the Indian Navy variant of the P-8A Poseidon that Boeing has developed for the US Navy.

File photo of the Indian Navy's first Boeing P-8I

Boeing UGM-84L Harpoon missiles for IN

The US State Department has approved a possible Foreign Military Sale to India of UGM-84L Harpoon missiles and associated equipment, parts, training and logistical support for an estimated cost of $200 million.

The Government of India had requested for twelve UGM-84L Harpoon Block II Encapsulated Missiles, ten UTM-84L Harpoon Encapsulated Training missiles, two Encapsulated Harpoon certification training vehicles, containers, spare and repair parts, support and test equipment, personnel training and training equipment, publications and technical data, US Government and contractor engineering and logistics support services, plus other related elements of logistics support.

This Harpoon missile system will be employed on the Indian Navy's *Shishumar*-class submarine (Type-209) and will "provide enhanced capabilities in defence of critical sea lines of communication." India has already purchased Harpoon missiles for integration on Indian Air Force Jaguar aircraft and Indian Navy P-8I maritime patrol aircraft.

Wings for Navy / Coast Guard pilots

The 82nd Helicopter Conversion Course, involving nine Navy and four Coast Guard pilots culminated at the passing out parade on 5 June 2014 at Naval Air Station INS *Rajali,* Arakkonam. Rear Admiral Davinder M Sudan, ACNS (Air) took the salute and pinned the 'wings' on the pilots. The pilots had completed the 22-week course at the Helicopter Training School, INAS 561 flying HAL Chetak Helicopters, which were earlier at INS *Garuda* in Cochin, shifting to Arakkonam in 1992.

Rear Admiral Davinder Sudan making presentations at INS Rajali, Arakkonam.

INS *Kolkata* delivered to Indian Navy

On 10 July 2014, Mazagon Dock Limited (MDL) delivered INS *Kolkata*, the first of three Project 15A stealth destroyers, to the Indian Navy. The Acceptance Document was signed at MDL by Rear Admiral RK Shrawat, Chairman and Managing Director, MDL and Rear Adm SP Lal, Chief Staff Officer (Tech), Western Naval Command, in the presence of MDL Directors and Navy personnel. The warship is scheduled to be commissioned by end-August 2014.

The 163-metre long vessel with a displacement of 7,500 tonnes will be the largest destroyer ever operated by the Indian Navy. Significantly more versatile than the destroyers that preceded it,

Kolkata is equally capable against a range of threats, from enemy submarines, surface warships and anti-ship missiles to hostile fighter aircraft. It incorporates modern weapons and sensors, an advanced information warfare suite, an auxiliary control system with sophisticated power distribution architecture and modular crew quarters. The remaining two destroyers in this class, *Kochi* and *Chennai*, are currently under construction at MDL.

Commissioning of ICGS *Achook* and ICGS *Agrim*

On 7 June 2014, the Indian Coast Guard ships 'Achook' and 'Agrim', the fifth and sixth in the series of twenty fast patrol vessels (FPVs), were commissioned at Mumbai by Defence Minister Arun Jaitley.

The 50 metre indigenous FPVs displace 270 tonnes, have a maximum speed of 33 knots with an endurance of 1500 nautical miles, are equipped with modern weaponry, advanced communication and navigational equipment. These will be employed for multifarious close-coast missions such as surveillance, interdiction, search and rescue and medical evacuation.

Indian Navy RFP for shallow-water ASW craft

The Indian Ministry of Defence has issued a tender to domestic shipyards for building 16 shallow water anti-submarine warfare (ASW) vessels, a $2.25 billion programme that will mark the first such effort by domestic yards. The tender, in the 'buy and make India' category, was issued in mid-June 2014 to private sector companies Larsen&Toubro, ABG Shipyard, Pipavav Defence and Offshore Engineering, and state-owned Goa Shipyard and Garden Reach Shipbuilders & Engineers. The vessels will replace Russian-made *Abhay*-class corvettes commissioned in 1989 and 1991.

The domestic companies will need to tie up with international organisations for certain critical technologies. Under a policy change in 2013, MoD decided to explore all avenues to buy weapons and equipment first from the domestic markets and then, if needed, by direct purchase from overseas. In the case of the shallow craft, officials and analysts said, "domestic industry has the ability to build the boats."

The ASW shallow-water craft will operate in coastal waters, in low intensity maritime operations and for mine-laying, carry out search and rescue by day and night, and have the ability to engage hostile craft. The vessels will be connected with the Navy's network-centric warfare system, which will also be linked with other ASW assets, including airborne manned and unmanned platforms.

INS *Sahyadri* at Darwin

INS *Sahyadri*, an indigenously-built guided missile stealth frigate, sailed some 3500 nautical miles to make a port call at Darwin, Australia on 10 June 2014.

The ship underwent an operational turnaround at Darwin, and thereafter participated in activities with the Royal Australian Navy. The ship's crew were also involved in various events like professional interaction, sports events and social fixtures. INS *Sahyadri*'s port call at Darwin serves to reinforce naval ties between the two countries.

From Darwin, INS *Sahyadri* sailed to Hawaii to participate in Exercise *RIMPAC*, the world's largest maritime exercise, which began on 26 June 2014. Commanded by Captain Jyotin Raina, INS *Sahyadri* is manned by 25 officers and 255 sailors of different specialisations/branches.

Exercise *Indra* 2014 in Vladivostok

Three ships of the Indian Navy's Eastern Fleet took part in the Indo-Russian naval exercise *Indra* in Vladivostok in the Russian Far East in mid-July 2014. Under the Command of Rear Admiral Atul Kumar Jain, FOC Eastern Fleet, *Rajput*-class guided missile destroyer INS *Ranvijay* (D55), *Shivalik*-class stealth frigate INS *Shivalik* (F47) and *Deepak*-class fleet tanker INS *Shakti* (A57) conducted joint training operations ashore, as well as in the Sea of Japan.

File photo of Russian destroyer Admiral Vinogradov at sea

The Russian Navy was represented by their Pacific Fleet flagship, *Slava*-class cruiser *Varyag*, along with *Udaloy*-class destroyer *Admiral Vinogradov* and *Ropucha II*-class assault ship *Peresvet*. Russian naval aircraft, both land-based and ship-based, were also involved in the exercise.

At close of the exercise, Rear Admiral Atul Kumar Jain said that Indian Navy sailors "had acquired a very good experience" in addition to praising the Russian crews for their "high morale and professionalism." Leadership from both Navies noted the extraordinary level of coordination, even during instances of inclement weather. "Despite the heavy rains that lashed Russia's Primorsky territory during the sea phase of the exercise, all tasks were fulfilled as planned."

File photo of INS Ranvijay during a naval exercise

Exercise *Malabar* 2014 underway in Japan

The 2014 edition of the annual Indo-US *Malabar* maritime exercise began on 24 July in Port Sasebo, Japan. The *Malabar* series typically involves frontline warships of the Indian and US Navies and this year marks the third time the Japanese Maritime Self Defence Force (JMSDF) is taking part in the exercise, in keeping with the increasing security ties that are being forged between India and Japan.

Three Indian Navy vessels took part this year: *Rajput*-class guided missile destroyer INS *Ranvijay* (D55), *Shivalik*-class stealth frigate INS *Shivalik* (F47) and *Deepak*-class fleet tanker INS *Shakti* (A57), immediately after the Indo-Russian *Indra* 2014 exercise between the Indian Navy and the Russian Navy's Pacific Fleet.

The Japanese Navy participated with two destroyers, a Lockheed P-3C Orion MP/ASW aircraft and one Shinmaywa US-2 sea plane, while the US Navy contingent included *Nimitz*-class aircraft carrier USS *George Washington* (CVN73) with embarked Carrier Air Wing 5, *Ticonderoga*-class guided missile cruiser USS *Shiloh* (CG67), *Arleigh Burke*-class guided missile destroyers USS *John S McCain* (DDG56), USS *Stethem* (DDG63) and USS *Pinckney* (DDG91); along with a P-3C Orion aircraft.

INS *Kamorta* delivered

INS *Kamorta* has been delivered to the Indian Navy on 12 July. The corvette, part of the Indian Navy's Project 28, is designed and built by Garden Reach Ship Builders & Engineers Ltd (GRSE), was launched on 19 April 2010 and is the first of four corvettes to be built as part of Project 28.

This frontline warship has an approximate displacement of 3400 tons, is powered by four Pielstick 12 PA6 STC 3800 KW diesel engines and can reach a maximum speed of 25 knots. The ship has stealth features and is equipped with Kavach trainable chaff launchers, 2 RBU-6000 anti-submarine rocket launchers and torpedo tubes plus Barak-1 missiles.

A consortium approach for design and development ?

Tejas LCA taking off (photo by Phil Camp)

In a statement made by Arun Jaitley in the Lok Sabha on 18 July, in his capacity as Defence Minister, "ten major projects of the Defence Research and Development Organisation (DRDO), including the LCA Tejas aircraft and several key missile programmes, have been delayed due to various reasons". Giving details of DRDO's delayed projects, Arun Jaitley stated during Question Hour that "corrective/ remedial" measures are being taken to address the issue of delays.

Besides the Light Combat Aircraft, other major projects delayed include the Naval Light Combat Aircraft, aero engine Kaveri, airborne early warning and control aircraft and long range surface-to-air missile. In addition, the Astra BVR missile, advanced light weight torpedo, dual colour missile approach warning system for fighters, among others, have also been delayed. On remedial measures to complete the projects, Jaitley said that a "consortium approach is being used for design, development and fabrication of critical components". According to him, synergy and better co-ordination were being promoted among user services, DRDO and production agencies through cluster meetings.

Astra BVR missile being test launched by Su-30MKI (photo DRDO)

Jaitley also said the general impression that DRDO is lagging behind and that the government is not providing enough support "may not be very accurate. It is not fair to say that activities of DRDO have been curtailed by paucity of funds," he said. On the proposal to allow 49 per cent foreign direct investment in the defence sector, Jaitley said the objective is to bring in best technologies into the country. The government has decided that for now it will be "Indian majority controlled" and will bring the best technologies in the defence sector.

The country has to come out of the situation where India is the largest buyer of defence equipment and ensure that "we have domestic capacity within India", he noted.

RIMPAC 2014 has India participating first time

At Exercise *'Rim of the Pacific'* (RIMPAC), the largest international maritime exercise in the world, hosted by the US Navy's Pacific Fleet every two years, the Indian Navy sent the indigenously built *Shivalik*-class stealth frigate INS *Sahyadri* (F49), commanded by Captain Jyotin Raina. The ship reached Joint Base Pearl Harbor-Hickam on 1 June 2014, after a three-day visit to Darwin, Australia, where she conducted a passing exercise (PASSEX) and in-company training with the *Anzac*-class frigate HMAS *Perth*.

A staggering 38 surface vessels and four submarines, representing 15 international partner nations, sail in close formation during RIMPAC 2014 (photo: US Navy/MC1 Shannon Renfroe)

This year marks the 24th exercise since the series began in 1971. At *RIMPAC* 2014, around 50 ships, over 200 aircraft, and some 25,000 personnel from 22 nations participated in the exercise, which ran from 26 June to 1 August. The exercise is "designed to cultivate and sustain international relationships" in the maritime domain. Interoperability between Pacific Rim armed forces, as a means of promoting stability in the region, is a key benefit, helping to ensure the safety of sea-lanes on the world's oceans.

The participants of *RIMPAC* 2014 came from countries across the globe, not just from Pacific nations and included those from Australia, Brunei, Canada, Chile, China, Colombia, France, India, Indonesia, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Peru, the Philippines, Singapore, South Korea, Tonga, the United Kingdom, and the United States. This edition of *RIMPAC* marked the first-time participation of a number of countries, most notably India, China and Norway.

6th C-17 Globemaster III for IAF

The 6th Boeing C-17 Globemaster III for the IAF flew into Palam on 28 July, the aircraft CB-8009 having departed Dover AFB in Delaware for RAF Brize Norton (where it was loaded with a refurbished T-6G Harvard for the IAF's vintage flight) and then on to India. The Defence Minister Arun Jaitely was conducted around the new acquisition by Air Chief Marshal Arup Raha at Palam.

The Indian Government had accorded approval to buy 10 C-17 Globemaster IIIs along with associated equipment for the IAF in June 2011, and the first of 10 aircraft arrived in India (Hindan) on 18 June 2013. Delivery of the last C-17 for the IAF is expected by December 2014.

Air Chief Marshal Arup Raha conducting Defence Minister Arun Jaitley at Palam's technical area on after arrival of the IAF's 6th C-17 Globemaster III. Also seen is Air Marshal SS Soman, AOC-in-C Western Air Command.

IAF C-17 Globemaster IIIs at Air Force Station Palam.

MKU body armour selected by Ecuador

Participating in a global tender, MKU have been awarded a contract for 40,000 body armour units by Ecuador for the protection of its Police Force. The body armour had been through extensive tests and field trials before being selected, this body armour having been tested and certified by the National Institute of Justice (NIJ), USA as compliant to their most stringent 0101.06 standard.

The contract was awarded by Minister of Interior of Ecuador Sr. Jose Serrano Salgado to MKU's 100% EOU at Kanpur in India, the single largest export order received by an Indian company for Body Armour. Mr Manoj Gupta, Chairman MKU has stated that, "MKU is extremely proud to receive this order. India is looked upon primarily as an importer of defence and security equipment. Orders like this will help in putting India on the export map of world class defence and security technology'.

MKU was setup in 1985 and has in its repertoire solutions covering more than 100 types of ballistic threats. It is a registered supplier to NATO since 1993 and has manufacturing facilities in India and Germany. Its products are used and trusted by more than 230 forces in over 100 countries worldwide including the UN and BAAINBw.

UAV Conference

Indian and Sri Lankan Coast Guard meeting

A three-member delegation led by Rear Admiral Ravindra C Wijegunaratne, Director General Sri Lankan Coast Guard (SLCG), visited India from 24-28 June 2014, for meetings with the Indian Coast Guard (ICG), headed by Vice Admiral Anurag G Thapliyal, Director General Indian Coast Guard. The visit was a follow-up to the various efforts by governments of the two countries, towards "cooperation between the Indian Coast Guard and Sri Lanka Coast Guard and pursuance of the discussions on maritime issues of mutual concerns to formulate a cooperative approach."

Focus of the meetings was to "further strengthen operational level interaction for Search and Rescue, preservation and protection of maritime environment, revalidating standard operating procedures and communication procedures between the Coast Guards."

Gen Bikram Singh visits China

Gen Bikram Singh inspecting a Guard of Honour with PLA Gen Fang Fenghui in Beijing on 3 July 2014

Indian Army COAS General Bikram Singh visited China in early July on an official visit, his four-day trip including programmes at Beijing and Shanghai, as well as visits to People's Liberation Army facilities and interaction with Chinese military leadership. The agenda for the visit included reviewing implementation of the 2013 Border Defence Cooperation Agreement and confirming plans for Indo-Chinese military exercises set to take place in India later this year.

The COAS met with General Fan Changlong, the senior most PLA officer and one of two Vice Chairmen on the Central Military Commission that is headed by President Xi Jinping. General Fan hailed the visit as a positive step in bilateral military relations and noted that India and China's "common interests far outweigh" their differences. Gen Singh also interacted with his direct counterpart in Beijing, General Fang Fenghui, Chief of General Staff of the PLA, who said that "the two countries should expand cooperation in areas including joint exercises, peacekeeping and anti-terrorism."

DRDO's portable bridge

A mountain footbridge has been developed by the Defence Research and Development Organisation (DRDO) for improving communication in remote areas as well as during disaster management operations. The bridge can span gaps up to 13.5 metres, has a pathway of 1.5 metre supported by hand rails, takes 2 + hours to deploy.

These bridges costs Rs 6.5 lakh each, are easy to transport and deploy and have been adapted from the original Mountain Foot Bridge (MFB) concept developed for the armed forces and made of high-strength aluminium alloy.

"Full control of border roads"

Concerned at the slow pace of road construction on the Indian side of the Line of Actual Control with China, the Indian Army has proposed that the Border Roads Organisation (BRO) should be directly under its control. The Army is pushing for drastic speeding up of border infrastructure development, including swift construction of border roads, the fact is that of 73 proposed strategic roads to be built, only 17 have been completed.

COAS General Bikram Singh has reportedly met transport minister Nitin Gadkari to discuss the status of crucial border road projects. The completion of the border road projects on the Sino-Indian border is one of the Army's top priorities. In February 2014, the parliamentary standing committee on defence reported "the rise of China is posing a serious strategic challenge to India. Several developments in China like enhancement of military capabilities through its modernisation programme development of infrastructure along the India-China border (especially in Tibet), expansion of roads and railways opposite Arunachal Pradesh, inroads into the Indian Ocean Region and adoption of high technology especially nuclear, space and missile capabilities are affecting the strategic balance between the two countries."

DRDO

Defence Minister briefed at Air Head Quarters

Defence Minister Arun Jaitley was briefed by Chief of the Air Staff, Air Chief Marshal Arup Raha on the Air Force's operational preparedness and capabilities during his visit to Vayu Bhavan on 6 June 2014.

The IAF has a large number of pending procurement requirements, which include additional C-17 Globemaster III heavy lift transport aircraft, medium-lift helicopters, attack helicopters, basic and intermediate jet trainers, mid-air refuellers and AEW&C aircraft. However, the priority remains for large numbers of new fighter aircraft to supplant the considerable numbers of obsolescent MiG-21 variants and MiG-27s even as both the MMRCA and LCA programmes are delayed.

Chief of the Air Staff, Air Chief Marshal Arup Raha in the cockpit of a Pilatus PC-7 Mk.II basic training aircraft at the Air Force Academy, Dundigal, Hyderabad which he visited on 20 June 2014

IAF Jaguars with MBDA ASRAAM

The Indian Government has signed a £250 million contract with European missile manufacturer MBDA to equip the Indian Air Force's Sepecat/HAL Jaguar strike aircraft with the company's ASRAAM short-range air-to-air missile. The deal was announced during the visit of British Foreign Secretary William Hague and Chancellor George Osborne to New Delhi in July 2014. While the exact number of missiles to be acquired has not been disclosed, the contract is understood to cover 350 - 400 missiles.

Inert ASRAAMs mounted on an ex-RAF Jaguar during trials (MBDA photo)

The ASRAAM is designated as the "new generation close combat missile" (NGCCM) by the IAF, which will mount it on the unique over-wing pylons of the Jaguar, freeing underwing hardpoints for air-to-ground ordnance in keeping with the Jaguar's primary strike role.

ASRAAM integration, captive carry flight trials and live-fire testing have been conducted with the Jaguar, using both ex-RAF aircraft as well as active Indian Air Force aircraft at the Aircraft and Systems Testing Establishment (ASTE) based in Bangalore. Sources from both MBDA and the Indian Air Force had reported positive impressions from these tests (see *Vayu* I/2014).

The RFP for new missiles to replace the obsolete Matra R.550 Magic I was issued in 2009, with MBDA's bid emerging as the winner in 2012. This builds on MBDA's recent success in the subcontinent, the company already having secured a €1 bn contract to supply 493 Mica missiles for the IAF's Mirage 2000 upgrade programme.

Refurbished Mi-17V5s for VVIP transport

According to reliable reports, the IAF is looking to refurbish Mi-17V5 helicopters to fulfill the VVIP transportation role in lieu of the AW101s which have been grounded following recent controversy. Essential changes include strengthening of the outer fuselage structure with armour plating, securing the cockpit with

bulletproof glass and installing modern protection suites. Inputs are also to be taken from the Special Protection Group (SPG). The Indian Government has ordered 151 Mi-17V5 helicopters, in three tranches during 2008 and 2012 of $1.2 billion (see *Vayu Issue I/2013*).

BSF to acquire eight more helicopters

The Border Security Force (BSF) is to procure eight more helicopters from Russia to enhance mobility of BSF troops engaged in anti-Maoist operations. BSF Director General Devendra Kumar Pathak said, "The BSF Air Wing already has 17 aircraft, including Cheetahs, Mi-17 1Vs and Dhruv ALHs" and the eight Mi-17V5 helicopters will arrive from September 2014. "We will also see if the new helicopters can be used along the India-Myanmar border. However, the BSF is yet to get approval to take over this border from the Assam Rifles," said Pathak.

The DG stressed that with expansion of the Air Wing, the BSF would also upgrade its air bases. The BSF currently has air bases in Raipur, Ranchi, Jagdalpur and Srinagar.

Indo-French *Exercise Garuda V* at Jodhpur

The fifth edition of the Indo-French *Exercise Garuda* V concluded on 13 June 2014 at Air Force Station Jodhpur. The exercise, beginning on 2 June, had a contingent from the *Armée de L'Air*, featuring four Rafales from 3/30 Squadron 'Lorraine' and one C-135 FR tanker from 2/91 Air Refuelling Group 'Bretagne.' French Air Force Chief, General Denis Mercier, attended the exercise. A total of 94 French Air Force personnel were deployed, including nine Rafale aircrew and 27 Rafale technicians. The Indian Air Force contingent consisted of Su-30MKIs, MiG-27 UPG and MiG-21 Bison aircraft, as well as Ilyushin Il-78 tankers and Ilyushin Il-76 AWACS aircraft.

The primary objectives of *Exercise Garuda* were "to enhance and improve cooperation and interoperability between the French and Indian Air Forces, including in the field of aerial refuelling." The aircrew conducted daily combat training missions against or alongside each other, in a range of tactical scenarios offering increasingly complex and realistic training situations.

Garuda V marked the first time Rafales have participated in an air exercise in India. *Exercise Garuda* is conducted alternatively between France and India since 2003, and is an important aspect of bilateral Indo-French military cooperation. The first such exercise took place in Gwalior in 2003. *Garuda II* took place in Istres Air Force Base, France, marking the first exercise in Europe that the IAF had participated in. Exercises were held at Kalaikunda and Istres in the following years. *Garuda IV* in 2010 was also the first time cross refuelling was done on each other's tankers, and was also the first trilateral format exercise, featuring Singapore.

An-32 upgrade delays

A recent Comptroller and Auditor General (CAG) of India report has revealed that as many as 61 of the 105 aircraft fleet of Indian Air Force An-32 were grounded in 2013 as result of delays in the upgrade and life-extension programme contracted for in June 2009. The project involved forty aircraft to be upgraded in Ukraine between 2009 and 2013, with the remainder to be overhauled in India under a transfer of technology (ToT) agreement worth Rs 272 crore.

An initial batch of five aircraft was to be in Ukraine by November 2009 with upgrades to be completed by August 2010. However, the aircraft only reached in March 2010 and were completed in May 2011, nine months behind schedule. By December 2013, fifteen aircraft were yet to begin the upgrade and overhaul process.

Meanwhile, the overhaul facilities to be built in India were to have been completed by June 2011, but remained under construction in mid-2013, with not a single An-32 overhauled in India. With many such aircraft reaching the ends of their total technical lives as early as 2009, the delays came to a head in late 2013, resulting in over two-thirds of the fleet as 'aircraft on ground' (AOG).

Akash supersonic missiles fired in ripple mode

On 28 May 2014, three Akash missiles were launched from the Integrated Test Range (ITR), Balasore, against targets towed by Lakshya pilotless target aircraft moving at "low altitude far boundary" . The missiles intercepted the small RCS targets within an interval of five seconds in ripple mode. The missiles were guided by multifunction phased array radar developed by Electronics and Radar Development Establishment (LRDE) a DRDO Lab and produced by Bharat Electronics Limited (BEL).

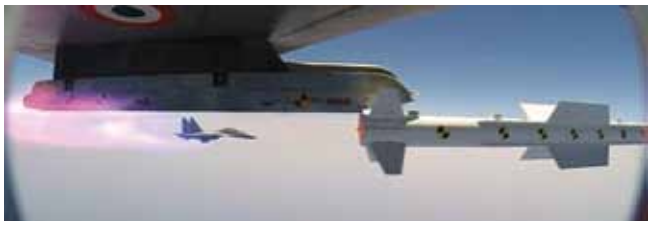
Su-30MKI display issues "resolved"

A software upgrade has rectified a major flight safety issue in the Indian Air Force Su-30MKI fleet. Reports of cockpit screens and head up displays (HUDs) going 'blank in flight' had emerged earlier this year, along with scattered instances of faulty mission computers. HAL Chairman RK Tyagi has recently confirmed that software upgrades have "solved the display issues and that the mission computer problem has been addressed by replacing faulty computers where necessary."

The display and mission computer issues caused controversy earlier this year after hacked electronic correspondence between Hindustan Aeronautics Limited (HAL) and Rosorobonexport was leaked, bringing these problems to public review.

More Astra test firings

On 20 June 2014, Astra BVR missiles were tested successfully from an Su-30MKI by the Indian Air Force from a naval range off Goa. The launch, conducted over 6 km altitude, was a control and guidance flight which successfully demonstrated interception of an electronically simulated target at long range. These tests, including the earlier launch on 9 June 2014, conducted to demonstrate the aerodynamic characteristics of the missile, have demonstrated the "repeatability, robustness and endurance capability of the Astra BVR-AAM as a weapon system".



The Indian Regional Transport Aircraft (IRTA) project

A high level meeting was chaired by Mr. Ajay Shankar, Member Secretary, National Manufacturing Competitiveness Council (NMCC) on 9 June 2014, at HAL Bangalore to set the contours of the proposed Indian Regional Transport Aircraft (IRTA) project. He stated that "given the skills-set and the cost advantage the country has the dream project should turn into realty by 2020-22". He called upon over 100 potential business partners present on the occasion

The 'Strategy Meet on Regional Civil Aircraft' being inaugurated by business partners with Mr Ajay Shankar, Member Secretary, NMCC (third from right) and Dr RK Tyagi, Chairman, HAL present.

to actively participate in the brain-storming session and discuss challenges and risks involved. "We can surprise ourselves and the world by rolling-out a medium-range civil aircraft", he suggested.

Chairman HAL, Dr RK Tyagi, stressed that "India must have such an aircraft considering the fact that it is the world's ninth largest market and will be third by 2020. It is therefore important to have our own aircraft. HAL and NAL have taken the lead to build this aircraft on PPP model where you all will be contributing".

Dr Tyagi continued : "A Special Purpose Vehicle (SPV) is being formed by HAL and NAL to steer this project. The purpose of this strategic partners meet is to ensure inclusive involvement of all the potential business entities right from the beginning".

Also participating were representatives from Indian and international companies including GE Aviation, Pratt & Whitney, Eaton, M&M, Titan and others, who shared their views and deliberated on the challenges on various fronts including

technology, time scales, conceptual design issues, manufacturing skills needed.

Dr RK Tyagi, stated that the RFP would be issued for engine of the aircraft as 11 bidders have already responded to the recent RFI issued for the 70-90 seater civil aircraft. The aircraft would be manufactured in India with an expected roll-out by 2022. T Suvarna Raju, Director, D&D of HAL gave an outline of the project. "In the initial period we expect around 400 aircraft to be produced. This is conservative estimate and the potential is much more considering that India has 450 airstrips and more cities would be linked with air travel in future", he stated.

HAL to embark on "large-scale modernisation"

On 17 June 2014, at the *Aerospace Luminary Lecture Series* organised by the Hyderabad chapter of Aeronautical Society of India, HAL Chairman Dr RK Tyagi stated that HAL intends to diversify into civil aviation and is making efforts to re-open HAL Bangalore airport for short-haul operations. "We are already in a position to operate civil aircraft at HAL Ojhar (Nasik), just about 200 km from Mumbai and 220 km from Pune. This should give a boost to regional economy", he felt.

Dr Tyagi stated that "modernisation is the key to any business", and that HAL have cleared modernisation proposals worth Rs. 6000 crores in this direction besides redefining the customer sourcing philosophy, advance resource planning and strengthening project and contract management. HAL are to get increasingly involved in the Unmanned Air Vehicle (UAV) and Unmanned Combat Air Vehicle (UCAV) business segments.

Air India joins Star Alliance

India's national carrier has become part of the Star Alliance Group with effect from 11 July 2014. Minister of Civil Aviation P Ashok Gajapathi Raju welcomed the news and stated that the airline's seven-year-long wait to join the alliance "was finally over. We are happy that AI has become part of the Star Alliance. This is one of the biggest alliances in the world. AI's revenues may increase by 4-5% by joining the alliance."

According to a statement, "the integration teams at Air India, Star Alliance and its member carriers will now complete the last necessary work in order to ensure that Air India can offer all Star Alliance customer benefits from July 11, 2014, onwards". Star Alliance network has now gone upto 27 member airlines, offering more than 18,500 daily flights serving 1,316 destinations in 192 countries.

IndiGo launches 500th daily flight

On 9 June 2014, IndiGo announced operation of 500 daily flights with the launch of four new flights connecting Delhi, Jammu, Pune, Chennai. The schedule sees introduction of second daily non-stop flights between Delhi-Jammu and third daily non-stop flights between Pune-Chennai. IndiGo will be providing increased frequencies on the routes and "offering greater travel options to both business and leisure passengers across these cities, and allow them to experience the on-time performance of IndiGo".

With 502 flights connecting 36 destinations across the nation and abroad, these new flights "will further consolidate IndiGo's position as the fastest growing airline in India." Earlier in the year, IndiGo also launched new daily non-stop flights between Delhi and Dibrugarh and return via Guwahati to Kolkata and Lucknow to Srinagar via Delhi.

New Spicejet livery

Spicejet's newest Boeing 737 has been adorned with a special livery, as seen below. Aircraft registration VT-SZK "Red Chilli" arrived in Delhi in late May 2014 from Boeing and "celebrates the frontline of SpiceJet, cabin crew and pilots, the ones that represent the airline as an entity day-in and day-out to their customers".

SpiceJet's Qatar operations

Kalanithi Maran-promoted SpiceJet, which was allotted 7,420 weekly seats for operations to Qatar in March 2014, has yet to begin services on this route from either of the five cities – Chandigarh, Hyderabad, Lucknow, Delhi and Trivandrum for which it has rights.

SpiceJet, which had posted its highest ever net loss of Rs.1,003.24 crore for the year 2013-14 has said that it is in advanced stages of talks for capital infusion with an investor but denied reports that it was selling some of its overseas parking slots to Qatar Airways. "I don't expect SpiceJet to operate six daily flights to Doha given their challenges unless there is a specific understanding with Qatar Airways," observed Kapil Kaul, South Asia CEO of aviation

consultancy firm *Centre for Asia Pacific Aviation*. "SpiceJet is heading for another loss in the first quarter of 2014-15. This year is most critical for the future of SpiceJet," he stated.

Qatar Airways to buy stake in Indigo?

Qatar Airways CEO Akbar Al Baker has stated that the Gulf airline is keen to pick up stake in the low-cost carrier IndiGo "if available. We are keen to invest in IndiGo, if it (stake) is available. It is the most successful Indian carrier, the most cost efficiently run Indian carrier and the most progressive one" observed Al Baker.

There has been no statement, however, from IndiGo's CEO Aditya Ghosh in response and IndiGo has not previously indicated that it is considering selling any stake. Still, some months ago, there were reports that IndiGo could go public selling part of its stake. Qatar Airways has a fleet of 132 aircraft and flies to 141 destinations carrying 18 million passengers every year.

GE Aviation and SpiceJet sign 'Flight Efficiency Services' contract

SpiceJet has selected GE's Flight Efficiency Services (FES) to support its fleet of 52 Boeing 737 and Bombardier Q400 aircraft. GE will provide flight data analytics and fuel management to optimise the airline's operational efficiency with the goal of substantially reducing fuel expenses for the airline. Deliveries for the programme have commenced in July 2014. GE's Flight Efficiency Service, which is widely recognised as the premium product in its class and in fuel efficiency management software worldwide. It aims to help the airline reduce its annual $600 million fuel bill, which is the largest cost component for airlines in India.

GE will provide consultation and evaluation services with the aim of reducing the airline's fuel consumption and carbon emissions. GE is also designing and implementing custom solutions for SpiceJet and performing on-going efficiency measurements.

GE Aviation and Mahindra in aerospace cooperation

An agreement to pursue opportunities for manufacturing aerostructures was signed on 15 July 2014 by GE Aviation, Hamble and Mahindra Aerospace. This will enable GE Aviation, Hamble (the Aerostructures business of GE Aviation) to collaborate on new opportunities with Mahindra Aerospace. Stefanie Darlington, Sourcing Leader for GE Aviation's Aerostructures business and Arvind Mehra, the Executive Director and CEO of Mahindra Aerospace signed the MoU.

Jet Airways extends OnPoint solution agreement with GE

Jet Airways have extended its OnPoint solution agreement with GE Aviation for an additional five years on the GE90 engines that power the airline's Boeing 777- 300ER. The extension, valued at more than $200 million ensures that GE will provide the maintenance, repair and overhaul of 22 GE90 engines through 2022.

Jet Airways have also signed an agreement with GE for a thrust bump on its entire GE90 fleet of 22 engines, which provides Jet Airways with the flexibility to operate high payloads even when flying out on short runways under severely hot operating conditions, as experienced in the summer months in many parts of Asia and the Middle East.

Thales considering "larger cooperation" with HAL

Mr. Jean-Bernard Lavy, CEO of Thales has expressed a keen desire to take forward on-going business activities in India in cooperation with HAL. "Thales would have a strategic look at India given the business potential in the defence sector and would be in India with his team sometime in November 2014." Thales, a major global aerospace company is involved with HAL in the Mirage 2000 upgradation programme and extends technical support on several major HAL platforms.

Thales and HAL executives at the Farnborough International Air Show on 16 July 2014. HAL Chairman, Dr. RK Tyagi is third from left.

Airbus Helicopter CEO and President, Mr Guillaume Faury and his team also met the HAL top executives. Airbus Helicopter is involved with HAL's Cheetah and Chetak programmes and have expressed the desire to play a greater role in the Indian helicopter market, identifying the Indian Multirole Helicopters (IMRH) and Navy Multirole Helicopters (NMRH).

Avi-oil

Nasmyth India's new Bangalore office

Nasmyth Group, which is a leading supplier of precision engineering services worldwide, inaugurated the new Bangalore office of its subsidiary, Nasmyth India on 26 June. "Nasmyth India's move to the new premises in Bangalore's Millenia Towers reflects the growing demand for the wide range of mechanical engineering and manufacturing services provided by the company and its Indian Partners, on behalf of the Group and ultimately our worldwide customer base." As Nasmyth India's General Manager said, "Nasmyth India plays a critical role in supporting the Group's globalisation programme so we were delighted to welcome the Deputy High Commissioner to this highly successful inauguration ceremony marking the official opening of the company's new offices."

The Nasmyth stand at Farnborough Air Show 2014

UTC Aerospace Systems contracted by Jet Airways

UTC Aerospace Systems has been selected by Jet Airways and Jet Lite to supply the wheels and carbon brakes for their new fleet of 50 Boeing 737-800 Next Generation aircraft. These use proprietary DURACARB® carbon heat sink material, which provides "exceptional brake performance and a 35 percent brake life advantage over competitive products".

"We enjoy industry-leading 'around-the-clock' customer and product support on our current fleets equipped with wheels and brakes from UTC Aerospace Systems," stated Dato' K Jeyakanthan, Senior Vice President Aircraft Projects & Product (Technical) of Jet Airways. "We look forward to excellent product performance and reliability in addition to realising the benefits associated with their brake life advantage for our new 737 Next Generation fleet."

Six more private airlines likely to get permits

Several new airlines are likely to be given their clearance in the coming months, with the Indian government giving the 'go-ahead' to four of the six companies which had sought permits for launching scheduled, private or charter air operations. While AirAsia India, Ligare Aviation Limited, Quickjet Cargo Airlines and LEPL Projects Limited have been granted the Air Operator's Permit (AOP), the two pending cases are those of Tata-SIA Airlines Limited and Air Pegasus Limited, according to Minister of State for Civil Aviation G. M. Siddeshwara.

While AirAsia India has started operations, Tata-SIA Airlines, a 51:49 joint venture between Tata Sons and Singapore Airlines, has announced plans to launch flights by September- October. Two other airlines, Air Carnival and Zav Airways, have been granted the initial No Objection Certificate (NOC) by the civil aviation ministry to start scheduled regional services. While Air Carnival proposes to operate in the Southern region, Zav Airways will fly in the Northeastern and Eastern regions, officials said.

Earlier, ministry officials said that NOC has also been granted to AirOne Aviation, Zexus Air Limited, Premier Air and Turbo

Megha. Non-scheduled operator AirOne, headed by a CEO of the erstwhile Air Sahara, is understood to have plans to launch a scheduled airline.

Jet Airways "to revitalise"

According to its Chairman Naresh Goyal, Jet Airways has started a major restructuring exercise, saying that the airline is "in the process of finalising a new product to have clarity of brand" apart from the group paring its debt and aiming to turn profitable by FY 2017. "We are looking at restructuring our balance sheet and are in talks with bankers for that. We are looking at a lot of consolidation (of our fleet). We may sell our surplus aircraft (Jet currently has 113 aircraft) or return them to lessors. We are finding out what is the most economical way to go forward. We will be announcing all this soon," Goyal announced. Etihad had last year entered into a $900 million funding deal with Jet, in which it paid $379 million for assuming a 24% stake in Jet Airways.

Etihad president James Hogan, however ruled out increasing the stake holding from 24% to the allowed 49% as of now. "We are a long-term investor in Jet. We have no exit strategy and are here to stay.... (when investing in an Indian carrier) we assessed other airlines too and felt Jet as the best partner for us... no market is more important to us than India," About Jet's turnaround plan, Hogan said: "This is not an overnight turnaround. The investment is there, the game plan is in place. Now, it is about delivering."

Etihad is playing a key role in the revitalisation of Jet Airways, whose CEO-designate Cramer Ball said the airline's domestic operations (which currently account for 55% of the group's revenue) "are not profitable." International operations, whose share in revenue will jump to 63% by next year, are profitable.

"The domestic operations will be changed in 12 months. We will remove the complexity in brand. The Boeing 737 product will have two classes," Ball said. The airline may offer increased baggage allowance to flyers. Jet's main issue continues to be with the branding of its costliest acquisition, Air Sahara, which was rebranded first as JetLite and then JetKonnect.

Northrop Grumman ATC Systems for AAI

Northrop Grumman's UK-based air traffic management systems subsidiary Park Air Systems has been contracted by Airports Authority of India (AAI) to deliver ground-to-air communications across the country, utilising the latest Voice over Internet Protocol (VoIP) communications technology.

Under the contract, Northrop Grumman Park Air Systems will supply more than 500 pairs of air traffic control (ATC) transmitters and receivers that will be integrated into the AAI IP network. The system will comprise the Park Air T6 transmitter and receiver radios, the Park Air S4 remote control units, filters, multicouplers and antennas. The supplied equipment will be interconnected using the internationally agreed VoIP protocol ED-137.

General Dalbir Singh is Chief of the Army Staff.

General Dalbir Singh took over as the 26th Chief of the Army Staff in New Delhi, at mid-day on 31 July, 2014. As profiled in *Vayu Issue III/2014*, he was commissioned in June 1974 into the 4/5 GR (FF). "With a lean and muscular frame at six-feet, the new Army Chief literally and figuratively stands tall not just in the army but also is the revered patriarch for the Gorkha troops as their senior-most serving General". By virtue of the same, he holds the twin ceremonial appointments of 'Colonel of the Regiment' 5 GR (FF) since 19 April, 2011 and as 'President Gorkha Brigade' since 1 January, 2014.

Lt Gen Philip Campose appointed Vice Chief of Army Staff

Lt. Gen. Philip Campose, formerly GOC-in-C Western Army Command, took over as the VCOAS on 1 August 2014. The General was commissioned in the 9 Gorkha Rifles in 1974 and later moved to the newly constituted Regiment of Mechanised Infantry in 1982. He has commanded an Independent Armoured Brigade, an Infantry Division on the Line of Control in J&K and a Corps in the Western Sector, besides heading a UN Peace Keeping mission in the former Yugoslavia and Northern Iraq.

He tenanted appointment of the Director General Perspective Planning (DG PP) at Army Headquarters at New Delhi, before taking over as General Officer Commanding-in-Chief, Western Command. He is the current Colonel Commandant of the Mechanised Infantry Regiment.

Lt Gen Kamal Jit Singh takes over as GOC-in-C Western Command

Lt. Gen. Kamal Jit Singh has taken over as General Officer Commanding-in-Chief, Western Command, on 1 August 2014. Commissioned into the Armoured Regiment in 1977, he has commanded an Armoured Brigade, an Armoured Division and an operationally committed Corps in the North East.

In a career spanning over 37 years, the General has served in Counter Insurgency areas, with the Assam Rifles and the United Nations Peace Keeping Force in Angola. He has held important staff appointments at formations and Army Headquarters levels including Assistant Military Secretary (MS Branch), Colonel General Staff of a Division, Brigadier General Staff of a Corps and Additional Director General of Perspective Planning. The officer has also been an Instructor at the School of Armoured Warfare and Directing Staff at the Higher Command Wing of the Army War College.

Air Marshal PP Reddy takes over as CISC

Air Marshal PP Reddy took over as Chief of Integrated Defence Staff to the Chairman Chiefs of Staff Committee on 1 July 2014. He was commissioned as a fighter pilot in the Air Force in June 1977 and is an alumnus of Rashtriya Indian Military College, National Defence Academy and Defence Services Staff College, Wellington.

He is a Qualified Flying Instructor and an Experimental Test Pilot with 3600 hrs on various types of fighters including the Su-30MKI. He has commanded a MiG-27 squadron and a fighter base in the Kashmir Valley. The Air Marshal has worked in the Plans Branch at Air HQ and was instrumental in the implementation of Su-30MKI, Il-78MK in-flight refuelling aircraft and MiG-27 upgrade programmes and has also served as the Chief Test Pilot at the Aircraft and Systems Testing Establishment, was Air Advisor at High Commission of India, London, Senior Officer-in-Charge Administration at South Western Air Command and Senior Air Staff Officer at Training Command. He was Director General (Inspection & Safety) at Air HQ prior to his present appointment.

Vice Adm Satish Soni is FOC-in-C Eastern Naval Command

Vice-Admiral Satish Soni took charge as FOC-in-C Eastern Naval Command at Visakhapatnam on 16 June 2014. Commissioned into the Navy in July 1976, he is a winner of the 'Sword of Honour' and a specialist in Navigation and Aircraft Direction. Some of the Admiral's key sea commands include those of stealth frigate INS *Talwar,* guided missile destroyer INS *Delhi* and missile corvette INS *Kirpan*. He has also been Flag Officer Commanding (FOC) of the Navy's Eastern Fleet, Chief of Staff of Eastern Naval Command and Commandant of the National Defence Academy at Khadakwasla. He has spent time at New Delhi in the Integrated HQ MoD (Navy) as Deputy Chief of Naval Staff, before taking over as FOC-in-C Southern Naval Command in May 2012.

Air Marshal Ramesh Rai is AOC-in-C Training Command

Air Marshal Ramesh Rai took over as Air Officer Commanding-in-Chief (AOC-in-C), Training Command at Bangalore on 1 July 2014. He was commissioned in the fighter stream on 29 December 1976 and has over 4500 hrs of flying to his credit and has commanded a Jaguar Squadron. He is an experimental test pilot, flying instructor and recipient of the Majithia trophy and Chief of the Air Staff (CAS) trophy for standing first in the pilot's course and 'best in flying'.

He has held important command and staff appointments including Joint Director Air War Strategy Cell (AWSC), Director Air Staff Requirements at Air HQ and as the Defence Attaché at Tel Aviv, Israel. Air Marshal Ramesh Rai has commanded the Advance HQ at Kolkata and Air Force Station, Bidar. The Hawk advanced Jet Trainers were inducted during his tenure at Air Force Station Bidar. He has held various important staff and instructional appointments including as Senior Air and Administration Staff Officer of Maintenance Command, and as the Chief Instructor (Air) at Defence Services Staff College(DSSC), Wellington prior to his elevation to the rank of Air Marshal on 1 June 2012. He served as Senior Air Staff Officer (SASO) of Central Air Command before taking over as AOC-in-C, Training Command.

Air Marshal Air Marshal S Neelakantan appointed DG (Inspection & Safety)

Air Marshal S Neelakantan took over as Director General (Inspection & Safety) at Air Headquarters (RK Puram) on 1 July 2014. He was commissioned as a Fighter Pilot in the Indian Air Force in December 1977 and is an alumnus of the National Defence Academy, Defence Services Staff College, Wellington and Tactics and Combat Development Establishment (TACDE).

Air Marshal S Neelakantan is a Qualified Flying Instructor who has flown over 3100 hrs on various types of fighter aircraft. He has commanded a frontline fighter squadron and two air bases. He led the Indian Air Force Contingent in Congo as part of the UN Peace Keeping Mission in 2006-07 and has held various staff and instructional appointments. He was Chief Instructor (Air) at DSSC Wellington before taking over as DG (I&S).

Air Marshal Anil Khosla as SASO Central Air Command

Air Marshal Anil Khosla took over as the Senior Air Staff Officer (SASO) of Central Air Command (CAC) at Bamrauli, near Allahabad on 1 July 2014. He was commissioned in the fighter stream of the Indian Air Force in December 1979, has over 4000 hours of flying experience particularly on MiG-21s and Jaguars.

He has held various staff and instructional appointments including those as Principal Director at Directorate of Information and Electronic Warfare, Director in Personnel Branch and Joint Director at Directorate of Concept studies, directing staff at Tactics and Combat Development Establishment (TACDE) and Flying Instructor School (FIS). His last appointment was as Air Officer Commanding J&K Area.

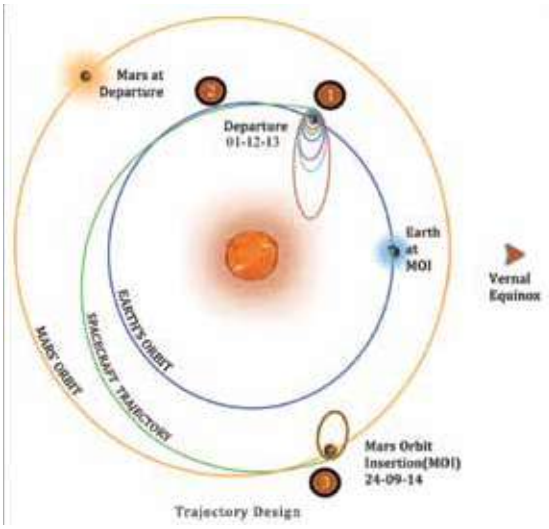
India's Mars Mission: "Orbiter on course"

ISRO performed the second of four planned Trajectory Correction Measures (TCM) on the Mars Orbiter Spacecraft on 11 June 2014, the trajectory correction measures keeping the Mars Orbiter on course to enter Martian Orbit on 24 September 2014, and were carried out from the ISRO Telemetry, Tracking and Command Network Station (ISTRAC). The TCM had a burn time of 16 seconds.

Originally scheduled for 9 April 2014, the course-correction was at that time deemed unnecessary and rescheduled for 11 June. The spacecraft was at the 475 million km mark on its 680 million km journey from Earth to the Red Planet. "The first Trajectory Correction Manoeuvre (TCM) was conducted on 11 December 2013. Two more TCM operations are planned around August 2014 and September 2014," said D P Karnik, director at ISRO. During the course correction on 11 June, described as a "minor correction" by ISRO officials, the Mars Orbiter fired its engines briefly for 16 seconds around 4:30 pm on the basis of radio commands issued from ISTRAC to move its position before continuing on its 10-month-long heliocentric cruise to Mars.

The Mars Orbiter had lifted off from the Satish Dhawan Space Centre in Sriharikota on 5 November 2013, launched by PSLV-C25. Six orbit-raising manoeuvres followed before a Trans Mars Injection manoeuvre on 30 November allowed it to enter helio-centric orbit, permitting the spacecraft to escape the sphere of influence of Earth and begin its cruise to Mars.

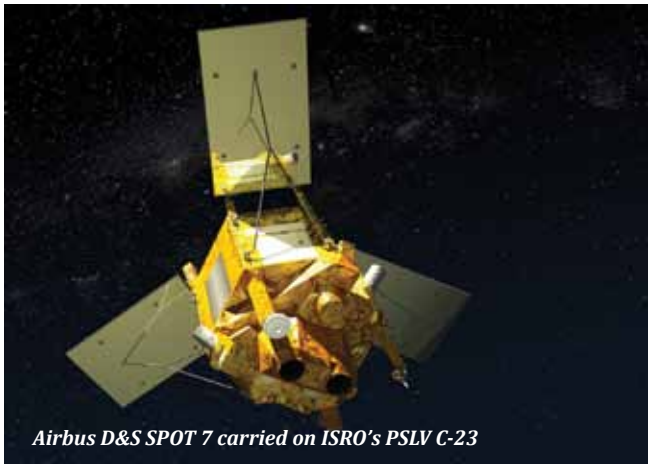
ISRO has been monitoring the spacecraft using its Deep Space Network complemented by that of NASA. The Mars Orbiter Spacecraft is carrying five scientific instruments.



PSLV-C23 launched

On 30 June 2014 ISRO launched PSLV-C23 from the Satish Dhawan Space Centre near Sriharikota. The launch vehicle carried SPOT-7, a 714 kg, French earth observing satellite as the main payload, which was injected into a 655 km Sun Synchronous Orbit (SSO). Other satellites included 14 kg AISAT of Germany, NLS7.1 (CAN-X4) & NLS7.2 (CAN-X5) of Canada, each weighing 15 kg, and the 7 kg VELOX-1 of Singapore. There have been 25 consecutive successful flights of PSLV till April 2014 and this was the 26th such launch. PSLV-C23 is the tenth flight of PSLV in 'core-alone' configuration, without the use of solid strap-on motors.

The launch was conducted as part of commercial arrangements that ANTRIX, ISRO's commercial arm, entered with respective foreign agencies. PSLV has previously launched satellites for the UK, Denmark, Austria, France, Singapore, Switzerland, Israel, Italy, Belgium, Republic of Korea, Indonesia, Argentina, The Netherlands, Algeria and Luxembourg. This launch was witnessed by Prime Minister Narendra Modi, who commented that it is a "global endorsement of India's space capability."



Airbus D&S SPOT 7 carried on ISRO's PSLV C-23

FSTC meets India's simulator demand

Flight Simulation Training Centre (FSTC) is a joint venture between Flywings Aviation of India and Sim-Industries, a Lockheed Martin subsidiary specialising in design and construction of flight simulators. While Lockheed Martin's simulator support as part of its 6-aircraft C-130J contract is fulfilled at Hindon AFS, home base of No. 77 Squadron 'Veiled Vipers,' FSTC is an important part of the emerging training market in India – both civil and military.

Until recently, only CAE carried out such flying training in India, with five facilities across the nation, including two full flight simulator centres in Noida and Bangalore. Given the extremely high levels of utilisation at the limited simulator facilities in the country, the opportunity for another participant to enter the market has long been viable. Even today, airlines are forced to send large numbers of pilots to centres abroad for simulator sessions owing to a shortage of in-country simulators. With Air Asia beginning operations and the as-yet unnamed Tata-SIA JV set to do so shortly, the 'simulator crunch' is only expected to get worse.

FSTC is perfectly placed to advantage of this growing demand for simulators, and in short order, the company's two installed Level-D simulators (one A320, one 737) are already running at 95 per cent capacity. The company's Gurgaon facility currently has bays for six simulators, with plans to fill the remaining four bays already well underway. To this end, the company is in talks with Embraer and Air Costa, following the latter's order for a large number of E-jets, which will necessitate a commensurate level of training. At present, the company provides training to virtually every major private airline in the country: Spicejet and Jet Airways keep the 737 simulator occupied whilst IndiGo sends pilots for training on the A320 simulator, despite having a joint venture training centre with CAE in Noida.

In a recent discussion with *Vayu*, Capt Dilawar Basraon, Chief Executive at FSTC and former IAF and airline pilot, noted that there was scope for expansion into military flying training as well. Most new aircraft acquisition contracts include training and support clauses, creating unique opportunities for the firm. For instance, the Boeing P-8I maritime patrol/ASW aircraft operated by the Indian Navy is based on the 737 airliner, with nearly identical training required for the aircrew. Future aircraft acquisitions, such as the Navy's MRMR programme, the IAF's Avro replacement programme and so on will require large numbers of military pilots to undergo cost-effective simulator training and FSTC believes it is "well-placed to deliver this."

FSTC receives EASA approval for A320 simulator

On 21 July 2014, FSTC (Flight Simulation Technique Centre) received EASA approval for its Airbus A320 simulator, making it the only pilot training centre in the region to have such approval.

Recruitment in the Indian aviation sector is on a growth trajectory with entry of new airlines, business plans of existing airlines, opening of new airports and modernisation of old ones. According to consultancy firm Deloitte India, "choosing the right crew and training are key moves for airlines." Consultancy firms like KPMG say that an increase in business travel, tourism and promotional fares will help add to the recruitment numbers in the sector, hence boosting the demand for training facilities.

Captain Sanjay Mandavia, founder of FSTC has said, "It is a great achievement for FSTC to be recognised as an EASA operator in such a short span of operation time.... a matter of national pride to be recognised as a quality training service provider along with the other training facilities around the world."

Captain Dilawar Singh Basraon, co-founder and manager of FSTC said, "With our presence in India it will be a huge saving for airlines and private pilots. Our simulators use third generation technology, which saves power consumption. Our 737 simulator is the only simulator in the country which supports CAT III B training which helps to land in foggy conditions. In addition it is the only simulation training facility approved by Boeing to do RNP (Radio Navigation Performance) approaches."

India's Defence Budget 2014

Small steps toward hopeful transformation

Fleet support vessels such as the Aditya-class tanker INS Aditya (A59) pictured here are vital to sustain the Navy's blue water ambitions (photo: Angad Singh)

While the UPA government had passed an interim budget in February 2014, before elections were held to constitute the 16th Lok Sabha, the bulk of discussions centring on the nation's financial allocations have begun thereafter, with most observers keen to follow the first major actions of the new BJP-led government. Changes to the defence budget, as compared to the interim allocations, are minor in monetary terms, being summed up by a Rs 5,000 crore hike to the capital budget, but are highly significant for the message they send out. The revenue budget remains the same Rs 134,412 crore assigned in the interim budget passed earlier this year.

However, to begin with, Finance Minister (presently also Defence Minister) Arun Jaitley decisively signalled a push for indigenisation by handing DRDO its largest ever increase in capital allocation : Rs 9298 crore, up from Rs 5975 crore in the interim budget and Rs 5258 crore in last year's budget. Following this mammoth 60 per cent hike, the entire R&D budget stands at Rs 15,283 crore, granting DRDO's longstanding demands to be allocated funding equivalent to 7-8 per cent of the total defence budget.

In the same vein, the capital allocation for the Ordnance Factory Board (OFB) was doubled, from Rs 530 crore to Rs 1207 crore, with the funds slated to go towards the modernisation of various facilities across India that manufacture arms, ammunition and equipment for the armed forces.

The three services' own capital budgets remained largely unchanged from the interim budget announced in February, with the Army to get Rs 20,665 crore, the Navy Rs 22,312 crore, and the Air Force Rs 31,818 crore for new equipment. It is crucial to note here that with significant portions of the capital budgets already committed toward paying for previously contracted acquisitions, the scope for large orders within present funding levels remains limited. Additionally, the capital outlay for aircraft and aero engines has actually gone *down* from Rs 33,776 crore in 2013-14 to

Rs 21,730 crore for 2014-15, casting a pall over military aviation in particular.

In a move seen as a direct answer to Chinese build up of border infrastructure, the Finance Minister has also included Rs 1,000 crore for "accelerating the development of the railway system in the border areas," a welcome effort for enhancing military mobility in key regions where it is currently hampered.

The Government also set a sum of Rs 1,000 crore for this fiscal to manage anomalies in pensions paid to ex-servicemen under the 'One Rank One Pension' policy, which was accepted by the new government. Also announced was the proposed construction of a War Memorial and museum at Princess Park near India Gate in New Delhi, with a sum of Rs 100 crore allocated for this purpose.

Finally, and perhaps most significantly, the Finance Minister translated years of empty words into action, increasing FDI in defence to 49 per cent, but with full management and control remaining in Indian hands. He also announced the creation of a 'Technology Development Fund' with an initial allocation of Rs 100 crore, to support public and private sector companies in research and development of defence related products.

First DAC meeting

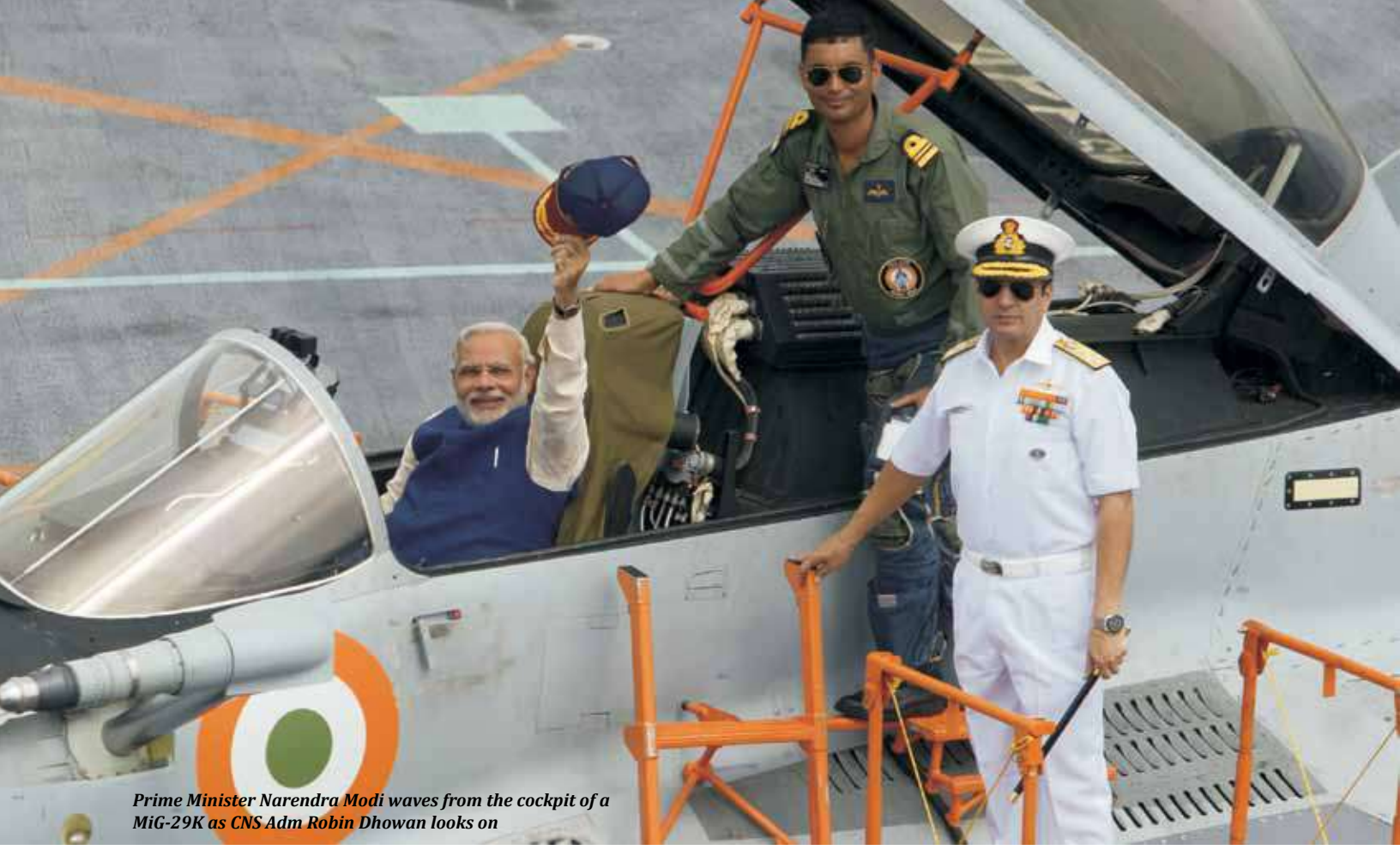
The Defence Acquisition Council (DAC) convened for the first time under the new government on 19 July, and underlined the push for indigenisation with a series of procurement approvals totalling Rs 21,000 crore. Defence Minister Arun Jaitley chaired the meeting, with DRDO chief Avinash Chander, Defence Secretary RK Mathur and the three service chiefs among those also in attendance.

Of the major procurements cleared during the DAC meeting, four were big-ticket purchases for the Navy and Coast Guard. The first (and largest) of these is a Rs 9,000 crore tender for construction of five fleet support ships, open to all public and private sector shipyards. Government-owned Goa Shipyard Limited (GSL) is to receive an order for five offshore patrol vessels (OPVs) worth Rs 2,000 crore, while Garden Reach Shipbuilders & Engineers Limited (GRSE) are to build five fast patrol vessels (FPVs) worth Rs 360 crore. Additionally, purchase of 32 maritime variants of HAL's Dhruv ALH for the Navy and Coast Guard were cleared, at the cost of approx. Rs 1600 crore. Addressing a deficiency in the search-and-rescue (SAR) capabilities of the armed forces, a combined purchase of SAR equipment for the three services worth around Rs 900 crore was also cleared.

Surprisingly, the Rs 15,000 crore 56-aircraft 'Avro replacement programme', which had faced opposition from its very inception, was once again given the go-ahead, with Defence Minister Jaitley noting that "this is a significant project in which the private sector will be the sole player and will lead to capacity building." In a repetitive refrain, according to the tender, "a qualifying foreign manufacturer will supply 16 aircraft in flyaway condition and produce the remaining 40 aircraft in India with an Indian private sector partner". The policy to allow only the private sector to participate in this tender had been agreed to by Jaitley's UPA predecessor AK Antony, but then-Minister for Heavy Industries Praful Patel opposed HAL's exclusion from the programme, stalling its approval until legal opinion overruled his objection. The programme's bid submission date has accordingly been extended to 28 August 2014.

More on this subject later.

The Indian Navy and Coast Guard presently operate a small number of HAL Dhruvs in the utility and SAR roles (photo: Angad Singh)



Prime Minister Narendra Modi waves from the cockpit of a MiG-29K as CNS Adm Robin Dhowan looks on

New PM on new Carrier

On 14 June 2014, the newly-elected Prime Minister of India, Narendra Modi was welcomed aboard INS *Vikramaditya*, the Indian Navy's new flagship, who then dedicated the vessel to the nation as it sailed off the coast of Goa. This was the PM's first military visit after taking charge and he addressed Indian naval personnel on board the aircraft carrier, stating that induction of the *Vikramaditya* was a "a matter of pride and happiness."

He also made a strong commitment towards self-reliance in the manufacturing of defence equipment, saying, "We need to give immense importance to the latest technology. This will help the nation. Why should we import defence equipment? We must be self sufficient. Why can't we send our defence equipment to other nations?"

The Prime Minister also reiterated his stance on a number of military-related

MiG-29KUB of INAS 303 ('Black Panthers') conducts a missed approach as part of the aerial display (photo: Sitanshu Kar/MoD)

Modi salutes Western Navy ships as they steam past the Vikramaditya

issues, promising to set up a War Memorial as well as reaffirming the government's commitment toward the 'One Rank, One Pension' (OROP) scheme for defence personnel.

The PM had flown in a Sea King Mk.42C and was given a ceremonial guard of honour by the Navy, following which he was briefed about the new aircraft carrier. He also sat in a MiG-29K fighter parked on the flight deck. Mr Modi was accompanied by Minister of State for Defence Rao Inderjit Singh, National Security Adviser Ajit Doval, Defence

INS Tarkash and another Talwar-class frigate conduct a live fire demonstration

Secretary RK Mathur and Navy Chief Admiral Robin Dhowan.

A planned air display by various Indian Navy assets was hampered by bad weather, as was an arrested landing intended to be made by a MiG-29K, which had to be called off owing to extremely rough seas. However, a number of naval aircraft, including MiG-29Ks, Sea Harriers, Boeing P-8Is, Tu-142MK-Es, Dornier 228s, Il-38SDs, Ka-31s and Sea Kings conducted flypasts over the carrier. The PM was also witness to a series of manoeuvres carried out by ships of the Navy's Western Fleet including the aircraft carrier INS *Viraat*, *Delhi*-class destroyers and *Talwar*-class frigates.

INS *Vikramaditya* was commissioned into the Indian Navy by the then defence minister AK Antony on 16 November 2013 in Severodvinsk, Russia (see *Vayu VI/2013*). She then sailed to her homeport of INS *Kadamba*, in Karwar, Karnataka where she was prepared for operational duty.

INS Viraat seen alongside Vikramaditya with Sea Kings and Chetaks embarked (photo: Sitanshu Kar/MoD)

Sea King Mk.42C conducting a flypast amid dreary weather (photo: Sitanshu Kar/MoD)

INS Mysore seen steaming alongside Vikramaditya, the choppy seas also visible to good effect! (photo: Sitanshu Kar/MoD)

Il-38SD from INAS 315 'Winged Stallions' seen with distinctive ESM turret, search radar and MAD boom (photo: Sitanshu Kar/MoD)

A Boeing P-8I from INAS 312 represented the very latest of Indian Naval aviation assets (photo: Sitanshu Kar/MoD)

Also from INAS 312 was the gargantuan Tu-142MK-E (photo: Sitanshu Kar/MoD)

Naval Commanders' Conference

Admiral Dhowan interacting with the CAS and COAS

"Expansion & future growth to remain anchored on self-reliance and indigenisation"

The bi-annual Naval Commanders' Conference was conducted at New Delhi between 24 and 26 June 2014 where the new Defence Minister Arun Jaitley complimented the Indian Navy on its "all round performance". The conference also presented an opportunity to Naval commanders to interact with MoD officials and the other service chiefs. General Bikram Singh, COAS and Air Chief Marshal Arup Raha, CAS, also addressed the Navy's PSOs and discussed issues pertaining to joint operations and military synergy.

Admiral RK Dhowan, who chaired the event, addressed the Navy's top leadership in his first Commanders' Conference as CNS. The Admiral outlined three inter-related priorities: sustaining combat readiness, building capabilities for the future and addressing human resource challenges. The senior naval commanders present also discussed several other important issues during the conference, including operational readiness, coastal security, maintenance philosophy, infrastructure development and foreign cooperation initiatives.

The CNS emphasised that combat readiness of the fleet and other operational formations were of prime importance and focused efforts are required at all levels to ensure the sustained growth of the Navy into "a formidable multi-dimensional force". Asserting that induction of INS *Vikramaditya* with integral fighter aircraft is a substantial boost to the Navy's capabilities, the Admiral also stated that the Navy's surface capability is further poised for a quantum jump with the induction of the INS *Kolkata* (*Project 15A* destroyer) and INS *Kamorta* (*Project 28* ASW frigate) in the near future.

The CNS expressed satisfaction at the steady augmentation of assets in the aviation arm of the Navy with progressive induction of Boeing P-8I long-range maritime reconnaissance aircraft, commissioning of the first HAL Dhruv ALH squadron and induction of BAE Hawk advanced jet trainers. Discussions were also held on the ongoing LCA (Navy) project. Capability gaps resulting from the ageing submarine fleet, shortage of integral helicopters in the fleets and the need for Mine Counter Measure Vessels (MCMVs) were also discussed.

The Admiral discussed the self-reliance programme of the Navy and stressed that indigenisation of platforms, weapons, sensors and equipment, through public as well as private sectors, should remain an area of focus. He emphasised that the "roadmap for the Navy's expansion and growth would continue to remain anchored on self-reliance and indigenisation."

The CNS reviewed the 'coastal security construct' and was satisfied with the steady progress made in strengthening the coastal security apparatus, through new inductions of Fast Interceptor Craft (FICs) and Immediate Support Vessels (ISVs) and the National Command Communication Control and Intelligence (NC3I) project. He asserted the need to remain ever vigilant and focused towards our coastal security responsibilities, through proactive coordination with other maritime agencies and coastal states. Admiral Dhowan also highlighted foreign cooperation initiatives and engagements, particularly the quick response of Indian naval ships and aircraft deployed for SAR efforts for the ill-fated Malaysian Airlines flight MH370.

During the course of the conference, the CNS reviewed progress of various infrastructure projects in the pipeline and noted a need to adopt sustainable green technologies, re-cycling and waste management to reduce the carbon footprint of Naval bases. He also discussed the utilisation of resources allocated to the Indian Navy and stressed on the need for cost consciousness, especially in the acquisition of spares, equipment and machinery.

On the personnel front, the Admiral Dhowan stated that the Navy's greatest assets were its men and women and that "their morale and wellbeing should always remain a primary concern". The need to attract and retain quality manpower by focusing on measures to provide a high quality of life at all stages of a Naval career was also discussed. The CNS also applauded the contribution of civilian personnel, who form a large component of Naval human resources. He reiterated his vision to run a taut, effective and happy Navy.

The conference was concluded with the CNS complimenting all personnel of the Indian Navy for their professionalism and patriotism, and exhorting them to prepare themselves and the Navy to meet the maritime security challenges being faced by the nation. "We need to pull on the oars together to propel the Navy to greater heights," he said.

INS Kamorta

First of the new generation ASW Corvettes

There is visible alacrity as seen in the frenetic activities onboard India's newly-built anti submarine warfare (ASW) corvette INS *Kamorta*, docked at the fitting-out jetty (FOJ) of Garden Reach Shipbuilders & Engineers Ltd. (GRSE), Kolkata.

The frontline warship with stealth features, INS *Kamorta*, is readying to sail out from the GRSE FOJ to join the Eastern Fleet in its role as the Indian Navy's newest submarine hunter/killer. Known earlier by its GRSE 'Yard-3017' nomenclature where the keel was first laid and launched in 2010, the sturdy warship is first in its class of four ASW corvettes being built under Project-28 for the Indian Navy. ASW corvettes *Kadmatt*, *Kiltan* and *Kavaratti* are to progressively follow suit.

The corvettes are equipped with a host of anti-submarine warfare equipment, and are also designated to be deployed as advance screen for the Carrier Battle Group to counter any submarine threat to the force.

INS *Kamorta*'s designated Captain (Commander Manoj Jha) and the ship's

company (officers and sailors) have been engaged in carrying out checks of all systems and equipment onboard including the crucial gas-leak checks as per drills, as the date for the formal acceptance of the warship from GRSE draws closer. The warship was delivered to the Indian Navy at Vishakhapatnam in July 2014, where the nuclear submarine INS *Arihant* is also being built.

Self-Reliance

The ASW corvette brings to fruition a significant project in India's pursuit for self-reliance in indigenous warship building, bringing closer home the Navy's quest to be a 'Builder's Navy' as well as a true 'Blue-water Navy' with ships and submarines designed and built within the country.

Project 28 was conceived in 2005 and a detailed design phase followed. Designed by the Directorate of Naval Design (DND), the successful construction of ASW corvettes with advanced stealth features is testimony to the Navy's growing capabilities in designing state-of-the-art naval combatants comparable with the best in the world. [The ship incorporates a large number of state-of-the-art equipment, which are being installed on a naval warship for the first time.]

Stealth capabilities in the ASW corvettes have been designed by featuring the full-beam superstructure with contemporary 'X-form' and optimally sloped surfaces to reduce radar cross-section. The ship's hull form has been made highly efficient for excellent sea-keeping and manoeuvrability. With an overall length of 109 meters, it is nearly 13 metres wide at its maximum bulge.

The hull of the ship is built with special grade high-tensile steel (DMR249A) developed by Indian Navy and procured from SAIL. GRSE trained its team of welders to achieve conditions of near zero-rejection state. This grade of steel is being used for the first time on any indigenously built naval ship.

INS *Kamorta* has a displacement of 3400 tonnes, the ship powered by four 3888 KW diesel engines running at 1050 rpm, achieving a maximum speed of 25 knots. The ship can cover nearly 3,500 nautical miles at 18 knots. It will be manned by 14 officers and 150 sailors.

With about 90 per cent of the ship being indigenous, P28 corvettes introduce many features for the first time in any naval warship, many of these bearing testimony to really commendable indigenisation efforts undertaken by the Indian Navy jointly with

Indian industries for furthering self-reliance in warship building capability.

Amongst the many firsts, this ASW corvette incorporates a low-noise CODAD (combined diesel and diesel) propulsion system with hydraulic coupling between main engines and gearbox. Two controllable pitch propellers driven by two raft-mounted gearboxes are capable of twin output or single output as required. This mechanism reduces underwater noise making detection of the ship by hostile underwater threats extremely difficult, the four engines being mounted on the rafts, two on each, for driving the propellers. Indigenously developed IRSS (infrared signature suppression system) devices are fitted in engine exhaust for reducing infrared signature, enabling it to operate stealthily.

INS *Kamorta* is equipped with a reverse osmosis plant for freshwater generation. The sewage treatment plant with vacuum toilet facilities is fully compliant with International Maritime Organisation regulations. The ship is also provided with an operator friendly TAC (total atmospheric control) system for high combat readiness with improved habitability and features a fully air-conditioned modular type accommodation. Electrical power for the ship is generated by four diesel engine sets providing 3 MW and connected with the ship's network ensuring 100 percent redundancy at all times.

The ship is also fitted with sophisticated, indigenously-made stabilising systems. The propulsion and power generation units with damage control system, enveloped are equipped an 'Integrated Platform Management System' for achieving a superior state of control and integration. Equipped with an 'Integrated Bridge System', operational watch-keeping needs have been given a high priority in its design with optimal space availability for other watch-related activities.

The ship is also fitted with the latest communication systems and navigational aids. It is also the first naval ship fitted with bow-mounted sonar for enhanced underwater surveillance. Integration of indigenous surveillance radar (*Revathi*) for surface and air surveillance is another first on any Indian warship.

The weapon suite of the ship is formidable and will be capable of engaging ships, aircraft and shore targets besides having 'astounding' anti-submarine capability. It will be the first warship armed with an indigenous rocket launcher for ASW warfare, while also being the first warship armed with trainable chaff launcher (*Kavach*). The weapons and sensors include fire-control radar, surface-to-air missiles, close-in weapon system, medium-range gun system, surveillance radar, chaff system for counter-measures against enemy radars and missiles, torpedo launcher, anti-submarine rocket launchers, EW system, combat management system and advanced sonar system.

The ship is also capable of deploying a helicopter, which adds considerable punch to the ship's anti-submarine capability. With a foldable hangar door fitted with a rail-less helicopter traversing system fitted, helicopter operations from the corvette's decks will have a significant edge over existing platforms of other warships.

GRSE's growing stature

Currently engaged with projects worth Rs. 10,000 crore and credited with an 'Excellent' MoU rating for last three years, GRSE manufactures a wide range of high-tech modern warships and hovercraft including frigates, corvettes, ASW corvettes, landing ship tank, fleet replenishment tankers, landing craft utility ships, survey vessels, water-jet fast attack craft and interceptor boats.

GRSE turnover has since tripled in a little over five years, thus reflecting the healthy growth of the undertaking. GRSE now boasts of a strong shipbuilding division that includes design and manufacturing sub-divisions, and is perhaps the only Defence shipyard in the country that has its own engineering division.

The successful handing over of the first P28 ASW corvette to the Indian Navy will surely bolster GRSE's growing stature as a major warship builder not just within India but also on the global stage.

(All photos by GRSE, Major DD Rokade)

Clear and Present Danger

Non-traditional security threats in the Indian Ocean Region (IOR)

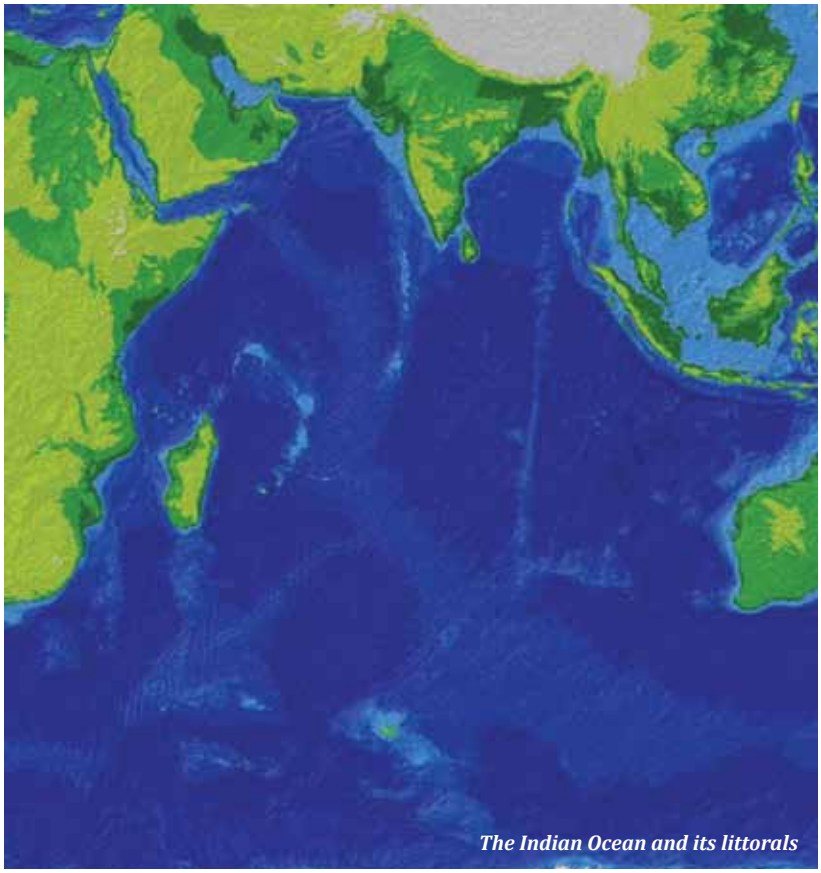
Aerial view of the Sendai refinery ablaze in the aftermath of the Japanese tsunami of 2011

The Indian Ocean Region(IOR) comprises 36 key and 20 peripheral States. This region contains about one-third of the world's population in 25% of its landmass. The region also includes numerous island territories of the littoral and other States and the IOR contains some important International Sea Lines of Communication (SLOC) such as the Straits of Hormuz, Malacca, Lambok and Sunda.

The Indian Ocean is the third largest ocean in the world. The IOR's littoral states contain more than two-thirds of the world's known oil reserves, 35 per cent of the world's gas reserves, 60 per cent of uranium, 40 per cent of gold, 80 per cent of all diamond deposits and a large variety of other mineral substances. These natural resources have created a great degree of wealth in some key Indian Ocean Region states, while others have either been lacking in resources, or, for socio historical reasons, have been unable to capitalise on such potential sources of wealth, largely owing to conflict or poor governance. The IOR a huge diversity of economies. It is estimated that approximately 60,000 ships cross the Indian Ocean each year, including nearly half of the world's containerised cargo. Only twenty per cent of the cargo transported through the Indian Ocean is traded within the region; the remaining eighty per cent is extra regional. The IOR an abundance of minerals, oil and natural gasses.

In an increasingly globalised network of nations, non-traditional threats to security are becoming significant. Their impact is as serious as that of traditional threats like those of military action, political unrest, regional conflicts and terrorism, among others.

Illegal migration is often carried out in dangerously rickety boats, leading to hundreds of deaths on the high seas



The Indian Ocean and its littorals

Human impact

With the growth of a global perspective, the movement between borders of land or water has vastly increased. The Indian Ocean itself has been the scene of irregular migration, which includes illegal migration smuggling, of which human trafficking has been of particular concern in the IOR. Countries of the eastern IOR, especially those located in Southeast Asia have been identified as a major source of such human trafficking.

All the countries in the region consider this phenomenon as a potential threat to their sovereignty. Even though governments make efforts to legally regulate migration, millions of people continue to seek passage to richer countries. The push and pull factors of economic need have given rise to a new class of criminals, one that preys on the aspirations of the migrant community.

Human trafficking operations are often carried out by terrorist groups, and this allows trained terrorists to enter other nations in the guise of refugees. Seeking asylum under false pretences, these terrorists not only intermingle with migrants and try to escape justice, but they often involve themselves in criminal activities in the countries that accept them and pose a threat to domestic security.

Natural disasters

Some of the most severe tropical cyclones are generated in the northern part of the ocean near the Andaman Sea and certain regions in that area experience heavy rainfall that often has devastating effect. Moreover, this region has been identified as particularly vulnerable to tsunamis.

Owing to the propensity of natural disasters in the IOR, the area is also known as the 'World's Hazard Belt' being regularly impacted by floods, droughts, cyclones, earthquakes, tidal surges, landslides, tsunamis, volcanic eruptions, epidemics and crop infestations.

Serious communicable diseases

The effects of transition on these societies are apparent in many ways, the consequences of these especially visible in relation to infectious diseases. Humans are engaged in a constant evolutionary struggle with microorganisms, with the latter poised to exploit changing circumstances.

Energy security

Energy is becoming a scarce resource in every part of the world. The decades since World War II have seen a variety of changes in the energy industry and the pursuit of energy supplies plays a major role in the relationships between nations.

As an example, a recent trade embargo in Iran has affected many countries including some super powers of the region. Furthermore if the 'Arab Spring' continues and spreads to other countries, this will have a direct impact on the IOR and could even evolve into a crisis at a later stage. If we analyse all these issues, the root cause of the problem is simply the thirst of having supremacy over the remaining world energy assets. The failure to generate renewable energy resources to meet the rising world demands puts tremendous pressure on existing resources, and by extension, the environment. The pressure to harvest resources like coal and natural gas has led to a number of problems such as deforestation, oil spills, ozone depletion and so on.

Bulk carriers are crucial to ocean trade and ensuring their free passage is key element of maritime security

This is manifested in the increase in chronic diseases such as Dengue, Malaria, Chikungunya, and HIV/AIDS, the emergence of new diseases such as Severe Acute Respiratory Syndrome (SARS), the re-emergence of diseases such as Tuberculosis (TB) and Diphtheria, and the threat of novel strains of infectious agents such as the H5N1 strain of influenza ('bird flu').

All of these developments highlight the dynamic consequences of social, medical, cultural, institutional and political change to public health. A renewed recognition of the threat posed by infectious diseases has compelled many countries in the IOR to consider this as a threat to national security.

Trafficking of flora and fauna

Many IOR countries have different biodiversity levels. The illegal trafficking of rare species of flora and fauna is amongst one of the most lucrative criminal trades in the world and, like other areas of organized crime, is smuggled across borders. Unchecked demand for exotic pets, rare foods, plants, corals, and traditional medicines is driving many species to the brink of extinction, threatening efforts to meet the global 2010 target to reduce biodiversity loss, and contributing to the spread to humans of virulent wildlife diseases such as SARS, avian influenza and the Ebola virus.

The illegal trade in wildlife and wildlife products that are indigenous to the region poses a threat to the balance of the ecosystem and it gives rise to a soaring black market, worth an estimated $10 billion a year. The creatures are trafficked through middlemen to rich markets in the west. The illegal wildlife trade is often linked to organised crime and involves many of the same culprits and smuggling routes as trafficking in arms, drugs, and persons.

Threats to the marine ecosystem

The Indian Ocean possesses a range of valuable natural resources including enormous amounts of mineral and energy resources that remain under-exploited.

Marine bio-security refers to the protection of marine environments from non-indigenous species, and this has direct implications on biodiversity in the marine ecological systems in the Indian Ocean. It has been found that invasive alien species are becoming a significant threat to marine biodiversity, where ballast water is viewed as a major cause of their proliferation.

The Indian Ocean region is also vulnerable to high levels of pollution caused by ocean dumping, waste disposal and oil spills as a significant amount of international trade takes place in the region's waters. The waste poses threats to the survival of marine organisms and consequently, on the marine ecosystem, on which millions of livelihoods depend. Overall environmental threat has impacted economic activities such as fisheries, tourism and also affected fragile ecosystems.

Indian Navy marine commandos have taken part in numerous anti-piracy operations in the IOR

Activities of extremists

For nations of the IOR, a primary security concern is stability in the region. It is evident that ethnic turmoil caused by race/religious extremism is prominent in the multi-ethnic countries of South Asia. Such conflicts are violently charged, generating militant separatist movements and proliferating readily available and highly trained terrorists.

The most notable aspect of such ethnically aggravated conflicts is the growth of terrorism in the region and its spill-over effects across the whole of the subcontinent. Continued tension in the region still continues to raise many fundamentalist terrorist groups with many different names under one common slogan – that of terrorism.

Drugs and arms trafficking

A symbiotic relationship closely connects the illicit trade in drugs and arms. The IOR hosts both the 'Golden Crescent' and 'Golden Triangle,' two enduring global centres for narcotics production. The combined value of drugs out of Myanmar, Afghanistan and Pakistan has been estimated at staggering $200 billion.

Drug trafficking is known to be the second largest profitable illegal business in the world after arms sales. With the enormous profit ratios involved, the networks that carry out such functions are highly influential and have access to the latest technology. Reports indicate that drugs are being smuggled in the cargo holds of dhows to Pakistan, Yemen, Oman, Saudi Arabia and the United Arab Emirates along the Arabian Sea. Drug trafficking therefore poses a serious challenge to maritime law enforcement agencies.

Prolonged internal conflicts have weakened a number of states around the Indian Ocean periphery. A heavy influx of arms since the Cold War has also left a legacy of arms smuggling in various sub-regions of the IOR.

Economic and financial crimes

The potential damage wrought by economic and financial crime has become increasingly clear over the past decade with a series of high-profile cases from IOR nations. Owing to this, many countries have severely damaged the credibility of a number of companies and financial institutions, leading to bankruptcy, loss of jobs and serious damage to both institutional and individual investors

In the developing world, however, the long-term impact on - and costs of - economic and financial crime for sustainable development are considerably higher. Indeed, many developing countries are particularly vulnerable to economic and financial crimes, given a number of factors, including weak regulatory frameworks and limited government capacity.

The challenge of conceptualising the extent of economic and financial crimes has been further complicated by rapid advances in technology that have provided new opportunities for such crimes.

Strategic significance

The Indian Ocean Region's significance in the global context derives from its economic and strategic significance. The vast differences between states in terms of geopolitical, socio-cultural and economic conditions create a complexity in the understanding of the various threats it is faced with. The role of security arrangements is thus one that must evolve in order to keep up with the changing nature of these threats. An understanding of the particular impact in a localised context is the key to finding a solution to the non traditional threats that are coming to the fore.

I conclude my essay with a famous quote from Sun Tzu :*"Determine the enemy's plans and you will know which strategy will be successful and which will not."*

By correctly understanding future threats and their origins, we can create strategies to overthrow them.

Indian Navy frigates Betwa and Trishul conducting manoeuvres in the Arabian Sea

SLNS Sagara (P622) seen docked in Sri Lanka — the vessel is among many that secure Sri Lanka's maritime domain

Lieutenant YK Rajapaksa, Sri Lankan Navy

(Note: This article was part of a supportive document for the Department of Navy in the National University of Defence of Ukraine, on 'Naval Forces' Effectiveness for Protection of Economic Activities of the State at Sea)

"Our Priority is in meeting requirements of the IAF"

VAYU Interview with

Vitaly Borodich (VB), Senior Vice President (Military Aviation), Irkut Corporation

VAYU: You have been in charge of combat aviation at Irkut for many years now. From your point of view, what has been main focus of the Su-30MKI programme?

VB: From the very start, our approach had been based on the perception that the Su-30MKI programme was not just to equip the IAF with a state-of-the-art combat aircraft, but on developing technological cooperation between aviation industries of our countries.

Harnessing the potential of Russia and India is a vital necessity for our two nations in this era of globalisation and increasingly intense competition in world markets. With implementation of the Su-30MKI programme, both countries have been developing their own competitive advantages.

In the case of Russia, we can refer to world-famous design institutes for combat aviation, modern technologies for military aircraft systems such as phased-array antennas, aircraft engines and related technologies, including thrust vectoring.

With reference to India, the Indian military have contributed to the programme by evolving the specifications of a modern fighter based on comprehensive analysis of regional conflicts. HAL and various highly developed IT industries of India have also contributed to the programme in a big way.

VAYU: Do you believe the main targets have been achieved?

VB: I personally believe that the programme's main aims have indeed been achieved ! Su-30MKI multi-role fighters

form the backbone of the IAF's combat fleet and will remain so in the foreseeable future. Once all current contracts are implemented, the IAF will have 272 of these aircraft. The majority of this number – 222 aircraft – will be co-produced with HAL, our main partner in India.

During implementation of the Su-30MKI licence production, specialists and experts from HAL and other Indian companies have mastered new competencies and technologies, shared with them by Russia. The MKI programme has actively involved major aviation industries, engines and parts manufacturers from both Russia and India.

Mastering of licence production by the Indian side has resulted in the phase of production from raw materials, thus confirming that Indian industries are now actually producing this aircraft. Additionally, high-tech products of Indian-origin, such as on-board computers, are not only installed on Su-30MKIs, but also supplied as integral parts of Su-30 family aircraft with the Air Forces of Russia, Algeria and Malaysia.

Military designers and engineers of our countries have forged a unique experience of cooperation, which has become a solid base for successful implementation of the Su-30MKI programme as well some new bilateral projects.

VAYU: In which manner do you see further development of the Su-30MKI programme?

VB: The most important part of a future MKI development is deep modernisation of this aircraft, so as to maintain their efficiency and superiority in the decades ahead. The Su-30MKI has tremendous potential for upgradation, particularly in avionics and armament. Technologies for such deep modernisation are readily available and can be implemented within a short period of time.

Major increase of the IAF's strike potential may be achieved by integration of two major Indo-Russian programmes : the Su-30MKI and BrahMos. At this time, integration of the BrahMos with the Su-30MKI is at the research and development phase. BrahMos JV has manufactured the prototype and a modified Su-30MKI is being developed in Russia.

The immediate task for us and HAL is the establishment of Su-30MKI overhaul facilities in India. Necessary documentation and equipment have been supplied to India and according to IAF plans, the first batch of aircraft is scheduled for overhaul during this year. I believe that HAL will achieve this target. We fully support all the efforts in increasing HAL's capacities in this area as well.

Undoubtedly, the priority of the joint Indo-Russian team is to keep the operational serviceability of the Su-30MKI at high levels, as necessary for meeting the IAF's tasks.

VAYU: What is the progress in this respect?

VB: Exploitation of modern combat aviation systems is a complex, multi-level process, during which course constant improvement of aircraft and their maintenance systems is carried out.

From the point of view of new technologies, the Su-30MKI has become a cutting edge aircraft. It is the first series-produced fighter with thrust vectoring engines which are integrated into the flight control system. As a result, this fighter has super-manoeuvrability and Indian pilots were among the first pilots in the world to have mastered this new combat manoevere. Besides this, many of the Su-30MKI's onboard systems are able to perform complex tasks in the auto mode.

Adaptation of these new features has dictated new approaches both in manufacturing, as well as in on-site maintenance at IAF flying units. Presently, alongside the IAF and Indian industries, we are implementing a set of efforts aimed at improvement, additional flexibility and optimisation of the whole system of technical maintenance and overhaul, supplying necessary equipment to a number of combat units.

At the same time, we are improving the Su-30MKI's avionics. From induction into service, in close cooperation with our Indian partners, we had developed and implemented new software versions which is another step towards increased efficiency of the aircraft and the reliability of its systems.

It should be emphasised that IAF pilots have made a major contribution to the fighter's enhancement in a really big manner. As top professionals, they are anxious to find new ways of getting the maximum from the Su-30MKI, and we Russians are really grateful to Indian pilots for all their inputs.

VAYU: Could you comment on recent reports in the media concerning problems in the IAF's Su-30MKI fleet?

VB: Firstly, we fully understand public concern on issues concerning national defence power. However in this case, the criticism on the Su-30MKI programme is not based on full and accurate data.

As you are probably aware, recent reports were based on stolen electronic documents and we cannot but note a certain degree of tendentiousness in the selection of leaked documents. Routine business correspondence involves many thousands of documents, which are not only about raising questions and concerns, but contain views on their settlement as well. In this regard, we do presume that leakage of a negative part of business correspondence may be part of an operation aimed at discrediting this programme. I would leave it to your readers to speculate on who gains from this.

VAYU: What is being done in order to improve the Su-30MKIs serviceability?

VB : The previous experience of our joint work proves that together with our Indian partners, we are successful in finding ways to improve the aircraft and its maintenance.

One current issue is connected with the increasing number of IAF air bases where Su-30MKI fighters are deployed. Mastering the operational serviceability of this complex multi-role fighter at new bases is a time-consuming exercise. As of today, Indian and Russian partners are focused on making this time-frame shorter.

We are ready to discuss new means of keeping Su-30MKI serviceability at the necessary level, such as contract servicing by the manufacturers' teams (specialists from Irkut and HAL). However our priority is in meeting requirements of the IAF.

Sukhoi Su-30MKI (photo: Angad Singh)

Garuda V at Jodhpur

Exercising with the Rafale

The Indo-French Air Force Exercise *'Garuda V'* commenced on 3 June 2014 at Jodhpur AFS, Rajasthan, successfully concluding after ten days of intensive joint operations with both Air Forces engaging in various combat missions including air-to-air refuelling, air-defence and precision strikes. The exercise involved IAF aircraft from the Gandhinagar-based South Western Air Command and Allahabad-based Central Air Command. *Garuda V* witnessed maiden participation of the Rafale in an air exercise in India.

The French detachment to Jodhpur comprised four Rafale 'omnirole' combat aircraft from Fighter Squadron 3/30 *'Lorraine'* and one C-135FR tanker from Air Refueling Group 2/91 *'Bretagne,'* while the IAF fielded Su-30MKIs, MiG-21 Bisons, MiG-27UPGs, as well as an IL-78 tanker and an IL-76 'Phalcon' AWACS. A total of 94 *Armée de l'Air* personnel were deployed, including nine Rafale aircrew and twenty-seven Rafale technicians.

Garuda exercises have been conducted alternately in France and India since 2003:

Garuda I : February 2003, Gwalior, India, in the presence of the French Chief of Staff. It was the first fighter-to-fighter exercise between the Indian Air Force and a foreign Air Force.

Garuda II : June 2005, Istres France. It was the first IAF exercise in Europe.

Trio of Rafales lining up for take off

Rafales on the flight line

Garuda III : February 2007, Kalaikunda Air Force Station, India

Garuda IV : June 2010, Istres France. First cross-refuelling on each other's tankers. First edition of the exercise in trilateral format was with Singapore.

Objectives of the *Garuda* series of exercises are to share know-how between French and Indian pilots, to enhance interoperability and cooperation between French and Indian Air Forces, including the key aspect of mid-air refueling. The aircrew conducted daily combat training missions against or alongside each other, which were reported to be both "challenging and realistic". "Sharing operational lessons from these joint missions has enhanced the operational capabilities of both countries as well as reinforced the longstanding cooperation between them". Conducted as it was, in a professional and friendly spirit, *Garuda V* has contributed significantly to the camaraderie between the units involved, in keeping with the spirit of the 'strategic partnership' between France and India.

Also notable during Garuda V were combat sorties by the IAF CAS, Air Chief Marshal Arup Raha, and his French counterpart General Denis Mercier. The former flew in a French Air Force Rafale B while the latter reciprocated in a Su-30MKI. Both Chiefs also interacted extensively with the pilots and technicians of the two Air Forces.

Angad Singh

Sukhoi Su-30 MKI taxing back to dispersal

Images from Garuda V (all images IAF PRO)

Su-30MKI mid-air refuelling

MiG-27UPG comes into land

MiG-21 Bison on short finals

Rafales on arrival at AFS Jodhpur

Joint aircrew briefing at Jodhpur

The two Air Chiefs with Rafale: French CAS Denis Mercier with Air Chief Marshal Arup Raha, CAS, IAF

The global helicopter market

Airbus Helicopters EC175

Updates, upgrades, new developments

According to an annual *Turbine-Powered Civil Helicopter Purchase Outlook**, it is expected that 4800–5500 civilian-use helicopters will be delivered over the years 2014–2018. Overall demand remains 'steady' versus the 2013 five-year forecast, with large fleet operator requirements offsetting a moderate softening in new helicopter purchase plans as reported in the survey. Latin America continues to lead all regions in new purchase rates, with up to 32 percent of respondent fleets slated for turnover with a new helicopter replacement or addition.

The forecast of civil turbine-powered helicopter purchases has the five-year share of demand from the US and Canada at 26 percent, which combined with Latin America represents 50 percent of the total global demand. Europe's share follows closely with 23 percent, with the Asia-Oceania region accounting for 19 percent, and Africa and the Middle East ranking under 8 percent.

"Global demand looks steady on the heels of a strong 2013 performance," observed Tom Hart, Vice President, Defence and Space Sales, Honeywell Aerospace. "Utility helicopter purchase interest is trending upward. Helicopter replacement cycles and increased operating hours in the law enforcement and oil and gas industries help sustain demand in those sectors. Several new platforms are scheduled to enter service in the next few years and this also is expected to bolster overall demand."

Operators who intend to purchase a helicopter within the next five years have noted that the age of their current aircraft, contracted replacement cycle and warranty expiration were key drivers for their decision. For those surveyed, the make and model choice for their new aircraft is strongly influenced by range, cabin size, reliability and safety, hot/high performance, and brand experience.

Moderately lower survey purchase plans were recorded in all regions this year; however large fleet or 'mega' operator requirements not included in the survey offset the softer results returned by survey

**Honeywell Aerospace*

respondents. As a result, total projected demand remains stable at relatively strong levels in the near term.

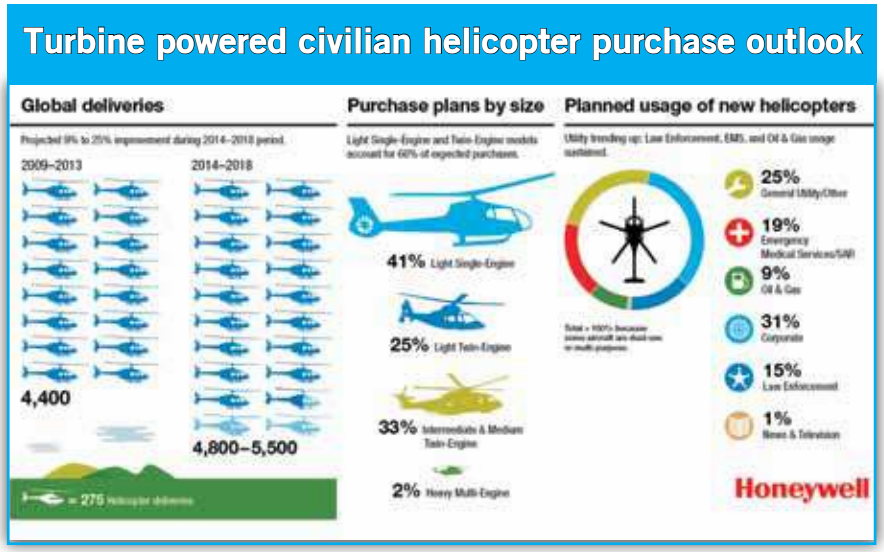
A significant part of the European pullback stems from a large drop in Russian buying plans compared to a year ago. The sample of Russian operators responding grew in 2013-14, but remains small and adds some volatility to the overall European results.

Latin America continues to have the highest fleet replacement and growth expectations among the regions. In terms of projected regional demand for new helicopters, Latin America now rivals Europe to claim the world's second-largest regional market, behind North America.

"With demand for new helicopters remaining steady, and aircraft lasting longer through replacement cycles, Honeywell is ready to support both new installations and fleet upgrades worldwide," continued Hart. "Our propulsion, safety, navigation, communications and flight services can help aircraft stay efficient, powerful, reliable and safe throughout their entire time in the air."

Demand in high-growth regions remains fluid with strong results recorded for China in the 2014 survey, while Brazilian purchase plans remain fairly stable and Indian respondents report more conservative purchase plans for new helicopters this year.

In terms of operator preferences by class of helicopter, light single-engine helicopters continue to be the most popular class, with the Airbus EC130/AS350 series, Bell 407 and Robinson R66 the most frequently mentioned models. Intermediate/medium twin-engine helicopters followed closely behind, with 33 percent of respondents planning to acquire a new model of this type. The most frequently mentioned models were the AW139, AW169, Bell 412, EC145 and Sikorsky S-76 series helicopters. The light twin helicopter class featured in 26 percent of total operator purchase plans in the 2014 survey, with the EC135, Bell 429 and AW109 series helicopters noted the most frequently. Finally, heavy multi-engine helicopters, such as the EC225, Mi-8/17 and S-92, registered a small decline in purchase plans in the 2013 survey; however, demand from large oil and gas fleet operators not included in the survey continues to support overall volume in the heavy class.




Kazan's Ansat

Sikorsky S-76

AgustaWestland AW169

Bell 429 (photo: Angad Singh)

Respondents were asked to indicate their current satisfaction over the last year with each model of aircraft they operate. The models with the highest net scores were the AW139, Bell 407, Bell 412, EC120, EC130/EC350 series and Sikorsky S-76. These top platforms account for nearly 50 percent of all survey make/model mentions and can be considered the top current production helicopters in terms of recent customer satisfaction attitudes and likelihood to promote. Many other make/models currently in production also received excellent scores that did not make it into the top six listing.

Of note was the fact that the study expected helicopter fleet utilisation to increase over the coming year. 20 percent of operators in North America, the largest regional market, planned increased fleet utilisation while 7 percent looked to decrease the rate of operations. In Europe, 22 percent of operators plan increased helicopter usage, while 6 percent look to drop usage. Riding on the large growth rate in the region, 36 percent of operators in Latin America plan increases, and only 4 percent plan decreases. In Asia too, 29 percent of operators plan increases, and 6 percent plan decreases. 23 percent of African and Middle Eastern operators plan increased helicopter use, while 11 percent plan to decrease.

When examining usage trends across segments, oil and gas was the highest at an annual average of approximately 720 hours per aircraft, followed by law enforcement at more than 400 hours per year. Tourism, emergency medical services and general utility were closely grouped at approximately 375–400 hours per year. Corporate segment operators reported the lowest average use at just over 300 hours per helicopter per year.

The Market for Light Military Rotorcraft

In a recent study titled 'The Market for Light Military Rotorcraft,' *Forecast International* predicts that 1,411 light military rotorcraft will be produced in the 10-year period between 2013 and 2022. The Connecticut-based market research firm estimates the value of this production at $23.6 billion

in constant 2013 US dollars. The study defines a military rotorcraft as light when it has a maximum gross weight of less than 6,804 kilogrammes (15,000 lb). The light military rotorcraft market has slowed after experiencing substantial growth in much of the previous decade. Annual production of light military rotorcraft more than doubled between 2006 and 2010, as yearly output rose from 94 units in 2006 to 209 in 2010. By 2012, though, production totalled 180 units, and it is predicted predicts that further decline is in store over the next 10 years.

According to *Forecast International* senior aerospace analyst Raymond Jaworowski, "the trend in annual production in the light military rotorcraft market over the next 10 years will be somewhat uneven, but the overall trajectory will be downward." The company's projections indicate that annual production will decline to 109 units by 2022. Says Jaworowski, "A shrinking market usually results in a fiercely competitive market, and the light military rotorcraft sector will be no exception. Manufacturers will aggressively compete for every upcoming procurement."

The light military rotorcraft market is being impacted by the fact that defence budgets in many nations are being reduced as governments, in the midst of severe financial straits, look to cut overall spending. In addition, a number of acquisition programmes for light military rotorcraft will come to an end in the next few years. Very few new programmes have emerged that would help keep overall production in the market on an upward, or even stable, course during the forecast timeframe. The situation is especially acute in the US and in much of Europe. However, the study does see some regional bright spots in the market for manufacturers, such as Latin America, the Middle East and South Asia.

The study includes projections of manufacturer market shares for the 2014-2022 period. Accordingly, Airbus Helicopters and Bell will be the leading manufacturers of light military rotorcraft during the 10-year timeframe, with Airbus Helicopters leading in unit production and Bell leading in monetary value of production.

Upgrade Market worth $5bn in 2014

Helicopters are essential to most military operations and extending the service life of rotorcraft has become a priority for many armed forces. Upgrading helicopters is less costly than acquiring new helicopters, just one of the reasons research from industry intelligence provides. The new report predicts a growing market for military helicopter modernisation this year, with a total value of $5.04bn calculated in 2014.

This new report, '*Military Helicopter Modernisation, Upgrade & Retrofit Market 2014-2024: Prospects for Leading Companies*' provides details of several major programmes ongoing worldwide that it believes will provide substantial demand in the short term. However, the lead rotary-wing analyst highlights a likely shift in the market over the long term as programmes are completed. Commenting on the publication of the report, the analyst said, "Although our research points to several more years of growth in the military helicopter modernisation market, companies seeking to capitalise on this growth should act fast, as opportunities in the market will begin to dwindle in the medium to long term."

Indian Air Force Mi-17V5 at Palam (photo: Angad Singh)

Developments in the Helicopter World

T129 ATAK for Turkey

Turkish Armed Forces took delivery of their first T129 ATAK Advanced Attack and Tactical Reconnaissance Helicopter on 22 April 2014. This was during an official ceremony on 10 June, the first of 59 helicopters, 9 in T129A Early Delivery Helicopter (EDH) configuration, and 50 in T129B configuration. T129 ATAK, is a new

generation, tandem two-seat, twin engine helicopter specifically designed for attack and reconnaissance purposes, developed from the combat proven A129CBT and incorporating totally new system philosophy with new engines (LHTEC CTS 800-4A), new avionics, visionics and weapons, modified airframe, uprated drive train and new tail rotor.

The T129A is equipped with a nose-mounted 20 mm. turreted gun with 500 rounds capability and can carry up to 4 rocket launchers under external pylons with a total of 76 unguided rockets. The T129B version will also feature MIZRAK ATGMs and CIRIT (70 mm. Laser Guided Rockets) designed for Turkish Armed Forces and Stinger air-to-air, ensuring multirole day and night capabilities.

7500th Mi-8/17 from Kazan Helicopters

On 23 May 2014, Kazan Helicopters, delivered the 7500th Mi-8/17 series helicopter, which was handed over to the Russian Air Force. Mi-8/17 series helicopters have by far been the Russian helicopter industry's bestsellers with over 12,000 produced and supplied to customers in over 100 countries around the world. Three main configurations of the Mi-8/17 are in production today: Mi-8MTV-1 (export variant Mi-171V), Mi-8MTV-5 (export variant Mi-17V5) and the Mi-172.

Recently Kazan Helicopters marked delivery of the 3,500th helicopter for export, a Mi-17V-5 to the Indian Air Force.

The Mil Moscow Helicopter Plant, which developed the helicopter, and Kazan Helicopters are presently working to upgrade and modernise Mi-8/17 series helicopters.

A step-by-step upgrade programme for the Mi-17V-5 is in place, as is the development of the new Mi-171A2.

123 Airbus Helicopters for China

During German Chancellor Angela Merkel's state visit in Beijing where she met with Chinese Premier Li Keqiang, Airbus Helicopters signed orders for 123 civil helicopters with three customers from various Chinese provinces. The rotorcraft will be used for general aviation activities covering multiple missions including utility work, aerial tours, passenger transport, business aviation, emergency medical services and search and rescue. The three contracts were signed with Fujian Xinmei General Aviation Co. (GAC), Guangdong Baiyun GAC and Yunnan Fengxiang GAC. These 123 helicopters comprise mainly light single-engine helicopters from Airbus Helicopters' Ecureuil family, as well as the light twin-engine EC135.

First EC725 produced in Brazil

The first 'built-in-Brazil' EC725 has been delivered to the Brazilian Navy, marking a major milestone in Airbus Helicopters' role in supplying mission-ready multi-role rotorcraft for three military services and to develop a capable national helicopter industry. The handover occurred at the new 'rotary-wing centre of excellence' operated by Airbus Helicopters' Helibras subsidiary at Itajubá in Minas, Gerais. Representing a €160 million investment, the facility includes the EC725's final assembly line, test benches, a paint facility, training resources and a state of the art engineering center. Brazil's armed forces have received a total of 12 EC725s to date, with the previous 11 helicopters either supplied from Airbus Helicopters' production site in France or partially assembled at Helibras' Itajubá facility.

Sikorsky S-97 Raider "powered on"

Sikorsky Aircraft "turned on" electrical power for the first time to the S-97 Raider prototype helicopter, signaling successful installation of the avionics system and a major step toward completing assembly of the new and first light tactical rotorcraft featuring X2 Technology. This was on

28 May 2014, at Sikorsky's Development Flight Centre, where the aircraft is being assembled. With 'powering on' the cockpit multifunction displays and control display unit (CDU) are operational, as are the CDU controlled electronic circuit breakers. The aircraft thereafter undergoes electrical power and avionics Acceptance Test Procedures (ATPs) to complete the checkout of the remaining avionics, electrical, and flight control systems.

The Raider is targeted to fly by the end of 2014 and Sikorsky plan to demonstrate the aircraft's capabilities to the US military beginning in 2015. "The helicopter is a revolutionary rotorcraft that will deliver X2 Technology in a new light tactical rotorcraft designed to outmatch conventional military helicopters in speed, maneuverability, and high altitude operations." The fly-by-wire controlled helicopter will feature counter-rotating rigid main rotor blades for lift and forward flight, and a pusher propeller for high speed acceleration and deceleration. Sikorsky proved the efficiency of the rigid rotor co-axial design in 2010 when its 6,000-lb. gross weight X2 demonstrator helicopter achieved 250-knot flight speed, or twice the speed of conventional helicopters.

200th NH90 helicopter for Belgium

The 200th NH90, a TTH (Tactical Transport Helicopter) variant, was delivered to Belgian Defence and will be operated from Beauvechain Air Force Base. The handover ceremony took place during the annual NH90 Product Conference held in June 2014 at the German Army Aviation School in Bückeburg. The twin-engine, medium-size NH90 helicopter programme is managed by the consortium NHIndustries, the Company owned by AgustaWestland (32%), Airbus Helicopters (62.5%), and Fokker (5.5%).

Sikorsky contracted for new combat rescue helicopter

Sikorsky Aircraft has been awarded a US Air Force contract to develop new combat search and rescue helicopters, which will develop a derivative of the UH-60M Black Hawk model for the Air Force's rescue mission. The award of an estimated $1.28 billion Engineering & Manufacturing Development (EMD) contract includes development and integration of the rescue mission systems; delivery of four Combat Rescue Helicopters; as well as seven aircrew and maintenance training systems. Initial training of Air Force aircrew and maintainers and five Combat Rescue Helicopters are also expected to be delivered by 2020, once additional aircraft and training options are exercised. This is the first step in the eventual production and fielding of up to 112 aircraft with

a potential value of approximately $7.9 billion, to replace the USAF's aging HH-60G helicopters.

Canadian CH-147F Chinooks delivered

The Royal Canadian Air Force have taken delivery of its 15th CH-147F Medium-to-Heavy-Lift Helicopter, ensuring advanced operational capability for the Canadian Chinook fleet. The Canadian CH-147F is an advanced, multi-mission helicopter that features a modernised airframe with a long-range fuel system allowing it to fly twice as far as standard range models. An upgraded electrical system provides additional power and redundancy, while a fully integrated Common Avionics Architecture System cockpit and Digital Automatic Flight Control System reduces pilot workload and provides greater situational awareness. The aircraft also has an advanced Aircraft Survivability Equipment suite that includes a Directional Infrared Countermeasures system that increases crew safety while allowing operations to be conducted in a wider range of threat environments.

Brazilian Navy for Lynx Mk21A Upgrade

The Brazilian Navy's Naval Aviation has signed a contract for a major midlife upgrade of eight Lynx Mk21A helicopters. The contract, valued in excess of US$160 million (€117 million), includes replacement of the aircraft's engines with the CTS800-4N product from LHTEC, navigation, displays suite and mission avionics. A comprehensive support and training packagethat includes

a Flight Training Device is also included in the contract.

The new generation CTS800-4N engines, already used on the British Army Lynx Mk9A, the Super Lynx 300 and the AW159, will provide the helicopters with major performance improvements in hot and high environments, enabling increased payload and an extended area of operation. A new glass cockpit will be complemented by an advanced avionic suite comprising a tactical processor, satellite-based navigation system, traffic collision avoidance system, instrument landing system, radar warning receiver/electronic surveillance measures integrated with countermeasures dispensers and a full Night Vision Goggle compatible

cockpit, together with a new electrically powered rescue hoist.

Elbit introduces Helicopter SKYLENS wearable HUD

Elbit Systems have introduced the Helicopter version of the Skylens wearable head-up display for Enhanced Flight Vision System (EFVS) applications. Helicopter Skylens provides the aircrew with a true "out of the cockpit" view, displaying flight symbology for day and night operation in severe weather conditions. In limited visibility conditions, the pilot is able to fly 'eyes out' thanks to the wide field of regard display. Similar to its commercial counterpart, the Helicopter Skylens is packed in a lightweight, easy-to-install device, much like a pair of sunglasses. A "revolutionary approach to meeting the challenges of today's aviators, Skylens provides head-up information while minimising the dependency on airport instrumentation", say company officials.

Skylens is part of the Clearvision Enhanced Flight Vision System (EFVS) family, displaying high-resolution symbology and video on a transparent visor, providing pilots with cutting edge head out capabilities. The Elbit Systems' helicopter avionics product line for civil applications fuses both synthetic and real-time imagery using a unique design symbology and computer flight guidance. These features offer helicopter pilots a "real-world" view of the terrain along with all obstacles within their flight path, allowing them to "see and avoid" even when visibility outside the aircraft is limited.

Australian Helicopters order 6 AW139s

AgustaWestland and Australian Helicopters have contracted for AW139 intermediate twin-engine helicopters that will be operated for *Ambulance Victoria* under a 10 year agreement to perform Emergency Medical Service (EMS) missions. More than 770 AW139 helicopters orders have been placed by over 200 commercial and government customers in over 60 countries. The AW139s perform a wide range of roles including search and rescue, emergency medical services, offshore transport, VIP/corporate transport, law enforcement, homeland security and utility. AgustaWestland has a long history of providing state-of-the-art helicopters to both commercial and government customers in Australia and New Zealand. In total, over 50 AgustaWestland helicopters are currently in service in the region.

Kongsberg and AgustaWestland in co-operation

Kongsberg Defence Systems and AgustaWestland have signed a protocol for extending and increasing co-operation relating to Maintenance, Repair and Overhaul (MRO) of dynamic components (including various gear boxes) for the NH90 helicopter and a range of AgustaWestland helicopters. Key elements of the agreement are

NH90

essentially the transfer of technology, which includes the establishment of advanced test equipment that will enable the full functional testing of gear boxes at Kongsberg in Norway. In December 2013, Finmeccanica/ AgustaWestland signed an agreement with the Norwegian Ministry of Justice and Public Security for the supply of 16 (plus options for 6 more) AW101 search and rescue helicopters.

AW159 Wildcat FASGW integration contract

AgustaWestland has signed a contract with the UK Ministry of Defence to integrate,

test and install the Future Anti-Surface Guided Weapon (FASGW) Heavy and Light missile systems onto 28 Royal Navy AW159 Wildcat helicopters. The contract award was announced at the Farnborough International Air Show by Philip Dunne, Minister for Defence Equipment, Support and Technology. The two missiles are the MBDA FASGW (Heavy)/ANL (Future Anti Surface Guided Weapon (Heavy)/ Anti Navire Léger) and the Thales Light Multirole Missile (LMM) (FASGW (Light)). Both will be integrated onto the AW159 Wildcat to give it the ability to attack a wide range of surface targets ranging from small high speed surface craft up to large surface vessels such as corvettes, as well as coastal and land targets.

Thales Scorpion HMSD selected by Airbus Helicopters

Thales's Scorpion Helmet Mounted Sight and Display (HMSD) System has been selected by Airbus Helicopters for

production and integration into its future Helicopter Weapons Systems, following a full and open competition. Scorpion will therefore be an off-the-shelf product for all new Airbus helicopters platforms or upgrade retrofits. Scorpion provides full color symbology and video for day and night missions, in addition to targeting, sensor video, and potentially Degraded Visual Environment (DVE) imagery, giving armed helicopters considerably improved mission situational awareness and effectiveness.

Bangladesh Air Force orders AW139 helicopters

The Ministry of Defence (MoD) of the People's Republic of Bangladesh has signed a contract for two AW139 intermediate twin-engine helicopters. These helicopters, which will be delivered by the end of 2015, will be operated by the Bangladesh Air Force to perform maritime search and rescue (SAR) and other utility missions. The contract, which includes a comprehensive support and training package, marks the establishment of the first dedicated maritime SAR helicopter fleet in the country. The Bangladesh Air Force's AW139s will feature an advanced mission configuration including search/ weather radar, FLIR, searchlight, rescue hoist, emergency floats and a state-of-the-art 4-axis dual digital AFCS with hover and SAR modes.

The vitality of SAR helicopters

VAYU Interview with

Lionel De Maupeou, Director for Sales, Marketing & Communication, Airbus Helicopters, India

Search and rescue (SAR) missions are perhaps one of the most complex and challenging of all helicopter missions. These missions gain even more importance in a country like India, characterised by a vast and varied terrain dotted by treacherous mountains, expansive deserts and a huge coastline. Last year's natural disaster in Uttarakhand and the role played by helicopters in the relief efforts is testimony to the importance of helicopters in saving lives when it matters the most.

***Vayu* spoke with Lionel De Maupeou, Director for Sales, Marketing and Communication for Airbus Helicopters, India on "the importance of helicopters during crisis and various roles they perform to help save lives."**

VAYU : What makes helicopters so essential for Search and Rescue missions?

LM: As the name suggests, SAR missions are in fact a combination of two distinct activities: determining the precise location where the help is needed, and then performing the rescue. Time is of the essence during these missions, as the help needs to reach the victims as quickly as possible. Also, hostile terrain and bad weather make the task difficult, often making landings impossible.

Helicopters are necessary for SAR missions because they provide immediate response, swift access to the site, have the ability to fly low and in and out of tight spaces and most importantly, have hovering capability. The hovering capability enables the rescue where a landing may not be possible as the rescuer can be rappelled down to prepare the victim who can then be hoisted back up to the helicopter.

Also, as the rescue missions need to be carried out in all weather and at any time of the day, the 'all weather' SAR concept developed for SAR helicopters enables them to handle the most difficult types of missions in all types of weather, over all types of terrains with day and night flight capabilities. Thus, helicopters are most effective in adverse situations and ensure mission success due to their unparalleled versatility and latest technology backed by the right mission equipment.

VAYU : Please comment on helicopters used for SAR missions in India ?

LM: A distinction can be made between sea SAR missions and mountain rescue missions. In the first case, medium-heavy helicopters such as the EC225 and soon-to-be-launched EC175, as well as medium and light-twin helicopters, such as the

AS-365N Dauphin 2 of the Iceland Coast Guard

AS365 N3e and EC145T2 are preferred for their hot and high performances ; in the second, reduced dimensions and highly manoeuvrable light helicopters such as the AS350 and EC135 are well suited for the job.

While India enjoys a unique blend of mountains, deserts, coastline and a huge forest cover, it faces an equally unique challenge of providing search and rescue in such a vast and varied landscape, especially in far flung corners of the country. The Uttarakhand flood and rain disaster last year is a case in point of these challenges, when access roads to rain hit areas were completely severed and many lives were in grave danger. India also has many mighty rivers crisscrossing several densely populated urban and rural areas facing flood threats during monsoons.

Helicopters have come to be a mainstay of India's search, rescue and relief operations across the country in all sorts of calamities because of their versatility, reliability and operational competence as recently witnessed during the 2013 Uttarakhand floods. The Indian defence forces have been conducting helicopter-based search, rescue and relief operations over the years. However, the helicopter fleet availability for SAR will most probably have to be strengthened considering India's vast expanse and defence force's own requirements. This was exemplified during the Uttarakhand disaster when commercial helicopters were pressed in service to meet the challenge and augment the relief efforts considering the scale of the calamity and the urgency to provide SAR support.

VAYU : Considering the difficulties, which types of helicopters can perform SAR missions?

LM: Helicopter SAR is a unique mission performed in the most challenging circumstances. To perform a SAR mission, when lives are at stake, is a tremendous responsibility. Saving lives, in the most difficult situation requires a perfect, fast and high-performance helicopter.

SAR helicopters require different types of equipment onboard to carry out SAR missions properly. Search and localisation equipment such as radar, GPS, electro-optical or infrared sensors are very important, as it is often difficult to locate victims in high seas. Radio equipment is also crucial for communications with civil and military personnel, and even with the survivors themselves. Once the rescue site has been located, a hoist is used—often with a stretcher or net—to lift survivors who may be wounded or unconscious, on board the helicopter. Another critical system is the autopilot and its SAR modes and the one Airbus Helicopters offers is 'generations ahead' of any other in the world. This, when combined with modern avionics suite, allow the flight crew to focus on their work by reducing the workload and thereby ensuring a safe and successful mission.

Airbus Helicopters' specialised SAR helicopter entered the market in the 1980s, and achieved a huge milestone when it won a major contract with the US Coast

Civilian helicopters like this Uttarakhand government-owned EC135 played a vital role in SAR operations during the 2013 floods in northern India

Guard for 95 Dauphins. Since then, this helicopter remains a reference in SAR missions as it features advanced technology and is designed keeping safety in mind with redundant systems and robust components.

Airbus Helicopters has an unmatched legacy of technology and expertise in SAR missions. Considering the severe conditions and challenging requirements of a rescue mission, the EC225 is just the machine for the job ! It is the only new generation helicopter designed for all types of SAR missions. The EC225 offers endurance, speed, range and superior performance, provides an ideal platform for both survivors and crew with its low vibration levels and exceptional comfort. As it is equipped with cutting-edge technology such as outstanding human-machine interface and automatic flight control system (AFCS), pilots have everything they need at their fingertips to perform precise, safe and successful missions.

Thus, the success of a SAR mission depends on the right aircraft equipped with the right equipment, latest technology and a crew with extensive experience.

The EC225

***VAYU**: How established is the helicopter SAR segment?*

LM: Over 1,500 helicopters around the world are specialised in SAR missions: 400+ in the civil sector (26%) and 1,100+ military helicopters (74%). In fact, the actual numbers are quite likely much higher, as many military helicopters perform SAR apart from their primary missions and are not classified as SAR aircraft. The same holds true for civil helicopters operated by civil security agencies and offshore transport companies. For instance, helicopters used in the oil and gas sector are mainly used for passenger transport, but they can also be called upon to perform light SAR activities during exceptional emergency sequences.

The geographic breakdown is as follows: Europe (in particular Western Europe) leads with over 540 aircraft dedicated to SAR missions; Asia-Oceania with over 400; USA/Canada with close to 350; Africa/Middle East (mainly the Middle East, which has only just begun to acquire SAR aircraft, for a total of almost 160 helicopters), and finally Latin America with over 80 units (mainly military).

Airbus Helicopters is the leader in the military market and one of the leading manufacturers in the civil segment owing to its wide range and cutting edge technology. While the EC225 and Dauphin account for the bulk of the Airbus Helicopters fleet currently, the EC175 shall lead the way in the near future. Eurocopter is committed to be at the forefront of helicopter SAR segment by providing the latest technology and the best products.

The Indian Navy has a dedicated SAR unit, INAS 321 operating SA316B Chetaks from INS Hansa, Goa

The Flying Artillery

Boeing's AH-64E Guardian

On 22 December 2010, the United States Defence Security Cooperation Agency (DSCA) notified Congress of a possible Foreign Military Sale (FMS) to the Government of India of 22 AH-64D Block III Apache helicopters, along with various engines, equipment weapons, training, parts and logistical support, in a deal worth $1.4 billion.

The original tender issued in 2008 featured six companies: Sikorsky, Bell, Boeing, Eurocopter (now Airbus Helicopters), Mil and AgustaWestland. Eurocopter and AgustaWestland pulled out early in the competition, while Boeing and Mil were shortlisted as finalists. Between Boeing's AH-64D Block III 'Apache Longbow' and the Russian Mil Mi-28NE 'Night Hunter', the AH-64D Block III emerged as the choice after extensive flying tests conducted by the Indian Air Force. The contract is likely to be signed in late 2014 (see box) and the attack helicopters are likely to enter IAF (or Indian Army) service from 2016 onwards under the designation AH-64E Guardian, featuring improved digital (Link-16) connectivity, joint tactical radio system, more powerful T700-GE-701D engines with upgraded transmission to accommodate more power, capability to control Unmanned Aerial Vehicles (UAVs), new composite rotor blades, full Air-to-Air Refuelling (AAR) capability and improved landing gear. The redesigned rotor blades increase cruise speed, climb rate, and payload capacity, while the updated Longbow radar has 'an over sea capacity'.

As per the notification, the Government of India is also requesting procurement of 50 T700-GE-701D engines, 12 AN/APG-78 Fire Control Radars (FCR), 12 AN/APR-48A Radar Frequency Interferometers, 812 AGM-114L-3 Hellfire Longbow missiles, 542 AGM-114R-3 Hellfire II missiles, 245 Stinger Block I-92H missiles and 23 Modernised Target Acquisition Designation Sight/Pilot Night Vision Sensors. There is also mention of global positioning systems/inertial navigation systems (GPS/INS), spare and repair parts, personnel training and training equipment and other related elements of logistics support.

Sensor technology remains a key advantage of the twin-engined AH-64D, well battle proven when deployed by the US Army in Afghanistan as part of *Operation Anaconda* and in support of *Operation Iraqi Freedom* to fulfil Close Air Support (CAS) roles. The AH-64D

Block III is also equipped with Northrop Grumman's AN/APG-78 millimetre-wave FCR capable of performing under poor-visibility conditions, less sensitive to ground clutter, while the short wavelength allows a very narrow beam width, resistant to Electronic Counter Measures (ECM). AN/APG-78 additionally incorporates an integrated AN/APR-48A Radar Frequency Interferometer for passive location and identification of radar-emitting threats. Block III includes increasing digitisation, the joint tactical radio system, enhanced T700-GE-701D turbo shaft engines (each providing 1,265kW) and drive systems, capability to control Unmanned Aerial Vehicles (UAV) and new composite rotor blades to increase the Apache's cruise speed (284-km/h), climb rate (889-m/min) and payload capability. The ferry range is 1,900 km and service ceiling is 6,400 m, with endurance being 3 hours 9 minutes.

Lockheed Martin has developed a new targeting and night vision system for the Apache, using second-generation long-wave Infra-Red (IR) sensors with improved range and resolution. The new system is called Arrowhead and has a targeting Forward Looking Infra-Red (FLIR) with three fields of view, a dual field-of-view FLIR, a Charged Coupled Device (CCD) TV camera, electronic zoom, target tracker and auto-boresight.

The Longbow Apache can execute an attack in 30-seconds while remaining behind natural terrain if necessary. The radar dome atop the rotor blades is unmasked for single radar scan and then masked again, enabling the processors to determine the location, speed and direction of travel of a maximum of 256 targets.

The Apache's 30-mm automatic M230 chain gun is located under the fuselage, with 1,200 rounds of ammunition and provides a rate of fire of 625 rounds a minute. AGM-114L-3 Hellfire Longbow air-to-surface missiles with millimetre wave seeker performs in full fire and forget mode up to a range of 12 km against armoured formations and fortified installations. Stinger Block I-92H Air-to-Air Missiles (AAM) are carried for armed escort and self-protection. In the close support role, the helicopter carries 16 Hellfire missiles on four rail launchers, along with 4 Stinger missiles. If integrated with the proposed AIM-9X Close Combat Missile (CCM), the helicopters will pose a reasonable threat to unsuspecting hostile fixed wing aircraft.

Hellfire missiles loaded on a US Marine Corps AH-1W Super Cobra

The proposed contract also includes 812 Lockheed Martin AGM-114L-3 Longbow Hellfire Anti-Tank Guided Weapon (ATGW) and 542 AGM-114L-3 Longbow Hellfire II ATGW. The AGM-114L-3 is a fire and forget weapon equipped with a Millimetre Wave (MMW) radar seeker coupled with inertial guidance, enabling Lock on after Launch (LOAL) capability, very effective against hostile multiple rolling armour. The MMW radar also rectifies the inherent limitations of Semi-Active Laser Homing (SALH) guidance system by providing capability in adverse weather and in the midst of battlefield obscurants such as dust, smoke and fog that are able to mask the position of the target or to prevent the designating laser from producing a detectable reflection. Besides autonomous homing on targets designated by the Longbow Fire Control system, the missile can also use advanced modes, currently being upgraded, which provide home-in on active jammers that try to degrade or disable the missile. The missile will also receive advanced countermeasures to defeat and cancel jammers. The AGM-114L-3 Longbow Hellfire weighs 49 kg, including the 9 kg tandem shaped charge High Explosive Anti-Tank (HEAT) warhead, and has a range of 12 km against armoured formations and fortified installations.

Complementing the AGM-114L-3 Longbow Hellfire will be the multipurpose 8 km-range AGM-114R or Romeo that uses a SALH guidance system and an integrated blast fragmentation sleeve (IBFS) warhead likely built around tandem shaped charge HEAT to engage targets that previously needed multiple Hellfire variants. Hellfire II locks on before or after launch and can engage multiple targets simultaneously. The missile uses trajectory shaping to enable optimal performance in degraded weather along with automatic target reacquisition after loss of track in low clouds. The digital autopilot can be reprogrammed in flight, to home in on new targets when employed in a LOAL mode. Equipped with electro-optical countermeasures hardening, the missile is capable of operating with pulsed radar frequency or A-Code laser codes for those aircraft equipped with dual code capability. AGM-114R weighs 50 kg and travels at a speed of Mach 1.3. Laser guidance can be provided either from the launcher, such as the nose-mounted opto-electronics of the AH-64 Apache attack helicopter, other airborne target designators or from ground based observers, the latter two options allowing the launcher to break line of sight with the target and seek cover.

Sayan Majumdar

In Search of Time Lost

The Indian Army's Field Artillery Rationalisation Plan (FARP)

The Indian Army has not inducted any new howitzers since the initial receipt of Bofors' FH77B 155mm howitzers in 1987. Some 400 of these guns were received in the late 1980s and the number of operational FH77Bs have since dwindled to 200. In an effort to maintain integrity in the acquisition process, the Ministry of Defence resorted to blacklisting firms and scrapping tenders at the slightest hint of "foul play". In addition, there was a tendency to re-tender if the competition boiled down to a single vendor, a cumbersome and time-consuming process. The situation today is critical. India needs to acquire large numbers of artillery guns, and towards this end, an ambitious Field Artillery Rationalisation Plan (FARP) has been formulated, under which, over two thousand new pieces of artillery are to be procured.

Towed guns are the backbone of an artillery arm and the FARP calls for the procurement of 1580 155mm/52 calibre towed artillery guns. Of these, 400 are to be bought through direct sale, while the remaining 1180 would be domestically produced. Meanwhile, the Ordnance Factory Board (OFB) has been contracted to upgrade existing M46 130mm guns to 155mm guns as an interim measure. Apart from towed guns, India also requires a large number of self-propelled howitzers, both wheeled and tracked. As per the FARP, over 200 self-propelled wheeled howitzers (SPWH) and nearly 100 self-propelled tracked howitzers (SPTH) are to be procured. Finally, the Indian Army does not possess a single state-of-the-art Ultra Light Howitzer (ULH) in its inventory. ULH's are indispensible in treacherous

M777 being airlifted by a CH-47 Chinook

1 full page Bharat Forge ad

terrain such as the Himalayas. If the newly raised XVII Mountain Strike Corps is to have significant impact, this will have to be supported by a component of modern Ultra Light Howitzers. OFB's Light Field Guns are being used as a short-term measure, though in a modern battlefield scenario, these guns would be woefully outmatched.

At Defexpo 2014, the *Vayu* editorial team studied the guns competing to meet stated requirements of the Indian Army.

Kalyani Group's Bharat-52

An encouraging development for the Indian Army is that the Indian private sector now has guns on offer to fulfil requirements of the Field Artillery Rationalisation Plan. On their stand at Hall 12, Kalyani Strategic Systems Ltd. unveiled their Bharat 52 155mm/52 calibre howitzer. The Pune-based company recently took over the Austrian arms firm Noricum, with ownership to Gerard Bull's GC-45 design and then moved the entire manufacturing workshop to India. Kalyani has also purchased an entire artillery gun factory from Swiss firm Ruag. Given their expertise in engineering, the company has confidently set about absorbing and developing technology to successfully produce an Indian field gun.

The Bharat-52 is a towed artillery system, with a reported range of 40 km. In its self-propelled mode, the gun can be moved short distances at speeds of up to 30 kmph, while the automatic laying provides sufficient mobility with 'shoot and scoot' ability. Weighing a little more than 14 tons, the system has a 3-5 rounds per minute rate of fire.

Kalyani Group's Bharat-52

Kalyani's Garuda 105mm vehicle mounted gun

The *Vayu* team spoke with Rajinder Singh Bhatia, executive Vice President and CEO of the Defence and Aerospace Division of the Kalyani Group. Two years ago, the engineers at Kalyani began work on the Bharat-52 artillery system : "the project is self-funded and not in response to any tender," said Mr Bhatia. "The gun has been completely indigenously designed and built and the company is looking to commence field-testing soon." The fact that the Group has at its disposal decades of experience in metallurgy, material sciences and engineering is an important factor and their prior activities in manufacturing heavy machinery and the acquired capabilities means that production capacity is already in place.

Meanwhile, a deal signed with Israel's Elbit Systems in August 2012 led to the establishment of BF Elbit Advanced Systems Pvt Ltd. This would allow the Group to also offer artillery solutions based on Elbit Systems' ATMOS 155/52 Mounted Gun and the ATHOS 155/52 Towed Gun Systems.

BAE Systems M777

BAE Systems' Ultra Light Field Howitzer, the M777, has been in operation with US, Canadian, Australian and Saudi forces since 2005. Weighing only a shade more than 4 tons, the gun had long been slated for procurement to fulfil the Army's requirement of 145 Ultra-Light Howitzers of 155mm/39 calibre. The gun's light weight is achieved from the extensive use of titanium, allowing it to be air transported by helicopter. It has a rate of fire of 4 rounds per minute, or 2 rounds per minute in sustained firing mode. The M777 is also equipped with LINAPS (Laser Inertial Navigational and Positioning System) and is capable of firing GPS guided munitions (*Excalibur*).

The M777 case has become notable in defence circles in India given the constant delays regarding its acquisition. A deal for 145 howitzers at $647 million, aside from technical support and offset obligations, was initially agreed upon. However, delays meant that BAE Systems had to keep their production line open far longer than planned, pushing up the cost substantially, to $885 million. An announcement by the MoD in February 2014 postponing the acquisition of M777 Ultra-Light Howitzer

BAE Systems M777

The OFB Dhanush

still further means that Mountain Divisions of the Indian Army, its intended operators, will have to make do with substitutes for longer.

OFB's Dhanush

Part of the deal with Bofors in the late 1980s was that the Swedish firm would provide design and manufacturing technology for its 155mm/39 calibre howitzers. Now, over two decades later, the Ordnance Factory Board has developed a 155mm/45 calibre improved gun from those plans of the FH77B. Named the Dhanush, the howitzer features a longer 6975 mm barrel, offering a range of 38 km as compared to the 27km offered by the original Bofors gun. The self-propulsion system on the twelve-ton Dhanush allows movement of distances up to half a kilometre, also being equipped with an auto-laying system. Most importantly, the Dhanush has an

electronic sighting and laying system, a vast improvement from the manual aiming system of the Bofors gun. Dhanush is slated to be manufactured by OFB's Gun Carriage Factory in Jabalpur, where a production capacity of 18 guns per year is being set up even as OFB is looking to double that capacity by 2016.

Six prototypes have been produced so far, one of which was on display at Defexpo 2014. Winter user trials of the gun were held in Sikkim in early February, while summer trials were meant to take place in Rajasthan through April and May. Trials held in Rajasthan last July met with failure, the barrel of the prototype having burst during firing. OFB has, however, pushed on with its development. A BAE systems powerpack is in use as of now, and a state-of-the-art electronics suite developed by BEL has been installed. The army has placed an initial order for 114 guns, although this may rise to 414 if the gun proves successful.

Nexter Systems CAESAR

The Indian Army has projected an immediate need for 200 Self-Propelled Wheeled Howitzers (SPWH), for operation in the plains and semi-desert terrain. Previous proposals to fit a Denel gun on a Tatra chassis never materialised. Having tied up with Ashok Leyland and Larsen & Toubro, Nexter Systems of France unveiled their CAESAR wheeled self-propelled howitzer at Defexpo 2014.

Already in use with the French, Thai, Saudi and Indonesian armies, the CAESAR on offer to India is a 155mm/52 calibre gun mounted on Ashok Leyland's 6x6 Super Stallion chassis, capable of firing 6 rounds per minute. The gun has a range of 40km using standard high-explosive shells, although this can be increased to 42km using Extended-Range Full Bore rounds and 55km using rocket assisted ammunition. Nexter emphasises CAESAR's 'shoot and scoot' ability: the system can fire six rounds and be out of action in less than one minute forty seconds, avoiding lethal counter-battery fire. A five-man crew and 18 rounds of ammunition are carried on board, and the system is fitted with semi-automatic loading, automatic laying and relaying and has a hydraulically–operated firing ramp. CAESAR is equipped with Sagem's Sigma 30 Inertial Navigation System.

An important aspect of the CAESAR is the mobility it offers. The system has an operational range of 80km, and its combat weight of less than 18 tons which allows easy deployment using C-130, C-17 or Il-76 aircraft. French CAESAR systems have been deployed in Afghanistan and in Mali.

Nexter Systems CAESAR

Nexter Trajan

Apart from the CAESAR, Nexter Systems are also offering the Trajan 155mm/52 calibre towed gun system in partnership with L&T for the Army's towed gun programme. Trajan is based on Nexter's successful CAESAR system, using the Caesar oscillating ensemble, ordnance and recoiling system. The reliable screw breech, automatic locking and two-stage muzzle brake have also been incorporated in the Trajan. Under terms of the partnership, L&T will be the prime contractor and main industrial operator in India. L&T is also slated to design the lower portion of the Trajan under supervision of Nexter.

Like the CAESAR, Trajan has an effective range of 42km using ERFB shells and 55km using rocket assisted ammunition. The Inertial Navigation System is directly attached to the cradle in order to ascertain the gun's absolute position. The Trajan is equipped with an optional ammunition handling crane and automatic shell loading. The 14-ton gun is also fitted out with a diesel engine embedded in a front box, driving a pump and transmission, which gives the howitzer self-mobility capability to move short distances. Trajan also incorporates high elasticity steel that reduces the weight of the gun, allowing it to move on a single axle.

Samsung Techwin/L&T K9 Vajra-T

The other gun surveyed by *Vayu* was Samsung Techwin and L&T's K9 Vajra-T. The K9 Vajra-T is a 155mm/52 calibre Self-Propelled Tracked Howitzer, a variant of the K9 Thunder produced by Samsung Techwin. The gun is currently in use with South Korean and Turkish armies.

The K9 Vajra boasts a range of some 40km using Extended Range Full Bore ammunition but over 50km with rocket assisted projectiles. Its 1000hp diesel engine allows the tracked SPH to traverse vertical obstacles, trenches, fords and side slopes, with a maximum speed of over 67kmph. The self-propelled gun has a direct fire capability to sight and effectively engage tank size targets at close ranges and K9 Vajra also features an Automatic Fire Control System, powered gun elevation/depression and traverse system. Data can be transmitted via data link or on-board fire control equipment, allowing automatic gun laying. The automatic loading system receives projectiles from the storage bay and places them on the ammunition tray for ramming.

Self AD

Importantly, L&T and Samsung Techwin have emphasised advantages of the K9 package, comprising the K9 Vajra-T tracked Self-Propelled Howitzer, K10 Ammunition Resupply Vehicle (ARV) and K77 Fire Direction Control Vehicle (FDCV). Employing the same chassis as the K9, the K10 ARV can supply a substantially large amount of ammunition to the K9. It has a fully automated resupplying capability and a transfer rate of 12 rounds a minute. The K77 FDCV is a mobile command centre. The operational concept allows a K77 Fire Direction Control Vehicle to effectively communicate and direct fire of a battery of K9 Vajra-Ts.

Even with overhang of nuclear weapons looming over any future conflict, there is little doubt about the primacy of artillery in a modern battlefield: the Kargil conflict is testament to that. In essence, it is vital that the Indian Army set about replacing its diminishing inventory of howitzers. With the new Defence Procurement Procedure in place, there is impetus for the Ministry of Defence to fast track fulfilment of the FARP so as to infuse a substantial amount of technical know-how and capability into the Indian manufacturing sector and meet the Army's long needed requirement, and restore the artillery arm to its status of being 'Queen of the Battlefield".

Nexter Systems Trajan

Samsung Techwin/L&T K9 Vajra-T

Nexter Systems, L&T and Ashok Leyland in partnership in MGS programme

Nexter Systems, Larsen & Toubro Limited (L&T) and Ashok Leyland Defence Systems have signed a consortium agreement to collaborate for the Mounted Gun System (MGS) artillery programme of the Indian Army. The consortium will have L&T acting as prime contractor.

The artillery system proposed for the MGS programme is a version of the well-known CAESAR artillery system fitted onto a 6x6 Super Stallion chassis from Ashok Leyland. Unveiled for the first time at Defexpo 2014, the Indian version of the CAESAR was also on display at the Nexter stand at Eurosatory 2014. The customisation of the systems to fulfil specific Indian requirements will be done in cooperation between the three companies. Nexter and L&T are already teaming for the Towed Gun System programme of the Indian ministry of defence, by proposing the Trajan which is under evaluation in India.

IAI

F-INSAS : India's Future Infantry Soldier

F-INSAS is one of the most ambitious plans of the Indian Army for the next decade. The motivation is to create an Infantry soldier who is highly survivable, mobile, lethal and sustainable with outmatch capabilities vis-à-vis adversaries, 24x7 and in any type of terrain or weather. The soldier will be a self-contained unit with high degree of situational awareness and decision-making capacity in real time. While shortfalls and lapses in the programme cannot be ruled out, the prevailing security milieu demands that the Indian soldier has the requisite tools to fight the battles of modern warfare.

An ambitious project envisaged post the Kargil War of 1999, was 'modernisation' of the Indian infantry soldier. The 'futuristic infantry soldier as a system', more widely known by the acronym F-INSAS, is a huge step in this direction and came into effect in the year 2007. The project envisages achieving specific milestones in time-bound manner such as the implementation of the programme for eight to ten infantry battalions (up to 10,000 infantrymen) by 2015, and fully upgrading rest of the Indian Army's infantry by 2020.

The main aim of the F-INSAS programme is to equip the Indian soldier with state-of-the-art equipment including multi-calibre and multi-mode weapons; information, navigation and communication equipment; protective gear; health and environment monitoring tools and portable renewable power sources.

The fully integrated soldier-system will function in a multi-role, multi-weather and fully aware battle-space, enhancing his capabilities of lethality, survivability, sustainability and mobility. The Indian Army is steadily implementing a major plan to make its units "light, rapidly deployable and more lethal at extended ranges, particularly in darkness".

These developments are crucial as the Indian Army faces a myriad of threats across the spectrum of conflict. The cornerstone and the first stage of F-INSAS is the development and procurement of multi-calibre and multi-mode assault rifles for the infantry soldier to replace the ageing Indian Small Arms System

Airbus DS develops new Swiss soldier engagement system

Airbus Defence and Space has successfully completed development of the integrated modular engagement system (IMESS) to the level necessary for series production. With IMESS, the Swiss Army has one of the world's most powerful and high-tech soldier systems at their disposal. By employing more efficient and powerful components – many of them newly developed – various capabilities have been optimised: tactical command-and-control capabilities from company level to individual soldier level have been improved through the integration of combat vehicles, including computer and radio connections. Radio communication has been optimised through increased range and new, standardised radio equipment. The use of head/helmet mounted displays provides a clearer situational picture and enables simpler navigation. The night fighting and reconnaissance capabilities could also be expanded. A modular architecture provides numerous standard interfaces to sensors, such as a thermal imaging device, as well as modules for link-up with external systems, such as unmanned aircraft.

Operational testing of IMESS in 2014 with an infantry squad.

(INSAS) rifle. The planned primary weapon will be a rifle capable of firing 5.56mm and 7.62mm ammunition, with a new 6.8mm calibre under-development. This first stage alone will reportedly cost Rs 25,000 crores. The new assault rifles will be modular in design, allowing replacement of sub-assemblies without specialised tools. The new rifles will feature interchangeable barrels, a combination of some or all from amongst 5.56x45mm, 7.62x39mm, 7.62x51mm, and 6.8x43mm systems. In addition, the rifles will feature holographic reflex sights and under-barrel grenade launchers (UBGL) for launch of air bursting grenades. Crucially, they will also be interchangeable for both right and left-handed users, overcoming the shortfall in many earlier weapons. Soldiers will use the 7.62 x 39mm barrels for counter-insurgency operations and 5.56x45mm barrels for conventional warfare.

Another very critical component of the F-INSAS project is the Tactical Communication System (TCS) as a replacement for the army radio engineered network (AREN). TCS will consist of "trunk nodes such as the key bandwidth carrier connection points, terminating at access nodes for Brigade-level communications". This will then extend to command posts at Company level. In 2010, it was reported that TCS would cost around Rs 10,000 crores, the Army conducting consultations with major IT firms to develop not only a system that incorporates mobile technology and equipment sensors, but one that is secure enough to protect highly sensitive data. The involvement of leading private players in the field of IT and telecom is crucial to the success of this endeavour. TCS will provide holistic connectivity between units on the ground with command posts and HQs. It will drastically improve situational awareness of the whole chain of command leading to better results and reduced casualties.

The third component is individual protective gear and monitoring tools attached to the soldier. The protective gear will consist of a visor and head mounted display (HMD), weather adjustable vests, light shrapnel proof jackets and wrist mounted PDAs. The crucial factor here would be to reduce weight of the load carried by the soldier to at least 50 per cent of current levels, so as to increase mobility and survivability. The FELIN system of France has been used in Afghanistan but has its shortcomings in terms of weight of the system and bandwidth availability. The medical sensor suite is likely to rank as one of the most costly features of the F-INSAS package and may require capability re-tailoring to meet the needs of both budget and practicality.

Some of these systems already adopted in other countries include the FELIN of France, FIST of Britain, IdZ of Germany and 'Future Force Warrior' of the US. However, all these systems have been successful in one scenario and but not all as the common theme which acts as an impediment to universal application

of these programmes is unavailability of practical power source to run all equipment attached to the soldier. Size and weight of the power source itself is a hindrance to the amount of effective equipment that can be mounted on a soldier, thereby adversely affecting effectiveness of the envisaged system. Another key factor is 'kinetic', but there are solutions. According to Dr Surendra Kumar, former director of India's Armament Research & Development Establishment (ARDE), "the weapons system will function on light-weight batteries that can be easily charged. Sensors fixed in the boots will be used to charge the batteries," in a development that would certainly be a huge step forward for both soldier system integration and sustainability. The solution to overall power for the Indian infantryman therefore, currently lies in the use of a single body-worn system harvesting a collection of small power sources, including a mix of solar, kinetic and traditional battery energy, with renewed emphasis being placed on bases and vehicles to supply outlets for manual recharging whenever needed.

Key recommendations

In the pursuit of achieving full scale F-INSAS implementation by 2020, the following recommendations can be made :

- Development of multi-mode and multi-calibre rifles by DRDO with indigenisation or ToT, whichever is practical.
- Provision of night vision and thermal imaging sensors to enhance 24x7 operational readiness.
- High calorific food for soldiers by DRDO.
- Integrated Management system including IT and telecom domains under public-private partnership to leverage the best.
- Utilise partnerships with advanced countries particularly USA, Israel and Britain to procure high end technologies which otherwise will have long R&D gestation periods.
- Training and new programmes to be introduced for soldiers and officers to comprehend the high tech systems which form a part of F-INSAS.
- Availability of bandwidth and spectrum by government to operationalise the TCS and other communication components.

Raveen Janu (CLAWS)

Global Soldier Modernisation Market $892.6m in 2013

The Global Soldier Modernisation Market 2013-2023, a defence and security report, expects the market for soldier modernisation spending to have reached $892.6m in 2013, as emerging national markets seek to develop all encompassing soldier integration projects and mature national markets invest in advanced technology designed to increase operational effectiveness, capability and flexibility.

Defence analysts stated that: 'Soldier Modernisation has developed significantly over the last 20 years in an attempt to equip military forces with fully mobile, capable, efficient and advanced systems for combat. Despite delays, cancellations and the restructuring of requirements for many Soldier Modernisation Programmes (SMP), the necessity for highly developed and interconnected soldier systems remain. Investment in soldier modernisation will therefore remain strong over the next decade, with greater focus upon improving situational awareness, enhancing communications and connectivity and reducing the overall weight burden by developing more efficient sources of energy supply and new weight distribution equipment."

Augmented Reality Interface

MBDA's STRATUS : flexible missile effects for the future battlespace

MBDA has unveiled the CVW101 STRATUS, its latest Concept Visions project, that provides a transformational, innovative approach to Command & Control and Mission Control of Missile Systems across domains (land, air and naval) and platforms, maximising the use of the weapon resources available in the battlespace in order to optimise the delivery and timeliness of effects. "Our approach to the future battlespace places the warfighter at the centre of the deployed weapon system resources with the ability to transparently use the best resources available through clear, simple presentation of information for decision making", explained Sandro Petrizzelli, Head of MBDA's Concept Visions 2014 international team. "Our aim was to deliver the concept of a distributed architecture which would optimise the operational efficiency of deployed missile systems. We are making all resources, sensors and effectors deployed in the theatre available to form part of the warfighter's local weapon system, with direct and easy access. This is why we say STRATUS creates a theatre-wide virtual weapon system, delivering tremendous efficiencies in terms of robustness, fire power, combination of effects and reaction time".

"To engage emerging types of threats, armed forces will not only need to have the kind of weapon systems we have showcased over the four previous years of Concept Visions, but they will also need to have access to many, varied weapon system assets at very short notice. For instance, immediate fire support may be needed from across the entire deployed set of weapon assets and not only from a locally deployed unit. In twenty years from now, we expect that our Armed Forces will face a more complex, dynamic and uncertain battlespace. Connectivity will continue to improve not only for allies but also for their adversaries, allowing aggressors to better combine air, land and naval attacks with the aim of creating surprise effects and saturating defences."

To deliver this, STRATUS brings together many key techniques: sharing weapon system resources, distributed coordination and use of a common, core interface for the command and control of all deployed and available weapon systems. The benefit lies in the enhancement of the collaboration between deployed weapon systems, providing higher levels of efficiency, flexibility and robustness at battlefield level. For a given level of capability, fewer assets will be needed, as they are shared in a more effective way across the battlefield.

Personal Human Machine Interface

VAYU at Toulouse

All systems GO!

Developments review at 'Airbus Innovation Days 2014'

Yes, its that time of year again when Airbus pull out all the stops to update and familiarise world media and their public relation agencies on their products, progress, developments, technologies and the future of civil aviation: simply put, it is *Airbus Innovation Days 2014*. Stretching over three days in mid-June at Toulouse (their Headquarters), along with excellent weather, over 150 invitees were briefed, followed by extensive Q&As at the Airbus Delivery Centre situated at the heart of Airbus' production facilities.

News had first come in about the Emirates cancellation of their A350XWB order, the introductory welcome was by John Leahy, Chief Operating Officer, himself who officially gave the information with relevant explanations. "Airbus confirms that Emirates Airline has decided to cancel its order of 70 A350 XWB aircraft. The decision follows on-going discussions with the airline in light of their fleet requirement review, as demonstrated by their order of 50 additional A380s at the last Dubai Airshow and their continuous interest in the programme. Airbus and Emirates Airline benefit from a long-standing relationship and the airline recently reiterated its confidence in Airbus products particularly praising the A380 and the benefits the aircraft brings to their operations."

The order for 50 A350-900 and 20 A350-1000 was originally placed by Emirates Airline in 2007 with first delivery slots scheduled from 2019. However, Airbus remains very confident in its A350 XWB programme. Half a year before entry into service, the A350 XWB order book stands at a healthy 742 firm orders (after the Emirates cancellation). The A350 flight test campaign is progressing well and is on track for Type Certification in the coming months. "Interest in the game changing A350 has always been very high with customers. Airbus expects the A350 order book to continue growing in 2014", continued Leahy.

Having put that aside, Innovation Days began with an update on the A320 neo (new engine option) programme, followed by a brief on Airbus in the international arena and Airbus series programmes. There were detailed briefings on the A350XWB airliner and developments related to it followed by sessions on 'Innovating Airbus Style' and 'Factory of the Future'.

Headquartered in Toulouse, France, Airbus is a truly global enterprise with fully-owned subsidiaries in the United States, China, Japan, India and in the Middle East, and spare parts centres in Hamburg, Frankfurt, Washington, Beijing, Dubaï and Singapore. Airbus also has training centres in Toulouse, Miami, Hamburg, Bangalore and Beijing, and more than 150 field service offices around the world. Airbus also relies on industrial co-operation and partnerships with major companies all over the world, and a network of some 2,000 suppliers (for the flying parts alone) in more than 20 countries.

Of great interest were detailed accounts of the technology of the future - 3D printing: and how this was going to be a game changer in the supply chain. On display at the Delivery Centre were internal parts of aircraft printed by 3D technology- and that these were being actually used in aircraft (see box item).

After a heavy day, and still trying to absorb all the technologies discussed, we left for a grand dinner and walk through at the nearby Aeroscopia museum. The 'Michelin starred' dinner was hosted by Fabrice Gregier, Airbus President and CEO who took questions between the courses!

The next day were briefings on how flight testing had evolved and future innovations, A350XWB test flight status, A320neo test flight campaigns, "how to stay closer to customers and staying ahead through engineering innovations." In between presentations, the invitees got to visit an A350XWB test aircraft which included a demonstration flight.

The Family

Airbus, as we all know, is the commercial aircraft manufacturer offering passenger airliners in the 'more than 100-seat market.' Over the last 40 years, customer focus, commercial know-how, technological leadership and manufacturing efficiency have propelled Airbus to forefront of the industry. Airbus, which now spearheads the newly consolidated "Airbus Group", today consistently captures some half of all commercial airliner orders, its comprehensive product line comprising families of aircraft ranging from 100 to more than 500 seats: the single-aisle A320 Family, including A320neo, the wide-body long-range A330 Family (including the freighter and the A330-based MRTT), the all-new next generation A350 XWB Family and the double-decker A380. Across all its aircraft families Airbus' approach ensures that aircraft share the highest commonality in airframes, on-board systems, cockpits and handling characteristics. This significantly reduces operating costs for airlines.

A320 family – and the A320neo

The A318, A319, A320 and A321 make up the single-aisle aircraft family. The A320neo (new engine option) is the latest of many product upgrades as Airbus continues to invest around €300 million a year in the A320 Family, these new models having been announced in December 2010 and featuring new engines (the PurePower PW1100G from Pratt and Whitney or the LEAP-1A from CFM) and large wingtip devices known as Sharklets. Together, these result in a 15% fuel burn reduction, corresponding to an annual CO_2 reduction of 3,600 tonnes per aircraft. Of course, Sharklets have been available as a forward-fit option since the end of 2012 and are today giving up to 4% percent reduced fuel burn over longer sectors, corresponding to an annual CO_2 reduction of around 1,000 tonnes per aircraft. In addition, Sharklets are now also available for retrofit to in-service aircraft.

A320 Family operators now can also benefit from enhanced 'Required Navigation Performance – Authorisation Required' (RNP-AR) combined with 'Required Time of Arrival' (RTA) time management. This allows the aircraft to conduct a 'continuous descent approach' (CDA) which is more efficient than the traditional 'dive and drive'. The net benefits include lower noise and fuel burn since less thrust is required. RNP-AR also enhances accessibility by enabling specially trained and authorised pilots to fly at lower altitudes with a more precise and efficient route into the airport, saving fuel and emissions and helping reduce the impact of bad weather on services.

In the first week of July 2014, the assembly of Airbus' first A320neo was completed following painting of the aircraft and the mounting of Pratt & Whitney PW1100G-JM engines. MSN6101, which will be the first A320neo to fly, will shortly

The assembly of Airbus' first A320neo has been completed following painting of the aircraft and mounting of Pratt & Whitney PW1100G-JM engines. MSN6101, which will be the first A320neo to fly, will shortly start its ground tests to prepare for first flight.

Airbus' 'First Family' – the A300 – celebrates 40 years

Airbus celebrated 40th anniversary of entry into service of its first aircraft – the A300B – operated by Air France as the launch customer. Starting in 1974, 878 A300/A310 Family aircraft have been manufactured. Even today, over 400 of these remain in service with 65 customers.

start its ground tests to prepare for first flight. The flight test campaign for the A320neo will kick-off in September 2014, paving the way for Entry Into Service during Q4 2015.

The PW1100G-JM engine continues to go through rigorous testing processes with certification planned for the second half of 2014. Airline operation or entry into service is planned for the fourth quarter of 2015. The PW1100G-JM engine successfully completed its first development flight 15 May 2013, on Pratt & Whitney's flight test aircraft. To date, the company has successfully completed more than 20 development engine builds and three flight test campaigns to validate the PW1100G-JM engine. The first engine was tested in November 2012, less than two years after the Geared Turbofan programme was launched.

Compared to an A320ceo without Sharklets, the A320neo powered by PW1100G-JM engine technology will provide customers with up to a 15 percent reduction in fuel-burn with a corresponding reduction in CO2 emissions. The PW1100G-JM engine also provides up to a 75 percent reduction in the A320neo noise footprint, which is also environmentally friendly and allows longer hours of operation at airports that operate under curfew. Moving on, the A330 Family, which spans 200 to 440 seats, and includes Freighter, VIP, and Military Transport/ Tanker variants, has now received more than 1,340 orders. Since the original version of the A330-300 entered service, the key factor has been its very low operating cost per seat. With more than 1,080 aircraft delivered to over 100 operators, the type is achieving average dispatch reliability "above 99 percent."

The A330-200 variant, seating 246 passengers in two classes, has the versatility to cover ranges from short-haul to true long haul, ideal for point to point operations. Currently, as more A320 Family 'single-aisle' operators discover the advantages of stepping-up to the 'twin-aisle' A330-

The lower-weight A330 regional version – planned for certification in 2014 – is tailored for regional and domestic operations in high growth areas as in Asia including China

ACJ320 Sharklet retrofit

Alpha Star Aviation Services of Saudi Arabia has become the first Airbus ACJ320 customer for an in-service retrofit of 'Sharklets', upswept fins attached to wingtips which reduce some 4 per cent in fuel consumption while also enhancing performance-and appearance. It is also the first Middle East customer for the in-service retrofit of Sharklets on an Airbus corporate jet. Alpha Star plans to fit Sharklets to an Airbus ACJ320 that is already in operation. The in-service retrofit comprises local structural reinforcement of the outer wing, a software upgrade to several flight-control computers, and replacement of the existing wingtips by Sharklets.

Airbus' ACJ320 Family, includes the ACJ318, ACJ319, ACJ320 and ACJ321. It is complemented by widebodies such as the ACJ330, ACJ340, ACJ350 and ACJ380.

There are five test & development A350 XWBs in the programme

200, they become new A330 operators who "recognise its merits as a compelling alternative to larger long-range airliners with a potential for growth with the A330-300." The A330-300 seats 300 passengers in two classes.

In 2013, Airbus announced a new lower weight variant of the A330-300 optimised for use on domestic and regional routes in high growth markets with large populations and concentrated traffic flows. Compared with current A330-300 variants, the new A330-300 Regional variant will be optimised to seat up to 400 passengers in

A350 XWB in water trough test

Asiana Airlines takes delivery of first Airbus A380

South Korea's Asiana Airlines has taken delivery of its first Airbus A380, becoming the eleventh operator of this type in the world. The A380 was handed over to Park Sam Koo, Chairman of Kumho Asiana Group, by Fabrice Brégier, Airbus President and CEO, during a special ceremony in Toulouse, in France. Asiana Airlines has ordered six A380s, powered by Rolls-Royce Trent 900 engines.

Airbus' best-in-class 18 inch wide economy seat comfort on missions up to 3,000 nm and offer significant cost savings through a reduced operational weight of around 200 tonnes. The reduction in fuel burn per seat and maintenance costs, thanks to these innovations, will result in an overall cost, reduction by up to 15% compared with today's long-range A330-300 variants.

The A330 is now offering operators the capability to fly "beyond 180 minutes", which has been certified by EASA. This helps operators by allowing higher payloads and schedule reliability, lower fuel burn, CO_2 emissions and flight-times. Airbus is also incorporating other technical improvements directed towards improving eco-efficiency and reducing the cost of operation. A good example includes navigation upgrades such as ATSAW (Airborne Traffic Situational Awareness), leading to shortened routings at optimum flight levels and facilitating more precise

A380 at the Dubai Airshow 2013

approaches. The A330 is also qualified to operate routings and precision approaches with "required navigational performance" (RNP) as part of its new generation suite of navigational aids.

The Cover Story

The A350 XWB is an all new family of mid sized wide-body airliners which will "shape the efficiency of medium-to-long haul airline operations, overcoming the challenges of volatile fuel prices, matching rising passenger expectations and addressing increasing environmental concerns." The A350 XWB Family consists of three passenger versions with long-range capability of flying up to 8,500nm/15,580km. In a typical two-class configuration, the A350-800 will offer 276 seats while the A350-900 and the A350-1000 will offer 315 and 369 seats respectively. With one aircraft available in three different sizes, airlines can best match their A350 XWB fleets to route capacity demands, guaranteeing optimum revenue potential. Pilots can fly all three versions with the same certification, further maximising airline profitability.

The A350 XWB's commonality in engines, systems and spare parts throughout the Family helps reduce operating costs even further. "Airbus recognises the need for sustainable development of air travel. The environment will benefit from the efficiency inherent in the A350 XWB Family." Next generation Rolls-Royce Trent XWB engines and state-of-the-art aerodynamics help reduce emissions well below current and anticipated future regulatory levels. Carbon dioxide (CO2) emissions per passenger will be up to 25 percent lower than with current generation aircraft in this category and exterior noise levels will be as much as 15 EPNdB (Effective Perceived Noise Decibel) below ICAO Chapter-4 requirements. Airbus forecasts a demand over the next 20 years for some 6,900 new twin-aisle passenger and freighter aircraft.

With the first flight of A350 MSN005, on 20 June the five-number development fleet is now complete. Being the second passenger cabin-equipped A350 and tasked with route proving and ETOPS validation, MSN005 embodies the operationally definitive configuration for Type Certification duties. This milestone means that the A350 XWB development programme is "at full speed and on track for certification in the third quarter of this year, to be followed thereafter by delivery of the first customer aircraft to Qatar Airways in the fourth quarter." As of June 2014, the A350 XWB programme had already achieved more than 2,000 flight-test hours in around 500 flights, and with this the programme is demonstrating the highest flying rate ever achieved in Airbus flight tests, with around 80 flight hours per aircraft per month.

Airbus has also successfully performed certification testing to demonstrate the A350 XWB's ability to operate from wet runways. During these tests at Istres, in France, the flight-test aircraft MSN004 travelled through troughs containing upto 22mm of water depth, at a variety of speeds, starting at 60kts, and successively increasing to around 140kts. This test validates how the aircraft would behave on a rain-soaked runway, and verifies that neither the water under the aircraft nor the spray generated by the nose landing gear would enter the engines or APU. For the test, the 'water trough' was created by applying to the runway's surface grooves and rubber strips inserted in the grooves to retain water, this pool being 100m long and 29m wide. The aircraft performed several runs as planned in order to test various situations including the use of reverse thrust.

Meanwhile, Airbus' A350 XWB flight test aircraft (MSN3) has completed hot weather testing in Al Ain, United Arab Emirates, the objective of the tests being to check behaviour of the engines and aircraft systems at temperatures reaching above 40°C.The aircraft performed several tests in flight as well as on the ground, including heat soak tests. These involve the airplane being left on the ground and in the sun for several hours with checks later performed on various cooling systems.

Wizz Air's 50th Airbus A320

Wizz Air, the largest Central and Eastern European low cost - low fare airline, has taken delivery of its 50th A320 Airbus aircraft during a special ceremony in Toulouse, taking the total of its A320 fleet to 52. The carrier was one of the first Eastern European Airlines to take delivery of an A320 with Sharklet fuel saving wing tip devices in April 2013. Wizz Air, which is an all Airbus operator, has ordered a total of 112 aircraft

The 'Big' Family

The A380 family starts from a baseline passenger aircraft with a capacity of 525 passengers in three-class configuration, seated over two spacious decks, with a range of 8,500nm/15,700km. Now in its seventh year of commercial service, the worldwide A380 fleet undertakes more than 170 commercial flights each day, carrying over two million passengers each month. With seating capacity ranging from 400 to more than 800 passengers, the A380 is an essential part of the solution for sustainable growth, doing more with less: alleviating traffic congestion at busy airports by transporting more passengers with no additional flights-and at much lower cost.

The A380 excels in performance. Compared with other large aircraft, the A380 offers 1,300nm more range, requires 17 percent less runway to take-off and uses 11 percent less runway to land. In addition, the A380 not only offers a 4,000ft higher initial cruise altitude capability than others, but also demonstrates a 20kt lower approach speed. The A380 also delivers on reduced noise, being the quietest long-haul aircraft for the foreseeable future, generating only half the noise on departure than others, and three to four times less noise on landing even as it carries 40% more passengers.

With the lowest fuel burn per seat, the A380 allows airlines to substantially reduce their environmental footprint in terms of CO_2 emissions. As stated by company officials, "the A380 offers the most comfortable, quietest, most efficient and innovative cabin; the lowest fuel burn, cost per seat and noise of any large aircraft; it leverages the latest technology, and has been certificated to the very latest standards; it has superior performance, and family development potential. And it is hugely popular with passengers, leading to higher load factors and more revenue–for higher profitability".

3D printed metal part in maiden flight

A 3D-printed 'bionic' cabin bracket for the A350 XWB has flown for the first time installed on Airbus' MSN005 flight-test aircraft. The bracket has been produced from Titanium powder using a three-dimensional "additive layer manufacturing" (ALM) technique. The part passed all the required tests and demonstrated a weight saving of 30% compared with a similar bracket manufactured with today's standard methods. ALM removes many of the traditional manufacturing constraints, thus complex designs can be produced more quickly and at lower cost. In addition, this type of manufacture benefits the environment as it reduces the amount of unused raw material waste by around 90 percent!

Airbus research & technology

Since the introduction of jet engined airliners the air transport industry has achieved enormous improvements in economic efficiency and environmental performance of aircraft. For instance, in the last 40 years, the aviation industry has cut fuel burn and CO_2 emissions by 70%, NOx emissions by 90% and noise by 75%. During this time, innovation has been a key driver in Airbus' success story. From the A300 to the A350 XWB, Airbus has been continually implementing new ideas. Environmental and safety considerations have long been an integral part of the company's activities at all levels, and are a key priority in the development of all new techniques, products and processes. Through innovation, and out-of-the-box thinking, Airbus will "continue to meet its eco-efficiency goals, and ensure that air travel continues to be one of the safest and most eco-efficient means of transportation." That's where Research and Technology (R&T) comes in. Innovation is the backbone of Airbus' ongoing success and the key to its future.

More than 3,000 people at Airbus are working either directly or indirectly on over 100 major R&T projects, investing around two billion euros every year in Research and Development (R&D). More than 500 patent applications are filed by Airbus each year.

Over the next 40 years, R&T cooperation and investment will be even more crucial because energy sources are set to become increasingly scarce and expensive, yet fuel remains the single biggest element of airline operating costs (30% for Single Aisle / 40% for Long Range aircraft), thus reducing consumption (and therefore emissions) and finding new alternative sources remains a key industry driver. The aeronautics industry needs further step-changes in economic and environmental performance throughout the aircraft lifecycle to address the challenges. In short, "Airbus places, and will continue to place utmost priority on R&T topics that it identifies as game-changers in the area of large commercial aircraft for the future of air transport."

Vayu joins the aerospace world in lauding Airbus for its constant innovations!

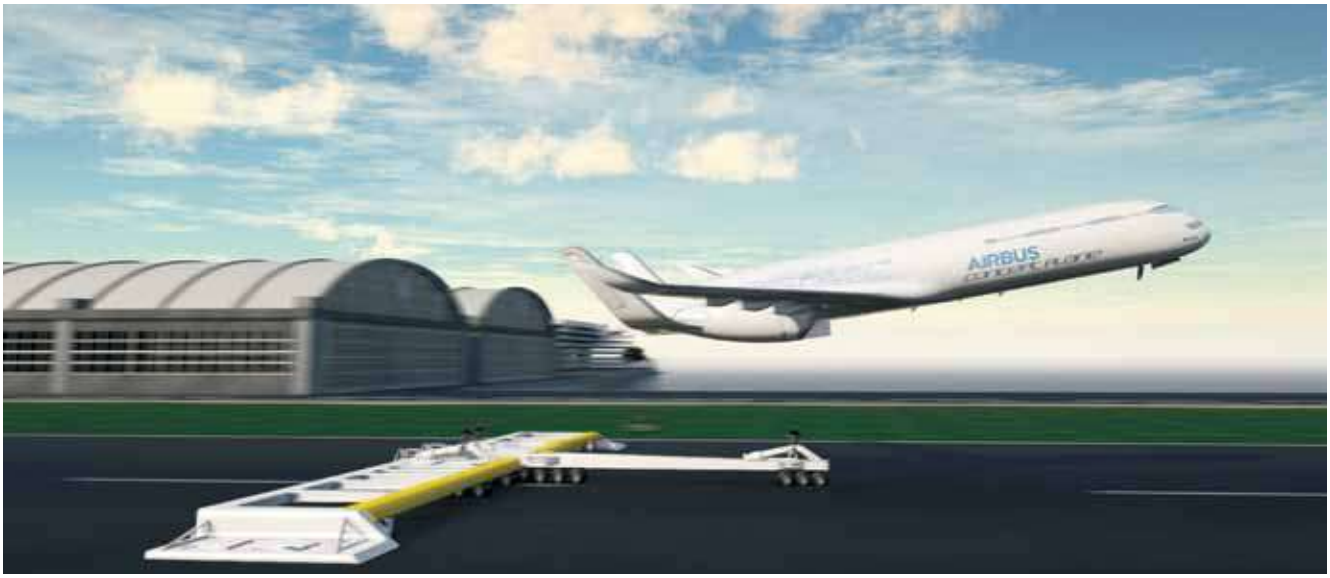
VSC

A350 XWB FFS nears airline training operations in Toulouse

The world's first A350 XWB full-flight simulator (FFS) is getting closer to readiness for training first airline flight crews. Already installed for some months at Airbus' Flight Training Centre in Toulouse and having been fine-tuned using real A350 flight-test data, the device is currently preparing for the Aviation Authorities' qualification process over the summer of 2014 leading to authorisation for full training operations in the fourth quarter 2014. Based on a CAE Series 7000 simulator and equipped with the latest visual system, this FFS is also the Training Centre's first FFS to be fitted with a full electrical motion system.

Airbus' Smarter Skies campaign for the future of air transport incorporates the use of formation flights along "express skyways," mimicking flocks of birds and taking advantage of the same efficiencies.

Media representatives from around the world (including Vayu) at the Aeroscopia Air Museum close to Airbus facilities at Toulouse.



Implementation of a steep 'eco-climb' during aircraft takeoff , was included in Airbus' Smarter Skies campaign launched in September 2012 and which will alleviate congestion through greater frequency, while also reducing noise and emissions.

VAYU in the Iberian Peninsula

Airbus Defence and Space activities in Spain

A400M Water Ingestion Test in progress. Airbus Defence and Space's San Pablo plant in Seville serves as the final assembly line for the A400M, C295 and CN235

As part of Trade Media Briefing 2014(TMB), Airbus Defence and Space's annual media briefing, Vayu was among the media organisations invited to visit the company's facilities in Seville and Getafe in Spain. The two-day visit commenced on 9 June 2014 with a visit to Airbus DS' San Pablo plant. Presentations and updates on the A400M programme, the C295 and CN235, Eurofighter and Airbus' UAS programmes followed, along with a visit to the assembly lines. The entire media team was next day flown to Getafe, just south of Madrid. One of the first military airbases in Spain, Getafe now also hosts a large Airbus Defence and Space facility. Updates on the A330 MRTT programme and Airbus Services preceded a visit to the conversion hangars where A330-200s are converted to A330 MRTT aircraft. The two packed days are reviewed in the following article by Vayu's Vijay Matheswaran.

Airbus Defence and Space's facilities in sunny San Pablo, on the outskirts of Seville in Spain, are a hive of activity. The plant hosts the final assembly line for the A400M new generation airlifter, as well as the production and assembly lines for the 'light and medium family' CN235 and C295 and its variants. It was here that Trade Media Briefing 2014 (TMB), the group's annual media briefing, began.

Last year's consolidation of the Group under the Airbus 'banner' has Airbus Military, Cassidian and Astrium being grouped together as *Airbus Defence and Space*. The move also puts Cassidian's Eurofighter and Unmanned Aerial Systems activities (UAS) activities into the Airbus Military business, a move that "has tripled the potential market for our products," according to Antonio Rodriguez Barberán, Head of Commercial and Military Aircraft.

A400M enters service

The A400M programme has sped along over the past year, with the first three aircraft now delivered to two customer nations. The first two (numbered MSN 7 and MSN 8) were delivered to France in August and November last year. Turkey, the second customer, received the third production A400M in April 2014, based at Kayseri. stated Rafael Tentor, Head of the A400M programme, "We are looking to deliver 11 aircraft this year, followed by another 23 in 2015. 14 aircraft are currently in the process of final assembly." The majority of these aircraft have been designated for France and the UK, although Turkey and the first Malaysian and German aircraft are amongst them.

All three aircraft delivered were of IOC standards and flight tests remain underway as per Airbus' schedule. Recently concluded tests include air-to-air refuelling, using the A400M as a tanker as well as a receiver, full flares jettison, unpaved runway operations, wet contact refuelling trials with a Transall C160 and testing of the Defensive Aids Sub-System. Eric Isorce, Head of A400M Flight Tests, is "positive" about the next phase to testing, set to commence using an A330 MRTT with the A400M as a receiver. Over course of the past year, 1270 hours of flight-testing have been carried out on

A400Ms. The flight tests lead to continual improvement on the aircraft, with the 2015 standard seeking to integrate new tactical capabilities in terms of full aerial delivery, self-defence and tanker capabilities.

On the operational front, the A400M had its first operational deployment when France's newly delivered aircraft were deployed as part of *Operation Serval* in Mali in December 2013. Flying from Orléans, the aircraft carried 25 tons of equipment and 22 personnel, covering the distance in 6 hours and 30 minutes. The sortie also involved French defence minister Jean-Yves Le Drian flying to the African state, as part of a tour also involving Chad and Niger. The second A400M, *Ville de Toulouse*, was also deployed to French Guiana and the French West Indies, making the aircraft's first transatlantic flight.

Rows of mammoth A400Ms in various stages of assembly greet the eye as one enters the assembly hangar at the San Pablo plant. The A400M is a versatile airlifter powered by four counter-rotating TP400 turboprop powerplants. According to Airbus, the aircraft is "one of a kind", for it merges strategic and tactical needs of an operator with a single aircraft, something that would have earlier required two or more aircraft. An inside fuselage width of 4m and length of nearly 18m allows an A400M to carry several items of outsize cargo, including an NH90 or a CH- 47 Chinook helicopter, or two Stryker infantry carrier vehicles (ICV) of 17 tonnes each. It can also carry a 25 tonne semi-articulated truck with a 6m container, or a rescue boat, or large excavators or mobile cranes needed for disaster relief.

A technician checks the engines in the assembly line. The A400M is powered by four counter-rotating TP400 turboprop powerplants.

An A400M designated for the Armee de l'Air seen at Seville, Spain

Keeping in mind the roles that the aircraft is expected to fulfil, Airbus engineers have designed the A400M with "unique landing characteristics." Its 12-wheel main landing gear is designed for operations from stone, gravel or even sand strips. Its efficient absorption of shock loads into the airframe structure and its minimised risk of foreign object damage allows the A400M to land on, and take-off from, short, soft and rough unpaved airstrips meeting the CBR4 standard. The onboard 32 tonne–powered winch and optional 5 tonne crane allows rapid loading and unloading once on ground.

The A400M has the ability to fly distances up to 4,700 nm / 8,700 km, at a cruising altitude up to 37,000 ft and at a speed of up to Mach 0.72. Being able to fly fast and at high altitudes, it is also an ideal tanker aircraft to refuel military fast jets plus other large aircraft at speeds of up to 422 knots true air speed (TAS) at 25,000ft. The type's low speed characteristics makes the A400M ideal for dropping supplies from low altitude, or paratroopers from way up high (40,000 ft) for Special Forces operations.

A330 MRTT Enhanced

Airbus Defence and Space's facility in Getafe is home to their military derivatives division, where A330-200s from Toulouse are converted to A330 Multi-Role Tanker Transport Aircraft. The A330 Multi-Role Tanker Transport programme has been on track over the past year with 21 A330 MRTT aircraft delivered, 5 to Australia, 3 to the UAE, 4 to Saudi Arabia and 9 to the United Kingdom. Airbus is under contract to supply the Republic of Singapore Air Force with 6 aircraft, while Qatar, France and India are, in the words of Antonio Caramazana, Head of Military Derivatives, "in final contract negotiations." Airbus has also responded to RFPs from South Korea and the European Defence Agency.

Conversion hangars in Getafe incorporate a spate of modifications to finished A330-200 aircraft from Toulouse. Structural reinforcements are done to allow the aircraft to carry 140,000 litres of fuel. As per customer requirements, the aircraft is fitted with a combination of Cobham 905E underwing pods, Cobham 805E Fuselage

A400M on the production line. This aircraft (MSN-016) is designated for the RAF.

Refuelling Unit (FRU), Aerial Refuelling Boom Systems (ARBS) and Universal Aerial Refuelling Receptacle Slipway Installation (UARRSI). Air Refuelling consoles and enhanced vision systems are also fitted. Away from the company's Getafe facility, conversion work for Saudi A330 MRTTs is also ongoing at the facilities of Iberia Airlines. According to Caramazana, "The next available slots on the conversion line will be in 2016. 2017-2019 will also be very full, given the expected backlog."

During *Vayus's* visit, Airbus Defence and Space announced an improved variant the A330 MRTT Enhanced. The new Enhanced variant will be in 'Green Aircraft' configuration, that is, the most recent A330-200 variants being built in Toulouse, including structural and aerodynamic improvements, as well as Power-8 computers. Additional military modifications to be incorporated are Mission Planning System (MPS) upgrade, solutions for implementing Identification Friend or Foe (IFF) mode 5 and Automatic Dependant Surveillance-Broadcast (ADS-B). A significant improvement introduced in the A330 MRTT Enhanced would be Boom Upgrade 3, an improvement to the Aerial Refuelling Boom System.

For India too

This means that India, too, is slated to receive the A330 MRTT Enhanced variant. However Indian aircraft will not carry the Boom Upgrade 3, as the IAF has opted for FRUs. Following a cancelled first bid, Airbus Defence and Space was again selected as preferred vendor to supply the Indian Air Force 6 A330 MRTTs in January 2013. The IAF has also selected Rolls-Royce Trent 700 engines to equip their MRTT aircraft. Mr Caramazana said that Airbus had expected the contract to be signed last year but "remain hopeful, however, that with the installation of a new government at the centre, the deal can finally be signed." Of interest is the news that senior Airbus executives met with Mr Narendra Modi before the elections, and noted "there is a sense of positiveness about getting the MRTT contract done." The deal involves supplying India with 6 A330 MRTT Enhanced aircraft.

MRTT conversion at the Getafe plant

Light and Medium Airlifters

While the A400M and the A330 MRTT might be their 'flagship' programmes, Airbus Defence and Space also produce highly successful light and medium airlifters, offering payloads from three to nine tonnes. Airbus DS' C295 tactical airlifter is in the running to replace the IAF's vintage Hawker Siddley HS 748 (Avro) transport aircraft in a 56-aircraft, $2.5 billion programme. As per the RFP, the selected vendor is to supply 16 aircraft in flyaway condition, while the remaining 40 are to be produced in cooperation with Indian industry. The C295 can carry up to 9 tonnes of payload or 71 personnel, while flying at 280 km/h at altitudes of 25000 ft.

Last year, Airbus announced an improved version of the C295, the C295W, featuring winglets, reinforced wings and uprated powerplants. The improved aerodynamic characteristics and power settings provide better take-off and landing, increased endurance and reduced fuel consumption. First flight of the new C295W took place on 11 April 2014. Peter Maute, Head of Marketing, Military Aircraft, said, "C295W certification is planned by October 2014." The C295W is in series production, with C295s to be delivered from 2015 onwards having a common reinforced wing, winglets ready.

"The aircraft performs a variety of roles," stressed Maute, "from fire-fighting, MPA, SIGINT, AEW&C and gunship tasks, among others." The fire-fighting variant of the C295 carries two palletised tanks with a capacity of 7000 litres. Palletised tanks offer a degree of flexibility, allowing removal of the tank to convert the aircraft for casevac and medevac roles.

The Maritime Patrol version of the C295 can also be converted for Anti-Submarine Warfare (ASW). In addition to the tactical systems provided for the MPA role, the ASW version features under-wing stations to carry weapons and other stores. Airbus Defence

A330 MRTT during trials at Leh, in Ladakh

Refuelling console of the A330 MRTT

and Space is also developing an Airborne Early Warning & Command (AEW&C) version of the C295. The primary sensor of the AEW&C to be fitted into the six-metre rotodome will be the IAI/ELTA 4th Generation Active Electronically Scanned Array (AESA) Radar with integrated IFF. The C295 AEW&C is to provide high quality 360° surveillance. A C295 demonstrator fitted with a rotodome has been conducting flight trials from their Seville facility since early June 2011. A Gunship version to offer Close Air Support to ground troops is available, as is Tactical Aerial Refuelling that increases the radius of action for combat SAR and Special Ops helicopters.

The Seville facility also serves as the production line for CN235 medium airlift aircraft. Capable of carrying up to six tonnes of payload or 51 personnel, cruising at altitudes of up to 25000 feet at speeds of 454 km/h, the CN235 can perform a variety of

Jordan selects the C295 gunship

At a ceremony presided over by Prince Feisal bin Al Hussein of Jordan, the *King Abdullah II Design and Development Bureau* (KADDB), ATK and Airbus Defence and Space signed an agreement to cooperatively work on a C295 gunship version. As per the agreement, a C295 currently operated by the Royal Jordanian Air Force (RJAF) will be converted for the a gunship role by ATK, joining two AC-235 gunships that were delivered to Jordan by ATK at SOFEX. The AC-295 gunship configuration will be based on the AC-235 Light Gunship which includes integrated mission and fire control systems, electro-optical and radar sensors, Hellfire missiles, ATK's side-mounted M230 30mm chain gun, an integrated defensive suite and 2.75 inch guided rockets.

Airbus CN235s at final assembly

roles. Much like the C295 (which is based on the CN235), this aircraft is equipped with a rear ramp and paratrooper doors that can be opened at speeds of up to 160 knots, allowing disgorgement of paratroopers or aerial delivery of cargo. Strong landing gear and tandem low-pressure tyres allow it to operate from short, soft, or unprepared airstrips. The CN235 can be modified to perform casevac and medevac roles, ISR activities, signal intelligence and for border control. Special versions of the CN235 allow it to function as a gunship, or perform tactical refuelling.

Over the past year, Airbus Defence and Space has received several orders for its light and medium transport aircraft, including from the US Coast Guard and Egyptian Air Force. Ecuador recently purchased 3 transport variants of the C295. In his briefing, Antonio Rodriguez Barberan stated that 17 C295s have been sold to "undisclosed" operators this year. A subsequent tour of the production line revealed Vietnam to be among those customers. The Royal Jordanian Air Force has recently received two CN235s modified for special operations.

UAS and the Eurofighter

Consolidation of Airbus' military activities into Airbus Defence and Space has seen the introduction of Cassidian's Eurofighter and the UAS division into Airbus DS. 2013 had rollout of the 400th Eurofighter Typhoon: the worldwide Typhoon fleet has now surpassed 200,000 flight hours. Peter Maute confirmed that Conformal Fuel Tanks (CFTs) for the Typhoon are "on the roadmap", as are integrating maritime capabilities and anti-ship weapons (Harpoon, Marte derivative).

In the UAS area, Jens Nielsen, Head, Unmanned Aerial Systems, admitted that while Airbus "has not been extremely active thus far", it intends to enter the UAS market in a big way. A 2-year definition phase for a MALE UAS is to soon start. In the words of Domingo-Urena Raso, "We have all the bricks to start a successful UAS programme."

Currently, Airbus collaborates with Dassault and Saab on the nEUROn project, for which it provides ground control stations. It is also involved in the Eurohawk project with Northrop-Grumman. Harfang, developed from IAI Heron, has amassed over 18,000 flight hours in some four years of operation in Afghanistan.

A tour of the Getafe facility was the culmination of TMB 2014, a trip full of information and enhancing knowledge. Much thanks to the personalities at Airbus Defence and Space and Avian Media for putting together an insightful and useful briefing.

C295s join an Orion on the flight line

Diehl and Elbit Systems on the A400M

Diehl Defence have signed an exclusive agreement with Elbit Systems, to equip the *Bundeswehr's* Airbus A400M transport aircraft with its self-protection system. Diehl combines three of Elbit System's J-MUSIC (Multi-Spectral Infrared Countermeasure) systems into a multi-turret DIRCM (Directed Infrared Counter Measure) system ensuring complete 360° protection of the aircraft. J-MUSIC is designed to protect large military and commercial aircraft against terrorist attacks by infrared-guided missiles.

Elbit Systems completed testing of the J-MUSIC system and has delivered systems to equip several aircraft for customers in 2014. The cooperation agreement between Diehl and Elbit Systems provides the Bundeswehr with an optimal, operationally ready DIRCM solution. Diehl will deliver the first DIRCM protection system for the A400M in 2015.

Ecuador orders C295s

Ecuador has ordered three Airbus C295 medium transport aircraft "for immediate delivery." The contract also includes a Full In Service Support (FISS) package for operation and maintenance of the fleet. The first aircraft was delivered on 6 June at the Airbus Defence and Space plant in Seville and the remaining two will be handed over later this year. They will be used for military and humanitarian missions such as the transport of civilian and military personnel as well as support to population in remote areas or in emergency situations. The C295s for the Ecuadorean Air Force follow several other Airbus aircraft previously operated by the Ecuadorean armed forces: the Ecuadorean Army uses two Airbus C212s and two Airbus CN235s, while two CN235s are part of the Ecuadorean Navy in the Andean country.

Thales to provide second UK A400M full-flight simulator

Airbus Defence and Space has awarded Thales a multi-million pound sterling contract to supply the Royal Air Force with a second full-flight simulator for the Airbus A400M military transport aircraft. The Full-Flight Simulator employs state-of-the-art visual and motion technology developed and produced by Thales that represents the current production cockpit configuration of the Airbus A400M aircraft and simulates the ground and flight operations of the aircraft in various natural and tactical environments. It includes an enhanced field-of-view visual system that can support training in all aircraft manoeuvres, including air-to-air refuelling and low-level tactical operations.

Airbus HC-144A fleet surpasses 50,000 flight hours with USCG

The US Coast Guard's fleet of 17 Airbus HC-144A *Ocean Sentry* maritime patrol aircraft has completed its first 50,000 hours of flight five years after the start of initial operational capability. The demonstrated maintainability of the HC-144A aircraft allows the Coast Guard to fly more hours per airframe in a year with the Ocean Sentry than any other type in its fleet. The fleet delivered by Airbus Defence and Space has successfully

undertaken a wide variety of maritime patrol missions from bases at Cape Cod, Mass., Mobile, Ala., and Miami. The Coast Guard will take delivery of its 18th aircraft this year and is planning to base three aircraft at the fourth HC-144A air station in Corpus Christi, Texas. The HC-144A Ocean Sentry is based on the Airbus CN235 tactical airlifter and maritime patrol aircraft built by Airbus Defence and Space, of which more than 235 are currently in operation in 29 countries.

Airbus A400M conducts paratrooping trials

Airbus Defence and Space has successfully completed the first paratrooping trials with the A400M. Spanish Army troops took part in a series of jumps at drop zones in France and Spain. The 11-flight test programme, which also included freefall jumps from the ramp, culminated in the successful despatch of 20 troops – ten from each of the left and right-hand doors – in a single run at 1,500ft. Further tests are planned. The A400M can carry up to 116 fully-equipped paratroops.

A330 MRTT tanker aircraft refuels A400M

Airbus Defence and Space has performed the first air-to-air refuelling of the A400M from the A330 MRTT Multi Role Transport Tanker. Through the course of four flights by day and night, in southern Spain, the A400M received more than 80 tons of fuel in 100 'wet contacts' from a Royal Air Force Voyager version of the A330 MRTT using the tanker´s Fuselage Refuelling Unit. The trials follow dry contacts conducted in an earlier test-phase and support the A400M´s capability to conduct extremely long-range non-stop deployments. The photo shows the two aircraft framed by the wing of an F-18 chase aircraft.

Egypt orders eight more Airbus C295s

Egypt has ordered eight more Airbus C295 transports in a deal which will take its fleet to 20 and makes it the biggest customer for the tactical airlifter. The new batch of aircraft will be delivered to the Egyptian Air Force by Airbus Defence and Space beginning next year and will follow the 12 aircraft previously ordered, of which six are already in service. The contract also includes a service support package for spares, training, and maintenance of the fleet.

WINGS OVER BERLIN

Visiting the German Air Show at Schoenefeld

The ILA Berlin Air show was held at the Berlin Expocenter airport over six days, from 20-25 May 2014, and saw 1203 exhibitors from 40 countries displaying the industry's entire range of current and developmental projects. The event covered all aspects of the aerospace industry and was a major attraction for the public: exhibitor numbers were the second highest in the 105-year history of the show, with some 227,000 trade visitors and members of the public visiting.

ILA 2014 was inaugurated by German Chancellor Angela Merkel, along with Lütfi Elvan, the Turkish Minister for Transport (Turkey was official partner country for this year's show as India was in 2008). Members from the German cabinet also attended the show, including the Vice Chancellor and Federal Minister of Economics and Energy, Sigmar Gabriel, the Federal Minister of Defence Ursula von der Leyen and the Federal Minister of Transport and Digital Infrastructure, Alexander Dobrindt.

The 'Space Pavilion' provided trade visitors and the public with graphic illustrations of benefits that space research provides for mankind. In the presence of Chancellor Merkel, representatives of the European Space Agency (ESA) and Airbus Defence and Space signed initial contracts that are to usher in the next development phase for the impending series of *MetOp* weather satellites.

As the largest individual exhibitor at ILA 2014, the German armed forces (*Bundeswehr*), presented their capabilities with a wide-ranging display of equipment, systems and services. The show also witnessed numerous business deals concluded, the International Suppliers Centre (ISC) having proved an effective marketing platform for the supply industry, with buyers making advance bookings for over 1,000 meetings with customers. Several thousand experts attended more than 60 conferences that discussed latest developments in the aerospace industry. Individual segments and topics such as UAS (Unmanned Aircraft Systems) and 'eco-efficient flight' had keen interest deployed, even as some 3,800 accredited members of the media from 55 countries covered ILA 2014.

In her address, Chancellor Angela Merkel said that facilities such as the Career Centre, which seeks to attract young people to work in the aerospace sector, are "worth their weight in gold." She gave her short address in front of a pre-production example of the new Airbus A350.

Debut of Airbus E-Fan

ILA 2014 was where Airbus displayed its E-Fan for the first time. This is powered by two encased propellers mounted on each side of the fuselage, having a total output of 60 kilowatts and obtaining their energy from lithium-ion polymer batteries installed in the wings. The main undercarriage is also fitted with a 6kW electric motor to enable the aircraft to taxi without consuming unnecessary energy. This virtually emission-free and silent model made its maiden flight on 11 March in Bordeaux. Airbus has plans to develop the two-seater E-Fan 2.0 trainer and the four-seater E-Fan 4.0 multi-purpose aircraft. "Production is scheduled to begin in 2017," said Chief Technical Officer, Jean Botti, speaking at the ILA.

During the show, over 300 aircraft were on display, on the ground and in the air, the most prominent being the Airbus A380, which along with a Boeing 747-8, an Airbus A350 XWB, marked the first time the aircraft was shown on the ground at a European air show. Also on display were the new generation A400M and an Antonov An-124, the world's largest production transport aircraft. Airbus Group presented its fully electric, experimental demonstration aircraft, the two-seater E-Fan, to the public for the first time.

Spectators were witness to two aerobatic teams at this edition of ILA. The *Patrouille Suisse*, flying 7 Northrop F-5E Tiger IIs, charmed the crowd with their performance. The Breitling Jet Team, flying 8 L-39C Albatros, made their German debut this year. Spectators were also treated to demonstrations featuring individual combat aircraft, including the Eurofighter, F-16, MiG-29 and Gripen, a 'Willfire' demonstration of the Bundeswehr's capabilities, and classic aircraft from aviation's past, such as the Noratlas.

Certainly, the most eye-catching exhibit was the long-range wide body Airbus A350 XWB. Largely made from carbon-fibre materials, the aircraft offers 25 percent savings on weight and fuel consumption, while being extremely quiet. MTU-Aero Engines presented its geared turbofan technology that sets new standards with fuel savings of approximately 15 per cent and a 50 per cent reduction in noise levels. Details were provided at ILA by Rolls-Royce of its UltraFan engine project, due to be launched commercially in 2025, which will reduce fuel consumption by 25 per cent compared with the turbines on present day wide bodied jets. Rolls-Royce and Airbus jointly presented the E-Thrust concept study: a regional aircraft capable of carrying 90 passengers and powered by a hybrid unit.

Turkey, the official partner country of ILA 2014, provided a comprehensive civilian and military display. The exhibitors, Turkish Aerospace Industries (TAI), Roketsan, Havelsan, Tubitak (the Scientific and Technological Research Council of Turkey), Turkish Airlines, FIGES Engineering und Defence and Aviation Cluster (OSSA) and the Aerospace

The Bundeswehr 'Willfire' flight demonstration

Airbus A350 XWB, bearing colour of launch customer Qatar Airways, touches down at Berlin Schönefeld Airport. This aircraft was on display at the 2014 ILA Berlin Air Show, and is the fourth prototype of this new generation airliner.

Clustering Association, displayed this nation's industrial capability, as well as research and development skills.

Emirates exhibit the new Airbus A380

Emirates had on display their new Airbus A380. Immediately after taking delivery of the airliner, Captain Alex Scerri and his co-pilot Angelika Barufke flew in to Berlin from Hamburg-Finkenwerder. This is the 48th aircraft of its type to be owned by Emirates, the Dubai-based carrier owning the largest fleet of A380s in the world.

German Defence Minister Ursula von der Leyen discusses technical features of the A400M cockpit with Airbus Group CEO Tom Enders.

Lake Constance (Bodensee) and its aerospace cluster

The Lake Constance region at the southern end of Germany, also known as the Bodensee, has numerous historical associations with aviation and was represented at the very first ILA in 1910 by the Zeppelin Company based in Friedrichshafen. At ILA 2014, eight companies with a joint stand represented the Cluster *BodenseeAIRea*. With this cluster initiative, the business promotion organisation of the Lake Constance region, together with its partners in this project, Fraunhofer Institute IAO, Duale College Friedrichshafen, Zeppelin University and Konstanz College, as well as 30 companies in this sector, are seeking to continue developing the aerospace industry in and around Lake Constance and thus establish it more comprehensively in the international market.

Airbus and IAI in joint venture agreement on UAVs

Airbus Defence & Space and Israel Aerospace Industries signed a joint venture agreement to supply the German Armed Forces, the Bundeswehr, with UAVs. The Air Force is being supplied with the unmanned IAI Heron TP reconnaissance aircraft as an interim solution until a replacement becomes available from European manufacturers. An Airbus spokesperson confirmed that there are two proposed solutions: to either purchase or lease these aircraft, the latter entailing less risks for Germany's military. The Bundeswehr has already leased the smaller Heron 1 for deployment in Afghanistan.

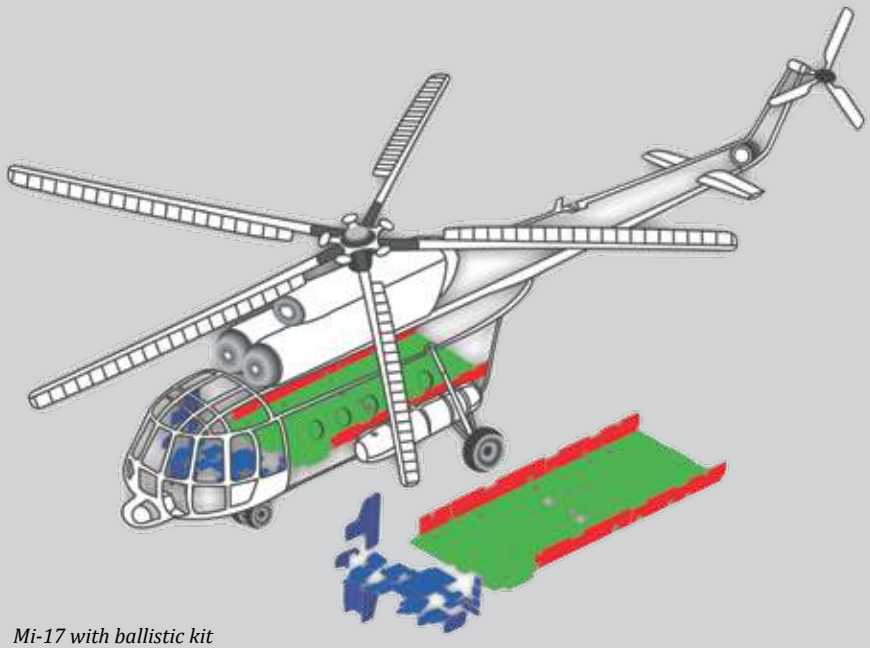
Eurofighter unveils 'paradigm shift' in capability

Eurofighter Jagdflugzeug GmbH chose the 2014 ILA Berlin Air Show to unveil details of a major capability enhancement package that secures the Eurofighter Typhoon's position as a swing-role/ multi-role combat aircraft. Briefing media and delegates at the German air show, former RAF Pilot Paul Smith, now a 'Capability Manager' for Eurofighter stated, "what we are showcasing at ILA represents a paradigm shift in capability of the Eurofighter Typhoon as a series of major enhancements are introduced to our customers. The second element of the Phase 1 Enhancements package known as 'P1Eb' takes Typhoon multi-role capability to a new level. This allows Typhoon to realise both its air-to-air and air-to-ground capability to full effect. It is a significant advancement for the programme."

Solo Türk, above made its German debut with a spectacular display by a single F-16 of the Turkish Air Force which sent two of its pilots to Berlin, the two young Turks flying on alternate days. Their aircraft had a striking design in black, silver and gold, the tail emblazoned with the eagle that appears on the Turkish coat of arms.

MKU showcases armour solutions for aircraft

MKU GmbH (formerly AST Security Equipment GmbH, now a wholly-owned subsidiary of MKU Pvt Ltd), a manufacturer of ballistic protection solutions for personnel and platforms, displayed a range of lightweight ballistic protection systems and unique patented attachment systems for helicopters, including its latest ultra light weight solution which has been developed after extensive R & D efforts and field trials in Germany. MKU GmbH is a registered NATO supplier since 1993 as well as an accredited supplier to the Federal Office of Bundeswehr Equipment, Information Technology & In Service Support (BAAINBw). In the last 25 years, MKU GmbH has provided protection solutions for more than 200 rotary and fixed wing aircraft including Mi17, Mi 8, Bell 212 (UH 1D), Super Puma, Sikorsky CH53, Black Hawk. Helicopters armored by MKU GmbH have seen active service in some of the harshest battlefields of the world including Afghanistan.



Mi-17 with ballistic kit

Patrouille Suisse celebrates 50th anniversary at the ILA

After a break in 2012, the *Patrouille Suisse* returned to ILA where they celebrated their 50th anniversary with an excellent programme. The Swiss air force team was established in 1964, with four Hawker Hunters and for the past two decades have flown six Northrop F-5E Tiger IIs in special red and white livery with the Swiss cross on the underside of the fuselage. It is likely that four Boeing F/A-18 Hornets will replace these in 2016. To mark their 50 years as a flying team, new elements and routines were included in the display, according to Lieutenant Colonel Daniel Hösli.

Elettronica at ILA

Elettronica GmbH, together with its mother company Elettronica Rome were present at ILA 2014. The company has successfully provided solutions and services for European Armed Forces, institutions and international industrial clients. Elettronica GmbH's core business comprises planning, development, manufacturing and services for systems, facilities and equipment relating to information, communication and microwave technology. Along with the manufacture of standard catalogue products, Elettronica GmbH specialises in the design and manufacture of special purpose products tailored to specific customer requirements, that is, systems for land-based EW and for Public Security.

Over the last 60 years, Elettronica successfully pursued the development of strategic and tactical surveillance capabilities as well as self-defence systems for various types of platforms, receiving recognition for not only being able to provide a wide range of EW solutions, but also having established true partnerships with its customers. As stated, "Elettronica invests about 10% of its resources in R&D, and collaborates with universities and research centres to develop ideas and projects which will become future and real solutions available to Elettronica's customers".

Rolls-Royce to strengthen R&D for future aero engines

At ILA 2014, Rolls-Royce revealed plans to develop key aero-engine technologies at its Dahlewitz site in Germany such research to create technologies delivering lower weight, lower cost, lower fuel consumption and higher performance engines. These technologies can be applied across future small and medium-size engines as well as larger engines in the wide-body market. As part of this, Dahlewitz will become the Rolls-Royce global *Centre of Competence* for power gearbox capability, performing research and technology development for power gearboxes and related components. The plans represent a substantial investment amounting to several hundred million Euros and are part of Rolls-Royce's global technology strategy to involve local industry partners and support provided by the relevant governments. One of the future engine designs announced by Rolls-Royce in February, called UltraFan, is a geared design with a variable pitch fan system.

The Greatest (Air) Show on Earth !

Their tails resplendently decorated with stylised Union Jacks, the Red Arrows are marking their 50th display season.

What has assuredly become the greatest air show on earth, is held annually near the small town of Fairford in the Cotswolds of Gloucestershine in England. This Royal Air Force Base, which one could easily miss but for some modest signage on the narrow country roads, is possibly the largest airfield in the UK, designated as the only Trans Oceanic Abort Landing site for NASA's Space Shuttle, its long runways rated with unrestricted load-bearing capacity. From RAF Fairford, the US Air Force mounted B-52 heavy bomber raids over Iraq in 2003 as also for *Operation Allied Force* in 1999 and the first Gulf War in 1991.

None of that was evident as *Vayu* visited the Royal International Air Tattoo 2014, or popularly, RIAT. The best description for this would be a right Royal *Tamasha*, with hundreds of aircraft types lined along kilometers of aprons and taxi tracks, ranging from new generation fighters and heavy transports, to maritime patrol aircraft, to vintage types including the iconic Lancaster bomber and Spitfire fighter of the Battle of Britain Memorial Flight.

The three-day event (11-13 July) had tens of thousands of visitors, a high proportion of them visibly excited enthusiasts who had come to the RIAT by train, bus and car, all herded into the airfield in disciplined manner and then released to enjoy themselves in virtual carnival atmosphere.

Nobody was disappointed! The flying display began with a thunderous take off by an Italian Air Force Eurofighter Typhoon, followed by an RAF Boeing Chinook and Alenia C-27J Spartan, before the thunder returned in the shape of a Turkish Air Force F-16C Fighting Falcon. Silence of the whispering

Amongst visitors to RIAT 2014 was Air Marshal Daljit Singh, AOC-in-C SWAC, IAF seen here with General Owe Wagermark ex-Swedish Air Force and Gp Capt Sudhir Verma

giant, Airbus A400M, was soon overwhelmed by Boeing's F/A-18F Super Hornet of the US Navy but soothened by an equally impressive but far less obtrusive performance by a Gripen C of the Hungarian Air Force. Disappointingly, the Lockheed Martin F-35B Lightning II remained a 'no show'.

And then some of the world's finest aerobatic teams : following the Aermacchi AT-339As of the Italian *Frecce Tricolori* were Northrop F-5E Tiger IIs of the *Patrouille Suisse,* Dassault–Dornier Alpha Jet Es of *Patrouille de France,* before the home team appeared, 9 BAE Hawks of the *Red Arrows* on their 50th show season.

Perhaps the greatest applause went to the *Breitling Wingwalkers* whose four Boeing Stearman biplanes each with a 'girl on the wing' in an audacious display of nonchalant verve, recalled the inter-war American 'barnstorming' years, the girls going through a full aerobatic routine, experiencing speeds of upto 150mph and forces of upto 4g.

Eurofighter F-2000A Typhoon of the Italian Air Force takes off from Fairford

Saab Gripen D of the Hungarian Air Force at static display

'Girls on the Wings' : the Breitling Wingwalkers at RIAT 2014

Farnborough INTERNATIONAL AIRSHOW
14-20 JULY 2014

Airbus aircraft dominate the static lineup at the show, from the massive A380 down to the diminutive C295

Farnborough International Airshow (FIA) 2014

$201 bn business deals mark high point for global trade event

By close of the exhibition, airshow organisers Farnborough International Ltd confirmed that the total sum of orders and commitments at the Farnborough International Airshow stood at $201 bn, beating all previous records set for the show. The figure represents an extremely positive note for the global aerospace industry.

Over the course of five days, orders and commitments for civil jet engines reached 1600 units with a total value of $34.5 bn and over 1100 aircraft totalling $152 bn. A further $14.5 bn was also achieved in service contracts, the combined figures thus reflecting the buoyancy of the aerospace industry internationally and in the UK. Speaking about the figures, Shaun Ormrod, chief executive for FIL said, "We are extremely pleased by these numbers, there is already an order backlog and these additional orders will keep manufacturers in business and people employed for some years to come. Great news for UK business and the economy."

Overall, the event footfall was good with visitor numbers standing at 100,000 and strong government attendance with the Prime Minister, David Cameron, opening the show and a tranche of government figures including Deputy Prime Minister Nick Clegg, and Members of Parliament like Vince Cable, Philip Dunne, Michael Fallon and Philip Hammond.

The 'Meet the Buyer' event proved very successful too, with over 1200 meetings taking place with 30 delegate companies and UKTI Commercial Officers. The event doubled in size compared to 2012, with over 300 companies participating. The official delegations programme was also well attended with over 77 military delegations in attendance from over 59 countries, including 10 delegations from the USA. The civil delegations programme also saw strong participation with senior management from 12 organisations including Hindustan Aeronautics Limited, AgustaWestland, Italy, Airbus and Sukhoi.

Speaking about the Show, Amanda Stainer, Commercial Director for

UTC

Farnborough International Ltd said, "We are delighted by the orders and commitments at the show, however, it's the networking outside of those deals that is just as important' as demonstrated by the number of exhibitors that have already rebooked for 2016. The value of bookings for the 2016 show has increased by a massive 1000% compared to 2014. We are very pleased."

During the show, Airbus won $75.3 bn worth of business for a total of 496 aircraft, making it by far the best Farnborough show for Airbus – both in terms of dollar value and number of aircraft. The deals comprise Memoranda of Understanding (MoU) for 138 aircraft worth $36.9 bn and purchase orders for 358 aircraft worth $38.4 bn.

Airbus kicked-off with the launch of the A330neo, followed by a brisk slew of announcements from major customers for a total of 121 A330neos worth $33.2 bn. Leading the charge was Air Asia X with a deal for 50 A330-900neos worth $13.8 bn. This landmark selection from one of Asia's fastest growing carriers, in addition to the stamp of approval from the leading lessors ALC, Avolon and CIT, has provided "further proof that Airbus and Rolls-Royce have made the right choice to build on the outstanding success of the medium-range A330 airliner with the latest technology Trent engines".

In the single-aisle sector, Airbus' A320 family garnered 363 commitments worth $39.0 billion. Of these, the orders for 317 A320neo and A321neo aircraft worth $34.4 billion are "a further reflection of how the A320neo family continues to outpace the competition." To put the icing on the cake, Airbus achieved the 3,000th A320neo family sale during the show. The milestone was reached when SMBC Aviation Capital ordered 110 A320neo airliners.

A mockup of CFM's LEAP turbofan

John Leahy, Airbus' Chief Operating Officer, Customers, said: "The orders and commitments we've received at this record-breaking Farnborough for both the A330neo and A320neo families are together an unequivocally resounding endorsement for these most cost-efficient aircraft." He added, "For both our single-aisle and widebody categories, the high representation of lessors – widely regarded as the global barometer of the industry – is indicative of the long term confidence in the capacity needs for sustainable growth for the airlines in the years ahead."

Deliveries of the A330neo will start in Q4 2017. "The A330 is a very important margin contributor for our group. It's also one of the most reliable and efficient commercial aircraft ever. Customers love it. With our decision to re-engine the plane, we will keep the A330 flying high for many more years to come. The development costs for the A330neo will be incurred from 2015 to 2017, with an impact of around -70 basis points on Airbus Group's 2015 Return on Sales target. However, we have a very good business case and the A330neo, once in service, will continue to significantly contribute to our group's earnings," said Tom Enders, CEO of Airbus Group.

Airbus Defence and Space 'Atlante' unmanned vehicle makes UK debut

Computer-generated rendition of an Atlante in flight

A next generation unmanned vehicle called *'Atlante,'* that has been developed by Airbus Defence and Space to the same standards as manned aircraft, was on static display in the UK for the first time at Farnborough 2014. The Atlante UAS has obtained a Cat 2 system certification that enables it to fly over segregated areas and so can operate in civil airspace. It is a medium altitude, long endurance tactical multi-payload unmanned aerial vehicle designed to carry out target identification, shoot correction and damage evaluation operations. It can also carry out other ISTAR missions including intelligence, surveillance, target acquisition and reconnaissance.

A380 landing at Farnborough as other show aircraft are parked on the apron

Russian Helicopters at Farnborough

At the airshow, Russian Helicopters presented the medium-lift coaxial rotor Ka-32A11BC, which can fly a range of special missions and is an effective tool in fighting fires, including those in high-rise buildings, and for rescue missions. The Ka-32A11BC holds an EASA type certificate and operates successfully in Austria, Switzerland, Portugal, Spain, Canada, Azerbaijan, Brazil, Indonesia, Kazakhstan, China, Russia, South Korea and Japan.

Russian Helicopters and Rosoboronexport also held a joint presentation of the Ansat-U training helicopter. The Ansat-U is a fly-by-wire helicopter that can be customised for different types of helicopters and can simulate various in-flight situations. State testing of the Ansat-U in Russia was completed in 2008, and since 2009 the helicopter has been in serial production and supplied to the Defence Ministry's training centre. Two well-known military transport helicopters were also displayed: the Mi-17V-5 and Mi-171Sh.

Kamov's Ka-52 'Alligator' attack helicopter

"The A330neo is the logical evolution of our reliable and versatile A330 Family. It provides an optimal solution for airlines around the world looking to minimise their fuel and operating costs while offering the best-in-class comfort to their passengers," said Fabrice Brégier, Airbus President and CEO. "We see strong market potential for the A330neo, and like its market-leading smaller sister, the A320neo, we are confident this new aircraft will be a success in the medium-haul segment. We are again leveraging a proven aircraft with a wide operator base and making it even more efficient with the latest innovations and technology developments."

In addition to the new Rolls-Royce Trent 7000 engines, the A330neo will feature incremental innovations, including aerodynamic enhancements such as new A350 XWB inspired winglets, an increased wingspan and new engine pylons. "Pilots will benefit from latest generation cockpit systems, and the A330 cabin will be further optimised to offer up to ten additional 18-inch wide seats. Passengers are winners too, as they will be able to enjoy a 21st century on-board experience with features including fourth generation in-flight entertainment (3D films), mood-lighting and full connectivity", promised company officials.

The CFM Executive Team, Jean-Paul Ebanga, Cedric Goubet, and Allen Paxson, celebrated record orders at the 2014 Farnborough Airshow. CFM International's LEAP and CFM56 product lines remain the "engines of choice" for

US Navy Boeing P-8A from Air Test and Evaluation Squadron ONE (VX-1) conducted displays armed with inert AGM-84 Harpoon AShMs mounted underwing

single-aisle aircraft, with the company signing orders, commitments, and long-term service agreements for a total of 1,062 engines at Farnborough. Highlights of the week included easyJet selecting the LEAP-1A engine to power 100 Airbus A32neo and 35 A320ceo aircraft, American Airlines selecting the LEAP-1A engine to power 100 Airbus A320neos, Monarch Airlines' commitment to purchase LEAP-1B engines to power 30 Boeing 737 MAX aircraft, along with a long-term service agreement and Hainan Airlines' commitment to purchase LEAP-1B engines for power 50 Boeing 737 MAX airliners.

"What an incredible week," exclaimed Jean-Paul Ebanga, President and CEO of CFM International. "We started the show predicting that 2014 would be another record year; that prediction came true in a big way. As of today, we have total orders and commitments for more than 3,000 engines. And it is still only July. Both the LEAP and CFM56 product lines continue to prove their worth to our airline customers around the globe and we are constantly gratified by the continued faith these airlines show in our people and our products. As always, our job is to continue to earn their trust every day, delivering the reliability and operating economics they have come to depend on from CFM."

Boeing marked 40 years as an exhibitor at Farnborough International Airshows by highlighting its commercial airplanes and its advanced defence capabilities. Boeing announced a new 200-seat 737 MAX 8 option that will give airlines up to 11 more seats of revenue. This latest addition to Boeing's comprehensive product and services line-up will deliver 20 per cent fuel-consumption savings compared to today's Next-Generation 737. Boeing also announced new details about the interior of the 777X.

Boeing Defence and Space unveiled their new Maritime Surveillance Aircraft at Farnborough. The aircraft, based on a Bombardier Challenger 605 business jet, will provide customers with maritime and overland surveillance, anti-piracy, coastal security and search-and-rescue capabilities.

Raytheon and Kongsberg team to provide air-launched OASuW solutions

Raytheon and Kongsberg Gruppen of Norway have formed a teaming agreement to provide new solutions for the Offensive Anti-Surface Warfare (OASuW) mission. As a centrepiece of the agreement, the companies will develop the Joint Strike Missile (JSM) for air-launched OASuW applications. The Joint Strike Missile is already funded for development for the Royal Norwegian Air Force at a time when the United States Navy is considering cost-effective solutions for next-generation OASuW weapons systems.

"The US and its allies gain new and innovative options in the OASuW arena through this agreement," said Dr Taylor W. Lawrence, Raytheon Missile Systems President. "Raytheon's global development capability allows us to identify and offer the advanced and affordable solutions our customers require for the complex missions of the future."

Raytheon and Kongsberg have already collaborated successfully in the global market for ground-based air defence systems and in other fields.

An Azul ATR 72-600 was on display at Farnborough 2014

Boeing signed a memorandum of collaboration with Paramount Group to jointly develop defence and security opportunities in key international markets. Paramount Group is Africa's largest privately owned defence and aerospace business.

Customers demonstrated their strong confidence in the family of Boeing commercial products, announcing orders and commitments for 201 Boeing airplanes valued at more than $40.2 billion at list prices. Additional orders announced during the week brought the number of net orders for 2014 to 783.

"Over 40 years of exhibiting at Farnborough, Boeing has consistently demonstrated its commitment and drive to innovate and develop game-changing products, equipment and services across the commercial and defence sectors," said Charlie Miller, VP of International Communications. "Farnborough 2014 was filled with excitement and enthusiasm among our customers, partners and suppliers and was a strong endorsement of our product line with commercial orders that bring our tally this year to 783."

Boeing products flying at the show included the new 787-9 Dreamliner, the P-8A Poseidon and the multi-role F/A-18E/F Super Hornet strike fighter.

ATR announced firm orders for 144 aircraft (119 ATR 72-600 and 25 ATR 42-600), with options for 112 additional aircraft, since the beginning of the year. This year's contracts, of which many were revealed during the week of the show,

L-3 WESCAM demonstrates electro-optical and infrared imaging capabilities

L-3 WESCAM provided a series of live product demonstrations of its MX-10, MX-15 and MX-25 electro-optical and infrared (EO/IR) imaging systems at FIA. The demonstrations showcased a wide range of advanced sensor capabilities in support of military, homeland security and airborne law enforcement agency ISR missions. "The MX-25 was engineered to support customers requiring very long-range imaging performance where positive identification is paramount," said Paul Jennison, Vice President of government sales and business development for L-3 WESCAM. "We're seeing growing interest in this capability worldwide and are especially pleased to showcase the system at Farnborough, which marks the first time it is being demonstrated outside of North America."

The multi-spectral, multi-sensor MX-15 system includes a colour low-light, wide-angle zoom EO imager and a zoom spotter – two significant technologies that were released in May 2014. Similarly, the MX-25 system is equipped with a dual-channel daylight and EMCCD low-light spotter.

Bombardier's first CSeries flight-test aircraft (FTV1) pictured during a test flight over Canada

represent a total value of over US$3.45 billion (US$6 billion including options). This allows ATR to further strengthen its position in the market for regional aviation, and thus confirms the predominance of turboprop aircraft, and particularly those of ATR, for short distances. Sales for the first half of the year highlight the appeal of the ATR '-600's for regional companies and the leasing company community, attracted by the economic and environmental performance of the aircraft, their technical reliability and their high standard of comfort. In 2014 the ATR -600's have also passed the symbolic mark of 500 firm orders since their launch at the end of 2007. ATR's backlog currently stands at 325 aircraft to be delivered in the coming years, a new record, representing a value of US$8 billion. On the back of this sales performance in the first half the year, ATR has increased its end of 2013 backlog by around 45%, seeing production ensured for almost 4 years.

Patrick de Castelbajac, Chief Executive Officer of ATR, was "very satisfied with ATR's performance over the first six months of 2014, which confirms the strong demand from regional operators for ATR aircraft. Among the contracts signed this year, we have new customers, but also several orders from existing customers satisfied with the operational performances of our aircraft." He added: "Over the last

Pratt & Whitney readies for GTF engine EIS

Pratt & Whitney, a United Technologies company, is launching its Entry Into Service (EIS) programme for the Geared Turbofan engine family. According to the Company, when the Geared Turbofan (GTF) engines enter service in 2015, a global partner network will be in place and prepared to support customers 24/7 on day one of EIS. "Pratt & Whitney will launch Geared Turbofan engines on five major aircraft platforms over the next four years," said Andrew Tanner, Vice President of Customer Service. "We are building on our comprehensive customer service network to ensure the highest level of support for more than 50 global operators who have already placed firm and option orders for over 5,500 engines."

two years we have increased our production capacity by almost 40%, an unequalled growth in the industry. This is in order to meet the increasing market demand for our aircraft. We must continue to increase our production rates and to develop the range of products in order to reinforce our leadership."

Bombardier Aerospace also had a successful week at the Farnborough International Airshow having announced firm orders, conditional purchase agreements and letters of intent for a total of 74 aircraft, valued at more than $4.25 bn. Bombardier Commercial Aircraft kicked off by announcing two letters of intent (LOIs) for up to 24 CS100 aircraft by Falko Regional Aircraft Limited. Through the week, Loong Air, Petra Airlines and an "undisclosed" African airline joined Falko in growing the list of CSeries aircraft customers to 20. In addition, an existing customer signed a conditional purchase agreement for up to 13 CS300 aircraft, and airBaltic and Falcon Aviation revealed themselves as previously undisclosed customers which contributed to bringing the number of firm orders and commitments to 513. Finally, in conjunction with Bombardier's opening conference, Export Development Canada, UK Export Finance, and Investissement Québec announced that they had jointly developed a working model for partnered financing of CSeries aircraft customers.

On the Q400 NextGen aircraft programme, Bombardier celebrated surpassing the milestone of 500 firm orders with the latest order from Horizon Air and Nok Air. In addition, Bombardier signed an LOI for five Q400 NextGen turboprops with Falcon Aviation, while Abu Dhabi Aviation disclosed that it was a previously unidentified Q400 NextGen customer, and Bombardier officially announced a cargo-passenger combi configuration of the turboprop. A CRJ900 NextGen aircraft in American Airlines' livery joined the Q400 NextGen aircraft on static display, while Bombardier showcased the enhancements that it brought to its regional jet programme, including up to 5.5 per cent lower fuel consumption than earlier-generation CRJ900 aircraft. Bombardier also shared its vision of double-digit fuel burn reduction by 2020.

Irkut MC-21 programme updates at FIA

At the Farnborough International Airshow 2014, Irkut Corporation together with Russian and foreign partners presented their MC-21 programme. The display reflected transition of the programme from the design to the production stage. Currently, the Irkutsk aviation plant — a branch of Irkut Corporation — is completing the first MC-21 aircraft for flight-testing.

New production facilities of AeroComposit and RT-Chemcomposite in Russia manufacture polymeric composite substructures for the MC-21 and one of them, the stringer panel of the tail plane torsion box, was demonstrated at the show. The United Engine Corporation PD-14 and Pratt & Whitney PW1400G new generation aircraft engines developed for the MC-21 family are also currently under testing, and UEC and Pratt & Whitney presented engine mockups. A number of leading aircraft systems manufacturers are participating in the MC-21 programme. Ratier-Figeac presented its innovative cockpit controls for the MC-21 aircraft. NPO Hydromash introduced a full-scale sample of the nose landing gear. New lightweight passenger seats in economy and business class configurations were presented by Zodiac (see below).

The PT-MS-21-300 flight simulator was demonstrated in the MC-21 pavilion, as developed by Full Flight Simulator Research and Production Company (CKT Company Ltd) and used for testing airborne equipment and for flight test preparation. The simulator is the first element within the training facility, which is installed in the centre for training of aviation personnel of JSC Aeroflot – Russian Airlines.

Seat mockups in front of the MC-21 display at the show

More–and more– News from FIA 2014

Raytheon at FIA

Precision weapons, advanced gunfire detectors, tiny jammers and a bus-size radar that tracks missiles as they hurtle through space were all part of Raytheon Company's technology showcase at FIA.

Raytheon experts met with numerous customers and briefed some of the world's media on innovations in its missiles, radars and other product lines during the Farnborough event. "Developing a common understanding of the complexity of the security challenges in today's global environment is the first step toward building a strong customer relationship," said Thomas A. Kennedy, CEO, Raytheon Company. "The Farnborough International Airshow has historically provided us with an ideal opportunity to showcase our technology and product portfolio to customers from around the world. Defining the right mix of cost-effective solutions to support our customers' needs drives solid business partnership and shared success."

Raytheon equipment on display included avionics and weapons, and with recent major contract awards such as the US Navy's Air and Missile Defence Radar, and the Navy's Next Generation Jammer, the company showcased its technology prowess at the airshow.

IAI's advanced electro-optical payload M-19HD

Israel Aerospace Industries announced that its innovative M-19HD payload had successfully completed its first airborne test-flight on a light aircraft as part of the development programme. Additional test-flights are expected on IAI's Heron unmanned aerial vehicle (UAV). The successful flight lasted about two and a half hours during which operations of sensors, payload stabilisation and tracking capabilities were tested.

M-19HD is a High-Definition, compactly designed, multispectral, multi-sensor, single line-replacement unit (LRU) payload (simultaneously incorporating up to 7 sensors). M-19HD enables continuous day/night surveillance in all weather conditions and provides acquisition ranges due to its powerful sensors, high stabilisation and image processing capabilities. M-19HD reduces the operator's workload and improves situational awareness by virtue of its multi-mode automatic video tracker (AVT). It also provides accurate geo-location using its embedded IMU/GPS (Inertial Measurement Unit/Global Positioning System).

Israel David, General Manager of IAI's Tamam Division stated that "We are in the midst of successful testing for the M-19HD payload. It is the ideal system for long-endurance ISR (intelligence, surveillance and reconnaissance) missions and area dominance. M-19HD is our flagship electro-optical payload; it will lead to a revolution in its field. The system is designed to be installed onboard advanced unmanned aerial platforms like IAI's 'Heron 1' and 'Heron TP' UAVs and to perform strategic missions. The M-19HD will provide our customers with improved performance, powerful sensors, high stabilisation and unique image processing features, together with long range persistent surveillance capabilities."

Selex ES Raven AESA radar on the Gripen NG

Selex ES has been contracted by Saab to supply the Raven ES-05 AESA (Active Electronically Scanned Array) radar for Saab's Gripen Next Generation (NG) fighters. In addition to the Raven radar, the company will also provide the Skyward-G IRST (Infrared Search & Track) passive sensor and IFF (Identification Friend-or-Foe) system, "both of which will be contracted for in the next few months." Selex's participation in the Gripen NG programme dates back to 2009, when an agreement was signed with Saab for the development of the Raven ES AESA radar. This was followed in 2010 by the selection of the Skyward-G IRST sensor and the IFF system.

Raven AESA radar seen mounted to the 'repositioner' that is unique to the Gripen NG

A production-standard Raven AESA radar is now installed on Gripen demonstration aircraft, while flight tests with the Skyward G IRST have been underway since March, achieving "excellent results and demonstrating the value of a passive sensor as an integral part of a weapons system". The IFF system will be delivered later in the year.

In a recent development, Selex's new BriteCloud Expendable Active Decoy (EAD) has also been chosen as an electronic warfare option for the Gripen NG and all other versions of the aircraft. Currently, the BriteCloud EAD is the only product of its type in the market and Saab will be the first partner to offer the new decoy, boosting the desirability of Gripen NG for new customers. Live BriteCloud trials on-board the platform are expected to take place by the end of 2014.

"The Gripen NG is in full-scale development for Sweden and has been down-selected and in final negotiations for Brazil."

MBDA's Brimstone 2 missile enters production

MBDA announced that production of the Brimstone 2 missile has commenced at the Lostock and Henlow manufacturing facilities in England. The missile incorporates the latest mmW radar and semi active laser Dual Mode Seeker capability, an Insensitive Munition (IM) rocket motor and warhead, and a new and stronger airframe for increased air carriage robustness. This new missile will enter service with the Royal Air Force (RAF) on Tornado GR4s and is being evaluated for the Typhoon.

Brimstone missile under final assembly

"Brimstone 2 provides greater operational flexibility by enhancing guidance capabilities against challenging targets and through a step change in IM compliance that significantly improves operator, maintainer and platform safety on operations and reduces the logistics burden of operational deployments", stated MBDA executives.

Entering series production is a key step to the fielding of the weapon on the RAF's platforms and follows the successful Qualification of the Brimstone 2 IM rocket motor and IM warhead, which are both in series production. MBDA took receipt of the first production batch of rocket motors on 10 June from Roxel and the warheads on 30 June from TDW. The Tornado GR4 will benefit first whilst activities are underway to assess Brimstone 2 for use on Typhoon. Following the award of a study contract to BAE Systems from UK MoD, on 18 June MBDA signed a contract with BAE Systems to support the evaluation of Typhoon integration of Brimstone 2.

Elettronica and Lockheed Martin cooperate on DIRCM for C-130Js

Lockheed Martin and Elettronica have signed a joint agreement to integrate Elettronica ELT/572 Directional Infrared Counter Measures (DIRCM) on C-130Js operated by the Italian Air Force and potentially on platforms operational in select markets. This represents the first installation of a DIRCM system onto C-130J Super Hercules.. Elettronica had secured an order with the Italian Air Force for its system ELT/572 DIRCM COMMON, in twin turret configuration, which will equip different types of platforms, from the C-130J Super Hercules to the EH101 helicopter in CSAR configuration, as well as the C-27J.

ELT/572 DIRCM turret

ATK and Alenia Aermacchi test the C-27J

ATK and Alenia Aermacchi have completed the first phase of ground and flight-testing of the fully configured multi-mission MC-27J tactical transport aircraft with the support of the Italian Air Force (ITAF). The series of tests exceeded all test objectives and demonstrated the accuracy of ATK's side-mounted GAU-23 30mm cannon. The ITAF MC-27J aircraft was modified with an L-3 Wescam MX-15Di Electro-Optical and Infrared Turret mounted under the nose of the aircraft to support multi-mission applications such as a Gunship, Intelligence, Surveillance and Reconnaissance (ISR) and Search and Rescue (SAR) missions; various radio and data links and ATK's Roll-On/Roll-Off (RORO) palletised gun and mission control systems. The MC-27J is an advanced multi mission system jointly developed by ATK and Alenia Aermacchi and based on the C-27J.

MC-27J seen in armed configuration

A320neo surpasses 3,000 firm orders

The A320neo (new engine option) Family reached an important milestone in July 2014, having collected more than 3,000 firm orders from 57 customers since its launch in December 2010. The milestone was reached when SMBC Aviation Capital ordered 110 A320neos.

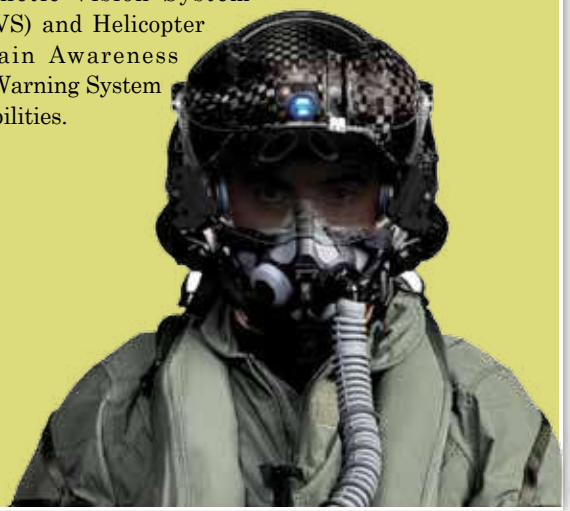
BAE unveils Digital Striker II HMD system

BAE Systems have unveiled its Striker II Helmet-Mounted Display (HMD), a fully digital solution that provides "today's combat pilot with exceptional night vision and target tracking technology integrated within a visor-projected system". With decades of combat-proven experience, the new platform-agnostic Striker II HMD builds upon BAE Systems' current Striker HMD, which has been successfully deployed on Eurofighter Typhoon and Gripen fleets. Delivering breakthrough abilities for night combat, the Striker II brings its high performance digital night vision camera inside the helmet, which helps reduce g-force effects on the pilot's head and neck to improve comfort, and eliminates the need to manually configure and adjust night vision goggle (NVG) hardware for day-to-night transitions. This next-generation HMD also includes a tracking system, which ensures that the pilot's exact head position and the aircraft computer system are continuously in sync, reducing problems common to other HMDs. The Striker II tracking system, with new hybrid opto-inertial technology, eliminates any delay in determining where the pilot is looking and can therefore perfectly position symbology onto the visor.

Rockwell Collins and Elbit deliver F-35 Gen III HMDS

The Rockwell Collins and Elbit Vision Systems Gen III Helmet Mounted Display System (HMDS), which provides situational awareness for fighter pilots, has been delivered to Lockheed Martin for software integration as part of the Low Rate Initial Production 7 for the F-35 programme. The HMD features a biocular 40x30 degrees field-of-, high view brightness and high-resolution display, with integrated digital night vision. All the information that pilots need to complete their missions – through all weather, day or night – is projected on the helmet's visor, an industry first.

At Farnborough 2014, Rockwell Collins also demonstrated the company's MultiScan ThreatTrack Weather Radar, EVS-3000 Enhanced Vision System and HeliSure product line for helicopters, all new offerings introduced this past year. Rockwell Collins also demonstrated its HeliSure flight situational awareness product suite for rotary wing aircraft. HeliSure delivers sensor data in real time through an intuitive user interface that features 3D visualisation for information that pilots can "easily and efficiently process." The first two products of the HeliSure family are Helicopter Synthetic Vision System (H-SVS) and Helicopter Terrain Awareness and Warning System capabilities.



Selex ES debuts advanced cockpit with panoramic display

Selex ES, have introduced a 'latest-generation cockpit' equipped with a new panoramic display designed to meet civil and military customers' growing requirements for "Flight Situation Awareness" for fixed and rotary wing platforms. The system offers pilots greater security in Degraded Visual Environments (DVE), like sand storms, fog and rain, particularly during critical takeoff and landing phases and in low altitude flight. This greater security reduces crew stress and overall workload. The panoramic display includes integrated high performance information fusion and is an efficient weight, size and cost thanks to the small number of computer units and avionics cables required. The system is also very easy to install.

Eurofighter reports "exceptional interest" at FIA 2014

Eurofighter Typhoon at Farnborough

AESA radar for the Typhoon

Alberto Gutierrez, CEO of Eurofighter GmbH, reported 'exceptional interest' from the international market. Gutierrez, who has headed the German-based consortium for just over a year, said: "This year's event was an exceptionally busy one for us. We showcased a new radar system, hit the 250,000 flying hours milestone for our fleet, and signed a major missile integration contract. On top of this we had high levels of interest from a series of international delegations who wanted to see what we had to offer. All in all it could hardly have been a better week!"

Eurofighter world-premiered its new Captor-E AESA radar system on a development aircraft at the Show – "a powerful new electronic radar which offers instantaneous performance and the widest field of view of any fighter radar currently on the market." Eurofighter has now delivered 412 Eurofighter Typhoons to six nations "with a seventh signed up." The Company recently completed a major software and systems upgrade on the aircraft which it claims offers a 'paradigm shift' in capability.

OIS Aerospace displays simulator

OIS AeroSpace displayed its next generation simulator development platform for cockpit simulators for fixed and rotary wing aircraft. This allows for integration and testing of real-time avionics hardware as part of the cockpit simulation environment and specifically permits the creation of new cockpit simulators. It also permits the testing and integration of diverse avionics from different suppliers that interact with the aircraft cockpit display system. It allows these units to be tested in a real-time simulation environment , and prior to its integration and installation in the aircraft, resulting in significant savings.

"OIS AeroSpace is pleased to announce the availability of the Fixed Wing and Helicopter Simulator Development platform. This platform provides us with an essential and attractive technology to support OEMs with their engineering and testing work packages for delivering on their Offset obligations", said Sanjay Bhandari, Chairman and Managing Director of the OIS Group of companies.

Farnborough INTERNATIONAL AIRSHOW
14-20 JULY 2014

Of specific interest – to India !

The MBDA Chalet in row D was particularly welcoming to Indian visitors, with formal announcement that the Indian MoD had signed a £250 million contract with European missile manufacturer MBDA to equip the Indian Air Force's SEPECAT/HAL Jaguar strike aircraft with the company's ASRAAM short-range air-to-air missile. The deal had been announced earlier during the visit of British Foreign Secretary William Hague and Chancellor George Osborne to New Delhi. The ASRAAM is designated as the 'new generation close combat missile' (NGCCM) by the IAF, which will mount it on the unique over-wing pylons of the Jaguar, freeing up underwing hardpoints for air-to-ground ordnance in keeping with the Jaguar's primary strike role (*see News in India*).

Rob Thornley and colleagues of MBDA Missile Systems in front of a mock up ASRAAM at their chalet.

Boeing Defence, Space & Security President and CEO Chris Chadwick is an old India hand, having led the Boeing team on the MMRCA programme. Chris did not duck any questions on Boeing's strategy for the present and the future, T-X next generation USAF trainer in particular. As quoted by *Show News* at the Farnborough Show, "we have a competitive differentiator on the T-X next-generation

Christopher Chadwick, President & CEO Boeing Defence, Spae & Security with Maureen Cragin, VP Communications.

Air Force trainer, from a couple of different perspectives. Our partner, Saab, brings a different design-develop mind-set. It is that collision of ideas that is helping us see better ways of designing in a more-for-less world".

"Our design is completely tuned to the US Air Force and its requirements and needs, and our competitors' are not. Their products were designed and developed for someone else's air force. They are going to have to make modifications, go back through flight test. They will have to add capability, perhaps take capability out, which will have a cost impact. We believe that from a cost perspective, we will have an advantage". It is understood that leading the Saab team with Boeing at St Louis is

Håkan Buskhe, Saab Group President and CEO at his keynote presentation at Farnborough Show 2014.

Eddy De La Motte, who earlier was one of the key programme managers for the new generation Gripen programme.

On the subject of Gripen : Saab are very optimistic about their future, exemplified by the amazing Gripen E new generation fighter : the company is understandably buoyant with the Brazilian contract nearing formalisation. Saab Group President and CEO Hakan Bushke took the stage during his briefing at their Chalet on opening day of the Show. The recurring theme for Saab at Farnborough 2014 was 'Breaking the Thought Barrier' and there certainly was much Smørrebrød for thought.

Despite the understandable disappointment in Switzerland (much more on that in the time to come), Saab has great confidence that at least 400 Gripen E/Fs will be sold in the international market over

New generation weapon systems, including mock ups of the Meteor BVR missile and small diameter bombs, as carried on Gripen NG, seen at Hall 4.

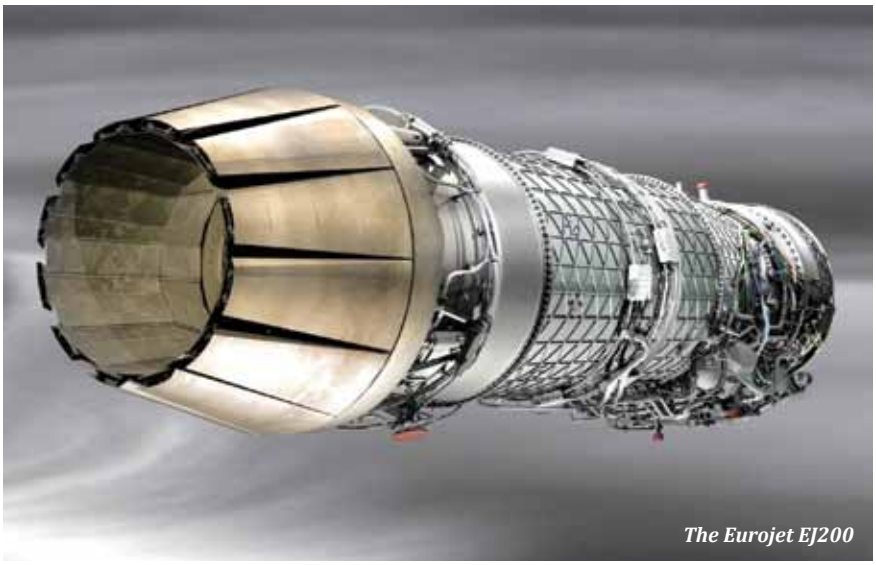
the next decade and Brazil's order for 36 Gripen E/Fs is just the tip of the iceberg. The Swedish Air Force will receive 60 brand new Gripen Es, with the earlier Gripen C/Ds being subject to an upgrade (MS-20). Amongst many leading edge systems being incorporated, is the Meteor ram-jet BVR missile, which along with the Raven ES-O5 AESA radar, makes this possibly the most advanced European origin fighter extant. As Lennart Sindahal, head of Saab Aeronautics

said during his update, "Today's Gripen is already tomorrow's fighter" !

Other European fighters are also modernising : earlier this year, the French ministry of defence awarded Dassault a contract for the next major Rafale upgrade, known as F3R. It includes more powerful processors and upgrades to the Multifunctional Information Distribution System-Low Volume Terminal data link and the automatic ground collision avoidance system. The Rafale is receiving the RBE2 AESA radar and DDM-NG missile-warning system.

The Eurofighter Typhoon however is somewhat late in getting its AESA radar on board. In the Tranche 3, there are provisions for the new radar even as the Royal Air Force is planning for Tranche 1 Typhoons to be retired in 2019. For Tranche 2 and 3 jets, though, the focus is on software upgrades. At Farnborough 2014, there was a ceremony to mark the first Captor-E AESA radar to be fitted on a Eurofighter Typhoon.

Dr AK Ghosh, Programme Director of the Advanced Medium Combat Aircraft (AMCA) and colleagues from ADA at the aircraft static display in Farnborough.



The Eurojet EJ200

The Eurojet Chalet in row A was close to the Eurofighter mock up on display, and there was understandable interest in future developments. Some 1500 EJ200 turbofan engines have been contracted for with over 1000 delivered and 500,000 engine flying hours achieved, its "outstanding engine performance, reliability and operational capability proven during in-service operation of the four nations (Germany, UK, Italy and Spain), Austria and the Kingdom of Saudi Arabia".

Eurojet's CEO Clemens Linden recalled the company's achievements over the past decades and new enhancements on offer: "The plan is to insert current technologies into the engine to reduce costs or improve performance, with a phased programme allowing the 'packages' to be retrofitted into existing engines if required. Already, the EJ200 can be considered to be a 4.5 generation engine, stated Clemens Linden, who is closely following developments in India, with the new Government enhancing FDI in defence to 49%. Eurojet are certainly also looking at new applications for their star engine and have been examining the possibility of meeting the requirements of 5th generation fighter programmes in South Korea – and India.

Although the spirited Grob 120TP basic turboprop trainer did not find favour with the Indian Air Force to meet its BTT requirement, many other air arms seem to be lining up to order this aircraft. After successes in Indonesia, now the Mexican Air Force has announced an order for 25 firm plus 15 options as also simulators and computer-based training systems, with deliveries to begin later this year.

According to the CEO Andre Hiebeler, "Currently the company is running 24 sales campaigns around the globe, for about 100 aircraft. Besides Mexico, latest customers include Argentina (10+15), and Kenya

Naresh Babu, MD HAL Bangalore Complex and T Suvarna Raju, Director D&D

(6+4). The G120TP has also been selected by Affinity (Elbit Systems and KBR) in that partnership's bid for the UK Military Flying Training System programme". In a unique approach, Grob plan to offer G 120TP-based training services to cost-conscious air forces around the world. "Air Forces can simply buy the service instead of building up and running cost training centres that sometimes run at only one third of their real capacity", suggested Hiebeler.

The other Grob aircraft type on display at the Farnborough Show was its G 520 EGRETT high-altitude, long-endurance surveillance aircraft. This particular aircraft has been bought back from Australia where its spent many years on various research programmes. Uniquely, the piloted or unmanned aircraft can fly up to 32 hours, carry up to one ton of payload and fulfil observation, research or reconnaissance missions.

Getting back to the travails of the IAF's basic turboprop trainer (BTT) requirement which has partially been met by the Pilatus PC-7 Mk.II from Switzerland, HAL are still working towards flying their HTT-40 aircraft powered by a TPE 331–12B engine in 2015. Meanwhile, the HJT-36 intermediate jet trainer programme is facing some turbulence.

HAL had its (double) chalet in row K, with models of the HJT-36 intermediate jet trainer and light combat helicopter (LCH)

Sqn Ldr Baldev Singh, HAL's Chief Test Pilot is seen in this enlarged image of the HJT-36 intermediate jet trainer, placed outside HAL's Chalet at Farnborough 2014.

A fine flying shot of the Grob 120TP

Reto Obrist, Production Test Pilot with Pilatus Aircraft of Switzerland, seen with the PC-21 turboprop trainer at Farnborough 2014. He had just ferried the 40th PC-7 Mk.II to the Indian Air Force Academy at Dundigal.

in the corners of an otherwise fairly sparse area. The Chairman Dr RK Tyagi and his senior colleagues, including Naresh Babu and T Suvarna Raju were inundated with meetings through the week. On 30 June, HAL had issued a global RFI inviting responses to "revisit, analysed and examine weight reduction scope/ optimisation ensuring required strength, stiffness & fatigue criteria.…" and sure enough there were many organisations expressing interest.

Expanding on this, HAL had given the following background information :

"The HJT-36 aircraft presently weighs around 4150 Kg in its Normal Training Configuration, i.e., with two pilots and full internal fuel without any external stores. HAL is envisaging achieving maximum possible weight reduction / optimisation for the aircraft.

The design of the above needs to be revisited, analysed and the scope for weight reduction / optimisation studied while

ensuring the required strength, stiffness & fatigue criteria. The new innovative ideas w.r.t. material, LRU's and other related equipments maintainability shall be included. Towards this HAL is looking forward for partnership / technical assistance / consultancy from a well experienced airframe design house. The interested companies may respond with detailed justification of their capabilities and tentative plan with time lines for HAL to consider issuing formal tenders.

This weight reduction / optimisation study must be comprehensive, encompassing all the Structure, Mechanical Systems & Electrical Avionics Systems. It should meet the adequate strength, stiffness and fatigue criteria, methodology for testing, Analysis and functioning details are to be provided."

A large group from the UK industry visited the HAL chalet for meetings with Chairman HAL and his senior directors on the Indian Regional Transport Aircraft (IRTA) programme. According to Dr RK Tyagi, Chairman, HAL, the RFP would be issued soon for the engine of the aircraft as 11 bidders have already responded to the recent RFI issued for the 70-90 seater civil aircraft engine. The aircraft would be manufactured in India with an expected roll-out by 2022. Mr T Suvarna Raju, Director D&D of HAL gave the outline of the project. "In the initial period we expect around 400 aircraft to be produced. This is conservative estimate and the potential is much more considering that India has 450 airstrips and more cities would be linked with air travel in future".

Dr RK Tyagi, HAL Chairman and Directors with Ms Carole Sweeney, Director of UK Trade & Investment and her team.

Model of the ARJ-21 at the COMAC stand.

Meanwhile, it would be well worth examining the journey of China's ARJ-21 regional airliner which has also been long in the making. Learning along the way and inviting foreign inputs as necessary, first production example of COMAC's ARJ-21-700 flew on 18 June 2014 and officials state that first deliveries will be in mid-2015. Apart from China's own requirement, with over 250 ARJ-21s ordered, an export drive is reaping dividends. At Farnborough the Republic of Congo signed an MoU for three ARJ-21s. In the future, a 98-105 seat ARJ-21-900 is planned as also the ARJ-21-700F freighter.

In pursuit of various Aviation Projects

VAYU Interview with AVM BL Thakra, COO, OIS AeroSpace

VAYU: At India Aviation 2014, you announced the creation of OIS-AS, stating that the firm will focus on aviation. Please detail key areas of business that OIS-AS will be focusing on in the military and civil aviation sectors.

BLT : OIS-AS has a broad focus across aviation, both military and civil. As an example, we have just bid for the IAF's MiG-29 upgrade and the An-32 overhaul programmes.

In addition to pursuing various aviation projects, our business focus includes the following segments: avionics, manufacturing, including of select components/parts, maintenance repair and overhaul, aero structural upgrade and testing, ground support equipment, training and simulation, technical documentation and indigenisation to address obsolescence. We plan to fulfil a range of requirements of aircraft operators, aircraft manufacturers, maintenance agencies and users for aircraft for airborne mission platforms.

Our capabilities include supply and licensed manufacture of avionics, rugged ATRs for avionics, wires and cables, rugged display and consoles, precision machined mechanical parts and subassemblies, and design and analysis of structures, electromagnetics, aerodynamics and control.

Meanwhile, we have already announced India OEM relationships with Magnaghi Aeronautica for SkyArrow, and Gemelli for noise reduction aviation headsets. More technology relationships are in the offing and will be announced at suitable times.

VAYU: Private sector participation in the Indian defence and aviation sectors has faced obstruction from policymakers for decades. Yet over the past few years, the winds of change have begun to blow and a number of industrial powerhouses are gearing up for opportunities ahead. What is your strategy for the future – collaboration or competition with the large firms?

BLT : Policy shifts have begun and are increasingly positive for private sector participation. This is encouraging. Fortunately, the policy shift has also begun to recognise and encourage the SME sector. Our approach is simple; we wish to collaborate with global and domestic companies and build a foundation on technology collaboration.

VAYU: At Defexpo earlier this year, OIS-AS announced a "strategic relationship" with Italy's Magnaghi Aeronautica for the

Sky Arrow light aircraft. Does this include production, either of parts or complete aircraft, in India? Furthermore, who are the potential customers for this aircraft in India, and will OIS-AS consider customers in the wider South Asian market as well?

BLT : Our initial priority is to introduce the aircraft platform into India with full training and MRO support. As India OEM we are able to produce the aircraft within India which will be subject to the appropriate business case justifying the set-up of additional manufacturing facilities beginning with parts followed by assembling and finally local manufacturing. Clearly the success of the aircraft within India and a growing future order book will be the key driver in this respect.

The Sky Arrow platform has the capabilities to serve the three growing areas of the Indian aviation market: aerial work (surveillance, surveying & mapping), flight training and the leisure segment.

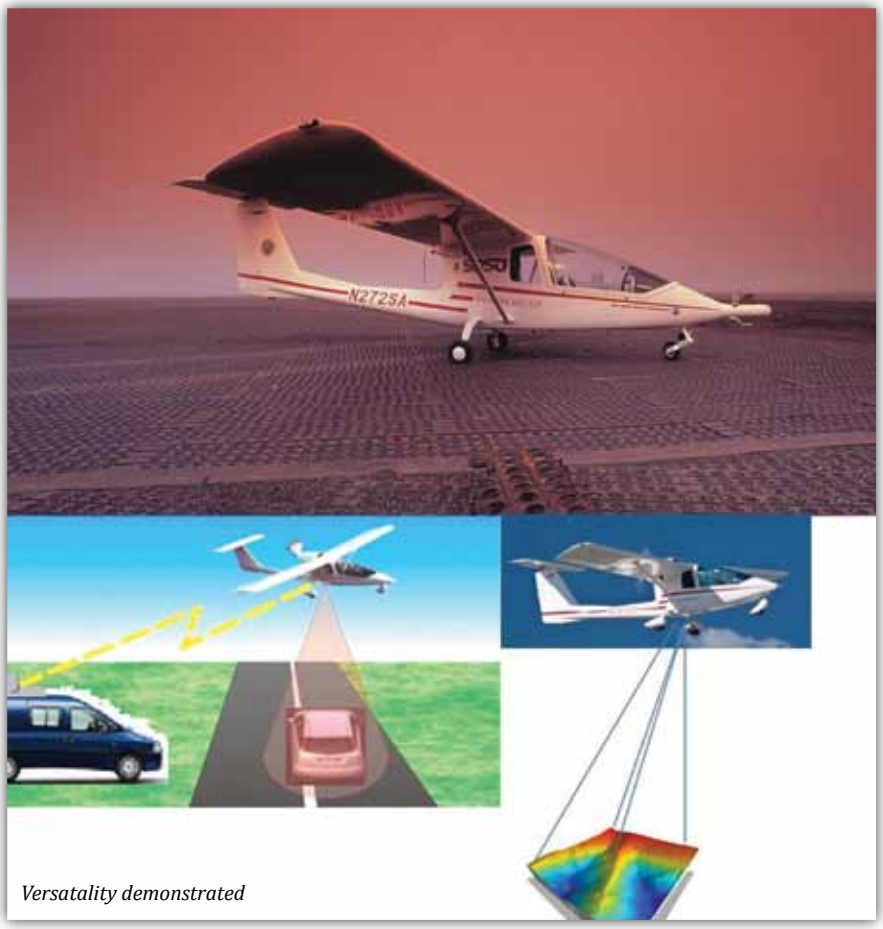
We see tremendous opportunities in providing the platform to customers in these market segments and the response received during *Defexpo 2014* and *India Aviation 2014* has demonstrated the potential demand and interest for Sky Arrow within India. Para military forces, NCC(Air Wing), agencies involved in Homeland Security, state governments, flying schools and hobby flyers are clear customer targets. Further, commercial flyers have demonstrated serious interest for their own purchases; which in turn opens up the possibility of lease management for us to maintain and operate a Sky Arrow where you can pay an annual fee, and during your actual utilisation, you only have to pay for Pilot–Fuel–Maintenance.

Currently, we are focussed on the domestic Indian market but are open to sales opportunities that may arise in the South Asian region particularly in the sphere of aerial surveillance solutions.

VAYU: The OIS 3-D bird detection radar took pride of place at both Defexpo and India Aviation this year. What sort of potential customers have evinced interest thus far and how many sales are you looking at in the short term (next 5 or so years)?

BLT : We have received strong interest from civil aviation authorities across various Asian countries. For privacy concerns, we are not in a position to disclose prospective customers. We have a positive outlook on the global potential of this product owing to the uniqueness of this product. It is a bit premature for us to disclose our detailed sales outlook; however, we would prefer to sell over 100 systems over the next five years.

Our customer targets include the Civil Aviation sector, Indian Air Force, Army Aviation, Naval Aviation, Coast Guard, Wind Mill Farms and Environment study organisations. We also have plans to sell and export our product globally.



Versatality demonstrated

VAYU : Regarding the OIS-AS partnership with Gemelli, what separates the Italian noise controlled communications systems from others on the market? Have any customers, civil or military, expressed interest in acquiring these systems?

BLT : All known brands offer some kind of noise suppression technology in aviation headsets. Gemelli has its own patented A.N.R and M.A.N.P technology with a wireless option which is unique in the market.

Usually, to reduce the noise, companies cut the band and just emit when people are talking. This system reduces the noise by 45% and people are with a silent band between conversations. Gemelli works directly on the noise of the entire soundtrack to preserve the sensation for the interlocutors. The microphone recognizes noise and voice and filters just to let the voice pass. This reduces the noise by 85%. Consequently, this is very good for handling agents and helicopter operators and MRO, as in essence it only transmits the speech without the background noise. This is particularly useful for a connection between the ramp worker and the cabin crew.

The system attracted lot of interest from both civil and military prospects. A leading airline in India's Academy's training head had shown strong interest during India Aviation. Further we intend to present the product to IAF. Demos are planned in a near future within India. We have already signed an MOU with an aviation MRO company and a helicopter operator for this.

HMS *Queen Elizabeth* launched

On 4 July 2014, a bottle of single malt whisky was smashed on the hull of the 65,000-tonne HMS *Queen Elizabeth*, first of two new Royal Navy aircraft carriers being built. Addressing the audience, the Queen said this "innovative and first class" warship, the largest ever to be built in the UK, ushered in an "exciting new era."

The Queen was accompanied by the Duke of Edinburgh for the ceremony

Prime Minister David Cameron said it was a "very proud day" for Scotland and the UK, while First Minister Mr Salmond said it was a "huge day" for the workers and their families.

Six shipyards in the UK including Tyne, Rosyth and Appledore have been involved in building the carrier. The estimated cost of the vessel and her sister ship is £6.2bn, well over the initial projected cost of £3.65bn. The *QE*-Class aircraft carrier has a length of 280m, width of 70 m and range of upto 10,000 nautical miles. The second ship, HMS *Prince of Wales* is scheduled for launch around 2017, followed by commissioning in 2020. A decision has not yet been made on whether to operate the second carrier. The carriers will be completed as originally planned, in a Short Take-Off and Vertical Landing (STOVL) configuration, deploying the Lockheed Martin F-35B.The Air Group will also include various helicopter types including the Chinook, Agusta Westland Apache, Lynx Wildcat and Merlin Crowsnest AEW.

RAAF orders 58 more F-35As

Acquisition of 58 more F-35A Lightning IIs for the Royal Australian Air Force has been approved. The first F-35A will enter operational service in 2020 with No.3 Squadron and full operational capability is anticipated in 2023. F-35As will replace the F/A-18A/B Hornets in RAAF service, to be withdrawn from service by 2022.

The first 14 F-35As are to be based with a training squadron at RAAF Williamtown, New South Wales, the additional 58 aircraft to equip three operational squadrons, two at RAAF Base Williamtown and one at RAAF Base Tindal, in the Northern Territories.

Embraer to partner with Saab in F-X2 programme

Embraer and Saab have signed a Memorandum of Understanding to partner in joint programme management for the F-X2 Project. Pursuant to selection of the Gripen NG as Brazil's next generation fighter jet, Embraer will perform a leading role in the overall programme performance as well as undertake an extensive share of work in the production and delivery of both the single and two-seat versions of the new generation Gripen E/F aircraft for the Brazilian Air Force.

Embraer will coordinate all development and production activities in Brazil on behalf of Saab and, in addition to its own extensive work packages, will participate in systems development, integration, flight tests, final assembly and deliveries. Furthermore, Embraer and Saab will be jointly responsible for the complete development of the two-seat version of the Gripen NG, at the same time that a strategic partnership for future global promotion and marketing of both single and two-seat versions is being discussed between the two companies.

"Through this partnership we will secure an excellent result for the Brazilian Air Force and will establish solid ground for success with future business opportunities and customers," stated Saab's President and CEO Håkan Buskhe. The agreement will be implemented following successful conclusion of the ongoing discussions between Saab and Brazil relating to the finalisation of F-X2 contracts, which are proceeding "as planned and it is hoped to reach a positive outcome by the end of 2014".

Final F/A-18 Super Hornets and EA-18G Growlers for Royal Australian Air Force

The F/A-18 and EA-18G Programme Office (PMA-265) have announced a contract to Boeing for 44 F/A-18 Super Hornet and EA-18G Growler aircraft over the next two years. With this, the Navy will acquire the remaining aircraft included in the programme of record by the end of fiscal year 2016 in addition to the 12 EA-18Gs requested by Australia in July 2013 for the Royal Australian Air Force.

Singapore extends F-16 training in USA

The US Department of Defence has notified Congress of an extension to Singapore's Lockheed Martin F-16 training programme in Arizona. According to the Defence Security Cooperation Agency (DSCA), the $251 million contract would extend the Republic of Singapore Air Force's *Peace Carvin II* detachment at Luke AFB by a further five years. The package includes a broad range of equipment and services, including training, captive air training missiles, jet fuel, air-to-air tanker support and other elements related to hosting a contingent of fighters in the continental USA. According to the DSCA, "the continuation of this training programme will enable Singapore to develop mission-ready and experienced F-16 pilots."

F-16C/Ds for Oman

Oman has received the first aircraft of its second order of F-16C/D Block 50, the aircraft to be ferried to Oman later this year. Through the US Foreign Military Sales programme, Lockheed

Martin was awarded a $600 million contract in December 2011, to produce the 12 additional F-16C/D Block 50s for the Royal Air Force of Oman. Ordered under the '*Peace A'sama A'safiya II* programme', they comprise ten F-16Cs plus two F-16Ds.

Continued success for PC-21s

Pilatus has commenced deliveries of its PC-21 trainer to Saudi Arabia, with two batches delivered in June 2014. As part of the training package, to include 22 BAE Systems Hawk advanced jet trainers, the first six PC-21s transferred are the initial examples of 55 on order. This will make the Royal Saudi Air Force operator of the largest fleet of PC-21s, which has also so far been supplied to Singapore (19), Switzerland (8), and the United Arab Emirates (25).

Denmark reopens fighter competition

Evaluation of new fighter types to replace the Royal Danish Air Force's aging F-16AM/BMs has begun with issue of a request for binding information (RBI) to manufacturers of four types: the Boeing F/A-18F Super Hornet, Eurofighter Typhoon, Lockheed Martin F-35A Lightning II and Saab JAS39 Gripen E. Such strategic evaluation will focus on aircraft performance in relation to defence policy objectives. Military issues will be assessed in relation to defence policy objectives; the ability to 'future-proof' the aircraft by keeping it constantly updated throughout its life. Economic evaluation will cover both acquisition and total life-cycle costs and industrial assessment will examine potential benefits of industrial relationships to support Danish security interests. The decision is expected in mid-2015 and it is expected to be for some 24-30 aircraft.

Russian AF order 16 MiG-29SMTs

RAC MiG will produce a further 16 MiG-29SMT multi-role fighters for the Russian Air Force, scheduled for delivery by the end of 2016. This contract was signed by Russia's Deputy Defence Minister Yuri Borisov and JSC RAC MiG CEO Sergei Korotkov, the deal valued at some US$475million. 28 MiG-29SMTs have been delivered to the Russian Air Force during 2009-10, these aircraft, along with six two-seat MiG-29 UBTs, had originally been built for the Algerian Air Force, which "rejected" them after the first 12 were delivered. The order means the immediate future for RAC MiG is secured even as production of the new MiG-35C is awaited.

Korean trainers for Paraguay

The Korean Government has offered to supply the Paraguayan AF a package of 12 aircraft, comprising six KAI KA-1 light attack aircraft and the same number of KT-1 basic trainers. There is also an option of setting up an assembly line in Paraguay to produce the type for the South American region, which will be in direct competition to Brazil's Super Tucano.

Nigerian Air Force upgradation

The Nigerian Air Force (NAF) plans to acquire additional fighter aircraft and helicopters, the CAS Air Marshal Adesola Amosu announcing plans for the 50th anniversary celebrations of the NAF. However, no details of the types to be acquired were revealed. "Very soon we will be showcasing the new platforms that have been acquired for us," he stated.

Dassault - Dornier Alpha Jet of the NAF

The NAF inventory has been deteriorating for years, with many aircraft grounded owing to lack of spares. The transport fleet of G222s and C-130Hs is now progressively being brought back into operational service, while all 12 MB339As are being refurbished by the Italian manufacturer. Funding was provided in 2009 to overhaul and return to service 19 stored Czech-origin L-39ZA Albatros aircraft, while the German-origin Alpha jet fleet is also being refurbished with upto 11 aircraft reportedly airworthy.

New acquisitions in recent years have included 12 Chengdu F-7Nis and three FT-7Ns from China, even as new helicopter types are being introduced into service, including AW109s and Robinson R66s. Two ATR42-500MP Surveyor maritime patrol aircraft entered service in 2009-2010.

Pilatus PC-12s for Afghanistan

The sixth aircraft of an order for 18 Pilatus PC-12/47Es for the Afghan Air Force's Special Mission Wing has recently been delivered. The 18 aircraft ordered last year were to be given

to Afghanistan for its Special Mission Wing (SMW), "to be used against drug trafficking and for counterterrorism". The $218 million contract itself was awarded to the Nevada-based Sierra Nevada Corporation, an integration and electronics specialist firm.

The PC-12 is usually used for corporate transportion and regional airline services, "the aircraft not designed for military service", but the US Air Force already has 21 aircraft modified for special operations, identifying these as the U-28A for operations notably in Africa.

Four units of four aircraft each are to be based at different locations across Afghanistan, while two are to remain at disposal of the Afghan Ministry of Interior, the final aircraft delivered by end July 2015.

14 CH-47Ds for Korean Army

14 US Army CH-47D Chinooks have been purchased under a Foreign Military Sales (FMS) contract by the Republic of Korea (RoK). Previously operated by the US Army's 3rd Battalion, 2nd Aviation Regiment, these will now be operated by the RoK's 301st Aviation Regiment, which already operates the 17 CH-47Ds and six CH-47SDs.

MH-60R tactical operational flight trainers for United States Navy

Three new MH-60R tactical operational flight trainers (TOFT) built by CAE USA for the United States Navy were declared ready-for-training and entered service with the Navy on 18 June 2014. One of the MH-60R TOFTs was at Naval Air Station (NAS) Jacksonville, another entered service at Naval Station (NS) Mayport and the third entered service at Marine Corps Base Hawaii. All three MH-60R TOFTs are fixed-based simulators that are used to train pilots, co-pilots and sensor operators in the complete range of missions flown by the MH-60R helicopter.

Additionally, CAE USA also recently delivered an MH-60R/S TOFT to the Naval Air Facility Atsugi, Japan. This simulator is the first-of-its-kind and is reconfigurable between the MH-60S and MH-60R helicopter platforms, is currently undergoing installation and integration testing, and will be ready-for-training later this summer.

C-130J Super Hercules for ROKAF

Two additional C-130J Super Hercules aircraft operated by the Republic of Korea Air Force (ROKAF) were ferried from the Lockheed Martin facility in end-May to join the ROKAF's other two Super Hercules aircraft, which were delivered in March. ROKAF aircrew also currently operate a fleet of C-130H 'legacy' aircraft.

The ROKAF's new Super Hercules is the longer fuselage or 'stretched' combat delivery variant. Lockheed Martin is also contracted to provide a two-year support programme, including C-130J aircrew and maintenance training.

MBDA's Sea Ceptor for New Zealand

The New Zealand Ministry of Defence has signed a contract with MBDA for the provision of Sea Ceptor for the Local Area Air Defence element of the Royal New Zealand Navy's ANZAC Frigate Systems Upgrade (FSU) project. This contract confirms the selection of the system by the RNZN for its ANZAC frigates that was announced in October 2013.

British Army to assess MBDA FLAADS

The British Ministry of Defence has placed a contract with MBDA for the land-based variant of the Future Local Area Air Defence System (FLAADS Land), funding an Assessment Phase that will demonstrate the adaptation and evolution of core weapon system subsystems (e.g. command & control) for land environment and prepare for the transition from Rapier Field Standard C (FSC) in British Army service.

The FLAADS Land system is centred around MBDA's Common Anti-air Modular Missile (CAMM) and its weapon command and control system, contracted for installation onto the Royal Navy's Type 23 Frigates as Sea Ceptor (*see Vayu VI/2013*). This approach leverages the existing investment to deliver the UK MOD with an affordable but highly capable air defence system for both the Army and Royal Navy, with a shared support and future upgrade path across both services.

Swiss select Elbit Systems for UAS

Elbit Systems has been selected by the Swiss Federal Department of Defence, Civil Protection and Sport ("DDPS"), as the preferred supplier for the UAS 15 new reconnaissance drone programme.

Irish RBS 70 upgrade

Saab has signed a contract with the Irish Defence Forces to upgrade their RBS 70 air defence missile systems. The order includes deliveries of improved firing units, new simulators, night vision equipment and associated weapons support, upgraded fire units to support the BORC night-capable sight and the latest Bolide missile, new external power supplies plus a four-year support agreement.

A350 hot-weather tests

Hot-weather testing of the A350-900 has been conducted from Al Ain in the United Arab Emirates by MSN3, powered by the Rolls-Royce Trent XWB, which arrived at location on 11 June for test flights. The operation focused on engine behavior and performance in high-temperature conditions, and checks on systems such as cooling equipment. The latter included a heat-soak activity in which the A350 was parked in the sun for several hours in temperatures reaching around 48°C (118°F).

Qatar Airways is launch customer for the type which has also been ordered by Etihad Airways, Kuwait Airways and Yemenia. Airbus is intending to secure certification for the A350 in the third quarter of 2014.

Successes for Pilatus PC-24

According to the Company, all Pilatus PC-24s to be built over the first three years of production were sold within the first two days of the European Business Aviation Conference and Exhibition (EBACE) 2014. "All PC-24 delivery positions planned between the start of deliveries in 2017 and the end of 2019" have been sold. Pilatus made a deliberate decision not to accept orders for deliveries from 2020 or afterwards, preferring to wait until a later date to announce plans for the opening of the order books for PC-24 deliveries from 2020.

Oscar J. Schwenk, Chairman of the Board of Directors stated, "EBACE 2014 delivered an incredible vote of confidence in Pilatus and our new business jet. Customers who opted for the PC-24 include both prestigious fleet operators and individuals of international stature". Based at Stans in Switzerland, the PC-24 project team is "going all out" to achieve the next milestone in the timetable which involves rollout of the first PC-24 on 1 August 2014.

Emirates GE9X services agreement

Emirates airline signed a 12-year OnPointSM solution agreement with GE for the maintenance, repair and overhaul of its new GE9X engines to power its 150 Boeing 777X aircraft. The OnPoint

L-R: Ray Conner, President and Chief Executive Officer, Boeing Commercial Airplanes; James Hogan, President and Chief Executive Officer of Etihad Airways; and David Joyce, GE Aviation's President and Chief Executive Officer

solution agreement is valued at more than $13 billion (USD) over the life of the contract. The OnPoint solution agreement is part of the finalisation of Emirates airline's record commitment for 150 Boeing 777X twin-engine aircraft, powered by GE's new GE9X engine. The agreement is worth more than $15 billion (USD) list price.

Irkut Corporation is "best Russian exporter"

Ministry of Industry and Trade of the Russian Federation announced the results of *Best Russian Exporter 2013* and JSC Irkut Corporation (a UAC company) was declared the winner in the Aircraft Manufacturing nomination. The annual contest is held to support industrial products export. Irkut Corporation has been the best exporter in the industry for the sixth time in a row since 2008. As Oleg Demchenko, Irkut Corporation President remarked, "This is the result of professional teamwork of the Corporation".

CFM56-5B engines for A321ceo Family

Delta Air Lines has selected CFM International's CFM56-5B engine to power its 15 firm A321ceo (current engine option) aircraft. The new aircraft will begin delivery in 2018 and join the other 126 CFM-powered A320 family aircraft Delta current operates. The airline plans to use the new A321s to replace similar, less-efficient domestic aircraft that are being retired from its fleet.

In fact, Delta was CFM International's first customer and launched the product into commercial service on 24 April 1982 when it flew the very first McDonnell Douglas DC-8-71 aircraft powered by CFM's first engine, the CFM56-2, on a flight between Atlanta and Savannah, Georgia. Presently, Delta operates some 210 Airbus A320 and Boeing 737 family aircraft powered by the CFM56-5B and CFM56-7B engines, respectively.

24 Bombardier CRJ900 NextGen for "unknown customer"

A customer, requesting to "remain unidentified" at this time, has placed a firm order for 16 CRJ900 NextGen regional jets and with options for eight additional airliners of the same type. Based on the list price for the CRJ900 NextGen aircraft, the firm order is valued at approximately $727 million. The value could increase to $1.12 billion should the customer exercise its options. Including this latest order, Bombardier has recorded firm orders for 1,833 CRJ Series aircraft, including 359 CRJ900 and CRJ900 NextGen aircraft.

PIA and CFM mark relationship

On 4 June 2014, Pakistan International Airlines (PIA) and CFM International celebrated their thirty year relationship. The Pakistani flag carrier was one of CFM International's very first customers and began operating CFM56-3-powered Boeing 737-300 aircraft in 1985.

First Leap-1B engine tests for B-737 MAX

On 18 June 2014, CFM International initiated ground testing of the first LEAP-1B engine at the Snecma (Safran) facilities in Villaroche, France, which launches a two-year programme for engine certification in 2016 and entry into commercial service on the Boeing 737 MAX in 2017.

The Leap-1B engine, which is exclusive powerplant for the 737 MAX family, fired for the first time on 13 June, three days ahead of schedule set in 2011. After a series of break-in runs, the engine operated smoothly and reached full take-off thrust. "We are really excited to have this engine on test. Now that we are running at full power, we can really see what it is capable of," observed Cédric Goubet, executive vice president for CFM. "All the testing done to date has validated the technology choices we made and we look forward to the LEAP-1B expanding our knowledge base."

Thales and Finmeccanica – Selex ES team up on UCAS

Thales and Finmeccanica – Selex ES have welcomed the FCAS arrangement between the United Kingdom and France. Within the framework, the two companies will cooperate on the development of the multifunction sensor suite and communication sub-system of the future Anglo-French Unmanned Combat Air System (UCAS). A two-year feasibility study, expected to be formally contracted before the end of 2014, will see the two companies work collaboratively in a 50/50 split to lay the groundwork for all the sensing systems required for a future UCAS.

Raytheon, Thales to upgrade TOW missile

Raytheon and Thales have signed a 27-month development and five-year production agreement in support of future improvements of Raytheon's tube-launched, optically-tracked, wireless-guided (TOW) weapon system. Thales has committed a £13.5m ($20.2 million) investment in the design and qualification of two new TOW missile subassemblies that will address obsolescence,

increase system fuze safety and reduce total missile cost.TOW is recognised as a preferred heavy assault anti-armour weapon system for NATO, coalition, United Nations and peacekeeping operations worldwide.

Raytheon's 'Exoatmospheric Kill Vehicle' intercepts target

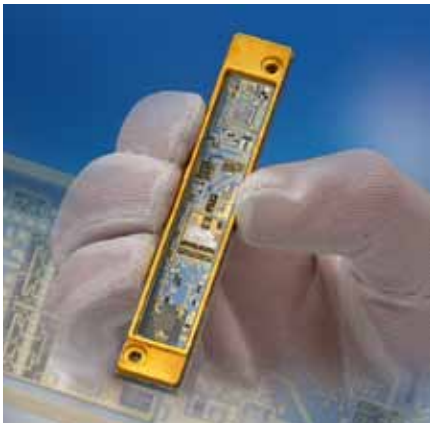
On 22 June 2014, Raytheon's *Exoatmospheric Kill Vehicle* destroyed an intercontinental ballistic missile target in space, marking the first successful intercept for the latest variant of the

EKV and ninth for the overall programme. The intercept took place during a Missile Defence Agency test of Boeing's Ground-based Midcourse Defence System, which is designed to protect the US against long-range ballistic missile attack by destroying incoming threats in space. The intercontinental ballistic missile target used in the test was launched from the *Ronald Reagan Ballistic Missile Defence Test Site* on Kwajalein Atoll in the Pacific Ocean, while the Ground-based Interceptor was fired from Vandenburg Air Force Base in California. Once in space, the interceptor released the EKV, which identified the target, tracked it and destroyed it. EKVs carry no warheads and eliminate targets by force of impact alone.

Airbus Defence and Space AESA radar

Airbus Defence and Space has developed a new generation of transmit & receive modules which give the new AESA radar systems with electronic beam scanning "an unforeseen cutting edge". The company continues to consolidate its leading position in state-of -the-art radar technology.

In contrast to conventional systems, radars based on AESA technology can perform several tasks simultaneously, the transmitting energy generated directly in the antenna, namely in a multitude of transmit & receive modules (TRMs), instead of in a delicate central transmitter whose functionality is of critical importance. The new technology offers "many operational advantages for the user that AESA radars can be used in many fields of reconnaissance and surveillance in future". These products using the new TRMs include the Eurofighter's future e-scan radar and the security radars in the Spexer family.



Airbus D&S passive radar tested

Airbus Defence and Space's newly developed passive radar has proven the functionality of its underlying technology in several field tests under real conditions. In contrast to conventional systems, passive radars do not emit any radiation, but instead analyse the reflections of signals from other sources, such as radio and television stations, to detect objects. They thus allow small or difficult-to-detect flying objects to be located with little effort even in zones which previously could not be seen or covered using active radar, while the system itself is practically undetectable. With its passive radar, Airbus Defence and Space is focusing on the requirements of civil and military air traffic control, which until now could not sufficiently be met using radar with active transmission.

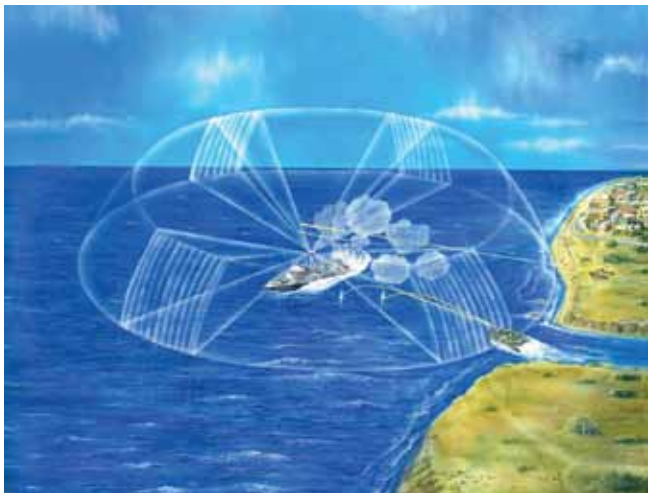
IAI's 'Green Rock'

Israel Aerospace Industries (IAI) have launched the *Green Rock*, a mobile autonomous tactical counter Rocket, Artillery & Mortar (C-RAM) system designed to support a variety of ground force protection missions, including fire source location, friendly forces fire correction and detection of low-flying airborne targets such as UAVs, gliders and hovering platforms.

The system provides a complete low/high trajectory target, real-time intelligence and rapid response solution for tactical forces. *Green Rock's* mission is to locate fire squad positions, distribute selective warning alarms and enable an effective fire response.

The system, developed by ELTA systems, an IAI group and subsidiary, can be installed on a variety of mobile or stationary platforms such as armored personnel carriers, high mobility multipurpose wheeled vehicles, and all-terrain vehicles. *Green Rock* includes a Phased-Array Pulse Doppler Radar which acquires and tracks the trajectories of ballistic munitions such as rockets, artillery and mortars, calculates the point from which they were launched, and predicts the location of the expected impact. This information is reported, via a communications system, to friendly forces to indicate and provide warning of relevant threats. Data can be also sent to precision weapons systems to allow a rapid and accurate response to source of the threat.

NAVGUARD Radar Protection System with MASS



Israel Aerospace Industries (IAI) plans to integrate its advanced radar self protection system NAVGUARD with Rheinmetall's Multi Ammunition Softkill System (MASS) for naval vessels. The system has performed in a live fire demonstration test scenario when confronted with incoming missiles launched from both sea and land. The ELM-2222S NAVGUARD Self Protection System, developed by ELTA Systems, is a lightweight, modular, self-protection system designed to cope with new maritime and land-based threats in order to increase ship survivability and features a digital phased-array radar based Missile Approach Warning System (MAWS), which automatically detects, classifies and verifies incoming threats, and consequently triggers the ships self defence systems. The defense systems utilise various techniques such as smoke dispensers or chaff and flares to defeat incoming missiles and avert a direct strike.

Elbit Systems for Philippines Army

Elbit Systems will supply upgraded armoured personnel carriers (APCs) to the Philippines Armed Forces, at a value of approximately $20 million, which will include 25 mm unmanned turrets, 12.7 mm remote controlled weapon stations (RCWS) and fire control systems (FCS) for 90 mm turrets. The APCs will be supplied over a one-year period. The contract marks a significant breakthrough for Elbit Systems, being the first one awarded by the Philippines.

MMP 5th generation land combat missile

At Eurosatory 2014, MBDA showcased their MMP (*Missile Moyenne Portée*), the latest addition to its range of land combat missiles. In December 2013, the programme was given the official go ahead by the French DGA (*Direction Générale de l'Armement*) with MBDA being notified of a contract for the development and production of 2,850 missiles and 400 MMP firing posts.

Intended for dismounted troops, MMP will initially replace the Milan and Javelin anti-tank missiles in service with the French Army and special forces from 2017. Over the last four decades, Milan, which is MBDA's "best seller", has achieved sales of 360,000 units in over 40 countries. However, taking into account battle experience gained from recent conflicts in which the French Army has been

engaged, the totally new MMP warfare system is a response to the demands that have been expressed in terms of required capabilities: firing from confined spaces, 'fire-and-forget', and self-guidance with a 'man-in-the-loop' facility.

Krauss-Maffei Wegmann and Nexter Systems plan alliance

On 1 July 2014, Krauss-Maffei Wegmann (KMW) and Nexter Systems (Nexter), two leading European providers of land defence systems signed a Heads of Agreement in Paris. The alliance of the two groups under the umbrella of a joint holding company creates a Franco-German defence technology group with a current annual turnover nearing 2 billion euro, an order book of around 6.5 billion euro, and more than 6,000 employees. The target date for the alliance is early 2015. In the meantime, the two future partners will both be subject to a process of due diligence and this alliance project subject to legal and customary regulation approvals.

Saab ESTL pod test

Saab's new self-protection system (ESTL) for fixed-wing aircraft was flown in early June, using a Swedish Air Force Gripen C. Saab expects this additional capability will draw interest from potential international customers. The ESTL is a modular self-protection system available for any fixed wing aircraft that can be installed on a mission-to-mission basis and configured for different threat scenarios. According to Saab, this provides "covert, sustainable, pre-emptive dispensing" by the use of missile approach and laser warning receivers. The ESTL concept includes a module of forward-firing flares, which together with the missile approach warning sensors and an optional chaff capability, makes ESTL a powerful shield against the latest missiles."

Saab acquires TKMS AB (Kockums)

Saab's acquisition of the Swedish shipyard Thyssen Krupp Marine Systems AB (TKMS AB formerly Kockums) has now been completed. "The acquisition strengthens Saab's position as a comprehensive supplier of naval military systems, and the company will become a business unit within Saab's business area Security and Defence Solutions named as Saab Kockums." Saab expects that operations will continue to be carried out primarily in Malmö,

Karlskrona and Muskö. In June, Saab and FMV signed a Letter of Intent regarding the Swedish armed forces' underwater capabilities. With the acquisition of TKMS AB, Saab is able to ensure access to the existing knowledge and intellectual properties (IPR) necessary for continued development, production and maintenance in the underwater sector for both the Swedish and the international markets.

TKMS AB designs, builds and maintains naval systems such as submarines and surface vessels. Other leading products include the air-independent Stirling propulsion system, submarine rescue vehicles and mine countermeasures systems. The company has approximately 850 employees and supplies systems and products to the navies of Sweden, Australia and Singapore.

MKU solutions for German Frigate Project

The *Baden Wurttemberg*–class frigate project F-125 (7200 tons) which is being built for the German Navy by two leading German shipyards, Thyssenkrupp and Lurssen at a cost of over 650 million Euro each, "is a unique project which features enhanced survivability ensuring that the ships remain operational in spite of severe damage owing to accidents or enemy action." It is associating with MKU GmbH, a leading manufacturer and solution provider for naval vessel protection in Germany with over 28 years of domain experience. Over these years, MKU GmbH has provided protection solution for more than 500 naval vessels, both big and small, including frigates, mega yachts, patrol boats, fast interceptor craft, RIBs and hovercraft.

Combat-system trials on the FREMM *Normandie*

The FREMM *Normandie* multi-mission frigate, second of the series ordered by OCCAR on behalf of the French DGA (*General Directorate for Armament*) and the French Navy have completed five weeks of intense activities off the Toulon coast, allowing validation of the frigate's combat system performance before delivery to the French Navy at end 2014. The series of trials was principally dedicated to the verification of the vessel's combat system. To perform these, the frigate was integrated into numerous scenarios, allowing progress in the setting up of its capacities in all areas of warfare (anti-aircraft warfare, anti-submarine warfare and others).

Qualification trials were performed relying on support resources made available by the DGA and the French Navy (radar beacons, fighter aircraft, maritime patrol aircraft, helicopters, surface ships and submarines). This support allowed, for example, deployment of the vessel's electronic warfare system (interception, decoys and jamming) or the establishment of tactical data links.

Su-25s and Mi-35s for Iraq

Even as the 'invasion' of Iraq by ISIS forces from Syria has resulted in bitter fighting and counter attacks by Iraqi special forces and the Air Force, reports from Moscow in late July 2014 confirm that deliveries of Su-25 attack fighters and Mi-35 gunship helicopters have been expedited. Russia's ambassador to Baghdad Ilya Mogunov has stated that "up to 10 Sukhoi fighters would be delivered by end of the summer".

Iraq also has contracts for Mi-28 attack helicopters and mobile Pantsir-S1 surface-to-air and anti-aircraft artillery systems, having signed contracts worth $4.2 billion to supply 36 of the Mi-28 attack helicopters and 48 of the Pantsir units in 2012, according to Russian Technologies (RosTec). Iraqi Defense Minister Saadun al-Dulaimi visited Moscow in mid-July in a bid to step up military cooperation, according to Lt Gen General Mohammed al-Askari.

Despite the billions of dollars spent on training and equipment by the United States during its eight-year occupation, Iraq's million-strong army completely folded when insurgents attacked last month. Within days, the Islamic State jihadist group and allied Sunni factions conquered Iraq's second largest city of Mosul and large swathes of the north and west.

The front lines have since stabilised and Iraq has received considerable intelligence assistance from Washington plus Sukhoi Su-25s from Russia. Ironically, some of these were from Iran which in effect has 'returned' the Su-25s which had been flown away from Iraq to Iran during 'Operation Desert Storm' in 1990.

Mi-35s sought by Pakistan

Following the announcement in mid-June by Russia's Ambassador to Pakistan Alexey Dedov that "Russia was willing to supply Mi-35 gunship helicopters to Pakistan to assist the country in fighting terrorism", the Indian Government has voiced concern with Russia over its move, during talks between External Affairs Minister Sushma Swaraj and Russian Deputy Prime Minister Dmitry O Rogozin visiting New Delhi. Pakistan's request for Mi-35 helicopters, was first made in 2009, but Russia has procrastinated on the issue owing to "its traditional defence ties with India."

Pakistan has a handful of Mi-24s (see above), being gunship helicopters which 'defected' from Afghanistan during the Soviet occupation

It is learnt that the Pakistan Army has requested the provision of between 25-30 Mi-35s from Russia. Its current inventory consists of over 360 aircraft, essentially helicopters but also some fixed-wing aircraft, and has strenuously employed its force of Bell AH-1 Cobra attack helicopters in the ongoing operations in North Waziristan. Pakistan Army Aviation already has 93 Mi-17/172 medium lift helicopters procured from Russia in the past which have supplemented the 60 odd SA 330 Pumas from France.

Operation 'Zarb-e-Azb'

Operation *Zarb-e-Azb* was launched by Pakistan's armed forces on 15 June 2014 in North Waziristan. The operation, named after Prophet Mohammad's sword in the battles of Badar and Uhud, involves a reported 30,000 soldiers tasked to target armed insurgent groups such as the Tehrik-i-Taliban Pakistan (TTP), al-Qaeda, East Turkestan Islamic Movement (ETIM), the Islamic Movement of Uzbekistan (IMU) and Afghan militant factions such as the Haqqani network. A military spokesperson has stated, "Using North Waziristan as a base, these terrorists had waged a war against the state of Pakistan and had been disrupting our national life in all its dimensions, stunting our economic growth and causing enormous loss of life and property." The Pakistan Air Force and Army Aviation have been flying strike missions, the PAF having targeted militants around Mir Ali in northern Waziristan from late May itself.

Preceding the operation, around 80,000 families were cleared from the area and relocated in special camps, "thus giving the armed forces free access to the militant groups hiding in the area."

In over four weeks, with PAF F-16s and F-7s employed on specific strikes and PAA gunship helicopters lending close air support, some 500 militants have been killed and 88 hideouts destroyed so far, according to official statements.

25 Years Back

From Vayu Aerospace Review Issue IV/1989

Indian defence team in USA

Defence Minister KC Pant visited the United States from 24 June for high-level discussions with US officials. He was accompanied by the Secretaries for Defence and Defence Research, the three Vice Chiefs of the armed forces and other officials. Visits included those to the US Air Defence and Space Command at Colorado Springs, the Aeronautical Systems Division and the Aeronautical Development Laboratories, Headquarters of the Atlantic and Pacific fleets at Norfolk and Honolulu respectively, as also the Wright-Patterson air force base at Dayton.

An important item on the agenda was technology transfer and specialist equipment for the Light Combat Aircraft (LCA) programme. "We attach particular importance to this visit in the context of the LCA", Mr Pant stated. Regarding the Light Combat Aircraft (LCA) Dr VS Arunachalam, Scientific Adviser to the Defence Minister who accompanied the Defence Minister, stated that India was looking for components and hardware in the USA which could keep the LCA "light", it wanted co-development of such material, particularly carbon-fibre technology for the wings.

To the question whether seeking help of USA and French would not mean diluting the indigenous component in the LCA, Dr Arunachalam said all such assistance was required during the prototype stage. After that it would be "an entirely Indian effort". The time frame for cooperation in co-development of some components of the LCA was expected to be settled after discussions at the experts level. Meanwhile, the Defence Ministry is reported to have appointed a fact-finding committee, headed by Prof R Narasimha, Director NAL to review the current status and viability of the Light Combat Aircraft (LCA) project following concern expressed by the IAF over delays to the project.

French involvement in LCA

During his visit to France (12-15 July) Prime Minister Rajiv Gandhi was expected to discuss with President Mitterrand possible future cooperation between the two countries for the design and production of the Light Combat Aircraft (LCA). Dassault was a consultant for the project definition phase and the French company is expected to be in the picture for the next phases leading to a prototype. Areas in which French involvement is expected include the radar, fly-by-wire systems and weapons integration.

An idea mooted during the French Defence Minister's visit to India in December 1988 was that the LCA could be jointly produced by India and France and the French may buy some of the aircraft later. The French, on the other hand, suggested that its Rafale futuristic fighter could be a joint project too and India had shown "interest" in the proposal.

AI for A.340s

Air India is negotiating with Airbus for the purchase of the futuristic wide-bodied Airbus A340. According to highly placed sources, Air-India is likely to buy 12 aircraft for a total of Rs 1,900 crore ($1.2 billion).

Air-India had considered the Airbus 340 and also the McDonnell Douglas MD-11 and Boeing 747 as viable alternatives.

US bans exports to India

The US Administration has recently banned export of space launch vehicle testing equipment to India. India has, however, made "alternative arrangements" to procure the electronic 'vibration test equipment', confirming that the US decision had already been conveyed to them. Commonly known as the 'shake and bake', this equipment is primarily used in the instrumentation of launch systems. US officials say the ban on the technology sale to India stems from the Agni intermediate range ballistic missile test launch in May. There is concern that India was finding other use for 'dual purpose items' procured from the USA.

Vayudoot evaluates 40 seaters

An evaluation group set up by Vayudoot for the selection of a 40-plus-seater aircraft for the third-level airline has nearly completed its work and is expected to make its recommendations to the board shortly. The Evaluation Committee has earlier shortlisted the Franco-Italian ATR-42, Fokker 50, British Aerospace ATP, and De Havilland Canada Dash 8.

Major considerations will be performance, present sales record and financial package offered by the manufacturers. The negotiating committee has also asked the manufacturers to submit a proposal for countertrade in order to reduce the outflow of foreign exchange.

Civil aircraft production

An expert group set up by the Planning Commission to explore the possibilities of undertaking manufacture of commercial aircraft within country is expected to submit its report shortly. It is reported that the manufacture or a range of small/medium-capacity aircraft is being recommended not only with a view to save foreign exchange but with the objective of setting up an industry which employs sophisticated technology.

The group has pointed out that in the transport sector, aviation has maximum potential for growth and as such requirements of the sector were bound to grow. Under the circumstances, total dependence on imports to meet the requirements of this sector will not only be a big drain on India's scarce foreign exchange resources but also a costly proposition which the country cannot afford.

The Su-27 as "show stopper"

Because it was so totally unexpected, the Sukhoi Su-27 completely stole the show at Paris 1989. Quoting an air show official, "it is an embarrassment of riches represented by the new Communist block combat aircraft at this years Paris Show, the Su-27, Flanker B' literally towers above them all". Never before has an aircraft performed so brilliantly at any airshow or wherever. One could see pilots from Western air forces nodding their heads in awe and whispering excitedly.

Tale Spin

ToT in reverse

We know the stringent requirements of the Indian Defence Procurement Policy (DPP) as also applied to the medium multi-role combat aircraft (MMRCA) which dictates transfer of technology with all its trappings. So what is all this ? The picture on the right has German pianist Stefan Aaron 'taking off' on his flying carpet from Munich airport, as part of his 'Orange Piano Tour'. Inspired by the Indian Maharaja on his flying carpet ?

Munich also happens to be epicentre of the German aerospace industry, from where many Indian aviation programmes emanated in the past, from the HF-24 of the 1960s to the 228 and ALH of the 1980s. Hundreds of Indian aeronautical engineers have received 'transfer of technology' (ToT) training at Ottobrunn and Oberpfaffenhofen, in turn taking their skills to Bangalore.

Did they leave the science of flying carpets behind ?

Back to Stool

US Marine Corps Capt William Mahoney had a problem : the front landing gear of his AV-8B Harrier had malfunctioned but he needed to land on flight deck of the USS *Bataan*, which was operating with the 6th Fleet in the Mediterranean.

Back to school – actually stool ! He got the deck crew to place a stool exactly there and gently guided the nose onto the stool and the rest was easy.

No way to treat an Engine

We all know of the travails dogging the Kaveri turbofan engine which has been under development by GTRE for decades (see *Vayu* Issue III/2014). Several alternative applications have been suggested including a marine Kaveri, a Kaveri-powered locomotive, a UCAV Kaveri but what is this ? A water tank Kaveri ?

(Picture taken outside the NFTC at Bangalore, which is engaged in test flying the Tejas LCA, albeit not with the Kaveri but the F404 turbofan).

103 passengers and only 40 meals!

A flight attendant on an airline's cross-country flight nervously announced about 30 minutes after take off that , "I don't know how this happened, but we have 103 passengers on board and only 40 dinners."

When the passengers' muttering had died down, she continued, "Anyone who is kind enough to give up his meal so that someone else can eat, will receive free unlimited hard drinks for the length of the flight." Her next announcement came an hour and a half later, "If anyone wants to change his or her mind, we still have 35 dinners available!"

(*Contributed by Lalit Mehra*)

Food truck grounds Air India

As if Air India's Dreamliners were not the airline's only problem. An Air India B-777-ER airliner was hit by a high-lift catering truck at the US Newark international airport, forcing the airline to ground the aircraft after it suffered considerable damage. The airliner was to depart for Mumbai but after the incident, the 325 passengers in crew were disembarked and accommodated in downtown hotels.

Wonder what kind of food they got to eat that evening ?

Spider Silk Superpower

It is recorded history that for over some 4000 years, the miracle of spider silk has created garments for mankind - and, not to forget, womankind, - this ambidextrous material being incredibly soft, warm, breathable and extremely lightweight, ideal for making silken underwear as also for layering, travelwear - and now also for soldier's bulletproof clothing.

Researchers have genetically engineered silkworms to produce spider silk, and have used the material to create gloves that will soon undergo strength testing and provide more answers. "Spider silk in nature has truly unique properties. If you think about a spider's web, it is designed by nature to intercept an airborne missile — a fly or another flying insect", according to Kim Thompson, Kraig Biocraft Laboratories, in the USA. The strength-to-weight ratio is off the scale and could provide soldiers of the future with soft but strong armour.

Afterburner

Shinmaywa