VAYU

Aerospace & Defence Review

I/2024

DRDO milestones
Tour of MBDA
CNS interview
HAL interview

Tuskers at 75
IAF No. 3 Sqn
3 BRD at 60
Exercises & visits

FLY NAVY, FLY

A HISTORY OF INDIAN NAVAL AVIATION

PUSHPINDAR SINGH
ANGAD SINGH

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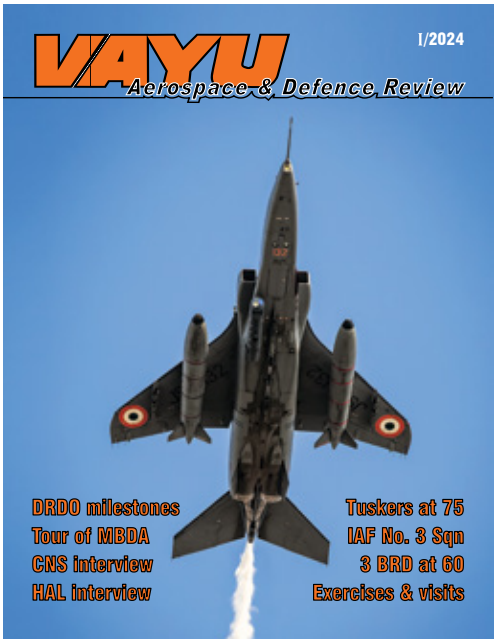

Cover : IAF Jaguar of the 'Tuskers'.
Photo by Angad Singh (Twitter @zone5aviation)

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Lt Gen Kamal Davar says...

....Amidst global churn India, US need a new road to Kabul

A nation projects its diverse strategic interests by a plethora of measures in which carefully conceived diplomatic initiatives play a pre–eminent role. Diplomacy should take a holistic view of the challenges and opportunities confronting the nation, weigh the various options and then help formulate a nation's policies in the desired dose of realism, pragmatism and flexibility as required. In dealing with its strategically significant neighbour, Afghanistan, otherwise dubbed as "the graveyard of empires", New Delhi's outreach towards Kabul will require a fresh appraisal considering newer ground realities emerging in that fratricidal violence driven nation. As most hard nosed diplomats and policy makers will acknowledge, a changing political landscape does require the shedding of old inhibitions, if they exist, in one's relationship with nations that were considered inimical earlier.

For decades, Pakistan has been endeavouring, with dubious intent, to enhance its influence in neighbouring Afghanistan. Even while the United States and NATO and international forces were positioned there from late 2001 till August 2021, the wily Pakistanis were running with the hare and hunting with the hound. They deceitfully supported the extremist Taliban while also "officially" supporting the democratically elected governments of Hamid Karzai and later Ashraf Ghani. Pakistan paid lip service to the United States by allowing American and other allied forces stationed in Afghanistan, by permitting them the use of their airbases and passage through Pakistani territory into Afghanistan of their logistical convoys. This step enabled them to obtain US largesse in not only military aid but direly needed financial handouts for their collapsing economy.

After the shoddy and inglorious exit of US forces from Afghanistan in August 2021, Pakistan dreamt of exercising direct control and power in Afghanistan. However, soon enough, the fiercely independent Taliban managed to gauge the double faced intent of Pakistan, and notably its sinister Inter Services Intelligence (ISI) network, and thus did not fall into their trap. Nevertheless, Pakistan still has a few proxies within the Taliban, including some smaller terrorist outfits it had supported earlier, and importantly, with the dreaded Islamic State in Khorasan Province (ISKP), which is discreetly enlarging its evil footprint in the region. However, Pakistan too has been at the receiving end of terrorist acts from the Tehreek e Taliban Pakistan (TTP), which though a separate outfit from the Afghan Taliban, does maintain contacts with the latter. The Pakistanis have been subjected to frequent gruesome terror acts by the TTP on their border outposts, Army and police installations, Shia mosques and the like. One other contentious issue existing is that like the rest of the Afghans, the Taliban and the TTP do not recognise the Durand Line, which is the official border between Pakistan and Afghanistan, delineated in 1883 between then British government in India and the Emir of Afghanistan.

The ongoing policy enunciated by the Pakistani government to deport around 1.5 million Afghan refugees (those without official documents or visas) living in Pakistan for years has irked the Taliban government and will deepen the growing chasm between Pakistan and Afghanistan.

Since the last decade or so, China has been earnestly endeavouring to enlarge its footprint in Afghanistan. It not only eyes Afghanistan's billion dollars' worth of mineral deposits, including copper mines, but also the proximity of China's restive Xinjiang province to Afghanistan makes it a vital border state. A friendly Afghanistan ensures that its territory is not used by Islamic terrorists to help their gravely suffering Uyghur brethren in Xinjiang.

In addition, with Beijing facing new security problems along the China–Pakistan Economic Corridor, it wants a new alignment of its ambitious Belt and Road Initiative to now pass through Afghanistan and Iran.

Among Afghanistan's neighbours, India occupies a pre–eminent and a respected place in Afghanistan owing to its well established policy of non interference in Kabul's internal affairs and providing generous humanitarian and development aid to that nation. That Pakistan has been zealously endeavouring to harm India's interests in Afghanistan for long has been the cornerstone of Pakistan's Afghan policy, including the use of the religion card. The Taliban, however, have not fallen prey to these Pakistani machinations.

Just recently, Afghanistan's almost dormant embassy in New Delhi, which owed allegiance to successive elected governments, appears to have been wound up. It was a matter of time before the Taliban government in Kabul would withdraw support to Kabul's embassy in New Delhi, and even the Indian government would have supported this step. However, the Afghan consulates in Mumbai and Hyderabad are still functioning. The fact now remains that though India has not yet formally recognised the Taliban regime, yet it has a functional diplomatic mission functioning in the Afghan capital.

Notwithstanding its continuing soft power forays in Afghanistan, India, like many other nations, has expressed dismay at the Taliban administration's human rights record, especially their handling of both women and minorities. India, while opening up newer channels to Kabul, should be able to influence the Pashtuns and other tribes to shed their antiquated mindsets about women and allow them educational and employment opportunities. Overall, with some convergence in Indian and US interests in Afghanistan, it will be pragmatic for a joint strategy to be worked out between the two strategic partners, bearing in mind China's diverse initiatives in the region. Thus, a fresher out of the box approach by India, considering the newer ground realities, might be warranted. Equally, India must analyse the new geopolitical churning across the entire South Asian region and factor these in its foreign policy edifice.

Air Marshal (Retd) Anil Chopra says.....

Why Indian armed forces must institutionalise climate change in their planning and operations

Climate change is already a defining challenge for security. A 'Threat Multiplier' that can aggravate conflict and geopolitical competition Climate change threatens half of the US bases worldwide. The adverse climate also makes it harder for the military to do its job. If India must safeguard the security of 1.4 billion people, it has to look at climate change seriously, mitigate its effects by adapting to it, and engage with the scientific community.

We must reconcile that extreme adverse weather and natural disaster events will increase, and more conflicts will erupt over access to resources and migrations that they may cause. Without affecting military capabilities, armed forces will have to become part of the global transition and control their own greenhouse emissions. The armed forces are known for managing ecological and environmental issues well, but climate change is quite different.

At the 2021 Summit, NATO Heads of State and Government endorsed a Climate Change and Security Action Plan for understanding and adapting to climate change. They planned regional assessments and case studies that included the impact of climate change on military installations and assets and on missions and operations. Since military forces would have to operate in extreme climatic conditions, such as very high or low temperatures, humidity, dust, and coastal salinity, it could affect both operators and equipment. It would also mean greater demand on the military for Humanitarian Aid and Disaster Relief (HADR) and for restoring critical services such as communications, energy, transport, food, and water supply.

NATO also carries out case studies of conflict zones where they have been or are likely to engage, such as North America, Europe, West Asia, Afghanistan, Northern Africa, the Arctic, and more recently, the Indo–Pacific. India has its own regional case studies to be done.

Facts

Human activity has warmed the atmosphere, land, and oceans. The June to August 2023 was the warmest on record globally by a large margin, at 0.66°C above average. As per the Intergovernmental Panel on Climate Change (IPCC), the last four decades have been warmer than any decade since accurate global temperatures began being recorded in the 1850s. Global surface temperatures were, on average, 1.090°C higher in 2011–2020 than they were in 1850–1900. The 10 warmest years recorded have been after 2010. Average global precipitation over land has increased since 1950. The global sea level increased by 0.20 meters between 1901 and 2018. The average annual Green House Gas (GHG) emissions during 2010–2019 were higher than any previous decade. Reducing GHG involves reducing fossil fuel usage.

As per NASA reports, September Arctic sea ice is now shrinking at a rate of 12.3 per cent per decade, compared to its average extent during the period from 1981 to 2010. Relative to 1970, the climate reference glaciers tracked by the World Glacier Monitoring Service have lost a volume of ice equivalent to nearly 25 meters of liquid water, the equivalent of slicing 27.5 meters of ice off the top of each glacier. Himalayan glaciers may lose 75 per cent of ice by 2100, causing dangerous flooding and water shortages for nearly 2 billion people who live downstream of rivers that originate in the Himalayas. A recent research found that Mount Everest's glaciers, for example, have lost 2,000 years of ice in just the past 30 years.

Absolute salinity is defined as the concentration of dissolved salts in seawater. About 85 per cent of the evaporation and 77 per cent of the precipitation occurs over the ocean. Saltier oceans result in increased freezing point, and lesser sea ice, and warmer climates, and directly changes the width of the habitable zone. Sea surface salinity impacts coastal military stations and equipment. Salinity has issues for mangroves as in Sundarbans.

There are other climate trends like droughts, heat waves, heavy rainfall, and floods occurring at higher frequency. Rising sea levels means land erosion, deforestation, and desertification, and breaking down of agriculture systems.

The global targets

It must be remembered that 1 per cent of the richest generate the same carbon emissions as the 50 per cent of the poorest globally. Rich developing countries have polluted the atmosphere in the last 300 years since the industrial revolution. They must take responsibility and support the developing world with technology and funding to go green. It has to be a global approach. Any funding supported by rich nations should be made more democratic, and not be tied with political strings. The carbon credit rating system needs to be made more real and implementable.

At the COP 26 in Glasgow, countries reaffirmed the Paris Agreement goal of limiting the increase in the global average temperature to well below 2°C above pre–industrial levels and pursuing efforts to limit it to 1.5°C. And they went further, expressing alarm and utmost concern that human activities have caused around 1.1°C of warming to date. The carbon dioxide emissions must be reduced by 45 per cent this decade to reach net zero around 2050. Developed countries came to Glasgow falling short on their promise to deliver US$100 billion a year for developing countries. Private financial institutions and central banks announced moves to realign trillions of dollars towards achieving global net zero emissions. Cost of renewable energy has fallen, and thus increasing opportunity.

Climate affects military operations

High temperatures affect load carriage for aircraft, and also impacts sensitive avionics. Frequent thunderstorms could mean mission re–routing more often and affect operations and fuel consumption. Climate change will increase jet–streams and also

increase Clear Air Turbulence (CAT). Climate change will impact space launch stations which are normally close to the shore.

Temperatures impact ground forces for efficiency. Tanks become hot like an oven. Very low temperatures result in frostbite and require special protective clothing. Dust storms affect all equipment. All this will require increased heating, cooling and ventilation of equipment. Climate change could also disrupt training plans.

Naval forces can be affected by ocean acidity. Change in sea surface temperatures affects sound velocity, which has implications for detection and localisation. Salinity affects buoyancy of submarines, and impacts submarine warfare. Increased temperatures would mean greater cooling requirements for ships propulsion systems. The International Maritime Organisation (IMO) has put restrictions on sulphur emissions to be reduced by over 80 per cent. They are also insisting on alternative fuels.

Extreme weather shortens equipment life–cycle, requires frequent servicing, and in turn affects availability and lifecycle costs. Militaries will require enhanced meteorological assessment tools, including climate change and security modelling using artificial intelligence and big data analytics.

Global emissions by militaries

Military emissions from flying jets, sailing ships, and training exercises, were left out of the 1997 Kyoto Protocol on reducing greenhouse gases. They were exempted again from the 2015 Paris accords on the grounds that data about energy use by armies could undermine national security.

Some experts claim that militaries account for 5.5 per cent of global greenhouse gas emissions. Others contest the figures as highly exaggerated. There are signs, however, that some militaries are becoming more open to reporting and making strides to cut their climate impact. The 31 member NATO security alliance, has created a methodology for its members to report their military emissions.

The Pentagon sent the US Army and Navy representatives to the COP27 climate summit in Egypt last year, for the first time ever. The Pentagon will begin incorporating climate analysis into its war gaming and analysis efforts as well as featuring the issue as part of its future National Defence Strategy.

Indian regional dynamics

There are approximately 15,000 glaciers in the Himalayas. Each summer, these glaciers release melting water into the Indus, Ganges and Brahmaputra Rivers. Approximately 500 million people depend upon water from these three rivers. These glaciers, like others in the world, are at risk of melting due to increasing temperatures and erratic weather patterns. Himalayan glaciers may lose 75 per cent of ice by 2100.

Glaciers depend on heavy precipitation to replenish ice on an annual basis. If these glaciers melt, many people dependent on them will be flooded during winter and experience drought during summer. Melting glaciers also cause landslides. There are river water issues between India–Pakistan and India–Bangladesh. Most rivers start in China. China is unwilling to share hydrological data with India.

Extreme weather events like cyclones with higher frequency and severity hit India and Bangladesh causing loss of life and prosperity. Water salinity affects mangroves in Bangladesh, some of which had to be vacated causing internal migration. Livelihood affected by climate change results in economic migration, as can be seen from Bangladesh to India.

The long–term changes in seawater temperature, acidity, deoxygenation, cyclones and sea level in the Bay of Bengal impacts ocean productivity, habitats and biological processes. Traditional fisheries are most vulnerable to climate change. Climate warming also affects the inland and coastal aquaculture sectors of the Bay of Bengal. There are fishing disputes between India and Sri Lanka.

As per Ministry of Power, India's electricity generation mix in May 2023 was tilted towards fossil fuels, with 56 per cent share (49 per cent coal, 6 per cent gas, 1 per cent others). 44 per cent non–fossil includes 11 per cent hydro, and solar and wind etc. 33 per cent, Nuclear share is 1.3 per cent.

India must take the lead and coordinate and support the regional countries through BIMSTEC, SAARC, SAGAR, and other forums and initiatives.

Action plan

The Indian military prides itself in ecologically and environmentally responsible operations. Most military stations are setting up solar power generation. They are managing waste through scientific eco–friendly means. Indian military is transitioning to non–fossil fuel technology, and looking closely at energy use and savings. Indian Air Force (IAF) has already begun using biofuels.

India has mastered HADR. These are post event actions. Climate change is a proactive preventive exercise. Security implications after climate change are also reactive actions. We need to look at preventing climate change closely. We need to build climate resilient infrastructure at military bases. Sun shelters are already being built for aircraft on tarmac.

India is becoming more active in the Indo–Pacific. There are many more maritime and air exercises. Indian Island territories are strategically located. There are plans to build more infrastructure. The Indian military has to thus prepare more for climate change and security issues related to coastal areas and Island territories.

Indian armed forces need to have special cells at service headquarters to look at climate change and security. This has to be an important subject studied at military academies and also researched by think tanks. The Ministry of Defence must order special case studies. Some important subjects could be, "Impact of climate change and sea level rise in A&N Islands", "Heat impact on military equipment in Central India and Desserts", "Extreme cold weather impact on Operations in Ladakh". Lastly, it is time that India releases its National Security Strategy. Similar strategies by other countries include climate change and security.

Air Marshal (Retd) Anil Chopra seen here at the Vayu Aerospace Review stand at Defexpo in March 2012. This article first appeared in www.firstpost.com

Admiral Arun Prakash says....

Resetting India's security aims in the new year

As year–end 2023 looms, a transient lull in India's endemic election fever may permit the media a respite to focus on other matters of serious national concern. The voting citizen, given his or her preoccupation with pressing issues such as jobs, prices, health and social harmony, may not see national security, for example, as a priority issue. But she should, because paying cursory attention to security threats — internal as well as external — will only aggravate them, and divert the nation's attention and scarce resources away from development and social welfare. Former Army chief, General MM Naravane, in his forthcoming memoir, highlights this with his recall of a serious security issue warranting a cabinet decision being handed to him as a "hot potato" in 2020.

Around us, we see a rapidly fragmenting landscape where schisms are breeding mutual hostility. If the Russia–Ukraine war served to widen the East–West divide, the Israel–Hamas conflict in Gaza has angered the Global South, which sees the West as guilty of hypocrisy, double standards and abetting genocide. As the world helplessly watches these brutal and sanguinary conflicts rage, the organs of the UN seem to have been rendered impotent and irrelevant.

This is, perhaps, the state of international anarchy that aspiring hegemon China has been waiting so that it can use its economic strength and coercive military power to "restore order and stability". After all, China's President Xi Jinping's cherished "China Dream" does envisage the establishment of a new world order, governed by the concept of "tianxia" (all under heaven), in which China will dominate by virtue of its acknowledged superiority.

Manifestations of "tianxia" are obvious in China's outrageous claims under the "nine–dash line" in the South China Sea, and repudiation of the 1914 McMahon line on the India–China border. As far as India is concerned, burgeoning trade apart, in every other aspect of the bilateral relationship, China has displayed open and deep–rooted hostility.

What started off as a stand–off between Chinese and Indian militaries along the Line of Actual Control three years ago has become a permanent posture. After 22 meetings of the special representatives and 20 military commanders, it is clear that a revanchist China is neither going to "de–escalate" nor restore the territorial "status quo ante" (whatever that means). For India, to downplay the ever present dangers inherent in living with such a hostile neighbour would be imprudent.

The ongoing conflicts in Ukraine and Gaza are as different as they can be, but both battlefields are seeing old paradigms being discarded and the deployment of new concepts, technologies and innovations. One hopes that our armed forces, even as they struggle with a radical new recruitment system while extracting military wisdom from ancient Indian texts, and exorcising the ghosts of a "colonial legacy", will also devote adequate attention to the lessons of the current wars.

The East European conflict holds special interest for India because the military hardware deployed in combat by Russia and Ukraine also serves our forces. But what should provoke serious introspection in the Global South are the conclusions drawn by a Swedish think tank from a study of the Russia–Ukraine war. Pointing out the obvious fact that none of the immediate goals of its "special operation" on 24 February 2022, were achieved by Russia, it infers that this spectacular failure, apart from other reasons, is attributable to the absence of a joint command structure and a concept of joint operations in Russia.

The war commenced with Russian commanders conducting operations independently. It was only eight

months later that a joint HQ was created and General Sergey Surovikin was given command of "integrated forces," a hitherto unknown body. After three months, Surovikin was replaced by General Gerasimov (till then chief of general staff), who was subsequently re–assigned "to organise closer coordination between military branches and services"; a goal that should have been achieved long before the war. One of the main reasons for Russia's military failure, the study says, is "the desire to preserve the archaic military culture at any cost."

Back home, the process of defence reform and initiating jointness appears to have stalled. In the four years since the institution of a Chief of Defence Staff (and 22 years since LK Advani's group of ministers recommended urgent defence reforms), little substantive change has taken place in India's outdated higher defence organisation.

Any conflict with China will require forces/resources to be withdrawn from across India's 14 Army, Navy and Air Force commands scattered all over the country. Facing this composite force, will be China's integrated western theatre command under its unitary commander. Our military learnt many bitter lessons during the 1987–90 tri–service Indian Peace Keeping Force operations in Sri Lanka, where issues related to inter–service coordination, command control, and logistics, led to many fiascos.

If the same fiascos are to be avoided, the obvious imperative is to reorganise these 14 commands into four or five "theatres", on geographic or threat–based considerations, and place land/maritime/air forces, as required, under the commander, charged with the conduct of operations.

However, such has been the internal resistance to issues related to "jointness" and theatre commands that this reorganisation has remained stalled for over two decades. It is no longer a secret that apart from concerns about loss of "turf" and

(Photo: Coindesk.com)

equitable sharing of senior posts, the main impediment to implementation of reforms has been inter–service disagreement over the employment of air power. While the IAF insists that air power is "indivisible" and must only be deployed under its control, the other two services want the "air warriors" to loosen their grip on air power assets and agree to modalities for sharing them with theatre commanders so that they can fight land and maritime campaigns successfully.

Moreover, while "indivisibility of air power" may have been an acceptable construct in the past, it is no longer valid because the Navy, Army and Coast Guard too deploy sizeable aviation components in service specific roles. However, there is no overlap/conflict of roles since the IAF's 2022 doctrine lists its main "objectives" as defence of national air space, prosecution of offensive air operations, war prevention through deterrence, and provision of assistance in internal security.

Even as this vexed issue awaits resolution, the situation is likely to be further complicated by IAF's reported proposal that the service be renamed as "Indian Air and Space Force" with consequential re–allocation of charters and resources. Inter–service "turf battles" are not unique to India and have been fought amongst services in the United Kingdom, the United States and elsewhere, in the face of defence reforms. In each case, however, practical compromises invariably emerged with the forceful intervention of enlightened politicians.

Can we hope for the dawning of realisation at the political level that further procrastination could impose a heavy price in terms of national security?

In the photo above is Admiral (Retd) Arun Prakash

Improved Akash Weapon System

Ministry of Defence, in 2023, signed a contract with Bharat Dynamics Limited, worth over Rs 8,160 crore, for procurement of improved Akash Weapon System (AWS) for Indian Army. The contract was for procurement of AWS for 3rd and 4th Regiments of Army Air Defence, comprising live missiles and launchers with upgrades, ground support equipment, vehicles and infrastructure. The AWS is a Short–Range Surface to Air Missile Air Defence System, indigenously designed and developed by DRDO. The project has overall indigenous content of 82% which will be increased to 93% by 2026–27.

Saab for 100% ownership of Carl–Gustaf manufacturing in India

Saab has secured approval from Indian authorities for 100% Foreign Direct Investment (FDI) for manufacturing the shoulder launched Carl–Gustaf weapon system in India. This is a milestone in Saab's progress towards the establishment of a new manufacturing facility in India which will produce the latest generation of the Carl–Gustaf shoulder–launched weapon. Saab will be partnering with Indian sub–suppliers and the systems manufactured at the facility will fully meet the requirements of "Make in India".

"It is a great honour to be trusted as a global defence company to receive approval for 100% foreign direct investment in India. This underlines our strong commitment to Make in India and our excellent collaboration with the Indian Defence Forces", stated Görgen Johansson, head of Saab's business area Dynamics. Saab's Carl–Gustaf system has been in service with the Indian Army since 1976 and is established as the main shoulder launched weapon in the Indian Armed Forces.

BEL contract for electronic fuzes

The Ministry of Defence, on 15 December 2023, signed a contract with Bharat Electronics Limited (BEL), Pune for procurement of Electronic Fuzes for the Indian Army for a period of 10 years, at a total cost of Rs 5,336.25 crore. As part of the 'Aatmanirbhar Bharat' vision, this contract has been signed for ammunition procurement under 'Manufacture of Ammunition for Indian Army by Indian Industry', a Government initiative for long term requirement of 10 years.

First sighting: Schiebel–100 with IN

The Indian Navy has successfully completed maiden pilot training of unmanned shipborne camcopter Schiebel–100 at INS Garuda, Kochi. "Induction of Schiebel–100 will enhance surveillance capability of Indian Navy in IOR".

BEL in orders worth Rs. 3,915 Crore

Bharat Electronics Limited received an order of Rs 580 Crore from Indian Army for AMC of Radars. This project will have participation of Indian electronics and associated industries, including MSMEs, which are sub–vendors of BEL. The Company has also received additional orders worth Rs 3,335 Crore since the last disclosure on 15 September 2023 and the said orders pertain to AMC for AEW&C system (Airborne Early Warning & Control), Uncooled TI sights, Software Defined Radios, SWIR pay load, AMC for IACCS, Passive Night Vision Binoculars etc.

BEL in orders from GSL and GRSE

Bharat Electronics Limited (BEL) has received orders worth Rs. 2,673 Crs from Goa Shipyard Limited (Value of Rs. 1,701 Crs) and Garden Reach Shipbuilders & Engineers (Value of Rs. 972 Crs) for supply of 14 types of sensors for use on Next Generation Offshore Patrol Vessels (NGOPV). This will have the participation of electronics and associated industries including MSMEs, which are

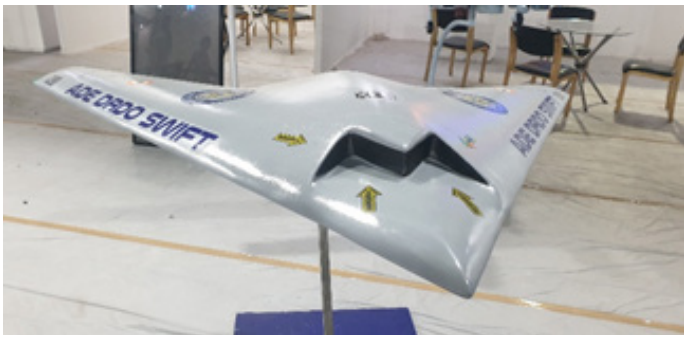
IAF highlights in 2023

Delivery of Twin Seaters, LCA Mk1 IOC & FOC contracts commences
5 Firing Units + 1 training centre of MRSAM deployed
Fabrication of SAMAR Firing Units completed
A–321 acquired by DRDO from Air India for AEW&C and available for IAF before they are modified
First C–295 MW inducted
Contract for supply of HTT–40 signed
Contract for Dornier–228 signed
Contract for Digital Receiver–118 (DR–118) RWR for Su–30MKI signed with BEL
IAF takes over independent VVIP operations on B–777
3 squadrons of Akash/advanced Rajendra Mk–II radars commissioned
Heron Mk II RPA inducted
MiG–21 Bison drawdown plan approved
New Generation Close Combat Missile fired 1st time
SCALP missiles fired and validated.
Apache helicopters carry out firing of Stinger missiles
ADRDE developing HDS for C–130J/C–17 under Tech Demo mode
Trials of Single/Twin ADR on C–17

sub–vendors of BEL. The equipment manufactured by BEL are part of the 'Atmanirbhar Bharat' programme.

Ghatak/SWIFT in 7th flight

DRDO successfully demonstrated another flight trial of Autonomous Flying Wing Technology Demonstrator, an indigenous high–speed flying wing UAV from the Aeronautical Test Range (ATR), Chitradurga in Karnataka on 15 December 2023. With this flight in the tailless configuration, India has "joined the elite club of countries that have mastered the controls for the flying wing configuration". This UAV is designed and developed by DRDO's Aeronautical Development Establishment (ADE). The maiden flight of this aircraft was demonstrated in July 2022, followed by six flight trials in various developmental configurations using two inhouse manufactured prototypes.



Training launch of SRBM Agni–1

Training launch of Short–Range Ballistic Missile 'Agni–1' was carried out successfully from APJ Abdul Kalam Island, Odisha on 7 December 2023. Agni–1 is a proven very high precision missile system and the user training launch, carried out under the aegis of the Strategic Forces Command, successfully validated all operational and technical parameters.


(File image)

SAMAR SAM at AstraShakti–2023

The Indian Air Force carried out successful firing trials of its inhouse designed and developed SAMAR air defence missile system during exercise AstraShakti–2023 at Air Force Station Suryalanka held in December 2023. The air defence system 'SAMAR' (Surface to Air Missile for Assured Retaliation) has been developed by a unit under IAF's Maintenance Command. SAMAR participated for the first time in the exercise and successfully achieved firing trial objectives in different engagement scenarios. The system can engage aerial threats with missiles operating at a speed range of 2 to 2.5 Mach. SAMAR system consists of a twin turret launch platform with the capability of launching two missiles in single and salvo mode depending upon the threat scenario. (Reported by ANI)

Akash SAM fires in salvo

India's Akash SAM air defence missile system destroyed 4 unmanned targets simultaneously at the recently concluded IAF Exercise AstraShakti–2023. This was from a single firing unit.

ISRO's PSLV–C58 launch

On 1 January 2024, ISRO's first mission of 2024 with the PSLV–C58 X–ray Polarimeter Satellite (XPoSat) was launched successfully with payloads POLIX and XSPECT plus 10 other payloads.

TBALs 250th AH–64 Apache fuselages

In December 2023, Tata Boeing Aerospace Limited (TBAL) delivered the 250th fuselage for the AH–64 Apache attack helicopter from its facility at Hyderabad. These fuselages are manufactured for customers around the world, including the US Army, and most recently, the six on order with the Indian Army. The joint venture between Boeing and Tata Advanced Systems Limited (TASL) employs over 900 engineers and technicians, leveraging cutting edge robotics, automation and advanced aerospace concepts in its manufacturing processes.

Airbus awards contract to Aequs

Aequs Pvt Ltd, has secured a contract with Airbus for supply of critical components for its single–aisle family of aircraft, the A320, A330neo and A350 over an extended period. Under the terms of the agreement, Aequs will make detailed parts, and parts with bench assembly for wings, fuselage, and pylons for Airbus' single–aisle family of aircraft over a period of ten years.

CAS inaugurates FMS for Do–228s

Exciting milestone in aviation training for the IAF! The Chief of Air Staff inaugurated a Full Motion Simulator for Dornier aircraft at Air Force Station Yelahanka on 24

November 2023. “This is a giant leap in training standards and aerospace safety as Air Force Station Yelahanka celebrates 60 glorious years of service to the nation”.

TCIL contract for Digital Coast Guard project

In alignment with the Government of India’s strategic vision for Digital Armed Forces, the Ministry of Defence has signed a contract with Telecommunications Consultants India Limited (TCIL) on 8 December 2023, at a total cost of Rs 588.68 crore, for the acquisition of Digital Coast Guard (DCG) project, under the Buy (Indian) category. A pivotal Initiative for the Indian Coast Guard (ICG), the DCG Project will unfold a comprehensive narrative of technological progression, encompassing the construction of an advanced Data Centre, the establishment of a robust Disaster Recovery Data Centre, amplification of connectivity across ICG sites, and the development of the ERP system.

EDGE’s Al Tariq PGMs for Tejas LCA

LCA Tejas at Dubai Airshow 2023 and the PGMs on display at the EDGE stand

EDGE of the UAE has announced the successful completion of the feasibility studies for the integration of the AL TARIQ long range precision guided munitions (LR–PGMs) on the Hindustan Aeronautics Limited (HAL) Tejas LCA. The announcement follows an MoU signed earlier in 2023 between AL TARIQ, a joint venture company, between EDGE and Denel (South Africa), responsible for the design and production of the uniquely modular AL TARIQ family of LR–PGMs, and HAL, an India based leader in the design, manufacturing, and maintenance of aircraft, engines, avionics, and related accessories. The aim of the MoU is to integrate the AL TARIQ LR–PGM onto the HAL Tejas LCA and other platforms as part of their campaign to offer a long–range precision weapon solution to the region.

The AL TARIQ family of modular, all weather, day/night LR–PGMs are designed to fit onto the Mark 80 series and the Indian designed High–Speed Low Drag (HSLD) series of aerial munitions. The addition of a wing kit converts the AL TARIQ–S (Standard Range) to the AL TARIQ–LR (Long Range), extending the stand–off range from 45km to 120km. Full integration and qualification of AL TARIQ’s LR–PGMs on HAL’s Tejas LCA is expected to be completed in the third quarter of 2024.

Thales' 2nd office in Bengaluru

Thales has launched its new office in Bengaluru. Yannick Assouad, Executive Vice President, Avionics, Thales officiated the ceremony, accompanied by Ashish Saraf, VP and Country Director for Thales in India. The new building will serve as an extension of Thales' Engineering Competence Centre (ECC) in Bengaluru, inaugurated in 2019, in support of the Group's ambitious ramp–up plans in the region and country. Thales' engineering teams in Bengaluru are contributing to high value added systems in the fields of aerospace and defence, including air traffic management, complex avionics systems, cockpit, flight management and connectivity systems, radar software, airborne intelligence surveillance and reconnaissance tactical management systems, among others.

Western Air Command Commanders' Conference 2023

A two day Commanders' Conference of Western Air Command (WAC) of the Indian Air Force was held on 11 and 12 December 2023 at New Delhi. Air Chief Marshal VR Chaudhari, Chief of the Air Staff (CAS) was the chief guest. During the conference, the CAS interacted with commanders of the WAC AoR (Area of Responsibility) and discussed the impact of emerging technologies, the need for capability enhancement and fully harnessing the potential of human resources.

TASL and Satellogic to build LEO satellites

Tata Advanced Systems Limited (TASL) and Satellogic Inc, a leader in sub–metre resolution Earth Observation (EO) data collection, announced their collaboration for establishing and developing local space technology capabilities in India. The project will commence with comprehensive training, knowledge transfer, and local assembly of optical sub–metre resolution EO satellites, the first of which is planned to be launched as TSAT–1A.

First Air India A350–900 in new livery

India's first Airbus A350–900 has "come home in the bold, new Air India livery" and it received a grand welcome at Delhi airport on 23 December 2023. "It is touchdown of a new Air India, for a new, resurgent India" stated the airline. As for the interiors, there are 28 'luxurious and private' suites with full–flat beds in Business Class, 24 Premium Economy seats with extra legroom and comfort, and 264 spacious and ergonomic Economy Class seats. (All photos: Air India)

Airbus Helicopters and Indamer for helicopter maintenance

Airbus Helicopters and Indamer have joined hands to provide after–market services for helicopters in India, in a significant boost to the development of the rotary–wing Maintenance, Repair and Overhaul (MRO) ecosystem in the country.

Under authorisation from Airbus Helicopters, Indamer will provide MRO services for Airbus helicopters at its facilities in Mumbai, New Delhi and Nagpur.

InterGlobe and Archer Aviation announce plans

InterGlobe Enterprises and Archer Aviation Inc, a leader in electric vertical takeoff and landing (eVTOL) aircraft, announced that they have entered into a memorandum of understanding (MoU) with the goal of partnering to launch and operate an all–electric air taxi service in India, subject to appropriate regulatory approvals and clearances.

Rahul Bhatia, Group Managing Director of InterGlobe, and Nikhil Goel, Chief Commercial Officer of Archer, signed an MOU to form a proposed partnership through which the parties aim to provide a revolutionary transportation solution for the country, improving urban mobility with safe, sustainable, and low noise electric air taxi service that is cost competitive with ground transportation.

IndiGo creates history

IndiGo created history in Deceber 2023 by becoming the first Indian airline to carry 100 million passengers in a single calendar year. With this achievement, it has joined a select club of global carriers to operate on such scale. IndiGo has also become one of the fastest airlines to reach the 100 million passenger figure. In CY 2022, the airline welcomed 78 million passengers on board (slightly above pre–Covid19 levels).

The new milestone represents a 22% increase in passenger traffic for 2023. IndiGo recently achieved another first for India, by becoming the first airline to operate more than 2,000 flights a day.

CDB Aviation delivers 1st A320neo to AI

CDB Aviation, a wholly owned Irish subsidiary of China Development Bank Financial Leasing Co, announced the delivery of the first of a fleet of six Airbus A320neo aircraft to Air India. In 2022, CDB Aviation became one of the first aircraft leasing companies to secure the placement of Air India's additional A320neo aircraft, which will support the carrier's multi–stage transformation initiative that is being rolled out post its acquisition by the Tata group.

AerCap delivers 1st Airbus A321 P2F to IndiGo

AerCap Holdings has delivered its first Airbus A321 Passenger to Freighter (P2F) aircraft to IndiGo. The aircraft conversion was completed by Elbe Flugzeugwerke GmbH (EFW) before being delivered to IndiGo at ST Engineering Aerospace in Singapore.

Lufthansa Group and Tata Communications in partnership

Tata Communications has joined Lufthansa Group's Corporate SAF programme with a bulk purchase of SAF for its corporate travel needs. The SAF agreement is the first of its kind by a corporate customer in India and Tata Communications has further communicated its interest of investing in SAF on a yearly basis. SAF is a decisive technological key to more sustainable flying. The SAF which is currently available and is used by Lufthansa Group is produced from biogenic residues, such as from used cooking oils. In its pure form, SAF from biogenic residues can reduce CO2 emissions by up to 80 percent compared to conventional fuel.

NIA signs MoU with IndiGo

Noida International Airport (NIA) has signed a Memorandum of Understanding (MoU) with IndiGo. With

this development, IndiGo becomes the inaugural or launch carrier for the airport, accentuating its commitment to support the rapidly growing Indian aviation market.

Boeing pilot roundtable for India and South Asia

Boeing successfully hosted the inaugural Pilot Roundtable in India, a two day event that drew active participation from the pilot community across India and the South Asian region, featuring delegates from Bangladesh and Sri Lanka.

Representing a unique gathering of diverse airline pilots within the region, the event served as a platform fostering discussions between India's pilot community and Boeing's expert panel.

APPOINTMENTS

Rear Admiral CR Praveen Nair is Commander of The Sword Arm

The 'Sword Arm' of Indian Navy, the Western Fleet underwent a change of guard on 10 November 2023.

Rear Admiral CR Praveen Nair, NM took over the mantle of Flag Officer Commanding Western Fleet from Rear Admiral Vineet McCarty. Rear Admiral Nair was commissioned into the Indian Navy on 1 July 1991. As a Communication and Electronic Warfare Specialist, he has had tenures on Indian Naval Ships Krishna, Kora and Mysore.

He has also served as the Fleet Electronic Warfare Officer and the Fleet Communication Officer of the Western Fleet and the Fleet Operations Officer of the Eastern Fleet.

Rear Admiral Nair has commanded the missile corvette INS Kirch, aircraft carrier INS Vikramaditya and commissioned the guided missile destroyer INS Chennai.

Vice Admiral V Srinivas is FOCINC, SNC

Vice Admiral V Srinivas took over as the 30th Flag Officer Commanding–in–Chief (FOCINC), Southern Naval Command at a ceremonial parade held at Naval Base, Kochi on 31 December 2023. Vice Admiral V Srinivas is an alumnus of the National Defence Academy and was commissioned in the Indian Navy on 1 July 1987. An Anti–submarine warfare specialist, he served onboard frontline submarines INS Shalki, INS Shishumar and INS Shankul (during Op Vijay). In his career spanning 36 years, he has commanded INS Shankul, on two occasions, destroyer INS Ranvir and the nuclear submarine INS Chakra.

APPOINTMENTS

Air Marshal PK Vohra is SASO, WAC, IAF

Air Marshal Praveen Keshav Vohra has taken over as the Senior Air Staff Officer (SASO) of Western Air Command of the Indian Air Force on 1 December 2023. The Air Marshal is an alumnus of the National Defence Academy and was commissioned as a fighter pilot in the Indian Air Force on 19 December 1987. He has served across the length and breadth of our nation having flown over 3500 hours primarily on MiG–21 variants and the MiG–29 aircraft. He is a graduate from the Defence Services Staff College, Wellington and Centre of Defence and Strategic Studies, Canberra, Australia. Prior to taking over as Senior Air Staff Officer Western Air Command, he was the Air Officer Commanding Jammu & Kashmir and Ladakh.

Air Marshal Makarand Ranade is DG (I&S)

Air Marshal Makarand Ranade assumed the appointment of Director General (Inspection and Safety) [DG (I&S)] at Air HQ New Delhi on 1 December 2023. An alumnus of National Defence College, New Delhi and College Interarmée de Defense at Paris, France, the Air Marshal was commissioned in the fighter stream of the Indian Air Force on 6 December 1986. In a career spanning over 36 years, the Air Marshal has held key field and staff appointments. These include command of a fighter squadron and two flying stations. He has been a directing staff at Tactics and Air Combat Development Establishment as well as at Defence Services Staff College.

Vice Admiral Kiran Deshmukh is Chief of Materiel

Vice Admiral Kiran Deshmukh assumed charge as the Chief of Materiel on 1 January 2024. An alumnus of VJTI, University of Mumbai, VAdm Deshmukh was commissioned as an Engineer Officer into the Indian Navy on 31 March 1986. He holds a Master's degree in Engineering and is a post graduate from Defence Services Staff College, Wellington. The Flag Officer has held various important appointments in the Staff, Personnel and Materiel Branch at Naval Headquarters, trial agencies, Material Organisation, Naval Dockyard and Command staff at HQENC. He has also served onboard frontline ships of Rajput Class, Delhi Class and Teg Class in various capacities.

Vice Admiral B Sivakumar is Controller Warship Production and Acquisition

Vice Admiral B Sivakumar assumed charge as the Controller Warship Production and Acquisition on 1 January 2024. An alumnus of the National Defence Academy (70th Course), he was commissioned as an Electrical Officer into the Indian Navy on 1 July 1987.

He holds Master Degrees in Engineering from IIT Chennai and Management from Osmania University. The Flag Officer has held various important appointments in the Staff and Materiel Branch at Naval and Command Headquarters, Dockyard and Training Establishments.

Air India's first widebody Airbus A350–900 lands in Delhi

"It was a historic moment to witness Air India with its new livery on a brand new next gen aircraft A350–900 touchdown at Delhi Airport. It was spectacular to see the Indian Flag on 1st A350 by the Indian carrier. This is much needed induction for Air India to change its perception of its long haul flights. The A350's fuel efficiency, top notch technology and seating capacity means better operations and cost savings", according to Samarth Mahajan who was well positioned with his camera to see the first arrival and landing of the A350–900 at Palam, Delhi.

Air India's first widebody Airbus A350–900 aircraft, registered as VT–JRA, arrived at Delhi Airport on 23 December 2023, marking a big step in the airline's fleet expansion plans. VT–JRA completed its journey from the Airbus facility in Toulouse, France, and arrived at Indira Gandhi International Airport in the afternoon.

Chief Executive Officer & Managing Director of Air India stated, "The A350 promises a world class, long haul travel experience on nonstop routes. The A350–900 has a three class cabin configuration with a total of 316 seats. The cabin includes 28 Business Class suites with full flat beds 24 Premium Economy seats with additional legroom and distinctive features and 264 Economy Class seats. All seats are equipped with in–flight entertainment systems and HD screens".

Photos by: Samarth Mahajan (Instagram @indian.spotter05)

Orders, deliveries, unveiling, commissioning and launches for IN/ICG

Crest unveiling of Y–12706 (Imphal)

The crest of Yard 12706 (Imphal), the third amongst the four Project 15B guided missile stealth destroyers being built at Mazagon Dock Shipbuilders Limited (MDL), was unveiled in New Delhi on 28 November 2023. The ship, which was named Imphal in April 2019 (at the time of its launching), was delivered by MDL to the Indian Navy on 20 October 2023. As part of its pre–commissioning trials, the ship recently carried out successful firing of an Extended Range BrahMos missile, making it an ideal milestone for conducting the Crest Unveiling Event for the ship. The event was conducted in the presence of the Raksha Mantri, Chief Minister of Manipur, and senior officials from the Ministry of Defence and State of Manipur.

As per the maritime traditions and naval customs, Indian Naval ships and submarines are named after prominent cities, mountain ranges, rivers, ports and islands. Indian Navy is immensely proud of its latest and technologically advanced warship named after the historic city of Imphal. This is also the first capital warship to be named after a city in the North–Eastern region of India, the approval for which was accorded by the President of India on 16 April 2019.

Designed by the Indian Navy's Warship Design Bureau (WDB) and built by MDL, this ship is a hallmark of indigenous shipbuilding and is amongst the most "technologically advanced warships in the world". The ship boasts a high indigenous content of approximately 75%, including MR SAM, BrahMos SSM, indigenous torpedo tube launchers, anti–submarine indigenous rocket launchers and 76 mm SRGM.

(Representative images)

Coast Guard ship decommissioned at Kochi

As the sun disappeared over the horizon on 4 November 2023, in a traditional armed force ceremony held at Coast Guard Jetty, Kochi; Indian Coast Guard Ship Samar was decommissioned with full honours. The Chief Guest of the ceremony was Additional Director General S Paramesh in presence of Guest of Honour DG Dr P Paleri (Retd). The occasion was graced by dignitaries and personalities from different walks of life, besides previous Commanding Officers and crew of the vessels. The ship was commissioned on 14 February 1996 at Goa by the then Prime Minister of India PV Narashimha Rao and was based at Mumbai under the operational command of Commander Coast Guard Region (West). Further, Ship was rebased at Kochi in 2009.

Commissioning of INS Tarmugli

The Indian Navy inducted a Fast Attack Craft, INS Tarmugli on 14 December 2023 in a ceremonial commissioning ceremony at Naval Dockyard, Vishakhapatnam. The ship has a unique distinction of having served under the flag of two nations with three names during her distinguished service till date.

Commissioned in the Indian Navy as INS Tillanchang, a Trinkat Class ship, she was in active service till 2006, and thereafter gifted to the Maldives National Defence Force (MNDF) by the Govt of India, as part of diplomatic outreach in the IOR.

The ship was commissioned into MNDF as MCGS Huravee on 16 April 2006, and served there till its decommissioning in May 2023. The ship was returned to the Indian Navy, which also provided an in–service Waterjet Fast Attack Craft, INS Tarmugli, to MNDF as the new MCGS Huravee. After detailed examination of the returned ship, a decision was taken to refurbish, repair and re–induct her into the force levels of the Indian Navy. The ship has undergone extensive repair and upgradation by the Indian Navy at Naval Dockyard, Vishakhapatnam, over six months, and was commissioned as 'INS Tarmugli' on 14 December 2023 at Visakhapatnam.

4th ASWSWC launched by GRSE

Garden Reach Shipbuilders and Engineers (GRSE) Ltd achieved yet another milestone on 16 November 23, by launching the fourth Anti–Submarine Warfare Shallow Water Craft (ASW SWC) barely five months after the launch of the third ship. GRSE is building eight ASW SWCs for the Indian Navy.

Of the 40 warships on order from the Indian Navy at various shipyards in the country, GRSE is building 19 warships. These include three Advanced Frigates under the Navy's ambitious Project 17A, four Survey Vessels (Large), eight ASWSWCs and four Next Generation Offshore Patrol Vessels (NGOPVs). Of the 19 warships, ten (apart from the one launched during the day) have already been launched and are undergoing various stages of outfitting.

Launch of three ships of ASW SWC (CSL) Project

Mahe, Malvan and Mangrol, the first three ships of 8 x ASW Shallow Water Craft (CSL) project being built by CSL, Kochi for the Indian Navy, were launched on 30 November 2023 at CSL, Kochi. The contract for building eight ASW SWC ships was signed between the Ministry of Defence and Cochin Shipyard Limited on 30 April 2019. The Mahe class of ships will be equipped with indigenously developed, state of the art underwater sensors, and are envisaged to undertake anti–submarine operations in coastal waters as well as Low Intensity Maritime Operations (LIMO) and Mine Laying Operations. The ASW SWC ships are 78 m long and displacement is approx 900 tons, with a maximum speed of 25 knots.

Keel laying of 4th and 5th ASW SWC Project

Keel Laying of the fourth ship (BY 526, Malpe) and fifth ship (BY 527, Mulki) of Anti–Submarine Warfare Shallow Water Craft (ASW SWC) (CSL) project was presided by RAdm Jaswinder Singh, Chief of Staff, Southern Naval Command and RAdm Subir Mukherjee, Admiral Superintendent, NSRY(Koc) respectively on 8 December 2023, in the presence of Mr. Madhu S Nair, CMD, Cochin Shipyard Limited and other senior officials

of Indian Navy and shipyard at CSL, Kochi. With all major and auxiliary equipment/systems sourced from indigenous manufacturers, these ships are the proud flag bearer of "Aatmanirbhar Bharat" initiative.

Delivery of MCA Barge, LSAM 9 (Yard 77)

The delivery of 'Missile Cum Ammunition Barge, LSAM 9 (Yard 77)', the third Barge of 8 x Missile Cum Ammunition Barge project, built by MSME Shipyard, SECON Engineering Projects Pvt Ltd, Visakhapatnam for Indian Navy, was undertaken on 22 November 2023 at Naval Dockyard, Mumbai for INS Tunir. The induction ceremony was presided over by Cmde Ashish Sehgal Command Refit Officer, Western Naval Command.

The contract for building 8 x Missile Cum Ammunition Barge was signed between MoD and SECON Engineering Projects Pvt Ltd, Visakhapatnam on 19 February 2021. Induction of these Barges would provide impetus to operational commitments of IN by facilitating transportation, embarkation and disembarkation of articles/ ammunition to IN Ships both alongside jetties and at outer harbours.

Launch of MCA Barge, LSAM 10 (Yard 78)

The launch of 'Missile Cum Ammunition Barge, LSAM 10 (Yard 78)', the fourth Barge of 8 x Missile Cum Ammunition Barge project, built by MSME Shipyard, SECON Engineering Projects Pvt Ltd (SEPPL), Visakhapatnam for Indian Navy, was undertaken on 20 November 2023 at Guttenadeevi, East Godavari, Andhra Pradesh (launch site of SEPPL). The launching Ceremony was presided over by Cmde Shanmugam Sabesan, CRO (East).

First ship of Survey Vessel (Large) Sandhayak delivered

Sandhayak (Yard 3025), the first of four Survey Vessel (Large) ships, being built at Garden Reach Shipbuilders & Engineers (GRSE), Kolkata, was delivered to the Indian Navy on 4 December 2023. The Contract for four Survey Vessel (Large) was signed on 30 October 18. The primary role of the ship would be full scale coastal and deep–water hydrographic survey of port/harbour approaches and determination of navigational channels/routes.

MDL to supply 6 next gen OPVs for ICG

The Ministry of Defence signed a contract with Mazagon Dockyard Shipbuilders Ltd (MDL), Mumbai, on 20 December 2023 for the procurement of six Next Generation Offshore Patrol Vessels (NGOPVS) for the Indian Coast Guard (ICG). The contract was made under the Buy (Indian–IDDM) category at a total cost of Rs. 1614.89 Crore. Out of the six vessels being procured, four would replace the existing aging OPVs and the other two would augment the ICG fleet.

2023 year end highlights of DRDO

Akash–NG: Flight trial of new generation Surface to Air Missile Akash–NG was conducted against a Banshee target from the Integrated Test Range, Chandipur, Odisha. It is meant for use by Indian Air Force with an aim of intercepting high manoeuvring low RCS aerial threats. The system has been developed with better deployability compared to other similar systems with canisterised launcher and much smaller ground system footprint.

ITCM Missile: Indigenous Technology Cruise Missile is a new generation 'Long Range Land Attack Cruise Missile' being developed for land and sea platforms. Flight trial was conducted on 21 February 2023 form the Integrated Test Range, Balasore, Odisha.

Maiden test of ASTRA BVRAAM on LCA Tejas: ASTRA is a BVR Air to Air missile to engage and destroy highly manoeuvring supersonic aerial targets. Light Combat Aircraft (LCA) Tejas, successfully fired the ASTRA indigenous Beyond Visual Range (BVR) AAM.

Man Portable Anti–Tank Guided Missile: MPATGM is a 3rd generation ATGM with 'Fire & Forget' and 'Top Attack' capabilities with day and night operational capability. Flight Trials of MPATGM was conducted for a range of 2.5 km at NOAR, Kurnool.

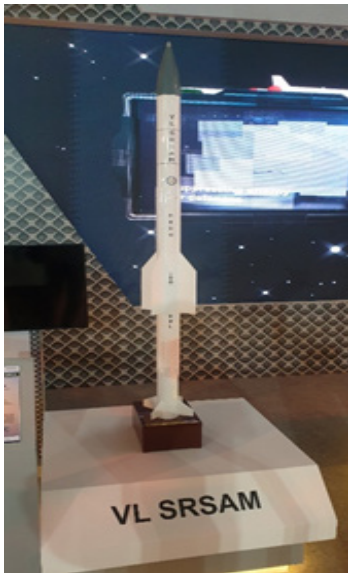
Very Short Range Air Defence System: VSHORADS is a 4th generation Man Portable Air Defence System system, it employing state of art uncooled imaging infrared seeker. The missile was flight tested against high speed unmanned aerial targets, simulating approaching and receding aircraft from Integrated Test Range, Chandipur, off the coast of Odisha.

MRSAM for Indian Navy: MRSAM for the Indian Navy is a joint development programme of DRDO and Israeli Aerospace Industries, Israel. The weapon system provides a point and area defence for P15A ships of the Indian Navy against a vast variety of aerial threats including fighter aircraft, subsonic and supersonic missiles, etc. The Indian Navy successfully flight tested MRSAM from Visakhapatnam.

Heavy Weight Torpedo: Indigenously designed and developed Heavy Weight Torpedo 'Varunastra' was successfully test fired with a live warhead against an undersea target by Indian Navy. 'Varunastra' is a ship launched anti–submarine torpedo having low drift navigational systems, acoustic homing, advanced acoustic counter measure features, autonomous guidance algorithms, insensitive munitions warhead and a GPS based recovery aid for practice torpedo.

Vertical Launch Short Range Surface to Air Missile: VL–SRSAM is a vertical launch short range surface to air missile having a strike range upto 80 km for fighter aircraft, helicopter, UAVs etc.

The missile has been developed for the Indian Navy for neutralising various aerial threats at close ranges including sea skimming targets. The missile was flight tested from Integrated Test Range, Chandipur.



BrahMos: BrahMos is a two stage precision strike supersonic cruise missile, operating on fire and forget principle, which can be launched from multiple platforms (at air, sea and ground) against land and sea targets. Indian Army test fired land attack version of extended range BrahMos supersonic cruise missile. Indian Navy with DRDO test fired two consecutive sea attack version of extended range BrahMos supersonic cruise missile.

Solid Fuel Ducted Ramjet Technology for Air Launched Tactical Missiles: The state of the art air to air missile powered with 'SFDR' propulsion enables the missile to intercept aerial threats at very long range at supersonic speeds and is configured with nozzle less booster, thrust modulation system and sustainer to deliver specific impulse in ramjet mode. The missile was flight tested this year.

Long Range–Anti Ship Missile: DRDO is engaged in development of technologies required for Long Range Anti–Ship Missile weapon systems capable of engaging a warship with a long range. The missile was flight tested from Integrated Test Range.

Autonomous Flying Wing Technology Demonstrator: DRDO has successfully carried out a flight trial of Autonomous Flying Wing Technology Demonstrator, an indigenous high speed flying wing Unmanned Aerial Vehicle (UAV) from the Aeronautical Test Range, Chitradurga in Karnataka. The successful flying demonstration of this autonomous stealth UAV is a testimony to maturity in the technology readiness levels in the country. With this flight in the tailless configuration, India has joined the elite club of countries to have mastered the controls for the flying wing technology. The aircraft prototype, with a complex arrowhead wing platform, is designed and manufactured with lightweight carbon prepreg composite material developed indigenously. Also, the composite structure, impregnated with fibre interrogators for health monitoring, is a showcase of 'Aatmanirbharta' in the aerospace technology.

Integrated Life Support System: Indigenously designed and developed ILSS for pilot of LCA Tejas was flight tested twice in February. The successful testing is an initial step to mark the country's presence in elite club of four nations possessing the complex ILSS technology.

Indigenous Power Take off Shaft: Maiden successful flight test of Power Take Off (PTO) Shaft was conducted on LCA Tejas in Bengaluru. The PTO shaft is indigenously designed and developed by Combat Vehicle Research & Development Establishment, Chennai of DRDO. The PTO shaft, which is a critical component in the aircraft, will support the requirements of future fighter aircraft and their variants and offers competitive cost and reduced lead time.

Military Combat Parachute System: A successful live parachute jump trial was conducted in April and September from 10,000 ft was successfully conducted at Drop Zone Malpura, on indigenously designed Military Combat Parachute System 'HANS' (High Altitude parachute with Navigation and advanced subassemblies)' to meet the military operational requirements of Indian Armed Forces.

HANS enables Special Forces to undertake para jump along with all necessary combat sub–assemblies and will replace all existing systems for free fall operations and give fillip to the 'Aatmanirbhar Bharat'.

Air Droppable Container: DRDO has designed and developed Air Droppable Container (ADC–150) with a pay load capacity of 150kg to enhance the naval operational logistic capabilities. ADC–150 will provide quick response to meet the requirement of critical engineering stores of ships under distress and far away from the coast.

DRDO and Indian Navy conducted the successful maiden test of ADC–150 dropped from Il–38DF aircraft.

Crew Module Parachute System for Gaganyaan Programme: CMPS was successfully demonstrated In–flight Abort Demonstration of Crew Escape System with the newly developed Test Vehicle followed by Crew Module Separation and safe recovery using parachute system developed by DRDO.

Naval Anti–Ship Missile–Short Range: NASM–SR missile is powered by two stage solid propulsion system with an in–line ejectable booster and a long burn sustainer. DRDO successfully flight tested the missile from ITR in

November. The missile was tested for a range of 35 km, using an indigenous IR seeker for its terminal guidance in 'Lock–on after Launch' mode.

Aero India 2023: DRDO displayed a wide range of indigenously–developed products, technologies and systems during the 14th Aero India held in Bengaluru in February 2023.

It showcased numerous exhibits, flight displays and seminars, besides displaying its flagship products at the India Pavilion. The display showcased the recent advancements made by DRDO that contribute towards Aatmanirbharta in Defence. The DRDO Pavilion showcased over 330 products categorised into 12 zones namely Combat Aircraft & UAVs, Missiles & Strategic Systems, Engine & Propulsion Systems, Airborne Surveillance Systems, Sensors Electronic Warfare & Communication Systems, Parachute & Drop Systems, Artificial Intelligence Machine Learning & Cyber Systems, Materials, Land Systems & Munitions, Life Support Services, and Industry & Academia Outreach.

TOTs: DRDO has carried out more than 1,600 ToTs to Indian Industry including both private and public. ToT is being carried out as per the policy and procedure approved by RM. DcPP/PA/DP of DRDO are given Technology free of cost i.e at "Nil ToT Fee".

Fuel Cell–based Air Independent Propulsion system: The system of DRDO's Naval Materials Research Laboratory will soon be fitted onboard INS Kalvari. An agreement was signed between senior officials of NMRL and Naval Group France to extend cooperation to enter into the detailed design phase for integration of indigenous AIP in the Kalvari class submarines.

As part of the agreement, Naval Group France will certify the AIP design for integration in the submarines. The AIP has a force multiplier effect on lethality of a diesel electric submarine as it enhances the submerged endurance by several folds.

Courtesy: MoD

DRDO's successful trials of Ghatak/SWIFT UCAV

Left: Image from the latest and 7th flight test and (Right) image of its first test in July 2022.

Defence Research and Development Organisation (DRDO) successfully carried out a flight trial of Autonomous Flying Wing Technology Demonstrator, an indigenous high speed flying wing Unmanned Aerial Vehicle (UAV) from the Aeronautical Test Range, Chitradurga in Karnataka on 15 December 2023. "The successful flying demonstration of this autonomous stealth UAV is a testimony to maturity in the technology readiness levels in the country. With this flight in the tailless configuration, India has joined the elite club of countries to have mastered the controls for the flying wing technology", stated DRDO.

This UAV is designed and developed by DRDO's Aeronautical Development Establishment. The maiden flight of this aircraft was demonstrated in July 2022, followed by six flight trials in various developmental configurations using two inhouse manufactured prototypes. These flight tests led to achievements in development of robust aerodynamic and control system; integrated real time and hardware in loop simulation, and state of the art Ground Control Station. The team had optimised the avionic systems, integration and flight operations towards the successful seventh flight in final configuration.

The aircraft prototype, with a complex arrowhead wing platform, is designed and manufactured with lightweight carbon prepreg composite material developed indigenously. Also, the composite structure, impregnated with fibre interrogators for health monitoring, is a showcase of 'Aatmanirbharta' in the aerospace technology. The autonomous landing of this high speed UAV, without the need for ground radars/infrastructure/ pilot, showcased a unique capability demonstration, allowing takeoff and landing from any runway with surveyed coordinates. This was possible using onboard sensor data fusion with indigenous satellite based augmentation using GPS Aided GEO Augmented Navigation (GAGAN) receivers to improve the accuracy and integrity of GPS navigation.

Raksha Mantri Rajnath Singh complimented DRDO, Armed Forces and the Industry for the successful flight trial of the system. He stated that the successful development of such critical technologies indigenously would further strengthen the Armed Forces. Secretary Department of Defence R&D and Chairman DRDO Dr Samir V Kamat also congratulated DRDO and the teams associated with this successful flight trial.

Safran and PTC in casting parts for LEAP engine

India based PTC Industries and Safran Aircraft Engines, the French global leader in aero engine design, development and manufacturing, announced a multi–year contract to develop industrial cooperation for LEAP engines casting parts. Under the terms of the contract, PTC Industries will produce titanium casting parts for Safran Aircraft Engines. This agreement reflects commitment to Indian Government "Make in India" policy. Safran Aircraft Engines' ambition is to develop a comprehensive aero engines ecosystem in India, strengthening its global supply–chain built for the LEAP production ramp–up.

Based in Lucknow (Uttar Pradesh), PTC Industries has a long standing expertise in advanced casting processes, as well as precision machining. The first titanium casting parts for LEAP engines are scheduled to be delivered early in 2024 for the LEAP engine powering single–aisle jet. "We are delighted to develop a new cooperation with one of the world leading aircraft engine manufacturer", stated M. Sachin Agarwal, Chairman & Managing Director, PTC Industries. "Through this partnership, we are looking forward to leveraging our expertise in casting process to support the ambitious production challenges of the LEAP programme."

"Having PTC industries expanding our global supply chain is a major step forward for our company", stated Dominique Dupuy, Vice President Purchasing, Safran Aircraft Engines. "PTC, with its investment in its new facilities in Lucknow, pave the way to a successful cooperation over the coming years."

Safran Aircraft Engines, alongside with other Safran companies, has a strong footprint in India with five production facilities in the country (between Hyderabad, Bangalore and Goa), which will be completed by a sixth site in Hyderabad dedicated to the LEAP MRO activities by 2025. The country is the third largest operator of the LEAP engine in the world, with 75% of Indian commercial aircraft being equipped with CFM's advanced turbofan. To date, more than 2,200 LEAP engines are ordered by Indian airlines.

Safran Aircraft Engines designs, produces, sells, alone or in partnership, commercial and military aircraft engines offering performance, reliability and environmental friendliness. Through CFM International, Safran Aircraft Engines is the world's leading supplier of engines for short and medium haul commercial jets.

PTC Industries Limited is a leading Indian manufacturer of precision metal components for critical applications for over 60 years. Through its wholly owned subsidiary Aerolloy Technologies Limited, the company is manufacturing and supplying Titanium and Superalloy castings for aerospace and defence applications within India as well as for exports. The company is substantially expanding its Aerospace castings capability by making a multimillion dollar investment in a new state of the art manufacturing facility at the newly acquired 50 acres land in the Lucknow node of the Uttar Pradesh Defence Industrial Corridor. This facility will be a fully vertically integrated with a Titanium and Superalloy Mill, producing aerospace grade ingots, billets, bars, plates and sheets in these critical and strategic materials.

PM visits HAL and flies in the LCA

Prime Minister Narendra Modi visited Hindustan Aeronautics Limited (HAL) after his maiden sortie on Light Combat Aircraft 'Tejas' twin–seater aircraft in Bengaluru, Karnataka on 25 November 2023. Mr. Narendra Modi became the first Indian Prime Minister who took a sortie in the Tejas, an indigenously designed and developed fighter aircraft. The Prime Minister had a look at production facilities of LCA Tejas aircraft in Bengaluru and was briefed about the technology intensive work being done at HAL towards realising the vision of 'Aatmanirbhar Bharat'. He was apprised about the initiatives being taken by HAL towards ramping capacities and capabilities.

The Prime Minister visited the LCA Tejas Final Assembly and discussed capabilities of the aircraft. Tejas has been operationally deployed with the Indian Air Force and will be the mainstay of the fighter fleet in years to come. The aircraft is capable of undertaking offensive air support role as well as ground attach roles and is quite superior to its contemporaries.

The Prime Minister walked through the production line of Tejas and interacted with the engineers on the various features of the aircraft. It was explained that the aircraft is presently powered by GE 404 engine which will get upgraded to GE 414 Engine for LCA Mk.II which will be manufactured in India with 80% Transfer of Technology arrangement with GE Engines for which the MoU has been signed with GE Engines. This will be the first time that an engine of this class will be produced in India with 80% Transfer of Technology. This ToT is likely to bridge the technology gap that exists currently in the aero engine domain of the country.

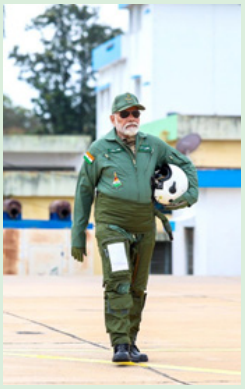
The Prime Minister was briefed about the capacity investments being done by HAL to produce LCA Tejas aircraft in greater numbers. The HAL has established two production lines of LCA Tejas at Bengaluru, which can produce up to 16 aircraft per year. Further, an additional production line is being established at HAL, Nasik to take the production rate beyond 24 aircraft from 2024–25 onwards. HAL is planning to advance the deliveries of current and future order of LCA Tejas to its customers.

The Prime Minister appreciated the capabilities of indigenously developed LCA Tejas aircraft and production facilities available at the HAL. He was also briefed about the progress on LCA Mk.1A programme. The production of fighter aircraft against 83 Mk.1A order concurrent with its design and development is under progress at HAL. Mk.1A variant will be a more lethal aircraft with capabilities such as AESA radar, BVR missile capability, EW suite, advance avionics and maintenance improvements. The deliveries of Mk.1A aircraft are planned from February 2024 onwards to IAF.

Various indigenous helicopters such as Light Combat Helicopter (LCH) Prachand, Advanced Light Helicopter–WSI Rudra and Light Utility Helicopters were also showcased to the Prime Minister. CMD, HAL CB Ananthakrishnan was present during the Prime Minister's visit. He thanked the Prime Minister for his continuous support and encouragement. He said that the Prime Minister's visit "has motivated HAL to work towards fulfilling the Aatmanirbhar goals in the aerospace and defence domain".

PM flies in Tejas

On 25 November 2023, Prime Minister Narendra Modi undertook a 30 minute sortie on the Tejas twin seat aircraft from the IAF's Aircraft and Systems Testing Establishment at Bengaluru. On behalf of the IAF, CAS Air Chief Marshal VR Chaudhari felicitated the PM after the sortie.



DAC approves major capital acquisition proposals

The Defence Acquisition Council (DAC), under the chairmanship of Raksha Mantri Rajnath Singh on 30 November 2023, accorded approval in respect of Acceptance of Necessity (AoNs) for various Capital Acquisition Proposals amounting to Rs 2.23 lakh crore, of which, acquisition worth Rs 2.20 lakh crore (98% of total AoN amount) will be sourced from domestic industries. This will give a substantial boost to the Indian defence industry towards the aim of achieving the goal of 'Aatmanirbharta'.

The DAC has accorded the AoN for procurement of two types of anti–tank munitions namely, Area Denial Munition (ADM) Type–2 and Type–3, which are capable of neutralising tanks and armoured personnel carriers and enemy personnel. To replace the Indian Field Gun (IFG), which has completed its service life, AoN for procurement of state of the art Towed Gun System (TGS) has been granted which will become a mainstay of artillery forces of Indian Army. The AoN was also accorded for 155 mm Nubless projectile for use in 155 mm Artillery guns which will enhance lethality and safety of the projectiles. All these equipment of the Indian Army will be procured under Buy (Indian–IDDM) category.

The AoN for procurement and integration of Automatic Target Tracker (ATT) and Digital Basaltic Computer (DBC) for T–90 tanks under Buy (India) category have also been accorded which will help in maintaining combative edge of T–90 tanks over adversary platforms. The AoN for procurement of Medium Range Anti–Ship Missiles (MRAShM) for surface platform of Indian Navy under Buy (Indian–IDDM) category has also been accorded. The MRAShM is envisaged as a lightweight surface to surface missile which will be a primary offensive weapon onboard Indian naval ships.

In addition, the DAC accorded AoNs for procurement of Light Combat Helicopter (LCH) for Indian Air Force (IAF) and Indian Army and Light Combat Aircraft (LCA) Mk.1A for IAF from Hindustan Aeronautics Limited (HAL) under Buy (Indian–IDDM) category. The AoNs have also been accorded by the DAC for upgradation of Su–30MKI aircraft indigenously from HAL. While procurement of these equipment will provide enormous strength to the IAF, acquisition from domestic defence industries will take the indigenous capability to a new height. It will also reduce dependability on foreign Original Equipment Manufacturers (OEMs) substantially.

Further to maximise indigenisation, the DAC has accorded approval for a major amendment in the Defence Acquisition Procedure (DAP) 2020.

It has been decided that henceforth, in all categories of procurement cases, minimum 50% of indigenous content shall be in the form of material, components and software that are manufactured in India. For the purpose of calculation of indigenous content, cost of Annual Maintenance Contract (AMC), Comprehensive Maintenance Contract (CMC) and After Sale Service shall be excluded. Also, the DAC has taken decision to further encourage start–ups/MSMEs participation in the defence ecosystem. For all procurement cases with AoN cost upto Rs 300 crore, registered MSMEs and recognised startups will be considered for issue of Request for Proposal (RFP) without any stipulation of financial parameters, which can further be relaxed with approval of Defence Procurement Board (DPB) for AoN cost upto Rs 500 crore on case–to–case basis.

Exercises and visits

EU and India in maiden naval exercise

India and EU ships conducted joint activities in the Gulf of Guinea, in an effort to reinforce naval maritime security cooperation in support of the region. On 24 October 2023, the European Union (EU) and India conducted their first joint naval exercise in the Gulf of Guinea. During the exercise, Indian Navy's INS Sumedha, an Offshore Patrol Vessel, was joined by three EU Member States' ships in the Gulf of Guinea: Italian Navy Ship ITS Foscari, French Navy Ship FS Ventose and Spanish Navy Ship Tornado.

IA/IAF in India–Kazakhstan KAZIND–2023

Indian Army and Indian Air Force contingent comprising 120 personnel departed for Kazakhstan to take part in the 7th edition of Joint Military 'Exercise KAZIND–2023'. The Exercise was conducted at Otar, Kazakhstan from 30 October to 11 November 2023. Indian Army contingent comprised 90 personnel led by a Battalion from the Dogra Regiment. The Kazakhstan contingent was mainly represented by personnel from Regional Command South of Kazakh Ground Forces. 30 personnel of Air Force from both sides also participated in the current edition of the Exercise alongside the Army contingents.

Indian Army and exercises

Valiant warriors of Sudarshan Chakra Corps carried out Specialised Heliborne Operations exercise with Thar Raptors to hone their skills on 29 October 2023. Swift insertion techniques were practised and the training assisted in optimum integration and operational synergy. Additionally, Black Mace Brigade and Thar Raptors conducted integrated training and showcased synergistic application of firepower resources in the deserts. The combined might of the air cavalry was demonstrated.

Bangladesh Air Force personnel in India

The Bangladesh Air Force came into being with one Chetak, one armed Otter and one Dakota, 9 Officers and 57 Men on 28 September 1971, at Dimapur, Nagaland. In order to keep the spirit of Liberation War alive amongst the personnel of Bangladesh Forces, 20 Officers and personnel of Bangladesh Air Force led by Group Captain Tanvir Marzan visited Dimapur on 31 October 2023, as a part of Bangladesh Air Force Raising Day celebrations. Officers and personnel of IAF including those belonging to Dornier and Mi–17V5 squadrons with a historical connection with the Kilo Flight interacted with the personnel of

BAF Bangladesh Air Force which has always shown keen interest in visiting important locations that were places of relevance during the 1971 Liberation War.

RAF back in India

The Royal Air Force were back in India working with their Indian partners as Typhoon fighters and supporting Airbus A330MRTT Voyager aircraft stopped over in Hyderabad on 2 November 2023. "Linking up once again with India, helping with our activities within the region!" (Photo: Twitter @Swestred)

Peruvian sail training ship at Mumbai

Buque Armada Peruana (BAP) Union, a Sail Training Tall Ship of the Peruvian Navy was on a goodwill visit to Mumbai from 31 October to 5 November 2023. On arrival at Mumbai, the ship saluted the flag of Flag Officer Commanding–in–Chief, Western Naval Command by firing of 15 ceremonial gun salvos. The ship was extended a traditional welcome with Indian Navy band in attendance.

IAF at Dubai Airshow 2023

An Indian Air Force (IAF) contingent landed at the Al Maktoum International Airport in Dubai for participation in the biennial Dubai Airshow, from 13 to 17 November 2023. The IAF contingent comprised two indigenous platforms; the Light Combat Aircraft (LCA) Tejas and the

Advanced Light Helicopter (ALH) Dhruv. While the Tejas was part of both the static and aerial displays during the Airshow, the Sarang Helicopter Display Team displayed their formation aerobatics skills. The IAF contingent was staged by its C–17 Globemaster III transport aircraft.

India & Bangladesh CORPAT and EX–Bongosagar

The 4th edition of bilateral exercise between Indian Navy and Bangladesh Navy, Bongosagar–23, and the 5th edition of Coordinated Patrol (CORPAT) by the two navies was conducted in the Northern Bay of Bengal from 7–9 November 2023. Ships and aircraft from both navies undertook joint patrolling along the International Maritime Boundary Line (IMBL), and subsequently conducted maritime exercises to enhance interoperability.

Indian Navy Ships Kuthar, Kiltan and Maritime Patrol Aircraft (MPA) Dornier participated in the exercise along with Bangladesh Navy Ships Abu Bakr, Abu Ubaidah and MPA.

GoG patrol with INS Sumedha

INS Sumedha is on an Extended Range Operational Deployment and is currently operating in the Atlantic Ocean along the West Coast of Africa. During this period, INS Sumedha operated in the Gulf of Guinea (GoG) undertaking a 31 days anti–piracy patrol. This is the second such patrol being undertaken by the Indian Navy in this crucial maritime region. The maiden GoG anti–piracy patrol was undertaken by INS Tarkash in Sep/Oct 2022.

India–Sri Lanka Mitra Shakti 2023

The ninth edition of Joint Military exercise “Exercise Mitra Shakti–2023” was held in Aundh (Pune) from 16–29

November 2023. The Indian contingent of 120 personnel was being represented mainly by troops from the Maratha Light Infantry Regiment. The Sri Lankan side was represented by personnel from 53 Infantry Division. 15 personnel from Indian Air Force and five personnel from Sri Lankan Air Force also participated in the exercise.

India/Australia AustraHind–23

The Indian Armed Forces contingent comprising of 81 personnel departed for Australia on 22 November 2023 to take part in the second edition of Joint Military Exercise Austra Hind–23. The exercise was conducted at Perth, Australia from 22 November to 6 December 2023. Indian Army contingent comprised 60 personnel from a Battalion of the Gorkha Rifles. The Australian Army contingent comprised 60 personnel from the 13th Brigade. One officer from Indian Navy and 20 personnel from Indian Air Force also participated from the Indian side. The Australian contingent included 20 personnel each from the Royal Australian Navy and Royal Australian Air Force.

India–USA Vajra Prahar

14th Edition of the Indo–US Joint Special Forces exercise "Vajra Prahar 2023" commenced at the Joint Training Node, Umroi on 21 November 2023. The US contingent was represented by personnel from the 1st Special Forces Group (SFG) of US Special Forces. The Indian Army contingent was led by Special Forces personnel from the Eastern Command. The first edition was conducted in the year 2010 in India and the 13th edition of the Indo–US Joint Special Forces exercise was conducted at the Special Forces Training School (SFTS), Bakloh (HP). The current edition was being conducted in Umroi Cantonment, Meghalaya from 21 November to 11 December 2023.

India–Nepal Surya Kiran–XVII

The Nepal Army contingent comprising of 334 personnel arrived in India to participate in the 17th edition of Joint Military Exercise Surya Kiran. The exercise was conducted in Pithoragarh, Uttarakhand from 24 November to 7 December 2023. It is an annual event and conducted alternatively in the two countries. The Indian Army contingent comprising of 354 personnel was led by a Battalion from the Kumaon Regiment. The Nepal Army contingent was represented by Tara Dal Battalion.

IAF's Exercise Dweep Shakti

Andaman & Nicobar Command showcased its prowess in long range strikes using indigenous weapons and air to air refueling thereby "contributing towards our nation's security" on 1 and 2 December 2023. Air Marshal Saju Balakrishnan, CINCAN steered a Su–30MKI maritime strike mission of Tiger Sharks ex–Port Blair. As part of Exercise, Maritime Jaguars of 6 Sqn AF, undertook night operations, demonstrating "strategic capabilities and extending their reach in the Indian Ocean Region".

INS Kadmatt at Yokosuka, Japan

INS Kadmatt, on a Long Range Operational Deployment to the North Pacific Ocean entered Yokosuka, Japan on 2 December 2023 for an Operational Turnaround (OTR). Onboard visits including professional interactions and community welfare activities took place during the stay. Interactions with the Japan Maritime Self Defence Force (JMSDF) included cross–ship visits, professional exchange of ideas, Joint Yoga Camp and coordination meeting for the Maritime Partnership Exercise (MPX).

ICG OPV Sajag at Dammam, Saudi Arabia

Indian Coast Guard Ship Sajag, an Offshore Patrol Vessel, made port call at King Abdul Aziz Port, AD Dammam, Saudi Arabia on 5 December 2023 for a three day visit. The visit aimed to strengthen long standing diplomatic ties and enhance cooperative engagements with the Saudi Border Guards and Saudi Naval Forces personnel towards professional exchange/interactions such as training on Vessel Board Search & Seizure (VBSS), Maritime Search & Rescue (M–SAR), cross–deck visits, Table Top Exercise on Marine Pollution Response (MPR) etc.

India–Vietnam "VINBAX–2023"

The Indian Armed Forces contingent comprising 45 personnel reached Hanoi, Vietnam to take part in the fourth edition of Joint Military Exercise VINBAX–2023. The exercise was conducted at Hanoi, Vietnam from 11–21 December 2023. The Indian contingent comprised 39 personnel from an Engineer Regiment of Bengal Engineer Group and six personnel of Army Medical Corps. The Vietnam People's Army contingent was represented by 45 personnel.

INS Sumedha at Port Lamu, Kenya

As a part of ongoing long range deployment to Africa, Indian Naval Ship Sumedha arrived at Port Lamu, Kenya

on 9 December 2023. The visit marked the maiden port call by any Indian Naval Ship at the recently developed Port in Kenya. INS Sumedha is the third of indigenously developed Saryu class of Indian Navy. The ship is equipped with an array of weapons and sensors and can carry multirole helicopters. She is part of the Indian Navy's Eastern Fleet based at Visakhapatnam.

INS Kadmatt at Manila, Philippines

As part of the ongoing Long Range Op Deployment, INS Kadmatt arrived at Manila, Philippines on 12 December 2023. The visit was aimed at bolstering maritime cooperation between India and Philippines. INS Kadmatt is an indigenously designed and built anti–submarine warfare corvette, equipped with state of the art anti–submarine weapon suite.

INS Kadmatt in Bangkok, Thailand

INS Kadmatt arrived at Bangkok, Thailand, on 19 December 2023. The aim of the visit was to further bolster India–Thailand maritime cooperation and enhance interoperability between both the navies. Harbour activities scheduled during the operational turnaround included cross–ship visit by personnel from Royal Thai Navy (RTN) Academy and planning conference for Maritime Partnership Exercise (MPX). On departure from Bangkok, the ship undertook MPX with HTMS Rattanakosin, a corvette of the Royal Thai Navy.

India–UAE Joint Military Exercise 'Desert Cyclone'

The UAE Land Forces contingent comprising 45 personnel arrived in India to participate in the 1st edition of the India–UAE Joint Military Exercise 'Desert Cyclone'. The Exercise was conducted in Mahajan, Rajasthan from 2–15 January 2024. The UAE contingent was being represented by troops from the Zayed First Brigade. The Indian Army contingent comprising 45 personnel was represented mainly by a battalion from the Mechanised Infantry Regiment.

The aim of the Exercise was to enhance interoperability in Sub–conventional Operations including Fighting in Built–Up Area (FIBUA) in desert/semi desert terrain under Chapter VII of the United Nations Charter on Peace Keeping Operations. The Exercise was meant to enhance cooperation and interoperability between both the sides during Peace Keeping Operations.

Drills rehearsed during exercise included Establishment of a Joint Surveillance Centre, Cordon and Search Operation, Domination of Built–Up Area and Heliborne Operations. "Exercise Desert Cyclone signifies further strengthening of bonds of friendship and trust between India and the UAE. The Exercise aims to achieve shared security objectives and foster bilateral relations between two friendly nations", stated MoD.

IAF's Exercises in 2023

IAF Mirage 2000s at Exercise Cobra Warrior, UK.

The IAF continued to train hard in 2023 exercising not only with sister services for enhancing jointness, but also with Air Forces of friendly foreign countries. Listed below are a few:

Ex Veer Guardian–23: Held in the period 12 to 27 Jan 23, this was the first air exercise between India and Japan.

Ex PASSEX with France: On 29 Jan 23, the IAF conducted 'Ex PASSEX' with French fighter aircraft sailing onboard the aircraft carrier 'Charles De Gaulle' in the IOR.

Ex Desert Flag–8 in UAE: IAF participated in 'Ex Desert Flag–8' in Al–Dhafra, UAE from 24 Feb to 20 Mar 23. This was the first ever participation by the Tejas in an international air exercise.

Ex Cobra Warrior–23: IAF participated in multinational Air Exercise 'Ex Cobra Warrior–23' in UK from 6 to 24 Mar 23. This exercise saw IAF aircraft staging through Saudi Arabia for the first time.

Ex Cope India–23: The USAF and the IAF participated in 'Ex Cope India–23' at AFS Kalaikunda (fighters) and Panagarh (transport aircraft) from 10 to 21 Apr 23. The Japan Air & Self Defence Force participated with one observer.

Ex Orion–23: IAF participated in multinational exercise 'Ex Orion–23' in France from 17 Apr to 5 May 23. The exercise saw the IAF's Rafale aircraft ferrying directly from France to India.

Ex INIOCHOS–23: IAF participated in a multinational exercise 'Ex Iniochos–23' in Greece from 24 Apr to 5 May 23. This was the first Air Exercise between India and Greece.

Ex Bright Star–23: IAF took part in Ex Bright Star–23 with Egypt from 27 Aug to 16 Sep 23. The IAF's MiG–29 fighters ferried directly from India to Egypt.

The following training exercises were conducted with sister services, aimed at increasing joint capabilities:–

Ex Kranti Mahotsav from 8 May 23 to 10 May 23 with 1 MLH.

Exercise Ex Chakra Drishti–23 from 10 May 23 to 12 May 23 with fighter, RPA and AEW&C.

IAF participated in EWT of 33 Armd, 16 Rapid, 6(I) Armd Bde and 47 Engr Bde from 8 May 23 to 27 May 23 wherein IAF's helicopters operated along with IA.

Exercise Western Command Theatre Spl Ops validation in May 2023 with helicopters along with Transport aircraft. It also witnessed RPA and fighter operations.

Exercise 2 Corps EWT on 23–24 May 23 with Su–30MKI.

Exercise Long range Maritime strike over Western seaboard on 2 Jun 23 with fighters, transport and AWACS.

IN carried out MiG–29K detachment at AFS Naliya from 22 Jul to 16 Aug 23 along with IAF.

Indian Navy Exercises in 2023

IN ships Kolkata, Sahyadri and P8I participated in the 31st edition of Exercise MALABAR 23 scheduled at/ off Sydney, Australia from August 11 to 23, 2023, along with ships and aircraft from US Navy, JMSDF and RAN. MALABAR 23 was conducted in two phases viz the Harbour Phase (August 11–15, 2023) encompassing cross deck visit, pre–sail conferences and delegation visits, followed by the Sea Phase (August 16–21, 2023) comprising various surface, sub–surface and air exercises involving units from all participating countries.

IN ships Chennai and Teg, along with aircraft (MiG 29K, P8I, Dornier, ALH and Sea King), participated in the 21st edition of Exercise Varuna 23 with French Navy Carrier Strike Group (comprising Charles De Gaulle, Forbin, Provence and Marne), alongwith maritime patrol aircraft Atlantique 2 off Goa from January 15 to 20, 2023. Subsequently, the FN ships Charles De Gaulle, Forbin and Provence entered Goa, while Marne entered Mumbai for the Harbour Phase of the Exercise. French aircraft Atlantique, A330 MRTT and A400M operated from INS Hansa, Goa.

IN ships Sahyadri and Jyoti participated in the 3rd edition of the Multilateral Exercise La Perouse conducted in Southern Bay of Bengal from March 13 to 14, 2023. Eight warships from six countries (Australia, India, France, Japan, UK and USA) participated in the exercise.

Sea Dragon is a multilateral Air ASW exercise conducted by US Navy. IN P8I aircraft participated in the 5th edition of Anti–Submarine Warfare (ASW) Theatre Exercise Sea Dragon 23 conducted at Guam, USA from March 15 to 29, 2023. Maritime Patrol Aircraft (MPA) from four countries (USA, Japan, Canada and South Korea) and USS Hampton (Los Angeles Class SSN) participated in the exercise.

IN Ship Trishul and Dornier aircraft participated in the annual bilateral maritime exercise Konkan 23 with Royal Navy ship HMS Lancaster off Mumbai from March 20 to 22, 2023. Both ships undertook multiple maritime drills to enhance interoperability and imbibe best practices.

IN ships Delhi and Satpura, alongwith P8I aircraft, participated in the maiden ASEAN India Maritime Exercise (AIME) and International Maritime Defence Exhibition (IMDEX) conducted at Singapore from May 2 to 8, 2023.

INS Sumedha participated in Multilateral Tri–Services Exercise Bright Star 23 conducted in the Mediterranean Sea from 6 to 13 Sep 23. The Exercise was conducted in two phases, Harbour phase and Sea phase.

IN and USN have been participating in a combined Salvage exercise since 2005. Seventh edition of IN – USN Diving, Salvage and EOD exercise (SALVEX) was conducted from June 26 to July 6, 2023 at Kochi. For the duration of the exercise, USNS Salvor (T–ARS 52) made port call at Kochi.

IN Ships Savitri and Kiltan participated in India – Sri Lanka bilateral exercise SLINEX 23 with Sri Lankan Navy ships SLNS Vijaybahu and Samudura at/ off Colombo, Sri Lanka from April 3 to 8, 2023. IN SLN SF exercise was also conducted as part of SLINEX 23 from April 3 to 6, 2023 at Colombo, Sri Lanka.

INS Kavaratti, along with one Dornier aircraft participated in the 4th edition of Exercise Samudra Shakti 23 conducted at Batam, Indonesia from May 15 to 19, 2023.

IN ships Tarkash and Subhadra, alongwith one Dornier aircraft, participated in bilateral exercise Al–Mohed Al–Hindi conducted at Al Jubail, Saudi Arabia, from May 21 to 25, 2023. Royal Saudi Naval Forces (RSNF) ships Badr, Abdul Aziz and two HIS–32 FACs, one Maritime Patrol Aircraft (MPA), MH–60R helicopter and Karayel UAV participated in the exercise.

INS Tarkash participated in the maiden India/France/ UAE trilateral exercise with FS Surcouf and Maritime Patrol Aircraft ex–UAE in Gulf of Oman from June 6 to 8, 2023.

Maiden India – France – UAE trilateral PASSEX was conducted from June 7 to 8, 2023, off Gulf of Oman. INS Tarkash, FS Surcouf and UAE Navy helicopter (Panther) participated in the exercise.

INS Satpura participated in the fourth edition of Multilateral Naval Exercise KOMODO – 23 conducted at Makassar, Indonesia, from June 4 to 8, 2023. The exercise saw the participation of navies from 36 countries and was conducted between Borneo and Sulawesi.

The 5th edition of AUSINDEX was conducted from August 22 to 25, 2023 at/off Sydney, Australia. IN Ships Sahyadri and Kolkata participated in the exercise, along with HMAS Choules and HMAS Brisbane from RAN. In addition to the ships and their integral helos, the exercise also witnessed participation of fighters and Maritime Patrol Aircraft (MPA) from Royal Australian Air Force (RAAF).

IN ships Ranvijay and Kavaratti, alongwith submarine Sindhukesari and P8I aircraft, participated in the 30th edition of SIMBEX–23, with Singapore Navy ships Stalwart, Valour, submarine Invincible and Fokker aircraft at/off Singapore from September 20 to 27, 2023.

Interview with Admiral R. Hari Kumar, Chief of the Naval Staff, Indian Navy

(Photos of CNS: Indian Navy)

***VAYU**: We all know the two leased MQ–9 Sea Guardians are performing well with the Indian Navy. Plus there is talk of 15 more under FMS. Is the Indian Navy also operating or considering the Drishti/Hermes 900 MALE UAVs being manufactured in India?*

CNS: AoN for procurement of 31 MQ 9B HALE RPAS for the three services, (16 for Land operations and 15 for Maritime Operations) from USG through Buy (Global) under IGA (FMS) has been accorded by DAC on 28 June 2023. Further activities towards contract conclusion are being progressed.

Bharatiya Nausena has also contracted for the supply of two Hermes 900 Starliner MALE RPAS. These RPAS are state of the art UAVs which will be manufactured in India under ToT with Elbit Systems, Israel with 60% Indigenous Content (IC). The RPAs are expected to be inducted in the Navy by February 2024.

MQ–9 Sea Guardian (Photo: GA–ASI)

Hermes 900 Starliner MALE RPAS will be jointly manufactured by ADTL/Adani and Elbit Systems (Photo: Vayu)

***VAYU**: That leads us to the next question and the hope for 6 more P–8Is. Where does this stand?*

CNS: The case for procurement of six additional P–8I's is presently under review by the MoD and would be progressed further based on MoD decision.

P–8I (Photo: Indian Navy)

***VAYU**: Can you tell us the status of helicopter upgrades for the Ka–28 and Ka–31 AEW if any? We heard there was work going on for the Ka–28.*

CNS: The KV 28 MLU Contract is being undertaken in two phases i.e. overhaul phase at Russia and the upgrade phase at INS Dega, Visakhapatnam. All ten KV 28s have been dispatched to Russia for their overhaul. The first two KV 28 overhauled helicopters were delivered to IN in July 2023 and are currently undergoing upgrades at Dega. As part of the upgrade, the helicopters are being fitted with state of the art sensors, viz. Radar, Sonar, Tactical Mission System and Weapon Suite. The first two KV 28s are likely to be accepted by IN in June 24 and the last ones by end 2025.

***VAYU**: And more on helicopters, how many more ALHs and MH–60Rs are yet to be delivered. Plus the status of the Navy ordering LUH's from HAL.*

CNS: The status of helicopters is mentioned below:

ALH Mk.III Contract Delivery: IN has been operating the ALH Mk.III aircraft, inducted from HAL, for Search and rescue, Utility Role and Maritime Reconnaissance. All contracted helicopters have been inducted in IN.

HAL ALH Mk.III (Photo: Vayu)

MH–60R Delivery Schedule: LOA for procurement of 24 MH–60R multirole helicopters under the FMS route was signed on 25 February 2020. Delivery of five helicopters has been completed in 2023. The sixth aircraft delivery is planned in December 2023. The delivery schedule of balance aircraft is up to 2027.

MH–60R (Photo: Vayu)

Naval Utility Helicopter: Naval Utility Helicopter has been included in the third positive indigenisation list. The DAC has accorded AoN for the Procurement of 60 Utility Helicopters–Maritime under Buy (Indian–IDDM) category as a 'Design and Development' project from Hindustan Aeronautics Limited (HAL) on 29 March 2023. HAL is progressing with the Design and Development of the UH–M prototype. The first prototype should be ready in

Naval Utility Helicopter in its earlier avatar (Photo: Vayu). Now it will probably be based on the HAL LUH.

October 2024 followed by a second prototype in April 2025. The delivery is scheduled to commence from January 2027.

***VAYU**: Finally, can you update us on the two projects from HAL for the IN, ie, DBMRH and TEDBF?*

CNS: Update on the two projects from HAL for the IN are as mentioned below:

Deck Based Multi–Role Helicopter (DBMRH): Bharatiya Nausena needs to augment the existing fleet of multirole helicopters taking into account the phasing out of aging helicopters and induction of frontline warships. The Deck Based Multi Role Helicopter for the Navy is part of a joint case being progressed by IAF as the lead Service. The helicopters would be designed and developed by HAL i.a.w provisions of Chapter IV of DAP 2020. HAL along with all other stakeholders are being engaged to present the case for consideration of MoD, seeking approval to initiate design and development i.a.w provisions of Chapter IV DAP 2020. Design and development of IAF and IN variants would be undertaken concurrently by HAL as per the requirements projected by the Services.

Deck Based Multi–Role Helicopter (DBMRH) seen above will be a variant of the HAL IMRH (Photo: Vayu)

Twin Engine Deck Based Fighter (TEDBF): TEDBF is a 4++ generation Short Take–Off but Arrested Recovery (STOBAR) Fighter being indigenously developed by ADA as a replacement for IN's MiG–29K fleet. Broad timelines for the TEDBF programme are for the first prototype flight in 2028 and the delivery of the aircraft in 2032. The TEDBF Programme is progressing as per envisaged timelines and all efforts are being made to achieve the milestones earlier than planned. To ensure economy of effort and expeditious development, all efforts are being focused on maintaining commonality with the ongoing IAF programmes with modifications to cater for IN's unique operating requirement and carrier compatibility requirements.

A model of Twin Engine Deck Based Fighter TEDBF (Photo: Vayu)

Some Indian Navy news

16 upgraded SRGMs for IN

MoD has signed a contract with Bharat Heavy Electricals Ltd for procurement of 16 Upgraded Super Rapid Gun Mount (SRGM) at a cost of Rs. 2956.89 Cr.

IN's NASM–SR tested

Indian Navy/DRDO successfully undertook guided flight trials of 1st indigenously developed Naval Anti–Ship Missile from a Seaking 42B on 21 November 2023.

Brahmos tested again

Imphal, Indian Navy's latest indigenous guided missile destroyer, scored 'Bulls Eye' in her maiden Brahmos firing at sea on 22 November 2023.

Indian Navy Day Press Conference, New Delhi

On 1 December 2023, Admiral R Hari Kumar, the Chief of Naval Staff (CNS), along with other naval officials, presided over the annual press conference preceding the Indian Navy Day 2023.

The two hour event was dedicated to launch several key projects and briefing the media on the current status of the fleet, milestones achieved in the year 2023, cooperation with foreign counterparts, plans for future modernisation, and successfully culminated or ongoing campaigns.

The launches included Integrated Logistics Management System (ILMS) 2.0, an automated computer software that optimises naval logistics by integrating inventory, procurement, maintenance, and distribution for enhanced operational readiness.

This was followed by the launch of the 3–book comic series "The Naval Journey of India" in 10 regional languages, including Marathi, Bengali, Tamil, etc. Furthermore, the Indian Naval Grievance Redressal and Monitoring System (INGRAMS) and revitalised CNS Discussion Forum were also launched. Moving forward with the annual report, it listed several key missions undertaken by the Indian Navy in a diverse range of fields. It included overseas deployment of warships, submarines and aircraft. Locations like Coco Islands, West Coast Africa, Oman, Maldives, etc, witnessed the presence of Indian Navy contingents on objectives like joint training, humanitarian assistance, anti–piracy, anti–narcotics and more. The trend of domestic and international Exercises was also showcased. Women empowerment was another

key sector where the Navy attained a breakthrough.

With the third (the latest) batch of Agniveers, more than 1000 women would now serve the Indian Navy as Agniveers.

Furthermore, it was revealed that the first ever woman Commanding Officer (CO) was undergoing pre–commissioning training in the western seaboard after which she would be deployed to command her warship.

However, neither the name of the

officer nor the ship was revealed. Regular participation in educational sectors, like organising quizzes like ThINQ 2023 in 11,741 schools across India, was deemed to be a success. Answering the media, CNS also answered various issues raised.

The CNS shared optimistic timelines of IAC–II and Twin–Engine Deck Based Fighter (TEDBF), expecting them to be inducted in 8–10 years once the central government gave its nod.

Also, he assured that the Indian Navy and the Indian Government were fully committed to bringing back the ex–Indian Navy personnel who are stuck in Qatar due to allegations of espionage. Last, but not least, in the field of future and "Aatmanirbharta", CNS reiterated that the Indian Navy was backing the indigenisation efforts with both planning and execution, as currently, ongoing construction of submarines and ships are by Indian shipyards.

Also, the navy aims to establish full indigenisation by 2047 and also aims to be a 175 vessel strong Navy by 2032–2035.

Report & photos by Rishav Gupta

Indian Navy Day 2023 celebrations

Prime Minister Mr. Narendra Modi attended the programme marking 'Navy Day 2023' celebrations at Sindhudurg, Maharashtra on 4 December 2023. He also witnessed the 'Operational Demonstrations' by Indian Navy's ships, submarines, aircraft and special forces from Tarkarli beach, Sindhudurg. Additionally, the PM inspected the guard of honour.

Addressing the gathering, the Prime Minister said that "the historic day of 4 December along the magnificent fort of Sindhudurg on the coast of Malvan, Tarkarli, the splendor of Veer Shivaji Maharaj and the inauguration of his spectacular statue at Rajkot Fort along with the roars of the Indian Navy has filled every citizen of India with passion and enthusiasm. It is indeed a moment of unprecedented pride to celebrate Navy Day from the victorious land of Sindhudurg".

Defence Minister Mr. Rajnath Singh was of the view that till a decade ago, the Navy was not considered important and it was believed that the only threat the country faced was land based. He highlighted the strides being made in the Navy to achieve 'Aatmanirbharta', making special mention of the country's first indigenous aircraft carrier INS Vikrant, which was commissioned by the Prime Minister in September 2022. "Earlier, most of the Navy's equipment was imported, but today we have become 'builder Navy' from 'buyer Navy'. Today, we are transforming it from Coastal Navy to Blue water Navy. This transformation truly shows the visionary leadership of our Prime Minister," he stated.

The Indian Navy celebrates 4 December as Navy Day every year to acknowledge the role of the Indian Navy and commemorate its achievements in 'Operation Trident' during the 1971 Indo–Pak War.

The Prime Minister thereafter witnessed the Operational Demonstration as the Chief Guest conducted at Tarkarli Beach. The event was hosted by Admiral R Hari Kumar, Chief of the Naval Staff and conducted by Vice Admiral Dinesh K Tripathi, Flag Officer Commanding–in–Chief, Western Naval Command. The Operational Demonstration showcased capabilities of Indian Naval ships, submarines, aircraft, helicopters and Special Forces. The event saw participation of more than 15 major and minor warships (mostly indigenous) along with over 40 aircraft comprising MiG–29K, indigenous LCA Navy and Advanced Light Helicopter, as well as the newly inducted multi–mission helicopter MH–60R.

Interview with CB Ananthakrishnan, CMD, HAL

Aircraft maker Hindustan Aeronautics Limited (HAL) has found itself in the spotlight after the Indian Air Force (IAF) announced plans to buy more fighter jets, light combat helicopters, and to upgrade its Sukhoi Su–30MKIs in potential contracts worth billions of dollars. HAL is also set to begin work on jointly designing and developing helicopter engines with French firm Safran, and is negotiating a deal for the joint production of fighter jet engines in the country with GE Aerospace. In an interview with Rahul Singh from The Hindustan Times, HAL chief outlined how the state–run firm is ramping up capacities, preparing to execute the big orders and projects, and pushing indigenisation along the way.

HAL has been on a roll. How prepared are you for the journey ahead?

We anticipated these projects and began laying the groundwork two to three years ago. The primary thing was capacity planning. The capacities we have created, and are creating, will become national assets for future programmes. We are confident of delivering on time. Apart from platforms like fighters and helicopters, we are also creating additional capacity for engines, avionics and accessories. There has been a paradigm shift in HAL's approach. We no longer wait to start work after an order or sanction comes, be it design or manufacturing activity. The moment we see the demand for a particular product, HAL ploughs its own money into these activities so that time is not lost. Today we ensure we have a head start even before a contract is signed. The potential orders for more light combat aircraft (LCA) Mk.1A and light combat helicopters (LCH) reflect the customer's confidence in us, in our ability to deliver higher numbers and handle tight timelines. We have enough capacity to execute current and future orders.

What is the status of the joint venture to design and develop helicopter engines with Safran?

The JV will become operational in January 2024, and production of engines is expected to begin in four years. These engines will be for the Indian multi–role helicopter (IMRH) and its deck–based version. There is a requirement for around 400 such helicopters. We are looking at basing the Safran–HAL JV at our new Tumakuru facility, which is the largest helicopter manufacturing facility in the country. We can manufacture up to 90 helicopters in Tumakuru every year, a mix of LCH, light utility helicopters and IMRH. With the JV based there, Tumakuru will become one big complex for helicopters and associated equipment. Safran and HAL will have a 50:50 work–share. IMRH could go into production with the new engine by 2031. The timelines are tight, but the good part is that we are already manufacturing the Shakti engine for the advanced light helicopter with technology transfer from Safran.

HAL has ramped up LCA Mk.1A production capacity to 24 aircraft per year. Is there more scope to scale up?

Our current goal is to deliver 24 aircraft from the Bengaluru and Nashik facilities from 2025–26. Once we have reached that goal, we can ramp up production to 30 aircraft per annum. It is possible if we can streamline the supply chain. But first we have to prove we can deliver 24 as there's a general sense that HAL is not capable of producing aircraft in big numbers. I don't want to get into that debate. More numbers are achievable as we know what our capacities and capabilities are. We are focussed on making more numbers available to our customers as soon as possible.

How is the first LCA Mk.1A shaping up?

As far as the first aircraft goes, the certification process of the new systems is underway by the Centre for Military Airworthiness and Certification. Most of this has been done, and only three or four more systems need to be certified. It should happen in the next two to three months. On the production side, we started work on the aircraft last year and it is now in an advanced stage. It should get into equipping soon. Once all the systems are certified, we will do the ground runs and test flying. The first Mk.1A will be delivered to IAF in February 2024, and the last of the 83 jets by 2027–28 – a year ahead of the contracted delivery schedule.

An order for 156 LCHs has been cleared...

We have manufactured 15 limited series production (LSP) helicopters and now the series production will begin. We have finalised the additional requirements. We want to deliver good numbers every year, instead of the normal 12–15. Our target will be to execute this order in the shortest possible time, in five to six years. That's around 25 choppers per year.

How are negotiations progressing with GE for the F414 engines?

We should have a deal in six months to a year. We expect GE to give us a price quotation soon and then discussions will gather momentum. Things are moving fast. Our target is to conclude the deal at a good price.

What will the Rs. 65,000crore Su–30MKI upgrade entail?

We have begun discussions with IAF. We have almost come to some sort of framework within which the upgrades have to be done. We will not depend on any foreign original equipment manufacturer for this upgrade of 84 aircraft. It will be an indigenous effort to the extent possible. It will involve equipping the Su–30s with the indigenous Uttam active electronically scanned array (AESA) radar, electronic warfare suites, weapon control systems, avionics and new weapons.

What do you think of India's self–reliance goals?

In one word, achievable. The Covid–19 pandemic and the geopolitical situation around the globe have re–emphasised the need to be self–reliant. We have seen challenges in the supply chain during the last two to three years due to the over dependence on foreign sources.

We are trying to change that. The government has released several indigenisation lists and set tight timelines to manufacture military hardware within the country. We have created an indigenisation cell, which is funded with 3% of our net operating profit. Around Rs. 200 crore will be ploughed into this fund every year. We have identified several indigenisation programmes and earmarked an initial budget of Rs.1,800 crore.

Interviewed by Rahul Singh
(Twitter @rahulsinghx), Hindustan Times
All photos: Vayu Aerospace & Defence Review

Latest developments at HAL

HAL and Airbus to establish civil MRO

HAL and Airbus have signed a contract for establishing MRO facilities for A–320 family of aircraft during a function at New Delhi. This collaboration with the largest European aircraft manufacturing company will strengthen Make in India mission by achieving self reliance in the aircraft Maintenance, Repair and Overhaul (MRO) industry in India. Under the collaboration, Airbus will supply the A320 family tool package and offer specialised consulting services to HAL to establish MRO facility for A–320 family of aircraft.

Good year for HAL's Dornier 228 in 2023

Ministry of Defence signed a contract with HAL for procurement of two Dornier aircraft for Indian Coast Guard along with associated Engineering Support package

at an overall cost of Rs 458.87 crore. The aircraft will be procured under the Buy (Indian) Category. The aircraft will be fitted with a number of advanced equipment like Glass Cockpit, Maritime Patrol Radar, Electro Optic Infra Red device, Mission Management System etc.

MoD also signed a contract for procurement of six Dornier–228 aircraft for the Indian Air Force from HAL at a cost of Rs 667 crore. The aircraft was used by IAF for Route Transport Role and communication duties. Subsequently, it has also been used for training of transport pilots of the IAF. The present lot of six aircraft will be procured with an upgraded fuel efficient engine coupled with a five bladed composite propeller.

Post successful completion of ground run and test flight of the Do–228, RCMA (Kanpur) accorded FCN for Biojet fuel trials on 21 September 2023. The first sortie for two hours with 10% blended fuel on one engine was successfully flown on 22 September 2023. Two sorties with 10% blended fuel on both engines was flown for four hours on 26 September 2023. Third sortie was flown on 27 September 2023. The trials on Do–228 aircraft using 10:90 admixtures of Bio–jet fuel with ATF were successfully completed at 5 BRD on 28 September 2023. Additional 6,000 ltrs of bio–jet fuel is under procurement which would be used in next phase of trials.

New Design and Test Facility at HALs AERDC

The Defence Secretary, Mr. Giridhar Aramane inaugurated a new design and test facility at HAL's Aero Engine Research and Development Centre (AERDC) in Bengaluru on 29 December 2023. Hailing the important work being done by HAL, Mr. Aramane stated, "HAL has received applause at the highest levels and the government trusts your capability to deliver and make the country self–reliant. Manufacturing sector is the future of our country and in the coming decades, HAL should focus on mastering technologies for all types of aircraft. Think ahead as the entire paradigm of warfare is changing." Thrusting on the role of unmanned aircraft in the future warfare, he encouraged HAL to collaborate with other private companies to develop new platforms. "HAL is the largest DPSU in India and I want it to become the top ten companies in the world," he added. He had a look at the

manufacturing range of various engines and test beds. He also paid a visit to HAL's Aerospace Division.

Mr. C.B. Ananthakrishnan, CMD (Addl. Charge), HAL stated, "The development of this facility marks a key milestone in HAL's growth trajectory. It is a testimony of HAL's commitment towards achieving Aatmanirbharta in aero–engine design and development." The new facility spanning over 10,000 sq. meters has been established under the modernisation plan.

The AERDC is currently involved in the design and development of several new engines including two strategic engines namely Hindustan Turbo Fan Engine (HTFE) of 25 kN thrust for powering trainers, UAV's, twin engine small fighter aircraft or regional jets and Hindustan Turbo Shaft Engine (HTSE) of 1200 kN thrust for powering light and medium weight helicopters (3.5 to 6.5 tonnes in single/ twin engine configuration).

The new state of the art facility houses special machines, advanced setups leveraging on computational tools, in–house fabrication facility and two test beds for testing HTFE–25 and one testbed each for testing HTSE–1200 and upcoming JV engine for IMRH to be co–developed by Safran, France and HAL.

In addition, the newly developed facility has setups for testing Air producer of Jaguar, Gas Turbine Starter Unit (GTSU) –110 M2 and 127E of LCA, Auxiliary Power Units of IMRH and AMCA, Gas Turbine Electrical Generator (GTEG) –60 for An–32 aircraft. Setups to carry out various critical tests for engine components and LRUs have also been established within the new facility.

The Centre, established in the 1960s, holds the unique distinction of being the only design house that has developed test beds for engines of both Western and Russian origin.

The Centre has successfully developed and certified PTAE–7 engine, the first indigenous turbojet engine of India powering Lakshya (Unmanned Aircraft), Gas Turbine Electrical Generator GTEG–60 for starting An–32 aircraft, Air starter ATS 37 and Air producer for starting Adour–Mk 804E/811 on Jaguar aircraft and Shakti engine for powering ALH to support Ad804/811 engine of Jaguars.

HAL highlights in 2023

HAL helicopter factory: Hindustan Aeronautics Limited (HAL) Helicopter Factory was dedicated to the nation by Prime Minister Narendra Modi at Tumakuru in Karnataka. The factory is India's largest helicopter manufacturing facility and will initially produce Light Utility Helicopters (LUHs). The factory will produce around 30 helicopters per year and can be enhanced to 60 and then 90 per year in a phased manner.

PM's Tejas sortie: In November, Prime Minister Narendra Modi flew a sortie in Tejas twin–seater Light Combat Fighter aircraft designed, developed and manufactured by Hindustan Aeronautics Limited (HAL) in Bengaluru. The sortie was carried out from the Aircraft Systems Testing Establishment, Bengaluru.

LCA Tejas: HAL handed over the first twin seater Light Combat Aircraft Tejas to the IAF in the presence of Rakha Rajya Mantri Ajay Bhatt in Bengaluru. The IAF placed an order for 83 LCAs with HAL.

AoN's: For procurement of Light Combat Helicopters and Light Combat Aircraft Mk.1A from HAL got a nod. The AoNs were also accorded for upgradation of Su–30MKI aircraft indigenously from HAL. Acquisition of Advance Light Helicopters MK–III for Indian Coast Guard from HAL were also cleared. Proposals for avionic upgradation of Dornier Do–228 and 12 additional Su–30MKI aircraft were also cleared.

HTT–40 Basic Trainer Aircraft: MoD signed a contract with HAL for procurement of 70 HTT–40 Basic Trainer Aircraft for the Indian Air Force at a cost of Rs 6,828.36 crore. The aircraft will be supplied over a period of six years.

Dornier–228 aircraft: Ministry of Defence signed a contract for procurement of six Dornier–228 aircraft for the Indian Air Force from HAL at a cost of Rs 667 crore. The present lot of six aircraft will be procured with an upgraded fuel efficient engine coupled with a five bladed composite propeller.

Upgraded Dornier aircraft for ICG: Ministry of Defence signed a contract with HAL for procurement of two Dornier's for Indian Coast Guard at an overall cost of Rs 458.87 crore. The aircraft will be fitted with a number of advanced equipment like Glass Cockpit, Maritime Patrol Radar, Electro Optic Infra–Red device, Mission Management System etc.

Chandrayaan–3: HAL played key role in success of Chandrayaan–3 including on–time delivery of 30 types of riveted structure, six types of welded structure and the satellite's bus structure Rover, Lander and Castings and Forgings.

Astra BVRAAM: ASTRA indigenous Beyond Visual Range (BVR) air–to–air missile was successfully fired from Light Combat Aircraft (LCA) LSP–7 off the coast of Goa.

HAL at Avionics Expo 2023, New Delhi

Chief of Defence Staff, General Anil Chauhan, inaugurated HAL's Avionics Expo–2023 in Delhi on 7 December 2023. Speaking on the occasion, he said avionics was the backbone of any modern flying machine. "My deepest appreciation to the HAL team for being an important cog in the process of strengthening the aviation capability of the nation. Today's Avionics Expo underscores HAL's commitment towards Atmanirbharta. Immediate beneficiary of such an initiative will be the Armed Forces. The two day Expo will provide a platform for networking between Avionics Industry and the Services, understanding the requirements of the services, and evolving solutions that fit our terrain, climate and operational requirements. In a data driven battlefield of tomorrow, avionics systems have to be capable of collecting, processing and disseminating information in real time for the decision makers", he added. CDS also walked through the expo and evinced keen interest in the avionics products displayed on the occasion.

The presence of CDS inspires the entire Aerospace fraternity, stated Mr. C.B. Ananthakrishnan, CMD (Additional Charge), HAL. "We have achieved self reliance in most of the avionics systems such as mission computers, navigation systems, communication systems,

weapon systems and display systems. Avionics is the fastest growing market with high margin potential. Given the design and certification challenges of avionics systems at the global level, it is high time for Indian Industries to take up Avionics System R&D and manufacturing on a war footing", he stated. "We will demonstrate HAL's capabilities and contributions toward self reliance in avionics, to our stakeholders, including the Indian Armed Forces, Ministry of Defence, Ministry of Civil Aviation, DRDO and other important institutions."

A pleasant surprise: UHF datalink for the Kiran UAV

(Image of the LED screen is not clear because of its very bright light)

HAL avionics equipment for the Dornier 228 upgrade

"The event will serve as a hub for professionals, industry leaders and stakeholders from the aviation sector. They will have ample networking opportunities to establish meaningful connections, foster collaborations and explore potential business partnerships. It is a testament to HAL's commitment to advancing aerospace technology in India", stated Dr D K Sunil, Director (Engineering and R&D). Later, Dr. D.K. Sunil proposed a vote of thanks and urged participants to make good use of panel discussions that featured experts from the Indian Armed forces, HAL, partner organisations, academia and live demonstrations of avionics products and systems.

The two–day event brought together leading figures from the military, scientific community, developers and industries to explore cutting edge advancements in avionics.

Avionics Product Displays: The expo unveiled a comprehensive range of avionics products designed and developed by HAL. Attendees witnessed cutting edge avionics systems deployed in various aircraft platforms, including advanced flight control systems, communication systems, navigation systems and more.

Panel Discussions: Engaging panel discussions featured experts from the Indian Armed forces, HAL, partner organisations and academia. Topics spanned emerging trends in avionics, challenges in system integration and the future of aviation electronics, providing a holistic view of the sector.

Live Demonstrations: HAL Avionics Expo 2023 offered live demonstrations of avionics products and systems, providing a unique opportunity to experience their capabilities first hand. Visitors witnessed the performance and reliability of HAL's avionics solutions in real time scenarios with outsourced partners showcasing their products as well.

Indigenous IADS for LCH and UHM, helicopter glass cockpit on display was another good surprise. This is intended to provide complete integrated flight, navigation, mission sensors data computation, display and MMI solution to carry out maritime utility operations of the Indian Navy by integration with various onboard avionics systems etc.

Networking Opportunities: The event served as a hub for professionals, industry leaders and stakeholders from the aviation sector. They had ample networking opportunities to establish meaningful connections, foster collaborations and explore potential business partnerships. This Avionics Expo is beyond an exhibition, it was a step toward achieving self reliance in avionics and a 'testament to HAL's commitment to advancing aerospace technology in India'.

Engineering students from in and around Delhi were invited to gain the unique experience.

Glass cockpit for Indian Navy MiG–29K upgrade of navigation guidance and air to ground combat capability to be carried out through integration of LDP 4i and LGB with indigenous mission computer, Smart Multi Function Display and Data and Video Recording System.

Lt Gen Kamal Davar (retd) writes on....

Military diplomacy: A powerful force multiplier for statecraft

India, according to many strategic analysts, both at home and abroad, since its independence in 1947, has not accorded adequate priority to one of the most powerful tools which can contribute to enhancing its national strategic interests, namely, military diplomacy. Being traditionally a nation with a firm belief in peaceful coexistence, military diplomacy has not been overly a popular term in the nuance and lexicon of Indian statecraft. However, all powerful nations do fully appreciate the time–honoured dictum that no country can achieve its foreign policy goals and security interests in today's highly stressed strategic environment if it disregards the effective employment of its military instrument.

A nation's capability to counter the myriad challenges to its economic well–being and security interests rests primarily on the strength and sustainability of the constituents of its Comprehensive National Power (CNP), both military and non–military. Deft diplomacy is a vital ingredient which also enhances a nation's CNP. Thus it merits a holistic institutionalised appraisal in the nation to gauge whether a rising power like India has a well conceived policy and suitable structures to make use of military diplomacy as a vital instrument to further the nation's strategic interests.

Definition of military diplomacy

Since time immemorial, nations have employed their militaries to achieve national objectives through the use of kinetic means. Conversely, diplomacy is just the opposite. Normally, diplomacy is a peaceful engagement and effort to establish cordial relations between states whereas it or military diplomacy too, having failed, may involve use of force. While there is no universally accepted definition of this form of statecraft, however, military or defence diplomacy (the terms military and defence are interchangeable) connotes the peaceful, non–kinetic employment of military capabilities and military resources in the pursuit of national foreign policy objectives. Noted strategic analyst Anton Du Plessis goes on to give a broader definition of military diplomacy as "the use of armed forces in operations other than war, building on their trained expertise and discipline to achieve national and foreign objectives abroad". It is also pertinent to point out that powerful nations do demonstrate their military capabilities by a threat of force, a form of coercive diplomacy, popularly captioned "gunboat diplomacy" a term which has been talked about since the 18th and 19th centuries. However, military diplomacy enhances foreign policy and defence cooperation amongst nations and is primarily an extension of a nation's soft power. It must not be confused with military interventions like India's actions in Maldives (Op Cactus) or the dispatch of the Indian Peace Keeping Force (IPKF) to Sri Lanka.

Military diplomacy encompasses high–level ministerial and military commanders meetings, transfer or sale of military equipment and platforms including joint production ventures, goodwill visits, training, both at military institutions and in the field, operational cum logistical exercises, regional defence forums (like Shangri La and Raisina Dialogues, ASEAN Security Forum etc), confidence building measures, humanitarian assistance during natural disasters and cooperation in combating sea piracy, establishment of air, sea traffic control and communication facilities, construction of specialised infra–structure like ports, airfields, bridges, exchange of specialist military personnel, participation in each other's military parades, fleet reviews or air shows and the like. Cooperation in the emerging realms of warfare including in the fields of cyber, hi–tech, artificial intelligence, space etc will also get enhanced with proactive military diplomacy endeavours.

The exchange and positioning of military attachés of the three services in each other's diplomatic missions has been, since years, an important ingredient of global military diplomacy. In today's terror afflicted world, the exchange of timely terrorist related intelligence will also fall under the purview of military diplomacy.

Military diplomacy: Objectives

Military or Defence diplomacy is undertaken to achieve overall national security as well as our foreign policy objectives. Overall, the Military Diplomacy environment has certainly improved in India but in the not so past, some observations by well–informed media/authors were not complimenting as regards Indian forays in military diplomacy. The London published Economist, in its March 2013 issue, under the article 'Can India become a great power?' had succinctly observed that the "Indian Armed Forces have grown exponentially since Independence, but no civilian leader has the faintest idea how to use India's growing military clout!" Dr Marc Faber, the well known author of the best seller, 'Gloom, Boom and Doom', had also opined that "India continues to be ambivalent about power, it has failed to develop a strategic agenda commensurate with its growing economic and military capabilities…… throughout history India has failed to master the creation, deployment and uses of its military instruments in support of its national objectives." Thus the goals of Indian military diplomacy need to be adequately tailored to further national objectives in today's highly complex regional and global security challenges. Over the past couple of decades, India certainly has improved in its military diplomacy postures.

On the face of it, the term 'military diplomacy' appears to be an oxymoron for diplomacy and military rightly belong to different realms. Nonetheless, it must be clearly understood by all stake–holders that military diplomacy does not replace the nation's foreign or security policies but supplements them for greater dividends for the nation. It works towards confidence building and development of closer ties between nations and conflict prevention is one of its primary objectives. Secondly, it aims at substantial accretions in the knowledge and progress of the latest techniques and technologies in weapons, equipment, and domain awareness in emerging concepts of warfare. Thirdly, training both theoretical and in the field with joint exercises is a significant feature of this form of diplomacy. All these goals contribute to a nation establishing and increasing its sphere of influence both bilaterally and even multilaterally.

Cooperation in non–traditional security areas like disaster management, anti–piracy threats, meeting pandemic threats or assistance in mass evacuations of own and other people from foreign countries in emergency situations are also part of defence diplomacy. A major spin–off of this form of defence cooperation is that, in emergency situations including while participation in UN or other international constituted operations, participating nations work towards understanding each other's tactics and strategies, equipment, logistics, SOPs and thus attain the important advantage of interoperability.

It needs no emphasis to state that the success of defence diplomacy in a nation will solely depend on the political, security and strategic dialogues to be in sync and complementing each other.

It will be pertinent to note that both the US and China are notable examples in the utilisation of their militaries for execution of their respective foreign policy initiatives. The US has pacts, alliances and military partnerships with many nations while the Chinese military diplomacy has been developing close security ties with its client states. Its over–ambitious Borders and Roads Initiative (BRI) is a classic example of China's grandiose thrust in its military diplomacy.

Evolution of India's military diplomacy

Immediately after independence in 1947, India was confronted with the realities of the Cold War and the continuous jostling for global dominance between the two superpowers, namely, the USA and USSR. But for sound geo–political reasons then, India's first Prime Minister, Jawaharlal Nehru, was a staunch votary of non–alignment and all of India's foreign policies were centered on chartering a path independent and virtually equidistant of the two competing power blocs. Consequently, India's defence cooperation and military diplomacy too remained 'isolationist' in its orientation and military linkages with other nations were frowned upon by India's new rulers. The exception to this rule was however, mercifully, India's willing participation in UN peacekeeping endeavours. In addition, during Nehru's prime ministership, India chaired the UN Neutral Nations Repatriation Commission in 1953 and sent a small contingent and field ambulance to Korea. In addition, during the 50s, India did engage in military diplomacy with Nepal and Bhutan but any noteworthy military initiatives with other nations, apart from visits of Service Chiefs and attendance at some military institutions, hardly materialised.

Former Army Chief, Gen Ved Malik in his seminal book 'India's Military Conflicts and Diplomacy' has

commented that "India started poorly in making use of military diplomacy as a national security and foreign policy tool." He opines that among the many reasons for this malaise, "the foremost being a steep erosion of every aspect of India's military capabilities; civil–military relations, military capabilities, leadership and morale." Gen Malik further lamented that "Nehruvian India was distrustful of the armed forces and kept them out of the Ministry of Defence and important decision making…South Block ensured that policymaking was crafted by bureaucrats and strategy by diplomats. Both lacked military expertise or perspective."

As is well known, Nehru's pacifist orientation was craftily manipulated by his bureaucracy and thus Indian Armed Forces were kept out of the decision making loop even on matters of national security, an anomaly for which the nation had to pay heavily in later years. However, after the end of the Cold War, in the 90s and commencing the early part of this century and till date, India's defence diplomacy has undergone a major transformation both in its span and scale in keeping with emerging foreign policy challenges.

Prior to fast forwarding to the current years, it will be worthwhile mentioning that meager efforts at fostering military diplomacy have existed since the early 50s. Since 1950, India's prestigious Defence Services Staff College (DSSC), Wellington (Tamil Nadu), has hosted officer students from the three services of friendly foreign nations. Beginning with officers from UK, USA, Australia, Canada and Burma, officers from Non Aligned and newly independent nations such as Sri Lanka, Malaysia, Nigeria, Kenya, Egypt, Indonesia and Ethiopia, Bhutan, Bangladesh and Ghana, among others send their student officers for this renowned military course each year. A fair number of these officers who attended the course have reached the top positions in their service hierarchies in their respective nations besides some of them from the DSSC and India's National Defence College (NDC) have risen to be heads of state of their nations. Dealing with such heads of states is much easier and probability of success in mutual ventures is accordingly much higher.

Notwithstanding bureaucracy in India not giving adequate emphasis to the benefits of military diplomacy, India, since decades, has been one of the largest contributors of troops on various UN peace keeping missions around the world and its record in this form of military diplomacy has been second to none. It is also worth mentioning here that the Indian Armed Forces also enjoy globally, a sterling professional reputation among other armed forces in the world. Thus India has been requested many times by friendly foreign nations to send military training teams. Some of these nations where Indian military training teams have been sent are Nepal, Bhutan, Iraq (where I too served for 2 years), Botswana, Angola, and Malaysia among some other nations.

Current status: Military diplomacy

Overall, India's Defence diplomacy has undergone a gradual yet qualitative change especially after the early 1990s. Currently, 73 nations from across the globe have their military representation with a total of 120 officers from the three services stationed in New Delhi. On the other hand, India has a total of 71 military officers as Defence/military/air/naval attaches posted to 44 nations with an increase in the near future planned as regards their numbers and the nations to be represented in.

India's diplomatic relations and military cooperation with the world's sole super power, US, have been steadily improving since the last three decades or so. The formulation of the "Kickleighter proposals" in 1991–92 gave a fillip to expanded cooperation among the armed forces of the two democracies after decades of being indifferent to each other. This protocol enabled the first ever military to military India and US paratroopers exercise in Feb 1992. This was followed by exercises by the navies of the two nations dubbed Malabar I, II and III which have now become a regular biennial feature. The last 10 years, in particular, have seen an unprecedented strengthening of the US India Defence relationship. In June 2005, India and the US signed a new framework for expanding their defence relationship in the next 10 years. This agreement was further extended for another 10 years in 2015. India is today the US military's biggest training partner with the US conducting the maximum number of military exercises with India than any other nation. In addition, the US has now become the third largest supplier of arms and equipment to India. Gradually, irksome differences between the two nations like transfer of technology, export to India of dual use technology and India signing some strict protocols regarding employment of weapons provided by the US or inspections etc, are slowly being smoothened out. In the last few years, India has acquired a number of systems including the LPD ship Trenton, modern transport aircraft like the C–130 Hercules and C–17, Chinook and Apache helicopters, AWACS, latest drones, P–8 maritime surveillance aircraft etc. India is currently also exploring the latest 5th generation fighter aircraft which the US is offering for making up India's depleting air power.

The signing of the India US Nuclear Accord between President George Bush and then Indian PM, Dr Manmohan Singh in 2009 took India US ties to a new level. India/US defence ties are on the upswing and were given a comprehensive thrust by Indian PM Narendra Modi and former US President Donald Trump as also by current US President Joe Biden. Both the Indian Navy and the Indian Air Force are now regularly participating in US conducted exercises like the Rim of the Pacific multilateral and Red Flag exercises respectively. The much heralded US/India Defence Technology and Partnership Agreement will take defence ties between the two nations to another level of defence engagement. The signing of the Logistics Agreement between the two nations enables both the nations to utilise each other's bases and logistics; indeed a radical departure from the past relationship!

Since the last few years in particular, the US has also been trying to push India to assume a much larger role in the Indian Ocean in collaboration with it, Japan and Australia with an eye on Chinese expansionist inclinations in the South China Sea and the East China Sea. Thus in the immediate future, the militarisation of the QUAD is well on the cards with these four nations joining hands together to keep China's unbridled ambitions in the Indo–Pacific at bay.

China's naked aggression in India's eastern Ladakh sector since April 2020 has further brought India and US together with the latter supporting India's stand and criticising China openly for its expansionist tendencies. India hopes that US President Joe Biden will continue to further re–energise the US no–nonsense stance as regards China. Meanwhile, the US and India must step up their cooperation as regards combating the China unleashed global pandemic COVID 19 and its newer variants. In addition, both nations must impress upon the world to ostracise China for its devious role in bringing misery to the world owing to China's likely foray into biological warfare or experimentation with various types of virus in their Wuhan based laboratories.

With Russia, defence relations have been a critically significant pillar of our long standing strategic partnership. The Indian MOD opines that "the two countries have a robust, multi–tiered institutionalised mechanism for regular interactions for deepening longstanding defence cooperation." The India–Russia Governmental Commission on Technical Cooperation needs to be given further impetus by both nations. High level visits to discuss various issues among the two nations especially regards weapons, equipment, ammunition and efforts to manufacture Russian equipment in India, like the Kamov 226T helicopter, have been going on intensively. It is important to mention here that with deepening defence relationships of India with Israel and the US, defence cooperation with Russia may take a hit in the years ahead as India diversifies its sources of importing of equipment including for its 'Make in India' programmes. We will have to diplomatically ensure that Russia maintains its historical fraternal ties with India; not an easy call, by any standards, with cash strapped Russia which has large scale defence cooperation ties with China! High level military to military consultations including upgrading our military diplomacy efforts with our long–standing defence partners are also the need of the hour.

It merits mention here that the Indian Navy has been at the forefront of lending a military dimension to India's 'Look East' policy unveiled a couple of decades back. The policy renamed as 'Act East' by the present NDA dispensation has directed the Indian Navy to vigorously reach out to the Indian Ocean littoral nations. Commencing 1995 onwards, our Navy had been conducting multi–national cooperation exercises code–named 'Milan' in it's out–reach to nations in the Bay of Bengal. The International Fleet Review conducted

in Feb 2016 by the Indian Navy at Vishakhapatnam, attended by 99 warships from 50 nations, was a spectacular display of India's military diplomacy at work. In addition, the Indian Navy also conducts the Malabar exercises regularly with the navies of the US, Australia and Japan to give a fillip to the QUAD formation and send out a strong message to China. Former Indian Naval Chief Admiral Arun Prakash has expressed that "an important component of India's evolving naval diplomacy has been the creation of a strong maritime domain awareness capability." Indian Armed Forces, the MOD and MEA should take a leaf out of the Indian Navy's 2007 Maritime Strategy which had clearly declared that "the main business of major navies in the 21st century is to use warships to support foreign policy." Many nations in the region do recall with gratitude the Indian Navy's humanitarian assistance and disaster management endeavours over the last few decades. We need to further develop such a capability to come to the help of many such smaller nations in the Indo–Pacific region.

As regards its neighbours, India has cordial military relations with all except, of course, Pakistan with whom not much should be expected in the foreseeable future. Despite countless efforts by India to normalise relations with Pakistan, the latter continues to zealously follow an anti–India agenda in all its strategic and security formulations. Accordingly, India must further step up military diplomacy with its other neighbours far more vigorously than hithertofore. China, as part of its grand design, in collusion with its protege, Pakistan, will do, whatever it can, to dampen India's efforts at establishing healthy relations with its neighbours.

Recommendations and conclusion

India today stands at a defining moment in its inevitable rise as an important global player. Nevertheless, India's rise is concomitant on the well conceived and determined steps the national government takes to attain that goal. As stated earlier, the nation thus will have to energise all the constituents which contribute to the enhancement of India's Comprehensive National Power. Military strength and military diplomacy are both vital and irreplaceable components which will go to enhance the nation's ascent in the comity of nations. Adm Arun Prakash, however, has pithily expressed that "unfortunately, neither India's political establishment nor its bureaucracy, defence and diplomatic, fully support the concept of the military entering the domain of diplomacy." It is a well known fact that some hard–core senior Indian diplomats do not subscribe to the armed forces playing a greater role in projecting Indian interests abroad. Regrettably, they fail to understand that military diplomacy is just a part of the overall national diplomacy endeavours and will thus conform to the strategic mosaic of India's foreign interests.

Foremost, the government must give adequate impetus in national strategy and national security issues to the Defence Services. It will be in the larger interests of the nation if in the formulation of national strategy, the requisite synergy between the MEA, MOD and the armed forces is achieved. The energetic pursuit of military diplomacy and defence cooperation with nations of interest to India will thence be a natural corollary. Secondly, India must step up its military diplomacy and defence cooperation in a substantial manner with its neighbours like Bangladesh, Afghanistan, Sri Lanka, Iran, Bhutan and ,importantly Nepal, with whom our relations do fluctuate from time to time. As Maritime Asia assumes increasingly larger strategic significance in the years ahead, Indian military diplomacy will have to touch the shores of East Asia and better naval cooperation achieved with nations like Japan, S. Korea, Philippines and importantly Vietnam. Our military representation, currently restricted to just 44 nations, must be substantially increased and also span continents like South America besides with nations along the Indian Ocean and Africa.

Importantly, our structures and the governmental/Services HQ set–ups to conduct military diplomacy are not at all adequately geared for the pursuit of military diplomacy. With the establishment of the appointment of the Chief of Defence Staff since the last two years, it will be appropriate to accord to the Defence Intelligence Agency (DIA), under him, the responsibility of conducting defence diplomacy in all its manifestations. On behalf of the MoD and the three services, the DIA can foster military diplomacy in concert with the MEA and any other ministries involved. A much larger number of military officers must be seconded to the MEA to give a fillip to our military diplomacy efforts world–wide. Officers from the MEA too must be posted to the Integrated Defence Staff in adequate numbers.

The Govt of India may wish to note that in today's world, there exist a large number of nations being ruled by military/quasi military governments and a large number of heads of state have a military background. It will be in the nation's interests to send some suitable retired senior officers from the three services as High Commissioners / Ambassadors to such countries, e.g. sending a retired suitable senior officer from an Indian Gurkha regiment to Nepal as our envoy will pay handsome dividends to the nation. Lt Gen SK Sinha, many years back had made a very successful ambassador to Nepal.

As India strives for its deserving seat on the 'global high table', South Block has to undergo a radical mind change and integrate military diplomacy as an inescapable constituent of its global diplomacy. As most nations look up to India for increasing security assistance to it, India will have to speedily establish integrated institutions and expertise within to comprehensively reach out to the growing demands and aspirations of friendly foreign nations including augmenting defence cooperation with India. We must not punch below our weight but reach out to smaller nations in more ways than one. Military diplomacy remains for India a viable instrument whose potential for national strategic endeavours remains grossly untapped and thus this anomaly needs to be speedily rectified in the larger interests of the nation. Leveraging military diplomacy must be accorded its due importance for the attainment of the nation's foreign policy and security objectives.

The writer, a retired lieutenant–general, was the first head of India's Defence Intelligence Agency, is a long–time Pakistan watcher and has been involved in Track–2 diplomacy.

Tuskers
No. 5 Squadron turns 75

While Man Aman Singh Chhina writes on the Tuskers, Angad Singh was in Ambala to cover the event with some great photography!

On 24 November 2023, the Tuskers, as the No. 5 Squadron of the Indian Air Force (IAF) is known, celebrated 75 years of its raising with an airshow at the squadron's home, Ambala, to mark the occasion.

The squadron, raised on 2 November 1948, at Kanpur and equipped with B–24 Liberator aircraft, has a long and distinguished operational history, including overseas service and wars.

Writing a detailed history of the squadron in a well–known defence website, Bharat–Rakshak.com, K Sree Kumar says the unit was initially equipped with five B–24 Liberators, originally operated by the British during the Second World War. This number went up to 16 as more aircraft were put into service. With the role of a heavy bomber squadron having been assigned to it, No 5 Squadron became the first unit in the IAF to undertake such a role.

Tragically, the first Commanding Officer (CO) of the squadron, Wing Commander Jal Rustom Sohrab Dantra was killed in Pune, where the squadron was based, in April 1949, in a ground accident involving B–24. Dantra had risen from the ranks to an officer's commission and was just 31 at the time of his death.

It was in 1957 that No. 5 Squadron moved on from B–24 Liberators and inducted B (I)58 Canberra aircraft. At this time the squadron was located at Agra and once again undertook the role of a bomber squadron albeit with an interdictor role as well. Wing Commander Waman Raghunath Dani was the Commanding Officer of the squadron at the time of this changeover.

In 1961, the squadron was selected to provide its aircraft for the first overseas deployment of the IAF. A detachment of Canberras was sent on deployment with the United Nations peacekeeping force in strife hit Congo. Wing Commander Anthony Suares was the CO of the unit and he led this deployment which saw the squadron participate in offensive tasks against the Katangan rebels destroying much of their fledgling air force in an air raid in early December 1961.

Wing Commander Suares received a Bar to Vir Chakra

An airshow at Ambala marking 75 years

All photos by Angad Singh
(Twitter @zone5aviation)

for the combat missions in Congo while Flight Lieutenant M M Takle, the navigator, received a Vir Chakra.

Soon, in 1965 the squadron was bloodied in full–blown operations against Pakistan with Wing Commander P P Singh at the helm. The squadron raided Sargodha in the initial days of the war and later made a daring raid on Peshawar, considered to be safe from IAF attacks by the Pakistan Air Force since it was located deep inside Pakistan.

Several other raids were also carried out by the unit along with bombing missions in support of the Indian Army targeting troops and armour concentrations of the Pakistan army.

Wing Commander P P Singh, who later settled down in Mohali, near Chandigarh, and retired as an Air Marshal, was awarded the Maha Vir Chakra for the operations. Four Vir Chakras were also awarded to Squadron Leader Chitranjan Mehta, Squadron Leader S N Bansal (Navigator), Flight Lieutenant H S Mangat (Navigator) and Flight Lieutenant Pradyot Dastidar (Navigator).

A few years later in the 1971 war with Pakistan, Wing Commander Man Mohan Bir Singh, another CO of the squadron, received the Maha Vir Chakra with the unit having undertaken extensive sorties in aid of ground forces in the fierce battle which took place in the Chhamb sector of Jammu and Kashmir.

Squadron Leader Ramesh Chander Kohli, Squadron Leader Dinesh Chandra Bhandari (Navigator), and Flight Lieutenant H P Singh (Navigator) received Vir Chakra.

Many years later, then living in retirement in New Delhi, Group Captain Talwar would face another battle when he took on an attacking mob during November 1984 anti–Sikh violence using his licensed weapon. The war hero had to spend some time in jail before justice could be done to him.

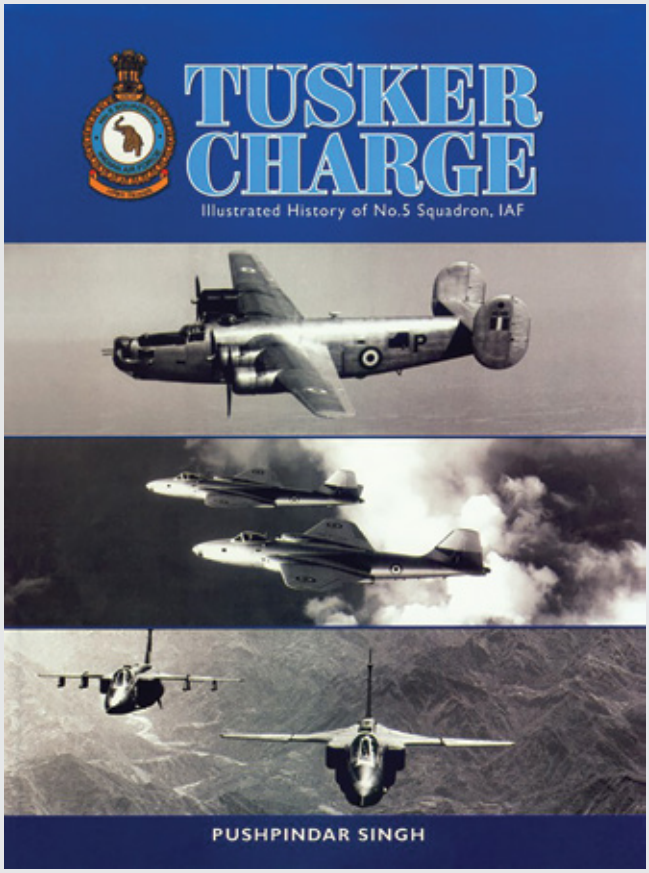
The squadron changed over to Sepecat Jaguar aircraft in 1981 when stationed in Ambala. It was commanded at the time by Wing Commander J S Sisodia. In addition to the deep strike role that it was assigned to as a Jaguar squadron, the unit also performed in a photo reconnaissance role.

A few years later, in 1988, the unit performed in aid of the Indian Peacekeeping Force (IPKF) in Sri Lanka under the command of Wing Commander A K Singh. He later rose to the rank of Air Marshal and retired as AOC–in–C Western Air Command.

Incidentally, Singh was one of the few officers of the IAF who were initially commissioned as a transport pilot but later switched to a fighter pilot role.

The squadron was awarded the President's Colours in April 1975 by the then President Fakhruddin Ali Ahmed. It has been stationed in Ambala since 1981 and has proudly justified its distinguished record of service, amplifying its motto 'Shakti Vijayte'.

Book on the Tuskers



Published by The Society for Aerospace Studies (and Vayu Aerospace & Defence Review), the book is authored by the late Pushpindar Singh, Founder and Editor of the Vayu magazine. Available at select outlets and can be ordered online, this book is truly a gem and goldmine of information on the Squadron.

Written by Man Aman Singh Chhina

The article first appeared in The Indian Express, November 2023

Photos by Angad Singh (Twitter @zone5aviation)

The author is an independent defence analyst with over a decade of experience writing on national security.

3 BRD celebrates Diamond Jubilee

Entering the final month of 2023 marked a momentous occasion for the 3 Base Repair Depot, as it commemorated successful completion of 60 years of establishment on 1 December 2023. Celebrating the diamond jubilee, a grand event was organised at Chandigarh Air Force Station, its home and also the hub of IAF transport fleet.

Air Marshal Vibhas Pande, serving as the Air Officer Commanding–in–Chief (AOC–in–C) of the Maintenance Command, presided over the event as the honoured chief guest. During the ceremony, the guest unveiled a commemorative cover marking the occasion. Additionally, a coffee table book chronicling the depot's remarkable six decade journey was also launched.

Air Marshal Pande congratulated 3 BRD on the significant day. He appreciated the veterans who laid the foundation of the Depot and also the serving officers who are committed to maintain the legacy of such important establishment. He further made remarks on the regular efforts of self reliance which are being made to ease the maintenance of Mi–17 helicopters, and boost the indigenisation campaign. This also ensured that supply chain of Mi–series helicopters and An–72 fleet wouldn't be severely affected despite the ongoing tense geopolitical situation.

Following the tradition, the Air Devils Skydiving and Para Motor Display put up a spectacular display for the crowd, along with the air warrior drill team "Subroto" performing their synchronised performance. A seminar focusing on 'enhancing skills for aviation maintenance in defence and civil MRO' was conducted. Participants from the Indian aviation industry, including key partners like GMR and Tata Defence, actively took part in the seminar.

The event had a small static display of helicopters, consisting of Mi–171V and Mi–17V5 as well. A walk around of the maintenance hangar was organised, which housed multiple airframes of Mi–17 parked and waiting for their turn of overhauling, while some closing completion of the process. Overhauling also includes the fitment of Electronic Warfare equipment, like the Missile Approach Warning System (MAWS) and Radar Warning Receiver (RWR). Some notable airframes were also the ones that are still in the United Nations colour scheme, indicating they returned from peacekeeping operations recently.

3 BRD is also set to overhaul/upgrade the Mi–26 helicopters, which served the Indian Air Force from 1985 to 2017. Due to a shortage of spares and aging, the helicopters had to be grounded (not formally retired), and since then lying on the tarmac of Chandigarh Air Force Station. Earlier plans envisioned for its rejuvenation, including transporting them to Russia, kept getting delayed for more than 5 years. However, now with the assistance of the Russian OEM, 3 BRD is likely to complete the overhaul in India within a year once the formal contract is signed.

History of 3 BRD

Overhaul requirement of transport and helicopter fleet of the IAF necessitated setting up of No. 3 Base Repair Depot at Chandigarh on 20 August 1962. Group Captain TMJ Kriplani, the depot's first Commanding Officer, set up the requisite facilities with Russian collaboration and commenced the first overhaul of the Il–14 transport aircraft and the Mi–4 helicopter. With the induction of new helicopters in IAF, the Depot graduated to overhaul of Mi–8 and Mi–17 helicopters. In fact, the Depot has today become the knowledge base for all Russian helicopters and has undertaken several tasks like life extension of Mi–25 helicopters, repair of Mi–26 helicopters and upgrade of Mi–35 helicopters as well. Chandigarh's 3 BRD presently also holds a distinctive position as the sole repair depot for IAF aircraft and aero engines while also serving as an equipment depot. It was recognised as the top aircraft and engine Base Repair Depot of the IAF for the 2022–23 term.

Article by: Rishav Gupta
Photos: Tapash Baniwal
(Instagram: @Jetwatcher06)

IAF's No. 3 Squadron prepares for bittersweet farewell to MiG–21

MiG–21 flying operations are in full swing at the sprawling Nal desert fighter base, with the Indian Air Force (IAF) exploiting the full potential of the last of its Soviet era interceptors before bringing the curtain down later this year on the iconic fleet that has served India for six decades as it moves on to the locally produced light combat aircraft (LCA) with several accidents calling into question the safety of the MiG.

IAF chief Air Chief Marshal VR Chaudhari announced on 3 October 2023 that the MiG–21 was being phased out, and the process is likely to be completed by 2025. In October end, IAF retired the MiG–21s of the No.4 Squadron based at Uttarlai in Rajasthan.

The MiG–21, India's first supersonic fighter whose induction began in 1963, has still not run out of juice, can hold its own in combat, and the fighter's handling is as good as any other's in the air force's combat fleet, said Group Captain Chetan Sharma, the commanding officer of IAF's No.3 Squadron, better known as "Cobras". "The aircraft will be pulled out of service by 2025 but it's business as usual for us. The venerable steed has held its own for 60 years," he stated.

The Cobras are among the last generation of MiG–21 pilots in the country; the No.3 is one of the only two remaining MiG–21 squadrons. The other one, No.23 or "Panthers", is based 185km north at Suratgarh, also in Rajasthan. The exact phasing out schedule is still being worked out. A squadron consists of 16 to 18 fighter jets. Both squadrons operate the MiG–21 Bison, the last variant of the single engine workhorse.

IAF has operated a raft of MiG–21 variants–Type 74 or MiG–21F, Type 76 or MiG–21PF, Type 77 or MiG–21FL, Type 96 or MiG–21M, Type 75 or MiG–21 Bis (upgraded Type 96), and the MiG–21 Bison.

The MiG–21 still allows the pilots to push the flight envelope (the design parameters for aircraft safety)

to meet mission requirements, the pilots at the No.3 Squadron said. "Any aircraft must be stretched to its limits to meet operational requirements. That's exactly what we are doing with the MiG–21s, pushing them to their limits. The squadron is flying by day and night to meet its commitments. We are combat ready and capable of executing any mission assigned to us," stated Sharma, as two fighter pilots, including a woman, taxiied out a MiG–21 to the runway for a training sortie.

The squadron was raised in Peshawar in October 1941. It has been equipped with a variety of aircraft including Audax, Hurricane, Spitfire, Tempest, Vampire, Ouragan and Mystere. But the Cobras have been flying only the MiG–21s since 1972. Sharma figures at serial number 51 on a wall mounted honour board in his office displaying the names of commanding officers of the No.3 Squadron whose motto is "Lakshya Vedh", or Destroy the Target with Precision. Six pilots who served in the squadron went on to become air force chiefs: four in India and two in Pakistan, the aircrew at the base recalled.

After a 45–minute sortie, Wing Commander Nanda Rajender and Squadron Leader Mohana Singh, one of India's first women fighter pilots, landed their fighter jet at the base at a speed of 340kmph. "As long as the MiG–21s are there in IAF, any fighter pilot would love to fly them. It's a different beast," Singh stated. In her early 30s, she was commissioned into IAF in 2016 after the service opened its fighter stream to women, a watershed in India's military history. She is among the three women fighter pilots in the squadron. "The number of sorties the aircrews are carrying out every month is similar to other squadrons with modern aircraft, if not more. There is no question of restricting flying because of the upcoming phasing out of the MiG–21s," said Sharma, who has logged a fourth of his total flying hours in his military service on the MiG–21s.

When not strapped in a MiG–21 cockpit, Sharma (call–sign Cobra1) likes cruising on his superbike. To be sure, IAF has had to keep its MiG–21 fleet flying longer than it would have liked because of the delay in the induction of new fighters. The locally produced light combat aircraft will fill the gap left by the gradual phasing out of the MiG–21s. It is to the credit of the air force's engineers

and technicians that the MiG–21s have flown for so long, Sharma said.

Several accidents have called into question the flight safety record of the MiG–21. More than 400 MiG–21s have been involved in accidents that have claimed the lives of around 200 pilots during the last six decades, earning the fighter jets ominous epithets such as "Flying Coffin" and "Widow Maker".

Fighter flying is a risky business and demonising the legendary aircraft, which has been the mainstay of IAF for decades, does it a great disservice, said Sharma, while listing out their role in the 1965 and 1971 wars with Pakistan. To be sure, more MiG–21s have crashed than any other IAF fighter because they formed the bulk of the aircraft in the IAF's inventory for the longest time.

The air force progressively inducted 874 MiG–21s. The MiG–21 Bis was upgraded to MiG–21 Bison in India in 2000. Of the 874 jets, more than 60% were licence produced in India.

The MiG–Bison was involved in IAF operations after the unprecedented, peacetime, cross–border strike against terror targets in Pakistan's Balakot in February 2019. Wing Commander Abhinandan Varthaman scripted military aviation history by downing a Pakistan Air Force F–16, seconds before his own MiG–21 Bison was hit by a missile forcing him to eject.

A former IAF chief once referred to the seat in the MiG–21 cockpit as "more coveted than that of a king's."

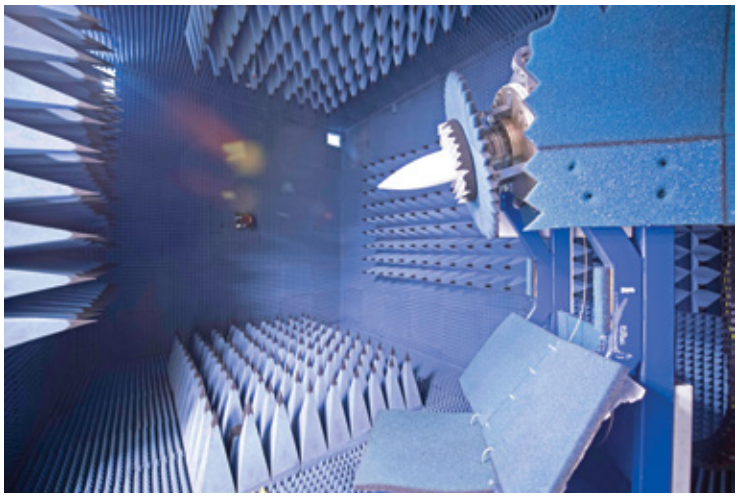
"Heed not the barbed taunt of 'widow–maker' my lovely filly, for you are in fact a man–maker of boys. Were I to go down with you, my soul would have been tortured to have anyone call you my 'flying coffin'; but my soul would have been mercifully becalmed would that our joint epitaph proudly proclaimed: 'In life you offered this pilot a seat more coveted than that of a king's; in death you took an air warrior to his glorious Valhalla," Air Chief Marshal AY Tipnis wrote in a piece published in the book First to the Last: 50 years of MiG–21s with the IAF published in 2013.

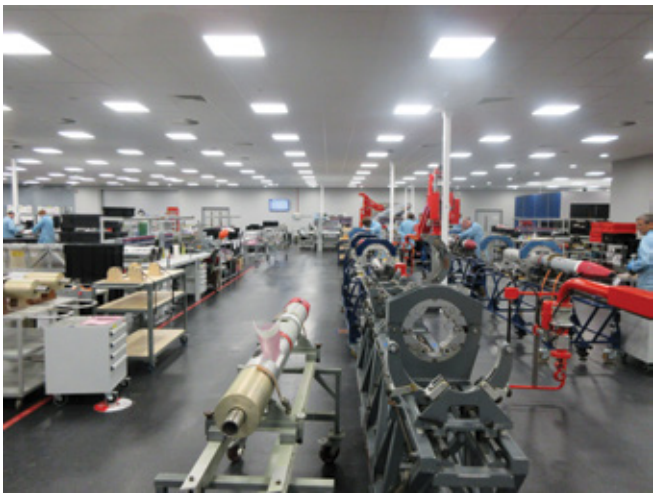
Even when the MiG–21 is midway through its last dance, the Cobras couldn't agree more.

Article by Rahul Singh
(Twitter @rahulsinghx), Hindustan Times
All photos: Simon Watson/Vayu Aerospace & Defence Review

VAYU on–the–spot report

Visit to MBDA facilities in UK and France





The four images above are from the MBDA Bolton (UK) site from where we started our tour. Clockwise: The main building at Bolton, missile integration, shop floor and HWIL (Photos: MBDA).

From 19–24 November 2023, MBDA invited a select group of Indian media for a tour of their European sites where they updated the Press on Indian–MBDA missile co–operation, their commitment to Atmanhirbar Bharat and showcased some of their key manufacturing sites where some Indian systems such as Meteor, SCALP, MICA and ASRAAM are manufactured.

The tour started from 19 November at Manchester, UK with the next day being spent at Bolton, UK. The day after that was Paris and on 22 November we were taken to MBDA's site at Selles–Saint–Denis. The next day was at Bourges with return to Paris the same night. On 24 November, we departed back for India a fully and much satisfied group!

MBDA has a long history with the Indian Air Force, Indian Navy and Indian Army and at every Aero India (at Yelahanka, Bangalore plus at Defexpo) has been showcasing the newest missiles in Indian service as well as the systems that could help equip all branches of the Indian Armed Forces in the future.

The current cherry on the crown are the weapon systems that arm the IAF's latest Dassault Rafale combat aircraft. These highly capable weapons from MBDA give the IAF an air combat capability that is unrivalled by any of India's neighbours. The most famous of these is the Meteor beyond visual range air to air missile (BVRAAM), which is

The Meteor for IAF Rafales and (right) MICA for both IAF Rafales and Mirage 2000's.

widely recognised as a game changer for air combat. The Meteor is powered by a special rocket ramjet motor that gives this BVRAAM far more engine power, for much longer than any other missile. This means it can fly faster, fly longer, and manoeuvre more than any other missile, giving Meteor the ability to chase down and destroy agile hostile fighters at even the furthers of ranges. As a result, Meteor has a no escape zone many times greater than any other air to air missile.

IAF Rafale with MBDA Scalp at Aero India 2023.

IAF Rafales are also equipped with the SCALP deep strike cruise missile from MBDA to strike hardened and protected targets deep inside enemy territory. The IAF's Rafales are also equipped with MICA, an ultra modern air combat missile which the Indian Air Force knows very well as it is also part of the upgrade package for the IAF's Mirage 2000 I/TI aircraft. MBDA is a longstanding industrial partner for India, with MICA being a prime example; L&T MBDA Missile Systems Ltd, MBDA's joint venture with Larsen & Toubro, who performs work in Coimbatore on MICA missiles and MICA missile launchers, delivering Make in India projects in support of Atmanirbhar Bharat.

MBDA is also proposing all these weapon systems, as well as the Exocet AM39 air launched anti–ship missile for the Rafale M for the new Indian aircraft carrier.

"MBDA is not new to partnership with the Indian Armed Forces and Indian industry, indeed it has been delivering battle winning capabilities to the Indian Air Force and collaborating with Indian industry for over 50 years. Throughout this history, there have been two guiding principles: to provide the very best technologies to the Indian Air Force, and to work in true partnership in support of the Indian Defence Industry. The company then is fully committed to the 'Make in India' programme, which aligns with MBDA's long–term strategy", stated officals during the tour.

L&T MBDA Missile Systems Ltd, MBDA's joint venture with Larsen & Toubro seen here at Defexpo 2020.

Other examples of technological edge equipping the Indian Air Force include the ASRAAM within visual range (or dogfighting) missiles or CCMs. ASRAAM is providing the IAF's Jaguar fleet with a "step–change in air combat performance", a capability that will soon also enhance the IAF's new Tejas LCA Mk.1A. That "Integration on Contract" is underway on LCA Mk.1A. It is also suitable for other IAF aircraft like the Hawk AJT etc.

ASRAAM CCM will soon also enhance the IAF's new Tejas LCA Mk.1A (in the photo is LCA Mk.1).

With its large rocket motor and clean aerodynamic design, ASRAAM has "unrivalled speed and resultant aerodynamic manoeuvrability and range". ASRAAM gives it a high kinematic capability that delivers superior end–game performance for within visual range air combat. MBDA also has agreements in place with Bharat Dynamics Limited for ASRAAM to be assembled in India to support Make in India.

ASRAAM overwing on IAF Jaguars.

The Mistral ATAM system has been successfully integrated on the Advanced Light Helicopter (ALH) and final integration is being done on the Light Combat Helicopter (LCH). "Utilisation of the Mistral missile on India's helicopter platforms also provides a bridge to their use in a ground based VSHORAD role, where the missile is fully compliant with India's requirements and outperforms

the capabilities of its rivals. Again, MBDA and BDL have signed an agreement for the establishment of an assembly line for Mistral missiles in India. MBDA has an excellent track record providing both operational and industrial capabilities in partnership with the Indian Air Force and Indian Defence Industry. The strength of these two pillars make it a long–term true partnership, and one that should only continue to get stronger", says the company.

Moving to the Indian Navy, MBDA says, "With a strong reputation as a reliable partner that has supported the Indian Navy for over 50 years, European missile firm MBDA understands the importance of operational capability and sovereignty to the Indian Navy".

As mentioned earlier, MBDA continues to deepen its relationship with Indian industry, with the recent formation of a joint venture with Larsen & Toubro to deliver a series of important missile programmes under the Make in India category. The highlight of this is that Larsen & Toubro MBDA Missile Systems Ltd (LTMMSL) is currently offering Sea Ceptor, the latest generation all weather air defence system, for the Indian Navy's Short Range Surface to Air Missile (SRSAM) requirement. Ludovic Dumont, MBDA India General Delegate says, "We are proud that L&T MBDA Missile Systems Ltd is offering Sea Ceptor, an Indian led SRSAM for Indian Navy, as part of Make in India. Our JV also proposes a new AKERON/MMP ATGM under Make in India for the Light Tank plus other anti–tank needs".

"Armed with highly advanced new technologies but proven and in service today, Sea Ceptor would provide Indian Navy ships with complete protection against all known and projected air targets including saturation attacks across 360° simultaneously. Sea Ceptor utilises the CAMM missile that features a next generation all weather fully active radio frequency seeker, two way datalink and soft vertical launch system to provide a step change in performance compared with previous generation systems. Sea Ceptor protects both the ship armed with the system and enables that ship to also protect other vessels, including high value units such as aircraft carriers. The weapon system has the capability to intercept and thereby neutralise the full range of current and future threats, including combat aircraft and the new generation of sea skimming supersonic anti–ship missiles cruising. With Sea Ceptor having no minimum engagement altitude, it also able to engage surface targets such as fast attack craft, the system provides an impenetrable barrier to all threats", states MBDA.

Sea Ceptor utilises the CAMM missile.

Ludovic Dumont, MBDA India General Delegate further states, "MBDA also has a strong pedigree as a provider of the latest and most capable aircraft weaponry, having provided a number of different strike and air to air weapon systems that have provided excellent frontline capability to the Indian Naval Air Arm over the years such as the Magic II air to air missiles on Sea Harrier or the Sea Eagle anti–ship missile that armed a number of Indian Naval Air Arm aircraft. MBDA produces a number of weapon systems that are already in the inventory of the Indian Armed Forces that could be invaluable to current or future carrier based combat aircraft of the Indian Navy. This includes air to air weapons such as the famous Meteor beyond visual range air to air missile, the MICA and ASRAAM close combat air to air missile or the Mistral ATAM air to air missile system for helicopters. For anti–ship and strike roles there is also the AM39 version of the Exocet missile that can arm a wide array of maritime aircraft, from naval fighter aircraft to maritime patrol aircraft and naval helicopters".

Moving on to MBDA and the Indian Army, the history of cooperation between the Indian Army and MBDA

Larsen & Toubro MBDA Missile Systems Ltd is offering Sea Ceptor air defence system for the Indian Navy's Short Range Surface to Air Missile (SRSAM) requirement on the Kamorta Class warships and perhaps later, for other classes of warships.

For anti–ship/strike roles there is the air launched AM39 version of the Exocet missile.

goes right back to the origins of the anti–tank missile and has provided the Indian Army with anti–tank systems ever since.

The first cooperation effort was on the first generation SS11B1 anti–tank missile that served in the Indian Army with distinction for many years. Throughout this time the missile was not just used by the Indian Army but made by Indian industry, with the SS11B1 cooperation programme between MBDA and Bharat Dynamics Limited (BDL).

This highly successful cooperation was followed by another great success, the manufacture of the MBDA designed MILAN missile in India. This missile, which continues to serve with the Indian Army providing reliable performance, is also made in India by BDL. To date over 50,000 examples of the MILAN missile have been made in India.

On 19 March 2021, the Acquisition Wing of India's Ministry of Defence (MoD) signed a contract with Defence Public Sector Undertaking Bharat Dynamics Limited (BDL) for supply of 4,960 MILAN–2T Anti–Tank Guided Missiles (ATGMs) to the Indian Army at a cost of Rs 1,188 crore, in New Delhi. "This will further boost the 'Make in India' initiative of the Government and is a 'Repeat Order' of contract, which was signed with BDL on 8 March 2016", stated MoD.

The Milan–2T is a Tandem Warhead ATGM with the range of 1,850 metres, produced by BDL under license from MBDA Missile Systems, France. These missiles can be fired from ground as well as vehicle based launchers and can be deployed in anti–tank role for both offensive and defensive tasks. Induction of these missiles will further enhance the operational preparedness of the Armed Forces. Induction is planned to be completed in three years.

The future looks bright for the fifth generation of anti–tank missiles to be Made in India also. MBDA has partnered with Larsen and Toubro and proposed the ATGM5, the "world's only true 5th Generation" Anti–Tank Missile, as the next advancement in the Indian Army's anti–tank capabilities. ATGM5 is categorised as an Indian Designed Developed and Manufactured (IDDM) product under the Make in India programme. ATGM5 offers many unique capabilities, including being truly network enabled, a multipurpose warhead with selectable effects, and high–performance seeker technologies.

AKERON/MMP ATGM

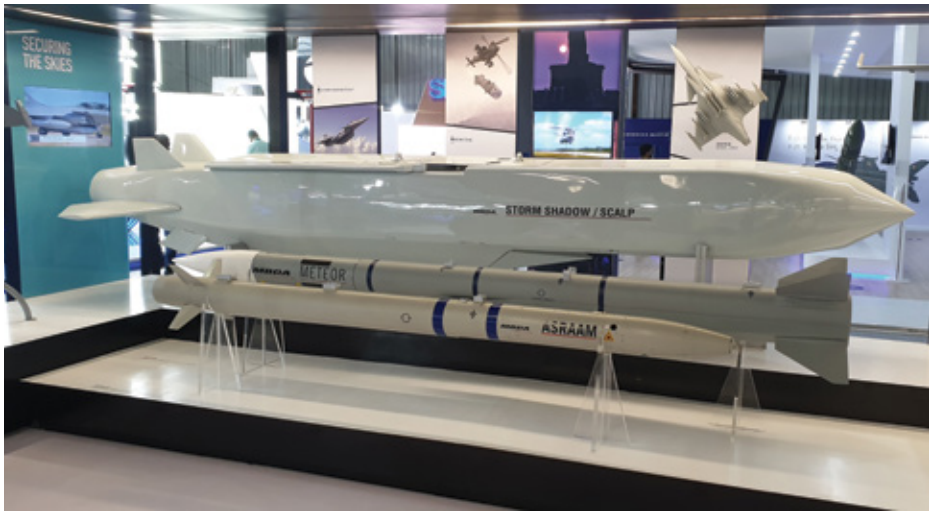
Representative image of the MILAN launcher and the BDL produced missile seen at Defexpo 2020.

Drawing on the next generation technologies of the MMP battlefield anti–tank weapon as the advanced successor to the highly successful MILAN, ATGM5 will be designed and manufactured in India to meet India's specific operational requirements. It will see the transfer of key next generation missile technologies to India, boosting the Indian defence industry sector and the sovereign capability of the Indian Army.

"We are very excited for the next stages of our partnership with the Indian Army and have recently signed an agreement with BDL for the Final Assembly Integration and Test line of the Mistral missile that can be utilised as a man portable air defence system (MANPADS) in a very short

range air defence (VSHORAD) role. Mistral has already been successfully integrated onto India's combat helicopters, the ALH and LCH, and by utilising the same Mistral weapon in multiple roles the Indian Army could reap the reward of major cost savings and operational benefits to be found in maintaining common equipment stockpiles, not to mention the training and logistics benefits.

Utilisation of the Mistral missile on India's helicopter platforms provides a bridge to their use in a ground based VSHORAD role, where the missile is fully compliant with India's requirements and outperforms the capabilities of its rivals with a proven single shot kill probability of over 96 per cent", state MBDA officials.



Scalp, Meteor and ASRAAM–all in IAF service.

The Mistral ATAM air to air missile system for helicopters seen here on HAL's LCH.

To conclude, the company says, "MBDA has been actively working in partnership with the Indian Army, India's government and industry to build India's defence industrial capabilities for over 50 years. MBDA is recognised world–wide as an absolute leader in the field of missile technologies.

We are also recognised as being the only truly integrated multinational company in the defence sector–cooperation is in our DNA in a way that is unique in the defence sector, and particularly in the field of missiles.

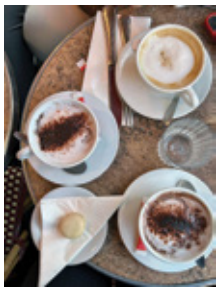
This makes us uniquely able to partner with India and to support the development of India's public and private defence–industrial capabilities".

We would like to thank everybody accompanying us plus involved in planning and executing this media tour. From what we could make out, it was no easy task. Everything was immaculately in place and things went off without a single glitch!

Well done Team MBDA India, UK and France! Cheers!

Snapshots of MBDA products in India and future plans

Work and fun times during the media tour
Captions not needed!



Updates from the world of MBDA

TDW to significantly ramp up PARM production

MBDA subsidiary TDW GmbH has been awarded a contract to produce and deliver 2,600 PARM to the German Armed Forces. PARM is a fully automated anti–tank effector that can defeat modern Main Battle Tanks. A single soldier is able to carry PARM and the system requires little training and is combat proven. Through its modular design, PARM can easily be adapted with different sensors and a remote control.

Firing of new gen Exocet from French frigate

A successful firing, by the French navy, of the latest generation of MBDA's Exocet missile Mer–Mer 40 Block 3c (MM40 B3c) took place from the multi–mission Alsace frigate (FREMM DA) off the coast of the DGA missile test centre (DGA EM) of Ile du Levant. Exocet MM40 B3c is the latest generation of MBDA's Exocet family of anti–ship missiles for integration on a wide variety of platforms including surface ships, submarines, fast jets, helicopters and coastal batteries. Previous versions of Exocet are in service with several navies around the world.

Mistral to arm Korean helicopters

MBDA has received a contract from Korea Aerospace Industries (KAI) for the integration of the Mistral ATAM anti–air missile system on the Korean Marine Attack Helicopter (KMAH). Mistral ATAM is based on the Mistral short range anti–air missile, known for its fire and forget engagement mode, ease of operation and kill probability. The ATAM system includes two launchers per helicopter, each carrying two missiles. Man–portable Mistral air defence systems are also in service with Republic of Korea's Armed Forces.

Sweden orders CAMM air defence missile

MBDA announced it had signed a contract in Sweden to deliver Common Anti–air Modular Missiles (CAMMs) for the Swedish Armed Forces. The contract, signed between MBDA and the Swedish Defence Materiel Administration FMV (Swedish: Försvarets materielverk), will see MBDA supply CAMM for the Royal Swedish Navy's five Visby Class Corvettes, which will deploy them from MBDA's Sea Ceptor naval air defence system. Sweden joins a growing list of militaries worldwide that have chosen to rely on the CAMM family for latest generation naval and ground based air defence, including major recent orders from Poland, as well as the UK, Italy, Canada, Brazil and more.

MBDA and KAI to deepen co–operation

MBDA and Korean Aerospace Industries (KAI) have signed an agreement to deepen co–operation. The agreement will see the companies explore new opportunities for the integration of new MBDA weapons onto KAI platforms and the export of both together via a joint marketing approach.

VAYU on–the–spot report

The Imperial War Museum, London

The Imperial War Museum in London stands as a poignant testament to the troubled legacy of conflict and the human experiences during wars, even the ones that transpired beyond European borders. Founded in 1917 during World War I, the initial purpose of IWM was to record the story of the Great War and honour those who served and sacrificed. Since then, the museum has expanded its scope, encompassing conflicts from World War II to the present day, offering a comprehensive narrative of war and its influence on society, which even reflects today. IWM London is also, in fact, the first museum in the world to house Second World War Galleries and The Holocaust Galleries under the same roof.

Located in Lambeth, the museum is housed in a historic building that was once the Bethlem Royal Hospital, known as Bedlam. The grand architecture is the habitat for some sombre and powerful exhibitions within. As visitors navigate through its halls, they witness a vast collection of artifacts, documents, photographs and immersive exhibits that reflect the realities of war to life. Also gratefully, there is no price tag for entry tickets, as free admission is allowed for visitors for all days of the week. The visiting hours are between 10 AM to 6 PM.

The museum's galleries cover various aspects of warfare, exploring not only the military strategies and battles but also allowing a glance at the personal stories of soldiers, civilians, and communities affected by infamous wars. Exhibits often feature authentic weapons, uniforms, and other items that provide a tangible connection to historical events. The atrium is the home to a range of significant vehicles, each holding its historical importance. Among them stand formidable tanks such as the British Mark V tank, a symbol from World War I, and the iconic German Tiger Tank. Fighter planes, ranging from the piston–powered Spitfire and Hurricane of World War II to more modern jet powered aircraft

like the Harrier. Adding to this collection are utility lifelines like the Willys MB jeeps and trucks. Notably, authentic wreckage, such as that of the Mitsubishi A–6M "Zero," serves as a compelling display, encapsulating the history of the Imperial Japanese military within the exhibit.

One of the most impactful displays is the Holocaust Exhibition. Dedicated to introducing visitors to such a dark chapter of human history, the space is a deeply moving and thought provoking area dedicated to exploring the persecution and genocide perpetrated by Nazi Germany during World War II. The 2–floor presence gallery houses over 2,000 photos, books, artworks, letters, and personal objects of some of the six million people killed during the troubled phase of history. The museum's commitment to preserving the memory of such events serves as a stark reminder of the importance of understanding the consequences of war and the significance of striving for peace.

Lord Ashcroft Gallery is one of the newly introduced sections of the museum. Named after Michael Ashcroft, a philanthropist, businessman and collector of military artifacts, this gallery is dedicated to showcasing the stories of individual bravery and heroism on the battlefield. The gallery primarily focuses on the stories of soldiers who have received the Victoria Cross (VC), the most prestigious gallantry earned for facing the enemy in wars that can be awarded to British and Commonwealth forces. It honours the recipients of this medal and shares their remarkable stories of courage and sacrifice. The gallery serves as a tribute not only to the recipients of the Victoria Cross but also to all those who have shown exceptional bravery and selflessness in the face of adversity during times of war.

Additionally, the Imperial War Museum also hosts temporary exhibitions, special events and educational programmes aimed

at engaging audiences of all ages and backgrounds. These initiatives offer a deeper understanding of the complexities surrounding conflict, the sacrifices made and the resilience shown in times of distress. The museum's overall mission is to ensure that the lessons of war should not be forgotten. It contributes to and also promotes the efforts to collect, preserve and personal histories related to human conflicts. By providing a platform of learning, the Imperial War Museum in London continues to serve as a vital institution in shaping our understanding of the past, acknowledging the lessons from the horrors of war and eventually influencing our approach to the future.

Article by Rishav Gupta
All photos: The Vayu Team

VAYU on–the–spot report

The National Army Museum, Chelsea London

The National Army Museum in Chelsea, London, proudly preserves the British Army's legacy through an immersive journey spanning centuries of military history. Established in 1960 and renovated in 2017, this institution offers a huge collection of artifacts, interactive exhibits, and poignant narratives and tales from battlefield. The big galleries encapsulate the evolution of warfare, its societal impact and the human experience, which enlightens the visitors about the multifaceted nature of a conflict. Through its interactive displays and educational initiatives, the museum aims to bridge the gap between past sacrifices and present day understanding, serving as an important medium to primarily display the British Army's valour, and transformation throughout history.

In 2017, the museum was expanded and redesigned with a multimillion pound redevelopment. Its new state of the art galleries and immersive displays reflect the narratives of soldiers, battles and the societal impacts of war. The museum's mission is not only to preserve historical artifacts but also to educate and inspire visitors, shedding light on the army's pivotal role in shaping British history. One can plan their visit from Tuesday to Sunday between 10 am to 5 pm, and without any concern of the entry fees as it is completely free to explore the museum.

The exhibits within the museum are diverse and comprehensive, covering a wide array of themes. From ancient battles to modern conflicts, visitors can explore the evolution of military tactics, weaponry and the profound societal changes brought by war. The displays vividly portray the experiences of soldiers from different eras, offering glimpses into their daily lives, challenges and triumphs on the battlefield. Apart from the tales of soldiers from the British Empire, the colonial forces, like that of India, were also honoured with tributes, like photos, clippings, artifacts and more.

One of the museum's standout features is its interactive nature. Engaging activities, simulations, and multimedia installations allow visitors to step into the shoes of soldiers, experiencing the physical and emotional aspects of military life. It includes multiple audiovisual elements, live drills/simulations, and even access to replicas of certain equipment. This hands–on approach fosters a deeper understanding of the sacrifices and complexities inherent in armed conflict.

Moreover, the National Army

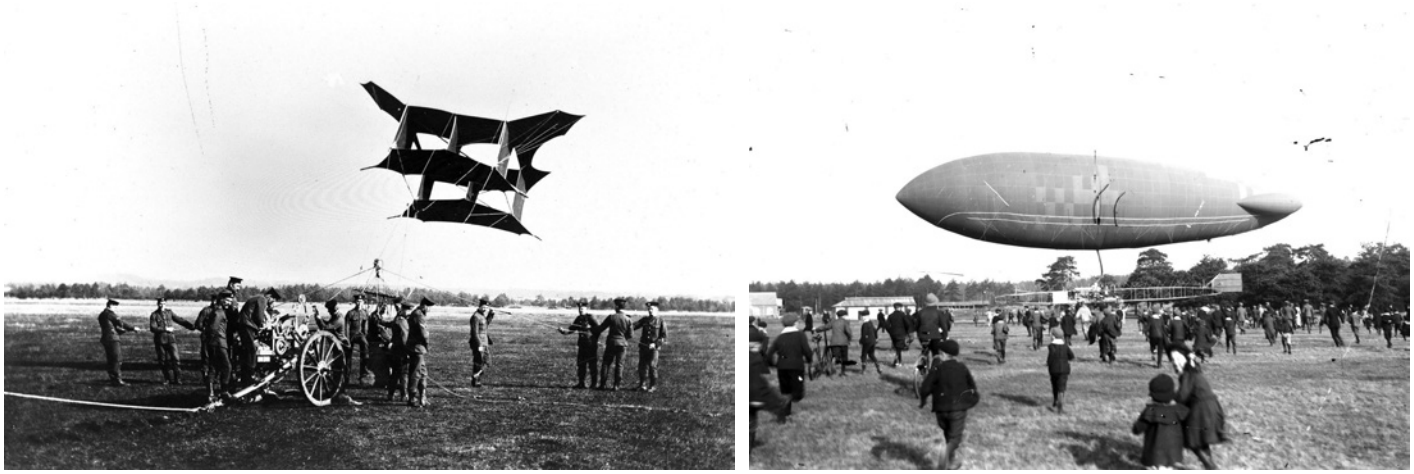
Museum isn't solely focused on battles and strategy. It delves into the human stories behind the uniforms, highlighting the diverse roles individuals played within the army. Women's contributions, the experiences of soldiers from various cultural backgrounds, and the impact of war on civilians are all part of the rich tapestry woven within its walls. Vehicle displays can be yet another breathtaking experience for visitors as they are able to explore the vintage range of utility and combat automobiles, including jeeps, trucks, tanks, APCs and more. Also make sure not to miss the ex–British Army Westland Lynx helicopter hanging from the ceiling!

The museum also serves as a centre for research and learning as it allows hosting lectures, workshops, and educational programmes aimed at influencing young enthusiasts as well as seasoned learners. Its extensive archives offer a wealth of resources for those eager to dive deeper into military history and understand it from depth.

In essence, the National Army Museum at Chelsea stands as a living tribute to the courage, resilience and evolution of the British Army. It honours the past while providing invaluable insights into the complexities of armed conflict, making it an essential destination for those seeking to explore the intertwined threads of history, society and warfare. The museum is committed to preserve the past while fostering an understanding of its relevance today, which ensures that its impact transcends beyond historical documentation.

Article by Rishav Gupta
All photos: The Vayu Team

Richard Gardner writes on.... Celebrating Aviation History



Left: Early aviation at Farnborough with Army kite launches and (Right) Gamma airship operating at Farnborough pre–1912.

Over the years many in the Indian aviation community will be familiar with Farnborough in Southern England, where the British aerospace industry hosts its bi–annular showcase international air show. Since the 1940s Indian military pilots and engineers have been valued participants at the Empire Test Pilots School, originally located at Farnborough before moving to Boscombe Down. Across on the other side of the Farnborough main runway the Royal Aircraft Establishment (RAE) provided a backdrop for the air shows, but behind its security gates and fences there was a unique air science powerhouse of invention where every aspect of aerospace activity was planned, developed and tested from the earliest days of human flight to highly classified supersonic and stealthy aircraft designs – along with all their associated weapons and avionics.

Aircraft based there undergoing development trials or performance and equipment evaluations included many types that would be no strangers in Indian skies, including Meteors, Vampires, Hunters, Canberras, Gnats, Jaguars, Hawks and Avro 748s. In fact this historic facility pre–dates powered flight itself as the site was originally the base for the British Army's Balloon School from 1905 where observation balloons and kites later led in 1908 to the first powered, controlled, manned flight in the country. This was designed, built and flown on site by pioneer aviator Samuel Cody and set the scene for rapid progress at Farnborough developing a whole family of aero engines and military aircraft from the BE2 of 1912 on through the creation of the Royal Flying Corps, also in 1912, just in time to provide air power for British and allied forces during the First World War. The RFC later became the Royal Air Force in 1918, from which the Indian Air Force emerged and has subsequently grown into the powerful Indo–Pacific entity of today.

Above: Aerial view of FAST Museum at RFC HQ building and (Below) an advanced stealthy combat design wind tunnel model from the 1990s.

When the former RAE moved its historic facilities into a new headquarters (now QinetiQ) on the Northern side of the airfield site in the late 1990s, it left behind some massive wind tunnel buildings. A new voluntary

organisation, Farnborough Air Sciences Trust (FAST), was set up in 1993 to campaign to save the main historic aviation structures, including the wind tunnels and other artefacts and items, and this was successfully achieved.

Conducted tours of the wind tunnels and an ex–RAF centrifuge building are undertaken during the summer months but a year round museum was opened in 2003 and offers free entry to the public every weekend. This was established in the former first Headquarters of the Royal Flying Corps, where the initial British military flying squadrons were formed from 1912, and most of the early numbered squadrons carry on their historic identity as Typhoon squadrons in today's RAF. Since establishing the museum, FAST's hundreds of thousands of ex–RAE reports, other documents, photographic images, film reels and artefacts have been collected, recorded, archived, and in many cases digitised, making the information more accessible to all. Many ex–RAE test aircraft plus missiles, rockets, early satellites and space launchers, and equipment and missiles have been added to the collection. Highly realistic flight simulators have also been installed offering museum visitors the opportunity for simulated control of Harrier, Lightning and Concorde aircraft.

Above: Display of British and German aircraft in early 1946 and (Below) the FAST built replica of Cody's British Army Aeroplane No 1A.

Close liaison with QinetiQ, DSTL, Bedford and Boscombe Down, and other former RAE establishments, the UK National Archives and the Science Museum, has been enhanced by achieving Arts Council Accredited status, the national museum standard, and membership of the Hampshire Military Museums Network and the Military Aviation Heritage Network. Its specialisation on air science makes it truly unique and school and university students are increasingly using its resources to support STEM academic projects. In 2014 in recognition of its efforts it received The Queen's Award for Voluntary Service.

The Trust's museum attracts a wide range of visitors from all over the country and around the world, who can learn how the RAE, over more than a century became a powerhouse of technical innovation. Access to the cockpits of selected actual fast jet aircraft and helicopters attracts much visitor interest, from former pilots to families and children who otherwise may never have experienced modern aircraft up close.

Statue of S. F. Cody, with a Lightning T5 in the background, which is acts as a "Gate Guardian"

Exactly one hundred years after the first British aeroplane took to the air, this historic occasion led to a special Centenary event. Former UK Prime Minister, Margaret Thatcher, was an honoured guest. At its centre was a full size, highly accurate, Cody Flyer replica built by an all volunteer FAST team. It is now displayed in its own pavilion alongside displays describing Cody's colourful life. Suspended above is an example of the locally built Zephyr

The last flying Vulcan is now grounded but visited Farnborough on its farewell tour and is seen here landing with the museum's Gnat in the foreground.

stratospheric, all electric, solar powered communications and surveillance unmanned aircraft which reflects the fact that behind closed doors Farnborough's active aerospace companies and QinetiQ remain at the cutting edge of aerospace innovation.

Above: From the First World War aircraft to the prototype Whittle W200 jet on display and (Below) part of Concorde display.

The Cody Flyer Replica project was followed by the unveiling of the Cody statue in 2013; now a Farnborough landmark. Over the years the late Captain Eric Winkle Brown, described as the world's greatest ever test pilot, opened numerous special events at the museum, including those celebrating the RAE evaluation in 1945 of captured German aircraft, the Centenary of the Fleet Air Arm and veteran test pilot gatherings. The museum's themed exhibits with original items and touchscreen displays, cover the earliest Edwardian days of Army ballooning and kiting through the development of air science and air power through two World Wars into today's aerospace world of digital technology, supersonic flight, flight safety and space vehicles.

With a popular museum shop, coffee room and picnic area, as well as car park, the museum facilities can be hired for meetings, training sessions, client events and social gatherings. FAST volunteer and guest speakers venture far and wide giving lectures and presentations on a variety of aviation subjects. Sponsorship from leading aerospace organisations has underlined FAST's serious intent. That now includes membership of Farnborough Aerospace Consortium, and close links with Farnborough International and Farnborough Airport.

Left: Harrier T4 on display outside museum and (Right) an Australian–built, RAE developed and operated, GAF Jindivik target–towing remotely piloted drone and the French built prototype Aerospatiale SA330 Puma helicopter that acted as a lead in to the production of a Westland Puma production line in the UK.

With new aerospace challenges facing the world, advanced technological solutions are pointing the way towards the next generation of air and space projects. A continuing challenge is identifying tomorrow's new generation of scientists and engineers who will create and support them in operation. Artificial intelligence and increasing adoption of autonomous systems will undoubtedly feature more over coming decades, but the story of how aviation and associated air science has developed to date will continue to provide a fascinating story. And Aerospace is more of a truly global enterprise than ever.

Richard Gardner MRAeS
Hon President, Farnborough Air Sciences Trust
Readers can find out more on: www.airsciences.org.uk

The Russian Super Weapons

Kh–47M2 Kinzhal (Images: Reddit and Wikimedia)

The Kh–47M2 Kinzhal/Dagger (AS–24 Killjoy) is a Russian nuclear capable Air Launched Ballistic Missile (ALBM) and qualifies as a long range standoff weapon. It has a claimed range of more than 2,000 km, Mach 10 speed and an ability to perform evasive manoeuvres at every stage of its flight. It can carry both 480 kg conventional High Explosive (HE) fragmentation or 100 to 500 kT nuclear warheads and can be launched from Tupolev Tu–22M3 (Backfire) bombers or MiG–31K (Foxhound) interceptors. The Kinzhal entered service in December 2017 and has been deployed at airbases in Russia's Southern Military District and Western Military District. The missile is designed to strike United States and North Atlantic Treaty Organisation (NATO) warships, including aircraft carriers, posing a threat to Russia's strategic military assets and to destroy NATO military infrastructures like airfields as well as Command & Control (C&C) nodes protected by Ballistic Missile Defence (BMD) system by overcoming any known or planned United States BMD systems including MIM–104 Patriot, Terminal High Altitude Area Defense (THAAD) and ship based Aegis.

The missile first stage solid propellant rocket is probably shared with OTK 9K723 Iskander–M Short Range Ballistic Missile (SRBM) and the guidance section is specifically designed for this missile offering greater range and flexibility. It has similar dimensions as the OTK 9M723 Iskander–M, the Kinzhal has a length of 8 m, a body diameter of 1 m, and a launch weight of approximately 4,300 kg. There are key distinct features from the ground–based Iskander, however, including a redesigned tail section, reduced rudders, and a special stub at the missile's tail designed to protect engine nozzles during high speed fight.

Within seconds from launch, the missile accelerates to hypersonic speed and performs manoeuvres at all stages of the flight to evade enemy missile defences. Guidance is inertial with possible fine adjustments by GLONASS series of satellites. The high speed of the Kinzhal likely gives it far better target penetration characteristics than lighter subsonic cruise missiles. Being three times as heavy and almost twelve times as fast as Tomahawk cruise missiles, the Kinzhal has more than 432 times the on–cruise kinetic energy. Russian media claims the missile's range is 2,000 km when launched by the MiG–31K and 3,000 km when launched by the Tupolev Tu–22M3. An aircraft's ability to launch from unpredictable directions would strain sectored (non–360 degree) radars, such as those currently deployed with the MIM–104 Patriot system. Circular Error Probable (CEP) is 10 to 20 metres. The weapon made its public debut during the Aviadarts international contest in August 2019. On 18 October 2023, Vladimir Putin ordered the Russian Aerospace Forces to begin permanent patrols over the Black Sea region with MiG–31K aircraft armed with Kinzhal missiles. Russian sources claimed that these missiles have received the capability of midflight re–targeting.

On 19 October 2022, Russian, and subsequently Indian media claimed that a Russian Sukhoi Su–57 shot down a Ukrainian Sukhoi Su–27 using the Vympel R–37M Beyond Visual Range Air to Air Missile (BVRAAM). This was the first registered "kill" by the fifth–generation Sukhoi Su–57 while the R–37M missile has risen to prominence during the 'Special Military Operations' repeatedly demonstrating Single Shot Kill Probability (SSPK) and enabling the Russian Air Force to maintain air superiority. R–37M was derived from the Vympel R–37 (AA–13 Arrow) BVRAAM developed to replace the MiG–31 mounted R–33 (AA–9 Amos). R–37 was designed and developed to shoot down ultra high value airborne platforms like Airborne Early Warning & Control (AEW&C), Air to Air Refuelling (AAR), Long Range Maritime Patrol (LRMP) and Joint Surveillance Target Attack Radar System (J–STAR) platforms, from stand–off ranges without necessarily having first to deal with their fighter escorts. Mid–body strakes enhance lift while folding tail controls allow semi–conformal carriage.

The new version is known as R–37M/Izdeliye 610/ RVV–BD (Raketa Vozduh–Vozduh Bolyshoy Dalnosty) armed with powerful Agat 9B–1388 active seeker designed for engaging low altitude targets. The dual mode solid fuelled R–37M/RVV–BD BVRAAM was unveiled at MAKS–2011 for the first time, capable of fulfilling the BVR role for "outer air battles" by taking out enemy AEW&C and AAR platforms at the initial stages of conflict. However, the missile has proven potent even against fighter sized targets. 4.06 m long RVV–BD weighs 510 kg, has a range up to 398 km in "cruise glide" mode and is capable of destroying targets with overload up to 8 g at an altitude from 15 m to 25 km. The hypersonic (Mach 6) missile is armed with a

60 kg high explosive fragmentation warhead. The R–37M is launched in fire and forget mode towards the target's hypothesised position, and once the R–37M comes within suitable range of the target; it activates its own active seeker and homes in on the target at high speed providing little reaction time to the adversary. The active seeker is equipped with a new miniature digital processor with an abundant memory and increased speed and resistant to electronic warfare. The missile is equipped with non–contact active radar and standby contact fuzes.

In Russian Air Force service the R–37M missiles arm the MiG–31BM interceptors, Sukhoi Su–35S and Sukhoi Su–57 air superiority fighters. It is not clear whether R–37M/RVV–BD arms Indian Air Force Sukhoi Su–30MKI air superiority fighters although the missile has undergone extensive live firings in India's test ranges.

R–37M/Izdeliye 610/ RVV–BD (Image: Wikimedia)

The 1,500–2,500 km ranged 6.2 m long Novator 3M14E/P–900 Kalibr (SS–N–30A) Land Attack Cruise Missile (LACM) has been designed to destroy ground based targets and consists of a booster stage and a subsonic low–flying sustainer stage. The onboard control system includes a barometric altimeter used to maintain altitude in terrain following mode (making the weapon stealthier than designs which rely on radar altimeters), plus a receiver for the GLONASS Satellite navigation system. The highly accurate (2–3 m CEP) missile has a low flight altitude, 20 meters above sea and 50–150 meters over land at a speed of Mach 0.8. At the terminal stage of the flight the guidance is effected by the 'Korrelatsionaya' system. This guidance system employs a Scene Matching Area Correlator package, which guides the missile to a set of coordinates within a preprogrammed image surrounding the target, similar technology to the Digital Scene Matching Area Correlator (DSMAC) in the BGM–109 Tomahawk. European sources claim this guidance package can hit completely hidden targets providing their location is well known relative to visually prominent features surrounding the aimpoint.

The missile exists in two versions, the 3M14E for submarine–launch and the 3M14TE for surface ships. Designed to be fired from standard 533mm torpedo tubes, the missile is almost identical in shape to that of the Klub–S/Klub–N 3M54E1 anti–ship missile. Pre–launch preparation and handling are done using the same hardware as is used for the other missiles of the Klub–S/Klub–N system. The only difference between the two land attack variants is that the 3M14E can be launched from a depth of 30–40m below the sea surface, while the 3M14TE surface ship version is compatible with vertical or slant launch from the TPS (transportno puskovoy stakan) transport launching container. The modified 3M14EE missile fitted with an enlarged 450 kg conventional unitary fragmentation warhead or bomblets (a mix of incendiary, armour piercing, high explosive, which can be varied to meet requirements).

The 3M14E and 3M14TE are intended for use against stationary ground targets such as administrative and economic centres, weapon and petrochemical storage areas, command posts, seaports and airports. Once the mission data needed by the mid–course navigation system has been prepared, it is loaded into the missile's onboard computer prior to launch. Both versions are launched under the power of a tandem solid propellant rocket booster fitted with four small lattice stabilisers. Once the missile has reached flying speed, it is powered by a small turbojet engine. For most of the flight to the target area, the missile flies autonomously, following the pre–programmed route and turning points. Once over land, it uses a terrain–following flight path that will make it a difficult target for enemy air defences. This low level flight mode poses a higher load on the wings and missile structure than flight over the sea surface, so the land attack missile has slightly redesigned wings of shorter span and deeper chord, plus a stronger structure.

Article by Sayan Majumdar

An insight into the Indian space programme

Moving one step closer to India's first Human Space Mission, the critical phase of preparations began for Gaganyaan with first Test Vehicle Flight TV–D1 successfully taking place on 21 October 2023 from the SDSC–SHAR Launchpad, Sriharikota (Photos: ISRO).

The habit of India and her people to dream above what seems to be impossible has always led the country to do majestic things; one such thing was the creation of the Indian Scientific Research and Development Organisation (ISRO) on 15 August 1969 to explore space. However, it is important to highlight that ISRO's formation was just a kind of official recognition of the Indian space programme by the Government of India. The roots of Indian space programmes can be traced back to the 1950s when DAE provided funds for space research across India, however, a significant leap to the Indian space programme came in 1962 when Indian National Committee for Space Research (INCOSPAR) was set up under the supervision of Dr Vikram Sarabhai which eventually evolved into ISRO.

The Father of Indian Space programme: Dr. Vikram Ambalal Sarabhai.

It is important to highlight that this was the period when India was itself struggling with numerous bigger challenges than just exploring space, however, it was Dr Vikram Ambalal Sarabhai whose constant efforts ensured that the Indian space programme was not diluted because of the other problems faced by the country. Vikram Sarabhai came from one of the richest families in India and had a Cambridge degree which allowed him to live a luxurious life outside India even at a time when Indians were rarely given any opportunity abroad.

But he decided to stay in the country and fight against all odds just to take India to space. His dedication could be understood by the fact that he used to charge a salary of only Re 1 from ISRO looking at his financial condition. However, it took a long for the people and government of India to understand the importance of space programmes. This could be understood by the fact that just after the launch of India's first rocket from Thumba in Kerela on 21 November 1963, a headline of a newspaper became very popular saying "India needs rice, not rockets".

Evolution of ISRO

Forming the base: 1950–1960s

The ISRO in its initial days neither had adequate infrastructure nor adequate funds, all it had people like Vikram Sarabhai, APJ Abdul Kalam and Satish Dhawan

who wanted India's space programme to be successful at any cost. Another ray of hope came to India from the Soviet Union when in 1957, USSR launched the world's first artificial satellite into the Earth's orbit, hence giving a clear signal to the world that any nation could now go to space.

While everyone was aware of the space race between USSR and America, another parallel space race was going on between India and Pakistan. Pakistan established Space & Upper Atmosphere Research Commission in the year 1961 (almost 8 years before ISRO) and launched a sounding rocket just in the year 1962 with American assistance. Pakistan in fact became the fourth country in Asia to reach space; meanwhile, the Indian space programme wasn't even properly established.

The news of Pakistan reaching space wasn't a great one for India, since development in space also meant development in the military capabilities of Pakistan. It could also lead Pakistan to learn about critical components used in missile technology which resembles a lot of space rockets like navigation, propulsion and the ability to manoeuvre at high speeds.

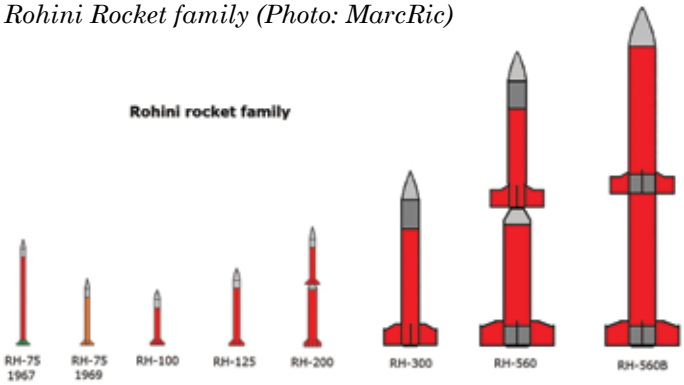
Dr Vikram Sarabhai was very aware of developments in Pakistan, he ensured to convince foreign nations like US, Russia and France to invest in the Indian space sector, even before it was officially recognised. It was because of this that India was able to test US Nike Apache sounding rockets in 1963. Some other sounding rockets later used in the Indian space programme were M–100 from Russia and Centaure from France, all of them being twin stage rockets. The launch of a sounding rocket from Thumba in Kerela marked the official beginning of India's space programme.

US Nike–Apache Sounding Rocket (Photo: Wikipedia).

The year 1966 was another significant year for ISRO as it was from this point Vikram Sarabhai discussed the idea of using satellite tech to deliver educational content to rural India. The discussions also later included Canadian Broadcasting Corporation (CBC) and United Nations development programme (UNDP) as partners in the initiative. The programme came into effect from August 1975 to July 1976 when educational content was delivered to over 2400 villages in over 6 states in India with the help of the ATS–6 satellite of the USA.

Another significant thing that happened to the Indian space programme was the successful development of an

Rohini Rocket family (Photo: MarcRic)



indigenous RH–75 sounding rocket. These sounding rockets were the bedrock on which the edifice of launch vehicle tech in ISRO could be built. The sounding rockets were consolidated under the Rohini rocket family with several variants such as RH–75, RH–100, RH–125, RH–200, RH–300 and RH–560 were developed subsequently.

Taking the big steps: 1970–1990s

The government of India in the year 1972 set up the Space Commission and Department of Space, bringing ISRO under it. The establishment of ISRO hence institutionalised space activities in India. Being under DOS, the ISRO is directly under the watch of the Prime Minister of India.

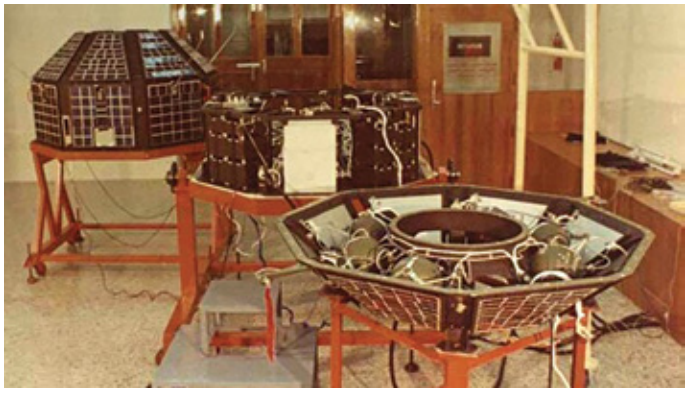
While the years 1950–1960s were more associated with forming the base of the ISRO, it was in the period of 1970–1990s when ISRO extensively developed some critical technologies like that of launch vehicles and satellites. The development of such technologies moulded ISRO into what it is today.

A major milestone in ISRO's development came in 1975 when ISRO placed its first man made satellite Aryabhata into the Earth's orbit with the help of a Soviet Cosmos–3 launch vehicle. This was only possible due to an agreement signed between USSR and India in 1972 which allowed USSR to use Indian ports for tracking ships and in exchange launch Indian satellites.

The Satellite Man of India: Prof Udupi Ramachandra Rao.

The former chairman of ISRO, Udupi Ramachandra Rao played an important role in this deal, it is for the same reason he is called "The Satellite Man of India". The Aryabhata was used to conduct experiments in X–ray astronomy, aeronautics and solar physics. Although

the launch wasn't purely a success the satellite started encountering some problems within five days, India became the first country in South Asia to put a satellite in space. However, the financial condition of ISRO even during the times of their major expansion could be understood by the fact that a toilet was converted into data receiving centre for the Aryabhata satellite in Bangalore. The success of Aryabhata led India to further develop the Bhaskara–1/2 satellite which was meant for studying oceanography and hydrology and was successfully put into Earth's lower orbit with the help of the Russian Intercosmos launch vehicle.



The Aryabhata Satellite

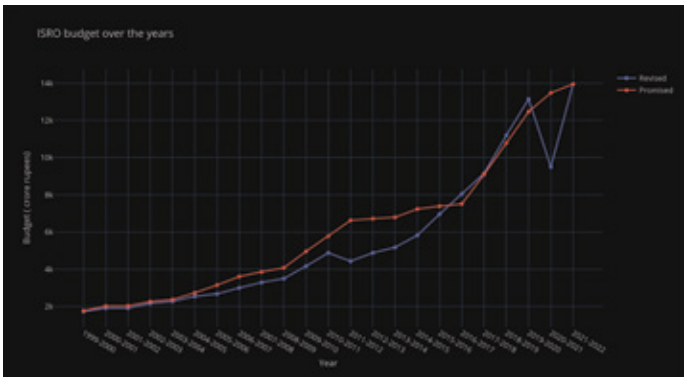
While ISRO had successfully started to place its satellite in Earth's orbit, it wanted to conduct its programmes independently without external support. This created a need for Satellite Launch Vehicles (SLV) in ISRO which would be derived from previous experiences with sounding rocket technology. The development of a satellite launch vehicle was a very turbulent phase in ISRO because initially, it had to face failures and difficulties. However, after further improvisations, the indigenous SLV–3 was successfully able to put India's RS–1 satellite in Earth's orbit, making India the sixth member of the exclusive space firing club in July 1980. The SLV programme further helped India to develop an Augmented Satellite Launch Vehicle (ASLV), Polar Satellite Launch Vehicle (PSLV) and Geosynchronous Satellite Launch Vehicle (GSLV). The PSLV came as a boon to ISRO out of the SLV programme since in no time it became the main workhorse

Various Launch Vehicles of ISRO (Image: insightsonindia.com)

of ISRO. The PSLV is one of the most reliable SLVs across the globe with over 50+ successful flights and has also put hundreds of foreign satellites due to its cost–effectiveness. It was just because of the reliability of PSLV that it was used in Chandrayaan–1, Mangalyaan and India's first space observatory, Astrosat.

ISRO in 21st Century

While ISRO still actively develops a lot of newer technologies, it would not be wrong to say that ISRO has come a long way from its origin in the 1960s. The ISRO was initially less oriented towards space exploration and research. ISRO conducted space research in a manner in which it used to directly benefits common people of the country by informing them about cyclones, and monsoons and conducting educational missions. It was only after the 1990s when ISRO had developed adequate facilities that it stepped into space exploration and research with Chandrayaan, Mangalyaan, ASTROSAT, reusable launch vehicles, navigation networks etc.



The timeline of ISRO's budget (Image: reddit.com)

ISRO is uniquely known all over the globe for its cost effectiveness, reliability and ability to operate under a limited budget allocated by the Government of India. The scale of the budget could be understood by the fact that India spends more on their postal service annually than it does on its space programme; in fact, the monthly expenditure of NASA is equal to the yearly expenditure of ISRO. It is because of the same reason we can launch a satellite at 60% of the cost and be able to conduct a Mission to Mars (Mangalyaan) at a cost less than that of a movie. The ISRO's annual budget stood at less than Rs 6000 crore till 2014 and only used to get a meagre increase of a few hundred crores annually. It was only after 2014 when the Modi government came into power and when ISRO had proved themselves by successful Mars mission, ISRO got a sharp increase in budget with an increase of almost 1000 crores annually.

Major missions conducted by ISRO recently

The list of overall ISRO's achievements cannot be simply covered in just a few pages or so, since behind every new mission of ISRO, there's a more exciting story. Still, here are some of the major missions and achievements of ISRO:

Chandrayaan programme: The Chandrayaan was India's first attempt towards exploration of the moon. The

Chandrayaan–1 was a lunar orbiter launched in 2008 to study the chemical, mineralogical and photo–geologic mapping of the Moon. It made India the first nation to discover water on the lunar surface. The programme was further followed by Chandrayaan–2 which aimed to deliver a lunar orbiter with a rover on the moon's surface. The mission was 90% succesful by the installation of a lunar orbiter except for the fact that the rover wasn't able to communicate after landing on the moon's surface. The Chandrayaan–3 would be launched on 13 July 2023 to successfully place ISRO's rover on the lunar surface.

Chandrayaan–3: a picture illustrating words of ISRO Chief S. Somanath: "India is on the moon".

The workhorse of ISRO: PSLV.

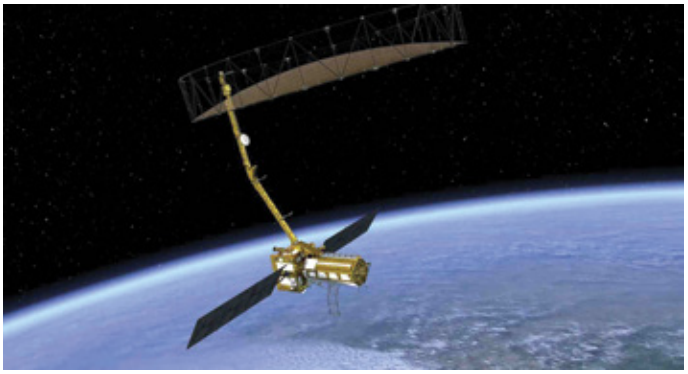
Mangalyaan mission: The Mangalyaan mission also called as Mars Orbiter Mission (MOM) aimed to install a spacecraft orbiting Mars to study more about the red planet.

It made India the first nation in the world to reach Mars in the first attempt at a meagre budget of just 450 crores.

It was also India's first interplanetary mission. The eight year lifespan that Mangalyaan was able to achieve in Martian orbit was also a remarkable feat of the mission. Currently, ISRO is also working on another Martian mission, work on which will start from 2024.

Satellite launches and navigation system: The ISRO has launched over 400+ satellites of 36 nations including several indigenous satellites. The satellite launched by ISRO also includes critical military satellites like variants of RISAT–1 and RISAT–2. The ISRO also held the world record for launching 104 satellites in a single launch for a long period before it was overtaken by SpaceX by launching 143 satellites. Furthermore, ISRO also started the Indian regional navigation satellite system (NavIC) in 2013. It is a satellite navigation system which provides real time positioning and timing services. It covers India and an area of 1500+ km near the country, which is expected to increase in future. It will make India self reliant in domain of navigation system which in turn will have enormous applications in commercial and military uses in future.

NISAR mission: The NASA–ISRO Synthetic aperture radar mission would be the shining example of the saying "Technology has no limits". The mission will feature highly sophisticated technology and will include critical components like advanced dual frequency SAR's, highly advanced data communication systems and a massive 39 foot Radar Antenna Reflector. The satellite even before its launch holds some records like of being the most expensive imaging satellite in the world and the first radar imaging satellite to use dual frequencies. The NISAR would measure earth's changing ecosystems, dynamic surfaces and ice masses which will provide information on biomass, natural hazards, sea level rise and groundwater. The mission will be a giant leap for humanity, as the project director of NISAR mentioned that "Virtually everybody on this earth would be affected by science data that NISAR is going to return". In the project NASA has provided L–band SAR, communication systems and solid state recorders while the ISRO will focus more on structure of satellite and launch services.



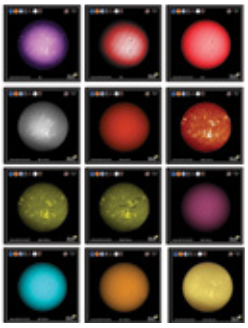
Artist impression of NISAR in orbit (Image: NASA)

Indian Space station and Gaganyaan: The ISRO under its long term vision aims to establish an Indian Space station in future, and to achieve that the Gaganyaan mission acts as the stepping stone. The Gaganyaan mission tends to demonstrate human spaceflight capability of ISRO and intends to place 3 astronauts at an altitude of 400 kms. The project finds its origins since 2006 with a budget of Rupees 10,000 crores and is expected to meet its parameters by 2024. The mission will see a manned flight only after successful completion of two unmanned flights where ISRO tends to ensure safety standards and reliability of equipment used. Considering the safety of astronauts

as the most important factor, ISRO has vigorously worked on Crew Escape System (CES) with 99.8% reliability and recently tested it in month of September 2023. The Launch vehicle Mark–3 (LVM3) was also structurally upgraded to Human–LVM3 (HLVM3) standards to incorporate CES and astronauts. One of the distinguishing factors of this mission apart from massive extent of indigenous technologies used is that ISRO tends to perform the Unmanned flights without using any animals as done by other space agencies before. Instead, ISRO will use its self developed humanoid called Vyommitra. The training of astronauts for the mission was carried out in Russia under a one year training course. Although, the mission is yet to complete a series of tests before a manned flight, till now it has achieved success in every test like re–entry test, pad abort test, drogue parachute deployment test and the crew escape system test.

Indian Navy units recovered the Gaganyaan crew module in October 2023; path paved by extensive planning, training of naval divers, formulation of SOPs and joint communication by combined teams of the IN and ISRO. Also seen above is the LVM3 launcher.

The Solar mission: The ISRO has recently expanded its reach by launching the first dedicated solar mission named Aditya L–1 to observe the sun. The ending letter L–1 in the mission signifies the Lagrange points where this observatory spacecraft would be stationed to study the sun. The L–1 point has major advantage of continuously viewing sun without any obstacles or eclipse. This will give a huge advantage to observe the sun and its associated activities without any constraints. The 1500 kg satellite has 7 payloads, 4 of which will directly study



sun and remaining 3 would study the Lagrange points. The mission intends to study dynamics of Solar upper atmospheric (chromosphere and corona), chromospheric and coronal heating, physics of the partially ionised plasma, initiation of the coronal mass ejections, and many such things regarding sun and solar weather. The study of these parameters will further help India in its future manned and unmanned space missions.

An illustration of Aditya–L1 mission (Image: iLearn CANA) and the SUIT payload captures full disk images of the Sun in near ultraviolet wavelengths. The images include the first–ever full–disk representations of the Sun in wavelengths ranging from 200 to 400 nm (Image: ISRO)

Apart from following missions, ISRO is actively working on several other interplanetary missions to planets like Jupiter and Venus. Furthermore, ISRO is hugely assisting in growth of the private space sector in country as mentioned by ISRO Chairman S. Somanath recently that "ISRO's research is now available to private sector for business opportunities". It is therefore no surprise that number of private space startups doubled in a single year and India now aims to get a 9% share in global space economy by 2030. It is indeed true that "ISRO is not just sending satellites into space; it is sending the dreams and aspirations of a billion Indians into the universe" as stated by India's Prime Minister N. Modi.

Article by Pratisht Chaudhry
All Photos by ISRO except mentioned (Twitter: @Pratisht3)

Conquering the Skies: A Deeper Dive into Suppression of Enemy Air Defenses (SEAD)

Rudram III

During October 2023, the Pakistan Air Force (PAF) as part of its 14–nation Sindh–Shield 2023 air exercise reportedly carried out simulated attacks on Indian air dense (AD) sites using JF–17 armed with Chinese made CM–400 anti–ship missiles in concert with newly acquired J–10s and Airborne Early Warning and Control (AEW) aircraft. It effectively attempted to validate the use of JF–17 and CM 400 combination as a tool of Suppression of Enemy Air Defenses (SEAD) and Destruction of Enemy Air Defenses (DEAD) against Indian AD capability which has been bolstered after the recent induction of the S–400 Triumf surface to air missiles (SAM). In the modern age of warfare, where air dominance often acts as a key determinant of victory, SEAD assumes a pivotal role, demanding meticulous planning and precise execution. This is becoming more relevant as complexities of the modern day battlefield are increasing with each passing day.

The present day battlefield is a complex and dynamic environment characterised by several crucial complexities and attributes. The complex and dynamic nature of the battlefield is connected with technological advancements in several directions.

- **Increased Connectivity and information sharing:** The use of information and communication technologies (ICT) have become more widespread, which has resulted in the creation of a highly networked battlefield environment. Further, the information capture by assortment of Intelligence, Surveillance and Reconnaissance (ISR) resources and sharing increases battlefield awareness. Despite the fact that this makes it possible to improve coordination and make decisions more quickly, it also leaves the organisation open to the possibility of cyberattacks and electronic warfare (EW).
- **Longer Range Precision Warfare:** Developing and deploying sophisticated weaponry, such as laser–guided munitions, guided missiles, and drones, has made it possible to carry out attacks with pinpoint accuracy from increasingly expanding range while causing as little collateral damage as possible. At the same time, the pre–emptive strikes carried out from long ranges with precision attack munitions always have the possibility of deviating from the intended flightpath and sometime striking unmarked areas. It necessitates application of appropriate targeting techniques to prevent collateral damage especially while targeting areas closer to civilian population. This is primarily relevant with precision strikes carried out using unmanned aerial vehicles (UAVs).
- **Autonomous Systems:** The increasing use of autonomous systems, including unmanned aerial vehicles (UAVs) and ground robots, offers significant advantages in terms of reduced risk to human personnel and increased situational awareness. Add to it the capabilities offered by loitering munitions and swarm drones. Use of ICT and long range precision strike capability have added greater lethality to autonomous systems as sought–after tools of war–fighting.
- **Cyber Warfare:** Militaries have become more susceptible to cyberattacks as their dependence on ICT and networking has increased. These types of attacks have the potential to interrupt communications, damage crucial infrastructure, and even influence weapon systems

employment. The implementation of a proactive approach and stringent cybersecurity measures are required to sustain the ICT driven and networked driven war–effort in the present times.

SEAD: A Crucial Aspect of Offensive Capability

With various dimensions and fast evolving dynamics, the present–day battlefield is a multifaceted and challenging environment. In such a case when the employment of airpower becomes a decisive factor, SEAD becomes a crucial aspect of the offensive capability. There are several reasons connected to it.

AN ALQ–99–AGM88

Ensuring Air Superiority: SEAD is linked with achieving air superiority. Enemy AD systems pose a significant threat to attacking aircraft, potentially hindering air strikes, bombing missions, and other essential aerial operations. By knocking over radar, AD and SAM sites from stand–off distances, SEAD effectively neutralises these threats, paving the way for successful offensive air assaults.

In the 1973 Yom Kippur War, only after taking out the SAM cover through multiple strikes, Israel could control the skies and dictate the terms of the war. During the last few decades, air campaigns, as in Libya in 1986 and 2011, the Persian Gulf War in 1991, Bosnia in 1995, Kosovo in 1999, and to some extent in Iraq in 2001 and 2003 effective SEAD operations have been key to sustain air superiority and the combat operations. Escorting strike aircraft with dedicated SEAD platforms, such as the EA–18G Growler, ensures that the airspace is clean of threats, allowing the strike aircraft to carry out their mission and secure vital positions without fear of being targeted by hostile air defenses.

In the ongoing Russia–Ukraine war, SEAD operations from both sides had the objective of ensuring unhindered air operations. By eliminating enemy air defence capabilities and contributing towards the degradation of the enemy's ability to carry out offensive operations under radar and AD cover, SEAD protects friendly troops and ground assets from air attacks, reducing casualties and safeguarding valuable resources.

The raid by the Indian Air Force (IAF) on the radar at Badin near Karachi during the 1965 Indo–Pak war ensured air superiority. Similarly, during the 1971 Indo–Pak war the radar at Sakeswar giving cover to the PAF's premier installation the Sargodha air base was hit by the IAF to ensure safer passage to strike packages.

Deception and Disruption: A passive element associated with SEAD operations centre around deception and disruption. DEAD operations use direct attacks to reduce radar cover, EW degrade radar effectiveness and both these two impose restriction on the enemy's military capability. SEAD/DEAD operations can temporarily disable enemy radar systems, creating blind spots that allow combat aircraft to operate undetected and launch surprise attacks. EW systems capable of creating false signals on SEAD platforms may be used to deceive enemy radar operators. Modern EW suites are designed to deceive and disrupt, making it difficult for the enemy to differentiate between real and false threats. Further, precision–guided munitions are frequently used in SEAD missions to target and destroy enemy radar facilities. The AGM–88 High–Speed Anti–Radiation Missile (HARM), for example, is designed to hunt down and destroy enemy radar transmitters, particularly those linked with AD systems.

By using Electronic countermeasures (ECM) as part of SEAD enemy communication systems can be degraded, and links between enemy forces disturbed, sowing confusion and hindering their ability to respond effectively to offensive actions. The EA–18G Growler, for example, is outfitted with electronic jamming pods like the AN/ALQ–99 to disrupt enemy radar and communication channels. It is in circulation that the IAF jammed Pakistani radars during the Balakot strike carried out on 26 February, 2019.

Achieving Strategic Objectives: SEAD and DEAD operations are vital in achieving strategic objectives. SEAD is used to pave the way for airborne operations aimed at capturing strategic locations, creating the corridor for air operations, securing airfields or communication hubs, providing significant advantages in the overall offensive campaign. For instance, the AGM–88 HARM can be employed to target and destroy enemy radar emitters disrupting enemy's ability to carry out precise artillery or rocket attacks. Such HARM strikes also help in clearing the way for friendly aircraft to secure vital locations.

By effectively suppressing enemy ADs and maintaining air superiority, offensive forces can gain a decisive advantage in the battle, ultimately leading to victory and achieving set objectives. Traditionally, it has been observed that since the early 1990 a sizable portion of air operations are SEAD/ DEAD campaigns despite the fact that the proportion of SEAD missions within total air operations have varied depending on the strategic objectives, the severity of AD threat, and the individual conditions of each conflict. A robust SEAD capability can serve as a deterrent, preventing potential rivals from engaging in conflict and supporting regional stability. When it comes to protecting national interests and defending against potential air

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threats, the SEAD plays a crucial role in guaranteeing the security and sovereignty of a nation.

Methods of SEAD Employment

SEAD leverages a diverse range of tactics and technologies to achieve its objectives. These includes kinetic and non–kinetic approaches.

Kinetic Strikes: For SEAD, Anti–Radiation Missiles (ARMs) are employed to knock off radar installations and other electromagnetic energy emitting sites including SAM locations. These missiles lock onto enemy radar emissions, enabling precise and long–range destruction of radar installations, effectively silencing their warning


Martel

systems and disrupting their ability to track and engage friendly aircraft. Specialized SEAD platforms, such as the EA–18G Growler, are equipped with EW equipment and are able to transport a wide range of ordnance, allowing them to launch both electronic and kinetic attacks against the ADs of the adversary. US made AGM–88/ AGM–88E/ AGM–45 Shrike, Russian Kh–28/ Kh–58, Indian Rudram series etc are common examples of ARMs while the SCALP EG / Storm Shadow can be also used for such roles. Even land or sea based surface to surface ballistic and cruise missiles can be used to carry our SEAD/DEAD missions. US Tomahawk, Russian Iskander and Kalibr, Indian Nirbhay, Brahmos etc missiles can be tasked to carry our SEAD strikes.

Non–Kinetic Strikes: Among non–kinetic methods EW, deception, use of decoys, cyber–attacks are viable options. Employment of dedicated SEAD platforms, such as the EA–18G Growler to interfere with and overload adversary radar capacity to accurately detect and track combat aircrafts. It also disrupts communication. Similarly cyber–attacks are used to disrupt the entire ICT infrastructure as observed in the Russian–Ukraine war. Other methods include the use of deception and decoys. Electronic deception encompasses a variety of strategies, including the transmission of erroneous radar signals and the imitating of the signatures of friendly aircraft. Utilizing deceptive tactics can cause adversary radar operators to get confused and redirect their attention away from true dangers. It is possible for aircraft engaged in SEAD to use chaff, which consists of small strips made of metal or plastic, to generate false radar reflections, so diverting the enemy's radar tracking. For the purpose of countering infrared–guided missiles, flares can also be utilized.

Synchronisation and Planning: SEAD missions require intelligence gathering, target identification, planning and proper execution. It involves team work between air, land, naval and space based resources. Mission execution involves support from ISR, EW, and ICT to combat operators carrying out the process with strike and escort packages working in tandem.

Evolving Landscape of SEAD

The technology and tactics employed in SEAD are constantly evolving to adapt to the ever–increasing complexity and sophistication of enemy AD systems. Use of low observable and stealth aircrafts are adding new dimensions to SEAD missions, as they allow for greater survivability and with reduced risk of engagement by enemy ADs. Similarly, advanced jamming systems offer greater precision and adaptability, allowing them to target specific radar frequencies and adjust to changing threats, significantly enhancing their effectiveness against advanced AD systems. Integrating SEAD operations with other military branches through robust communication networks enhances coordination and mission effectiveness, enabling a more comprehensive and synchronised approach to achieve air superiority. Disruptive technologies like artificial intelligence, robotics and autonomous systems are revolutionising the future of SEAD with better reach, enhanced reliability, minimising risks to the human operators and expanding the operational envelop. Moreover, lasers and other directed energy weapons are being tested as game–changing options to counter AD systems with high precision and minimal collateral damage.

Conclusion

SEAD operations have played critical roles in offensive actions throughout the modern history of warfare, facilitating successful air campaigns, offering critical tactical advantages, and eventually contributing to the achievement of strategic objectives. Militaries can ensure air superiority, protect their forces, and emerge triumphant in war by efficiently suppressing opponent Ads by adopting appropriate SEAD methods. The continual development of SEAD technology and tactics emphasises the importance of this part of offensive capability and its continued relevance in today's complex and dynamic battlefield. In case of South Asian standoffs, SEAD operations will dictate the outcomes of military conflicts and the nation with better awareness about its potential & willingness to use will emerge victorious.

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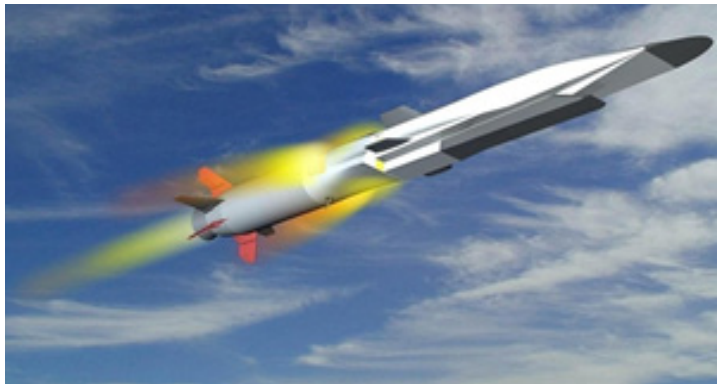
Hypersonic Weapons



L–R: Rendering from Raytheon and rendering of Russia's Zircon hypersonic missile.

Hypersonic weapons, which are projectiles or missiles that travel at speeds of at least Mach 5, have gained attention in recent years due to their potential to pierce air and missile defences. The most important types of hypersonic weapons are hypersonic gliders and hypersonic cruise missiles. Hypersonic gliders are glider like projectiles that are launched into space by a booster rocket and then accelerate to hypersonic speeds by gliding and bouncing on the atmosphere until they reach their target. Hypersonic cruise missiles, on the other hand, are cruise missiles with special air breathing engines that enable them to fly at hypersonic speeds.

Hypersonic weapons offer several advantages over traditional ballistic missiles and cruise missiles. They combine the speed of ballistic missiles with the manoeuvrability of cruise missiles, making them highly effective at penetrating modern air defence networks. They also reduce reaction time and can hit time sensitive targets much faster than cruise missiles. Hypersonic weapons can be launched from various platforms, including ships, submarines, aircraft and trucks.

The development of hypersonic weapons has been a subject of competition among major military powers, with the US, Russia and China being at the forefront of research and development. In 2019, the US rated the technological maturity of hypersonic gliders at 5 out of 9, with expectations to reach level 6 out of 9 in 2020, which is considered a low risk for starting system development. However, China has already tested a working prototype of a hypersonic glider in 2021, indicating that it may have surpassed the US in hypersonic glider technological development.

The engines used in hypersonic cruise missiles are different from traditional jet engines, as they need to withstand the stresses of hypersonic flight. Jet engines, which are commonly used in lower speed aircraft, have compressors to compress air for efficient combustion, but they are heavier compared to engines built for higher speeds. Hypersonic cruise missiles require specialised air breathing engines that can operate at hypersonic speeds, making them more difficult to intercept and track, and enabling them to have short time to impact capabilities.

In conclusion, hypersonic weapons are a disruptive technology with the potential to significantly impact modern warfare. Their combination of speed, manoeuvrability, and ability to penetrate air and missile defences make them highly effective and challenging to defend against. The development of hypersonic weapons has become a competitive race among major military powers, with the US, China, and other countries investing heavily in research and development. The technological maturity of hypersonic weapons is still evolving, with China making significant strides in recent years. As hypersonic weapons continue to advance, they are likely to shape the future of military strategies and operations.

Courtesy: Market Forecast

Raytheon and NGC for hypersonic weapon advancements

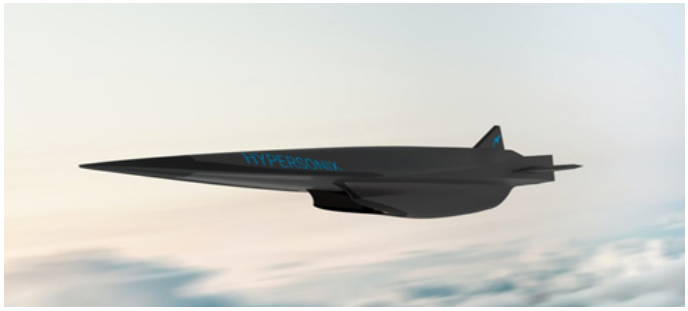
Raytheon in partnership with Northrop Grumman Corporation has been awarded a follow–on contract from the Defence Advanced Research Projects Agency (DARPA) to reduce risk for future air breathing hypersonic systems. Under the agreement, the Raytheon led team will build and fly additional Hypersonic Air breathing Weapon Concept (HAWC) flight vehicles. This artist's rendering shows the Hypersonic Air breathing Weapon Concept, which will integrate Raytheon's air breathing hypersonic weapons with scramjet combustors from Northrop Grumman.

VMAX hypersonic glider test

France has successfully conducted an inaugural test of a prototype hypersonic glider, according to an announcement by the country's defence procurement agency. The test involved the launch of a sounding rocket carrying a VMAX hypersonic glider from the Biscarosse missile test site located on the Bay of Biscay in southwestern France. Executing a highly challenging long–range trajectory, the flight test represented an unparalleled technical feat that will shape the future of France's national hypervelocity roadmap, as stated by the agency in a released statement. While no specific details regarding the test's outcome were disclosed, the agency confirmed that the data collected during the test is currently undergoing analysis.

Kratos and Hypersonix's DART AE Hypersonic System

Hypersonix Launch Systems Ltd and Kratos Defense & Security Solutions have announced an exclusive teaming agreement to provide the Hypersonix DART AE Hypersonic System within the US market, integrated with Kratos' Zeus family of solid rocket motors. The DART AE is a three meter long, single use, high temperature alloy, hydrogen fueled, scramjet technology driven, autonomous, multimission, air breathing hypersonic platform used to develop, demonstrate, test and evaluate hypersonic technologies and for "other" potential hypersonic applications.



Hermeus signs hypersonic aircraft contract

Hermeus has been awarded a contract by the Defence Innovation Unit (DIU) to mature hypersonic aircraft subsystem and mission system technology. Hermeus will utilise its commercial high speed flight test prototype, Quarterhorse, to support technical maturation and risk reduction for future hypersonic aircraft. The contract is part of DIU's Hypersonic and High Cadence Airborne Testing Capabilities (HyCAT) initiative, which aims to utilise commercial flight test capabilities to expand the Department of Defence's high–speed flight test capacity.

Stratolaunch awarded flight test contract

Stratolaunch, LLC announced the receipt of a flight test contract award from Leidos, the prime contractor for the US Navy's Multiservice Advanced Capability Test Bed (MACH–TB). The contract award is funded by Naval Surface Warfare Centre (NSWC), Crane Division through the Strategic and Spectrum Missions Advanced Resilient Trusted Systems agreement. This contract award funds five Talon–A hypersonic flights and optional payloads.

NSWC Crane's MACH–TB programme focuses on hypersonic flight testing using robust, agile, and modular approaches. The Leidos led team intends to deliver an affordable solution, leveraging commercial launch vehicles, including Stratolaunch's Talon–A hypersonic vehicle, for flight testing hypersonic payloads. Stratolaunch's Talon–A, a reusable autonomous hypersonic vehicle, operates as a high cadence, high speed testbed to advance the MACH–TB programme development. Stratolaunch's hypersonic contractor owned and operated flight test service directly complements the goals of MACH–TB.

Milrem Robotics' new combat UGV

Milrem Robotics has unveiled a new combat UGV. The new system is the combination of Milrem Robotics THeMIS Unmanned Ground Vehicle (UGV) and HITROLE Light Remote Weapon Station (RWS), one of the land turrets developed by Leonardo.

Patria's vehicles for Sweden

The Swedish Army has officially received the first batch of new Patria's six wheeled armoured vehicles, in Sweden called Pansarterrängbil 300. The vehicles, which were manufactured in Finland, will be part of the current expansion of Swedish Armed Forces.

Thales GM200 radars for Denmark

Building on the strong international NATO cooperation, as well as strategic bi–lateral defence ties between Denmark and the Netherlands, DALO signed an agreement with COMMIT for the acquisition of five Thales Ground Master 200 Multi–Mission Compact radars (GM200 MM/C).

Switzerland agreement for PAC–3 MSE

US and Switzerland officials formalised an agreement for Switzerland to purchase Lockheed Martin's Patriot Advanced Capability–3 (PAC–3) Missile Segment Enhancement (MSE) missiles and related support equipment. With this agreement, Switzerland becomes PAC–3's 15th partner nation.

Rolls–Royce's UltraFan demonstrator

Rolls–Royce has successfully run its UltraFan technology demonstrator to maximum power at its facility in Derby, UK. The initial stage of the test was conducted using 100% Sustainable Aviation Fuel (SAF). This is an important milestone for the UltraFan demonstrator, which was successfully tested for the first time earlier this year. Since then, the UltraFan team has been gradually increasing the power as part of the rigorous testing regime and the demonstrator has performed in line with expectations.

Korea for 38 SM–6 BLK I

Korea has requested to buy up to thirty–eight (38) Standard Missile 6 (SM–6) Block I missiles. Also

included are MK 21 Vertical Launch System (VLS) canisters; obsolescence Engineering, Integration, and Test (EI&T) materiel and support; handling equipment, etc.

Romania for 54 M1A2 Abrams MBTs

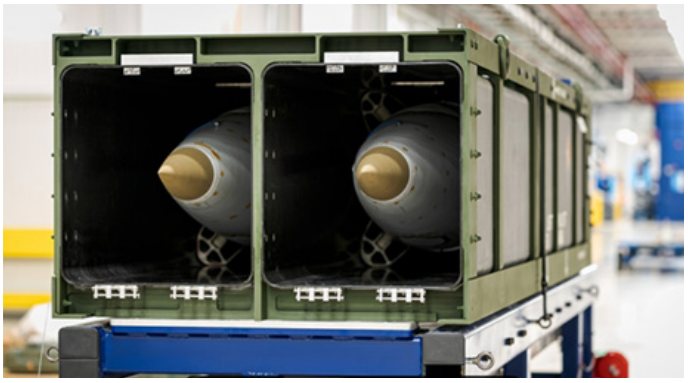
Romania has requested to buy fifty–four (54) M1A2 SEPv3 Abrams Main Battle Tanks; fifty–four (54) M1A1 Structures; four (4) M88A2 HERCULES Combat Recovery Vehicles; four (4) M1110 Joint Assault Bridges; four (4) M1150 Assault Breacher Vehicles; four (4) Heavy Assault Scissor Bridges (HASB); fifty–four (54) M240C 7.62mm machine guns, etc.

Romania for 263 Javelin's

Romania has requested to buy two hundred sixty–three (263) Javelin FGM–148F missiles; and twenty–six (26) Javelin Light Weight Command Launch Units (LWCLU). Also included are enhanced producibility basic skills trainers; missile simulation rounds, etc.

LM delivers 1st PrSM to US Army

Lockheed Martin has delivered the first Precision Strike Missiles (PrSM) to the US Army providing long



range precision fires capability and achieving a major modernisation milestone. Initial deliveries followed a successful production qualification test at White Sands Missile Range, New Mexico in November 2023.

BAE and UK's Future Artillery Programme

BAE Systems, Babcock and Rheinmetall BAE Systems Land (RBSL) are joining forces to offer the ARCHER wheeled mobile artillery system to the UK Ministry of Defence (MoD) as the replacement for the legacy AS90. The ARCHER Artillery Alliance will offer the advanced technology system, which presents the lowest risk solution for the Mobile Fires Platform (MFP) programme, as the UK aims to modernise its 155mm capabilities.

GE Aerospace tests 10 different engines with 100% SAF

GE Aerospace reached a new milestone for a more sustainable future of flight with the completion of testing on its 10th engine model using 100% Sustainable Aviation Fuel (SAF) since 2016, confirming the company

and its joint ventures have one of the most expansive programmes for testing the alternative fuel in the industry.

Saab Double Eagle for Kuwait

Saab has received a contract from the US Navy for a Double Eagle Semi Autonomous Remotely Operated Vehicle (SAROV) for the Kuwait Naval Force. The Double Eagle family of undersea vehicles is an operationally proven ROV system, used by navies around the world supporting mine countermeasure (MCM) missions. In the SAROV configuration the vehicle can be used both as an Autonomous Underwater Vehicle (AUV) for detection, classification and identification, and as an ROV for mine disposal.

Korea for 42 AIM–9X Block II's

Korea has requested to buy forty–two (42) AIM–9X Sidewinder Block II+ Tactical Missiles; ten (10) AIM–9X Sidewinder Captive Air Training Missiles (CATM); five (5) AIM–9X Block II+ Sidewinder Tactical Guidance Units (GU), etc.

Japan for 200 Tomahawk's

Japan has requested to buy up to two hundred (200) Tomahawk Block IV All Up Rounds (AURs) (RGM–109E); up to two hundred (200) Tomahawk Block V AURs (RGM–109E); and fourteen (14) Tactical Tomahawk Weapon Control Systems (TTWCS). Also included is support for the Tomahawk Weapon System (TWS), the All Up Round, the Tactical Tomahawk Weapon Control Systems (TTWCS) and the Mission Distribution Software Suite Centers, etc.

Norway for NASAMS

The Norwegian government has announced investment plans to strengthen air defence in Norway by ordering new NASAMS air defence systems from Kongsberg Defence & Aerospace (KONGSBERG).

Embraer delivers upgraded 5th E–99

Embraer has delivered to the Brazilian Air Force (FAB) its fifth EMB 145 AEW&C aircraft, upgraded and designated as E–99M in the FAB. The aircraft has been updated to perform Airborne Early Warning and Control (AEW&C) functions, as well as participate in intelligence, surveillance, and airborne reconnaissance missions. The

EMB 145 AEW&C is also operated by the air forces of India, Mexico and Greece.

South Korea selects Embraer C–390 Millennium

South Korea's Defence Acquisition Programme Administration (DAPA) has announced Embraer's C–390 Millennium as the winner of the Large Transport Aircraft (LTA) II public tender to provide the Republic of Korea Air Force (ROKAF) with new military transport aircraft. South Korea is the C–390 Millennium's first customer in Asia.

German Navy NH90 Sea Tiger in maiden flight

The first NH90 Sea Tiger took off on schedule for its maiden flight, at Airbus Helicopters' site in Donauwörth, Germany. The German Bundeswehr ordered 31 NH90 Sea Tiger multi–role frigate helicopters for the German Navy's shipborne operations in 2020.

Dassault Falcon 6X enters service

Dassault Aviation's Falcon 6X entered service on 30 November 2023. "Dassault Aviation shares this remarkable occasion with its customers, who are sure to receive an exceptional aircraft," stated Dassault Aviation Chairman and CEO Eric Trappier.

Navantia commissions S–81 Isaac Peral

Navantia has commissioned the S–81 "Isaac Peral" submarine to the Spanish Navy in the Naval Base in Cartagena. The event was presided by the Minister of Defence, Margarita Robles and attended by the Chief of Defence Staff, Admiral general Teodoro Lopez Calderon; the Chief of Staff of the Spanish Navy, Admiral general Antonio Pineiro; along with Navantia's Chairman, Ricardo Domínguez and Navantia's shareholder (SEPI) Chairwoman, Belén Gualda.

Hanwha awarded by Australia for 129 IFVs

Hanwha Aerospace announced that its subsidiary, Hanwha Defence Australia (HDA), has signed a $2.4 billion (USD) contract with the Australian government for the delivery of 129 Redback Infantry Fighting Vehicles (IFVs), including the development and delivery of the training system components and support system components.

Germany for 80 MK 54 torpedoes

Germany has requested to buy up to eighty (80) MK 54 All Up Round Lightweight Torpedoes (LWT). Also included are MK 54 Mod 0 LWT spare parts; Recoverable Exercise Torpedoes (REXTORPs) with containers; handling shapes and containers; torpedo spare parts; tools for mounting and dismounting of Air Launch Accessories (ALAs), etc.

1st F–35A for Belgium

Lockheed Martin presented Belgium's first F–35A Lightning II to the Belgian government during a rollout ceremony at Lockheed Martin's F–35 production facility. "This event marks a significant milestone in the Belgian Air Force's history and strengthens the alliance between the United States and Belgium, a key NATO ally".

Kongsberg NSMs for Spain

The Spanish Navy awarded Kongsberg Defence & Aerospace a contract worth EUR 305 million for delivery of Naval Strike Missiles (NSM). The first ship class to be equipped with NSM is the F–110 class frigate, which is currently under construction by Navantia. The missiles are intended to be deployed on the F–100 frigates during their Mid–Life Update, as well as on future ships.

Japan for 120 AIM–120C–8's

Japan has requested to buy one hundred twenty (120) AIM–120C–8 Advanced Medium–Range Air–to–Air Missiles (AMRAAM); and three (3) AIM–120C–8 guidance sections. Also included are AIM–120 Captive Air Training Missiles (CATM), missile containers, and control section spares, etc.

Greece for 35 UH–60M Black Hawks

Greece has requested to buy thirty–five (35) UH–60M Black Hawk helicopters; eighty (80) T700–GE 701D engines (70 installed, 10 spares); forty–four (44) AN/AAR–57 Common Missile Warning Systems (CMWS) (35 installed, 9 spares), etc.

Japan for 44 AIM–9X Block II Sidewinders

Japan has requested to buy forty–four (44) AIM–9X Sidewinder Block II Tactical Missiles; and twenty–nine (29) AIM–9X Sidewinder Captive Air Training Missiles (CATM), etc.

Italy for 21 M142 HIMARS

Italy has requested to buy twenty–one (21) M142 High Mobility Artillery Rocket Systems (HIMARS); and one (1) M31A2 Guided Multiple Launch Rocket System Unitary (GMLRS–U) High Explosive (HE) Pods with Insensitive Munitions Propulsion System (IMPS), etc.

Prototype ADVEW for the Super Hornet

The United States Navy awarded Raytheon an $80 million contract in a down select to prototype Advanced Electronic Warfare, or ADVEW, for the F/A–18 E/F Super Hornet. This prototype will be considered as a replacement for the existing AN/ALQ–214 integrated defensive electronic countermeasure and AN/ALR–67(V)3 radar warning receiver with a consolidated solution that will deliver superior electronic warfare capabilities to the backbone of the Navy's carrier air wing.

Canada orders MQ–9B SkyGuardians

Canada has signed a contract to purchase a fleet of MQ–9B SkyGuardian Remotely Piloted Aircraft Systems (RPAS) from General Atomics Aeronautical Systems, Inc. (GA–ASI). The order includes the associated Certified Ground Control Stations and support equipment from GA–ASI. The first delivery is expected in 2028.

Saab order for RBS 70 Bolide

Saab has received an order for RBS 70 Bolide missiles from the NATO Support and Procurement Agency (NSPA). The order value amounts to SEK 350 million and deliveries will take place during 2027. The RBS 70 system has an installed base in more than 19 countries, with 1,600 RBS 70 systems and more than 18,000 missiles delivered.

Rubin Design Bureau's Improved Kilo Class submarines

Rubin Design Bureau's Pr. 636 diesel–electric submarine (Improved Kilo) is designed for action against hostile underwater and surface ships, for protection of naval bases, coastal areas; sea communications, reconnaissance and other missions. The submarine has a high reserve of buoyancy and unsinkability. The construction of an Improved Kilo class vessel, including the trials, takes only three years and a team of suppliers has been carefully orchestrated. The boat is fitted with state of the art equipment for reducing self–noise down to natural noise of the ocean. That ensures the early detection of an adversary. The Pr. 636 submarine differs from its foreign counterparts of the same class in terms of exclusively powerful weaponry and the ability to attack land targets.

The Improved Kilo class submarine features advanced onboard systems designed by Russian OEMs in XXI century.

The submarine is equipped with missile system that allow missile salvo attacks against sea and land targets. Capability of target detection are at distances that exceed opponent's capabilities, low noise level. Submarines are fitted with electronic equipment based on components that allow keeping the equipment in operable condition during the entire life cycle of the submarine. Pr. 636 submarines with Club–S System in different versions are in service with the Russian Federation and they have proved their high reliability and performance in the navies of different foreign customers.

Text and photos: Rubin Design Bureau

All photos: Rubin Design Bureau

Updates from Saab

NATO underwater exercises

Saab's underwater systems supported elements of two 'operational experimentation exercises' involving over 2,000 civilian and military personnel from 15 NATO nations, Ireland and Sweden. Saab deployed the AUV62–AT anti–submarine warfare training target, alongside the Remotely Operated Vehicle (ROV), Seaeye Falcon. The Seaeye Falcon was operated from the Portuguese Navy Vessel, Dom Carlos I, while the AUV62–AT was operated from a naval base.

Order for Gripen C/D upgrade

Saab has received an additional order from the Swedish Defence Materiel Administration (FMV) to ensure the continued operation and capability enhancement of Gripen C/D. The order is valued at SEK 579 million. The additional order includes designing new development and simulation environments for Gripen C/D as well as developing new support systems that will facilitate the harmonisation of Gripen C/D and Gripen E for the Swedish customer. The order also includes supplementary orders for equipment and hardware.

Carl–Gustaf order from Japan

Carl–Gustaf is a man portable multirole weapon system that provides high tactical flexibility through its wide range of ammunition types. It is extremely lightweight and has established itself as the main shoulder launched weapon in many countries. It has been in use with the Japan Self Defense Forces since 1979.

Saab receives another Carl–Gustaf order

Saab has received yet another order from an international customer for the man–portable, multi role weapon system Carl–Gustaf. The order value is approximately SEK 1.3 billion and deliveries are planned 2024–2025.

Contract with Korea for Arthur systems

Saab has signed a contract with South Korea's Defence Acquisition Programme Administration regarding support and supply of spare parts for its Arthur weapon locating systems. The order value is approximately SEK 795 million and the contract period is 2023–2028. Saab will carry out the work with its local support team in South Korea, in cooperation with a team in Gothenburg, Sweden for spare parts supply and back office support.

Rosoboronexport at Dubai Airshow 2023

JSC Rosoboronexport (part of Rostec State Corporation) organised the exhibits of the latest Russian made air force, air defence and electronic warfare equipment at the recently concluded Dubai Airshow 2023. As part of the exhibit, located in a single Russian pavilion with a total area of over 750 square meters, Russia's 13 largest defence manufacturers showcased 250+ models of modern weapons and military equipment.

Il–76MD–90AE

"The Dubai Airshow has steadily ranked among the top five largest and most important international aerospace exhibitions. For JSC Rosoboronexport, it is one of the main foreign platforms to promote Russian aircraft and air defence equipment, primarily in the Middle East and North Africa, whose share in the company's order book reaches 50%. Here we have to compete with the global leading arms manufacturers," stated Alexander Mikheev, Director General of JSC Rosoboronexport. "Dubai Airshow is a venue to unveil new products. In 2023, we presented here for the first time the Il–76MD–90A(E) military transport aircraft, the latest air weapons for the fifth generation fighters, including the RVV–MD2 and RVV–BD air to air guided missiles, the Kh–69 cruise missile, as well as the world's best Ka–52 attack helicopter with a line of air weapons, which has proven effective in countering modern armored vehicles in real combat conditions."

The Il–76MD–90A(E) military transport aircraft, located in an outdoor static display area, is multifunctional and has been successfully used for a wide range of missions, including for special and airdrop operations. It can carry up to 60 tons of cargo to a distance of up to 4,000 km, and 20 tons to 8,500 km. The aircraft is equipped with a multi channel electro optical sighting system to determine an airdrop area and control personnel and cargo airdrops, as well as the President–S defensive aids system. Along with the Il–76MD–90A(E), JSC Rosoboronexport showcased various airdrop systems, including the Junker–DG–250 automated cargo delivery system for the first time in the Middle East.

During demo flights, the Ka–52 scout/attack helicopter, recognised by international experts "as the best helicopter in its market segment", showed visitors the elements of piloting available only for a coaxial helicopter: flat turn towards the target, lateral movements at high speeds and deep sideslip with a negative pitch angle.

The Russian Aerospace Forces' Russian Knights aerobatics demonstration team, which arrived at the Dubai Airshow at the invitation of the UAE Ministry of Defence, performed aerobatics on Russian Su–30SM and Su–35S fighters during demo flights.

In the unmanned aerial vehicles segment, JSC Rosoboronexport presented the Orlan–30 unmanned aerial system in the outdoor static display area, and the Orion–E reconnaissance/attack UAV and KUB–E loitering munition in the pavilion.

In the pavilion, visitors to JSC Rosoboronexport's stand could see the Su–57E fifth–generation fighter, Il–78MK–90A tanker aircraft, Su–35 multirole super maneuverable fighter, Mi–28NE attack helicopter and the Mi–171Sh military transport helicopter.

In the air defence segment, the company exhibited a

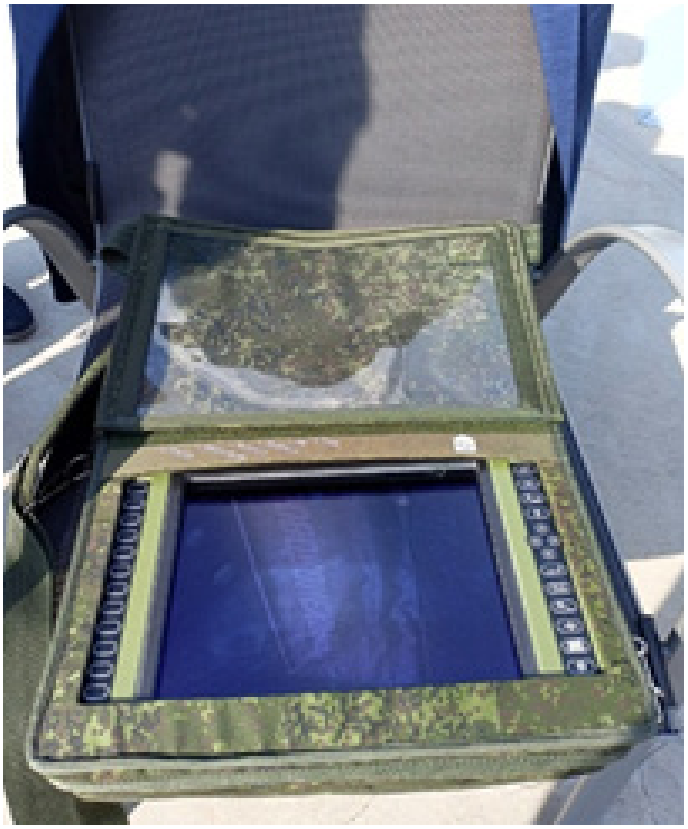
Orlan–30

Ka–52

Repellent–Patrol

wide range of air defence and electronic warfare systems. They can be used both independently and as part of a layered air defence system. The Russian exhibit included the S–400 Triumf and S–350E Vityaz air defence missile systems, the Viking surface to air missile (SAM) system and various versions of the Tor SAM system produced by the Almaz Antey Air and Space Defence Corporation. A line of air defence equipment from the High Precision Systems holding company, incorporated into Rostec State Corporation, was represented by the Pantsir–S1M self–propelled anti–aircraft gun/missile (SPAAGM) system, Igla–S and Verba man–portable air defence missile systems.

S–350E Vityaz



Visitors to the Russian pavilion got acquainted with Russian counter UAV assets, including the RB–504P–E, Repellent Patrol, Argument–2 and Argument–3 systems, as well as the Pole–21E and R–330Zh electronic warfare systems for countering precision guided munitions. Visitors were also presented a Russian automated system used against small UAVs.

As part of the Dubai Airshow 2023, JSC Rosoboronexport showed a new export product developed by the company's specialists in cooperation with relevant experts of the Russian Aerospace Forces – an integrated survival and self defence system for aircrews of aircraft and helicopters who have ejected or found themselves on the ground after an emergency landing. A key element of the new system is a 5.56mm Kalashnikov AK–19 shortened assault rifle, presented abroad for the first time.

All about NGC's B–21 Raider

Benefitting from more than three decades of strike and stealth technology innovation, the B–21 is the next evolution of the US Air Force strategic bomber fleet and the world's first sixth generation aircraft to reach the skies.

When it comes to delivering America's resolve, the Raider will provide the Air Force with long range, high survivability and mission payload flexibility. The B–21 will penetrate the toughest defences for precision strikes anywhere in the world. Here is what you need to know about Northrop Grumman's B–21 Raider as it continues flight test.

Sixth Generation. The B–21 Raider is setting standards for sixth–generation technology. On the outside, next gen stealth and advancements in low observable processes will make the aircraft easier and less costly to maintain than prior systems. Inside, the B–21's open architecture will enable rapid upgradability from inclusion of new weapons to software upgrades thanks to advanced networking capabilities and successful cloud environment migration. With these innovations, the B–21 is designed to meet evolving threats for decades to come.

Partnership Approach. The B–21 Raider programme is reimagining traditional acquisition processes. Through active contract management, Northrop Grumman and the Air Force have worked in a partnership focused on shared success over the long term. The teams' focus on transparency is evident in the industry–first data sharing agreement that provides the end user with access to valuable data, including the B–21 digital twin.

Backbone of the Fleet. The B–21 Raider forms the backbone of the future for US air power. The B–21 will deliver a new era of capability and flexibility through advanced integration of data, sensors and weapons. Capable of delivering both conventional and nuclear payloads, the B–21 will be one of the most effective aircraft in the sky, with the ability to use a broad mix of standoff and direct attack munitions.

Production Focus. A key strategy of the programme was to build a production representative first test aircraft. Rather than a prototype, the B–21 test aircraft is equipped with mission systems and was built by the same manufacturing technicians using the same processes and tooling for production aircraft. The body of knowledge and experience gleaned in the development process supports a smooth transition into production on the path to delivering operational capability.

A Digital Aircraft. Northrop Grumman uses agile software development and digital engineering tools to mitigate production risk and enable modern sustainment practices for the B–21 programme. Ground testing demonstrated the efficacy of digital modeling with results that outperformed industry standards, paving the way for next gen platforms and systems.

Advanced Manufacturing. By embracing the benefits of advanced manufacturing, Northrop Grumman invested in a digital ecosystem for the B–21 throughout the aircraft's lifecycle. From training and augmented reality tools allowing technicians to visualise tasks and solve problems before ever touching the plane, to easing integration of supplier parts on the aircraft, these advancements have reduced risk, supported efficiency and cultivated expertise throughout the manufacturing workforce.

A National Team. Since contract award in 2015, Northrop Grumman has assembled a nationwide team to design, test and build the world's most advanced strike aircraft. The B–21 team includes more than 8,000 personnel from Northrop Grumman, industry partners and the Air Force, with more than 400 suppliers across 40 states. The partnership approach extends to the flight test campaign. Initially stood up in 2019, the B–21 Combined Test Force is comprised of Northrop Grumman and Air Force personnel working together to conduct flight test operations prior to aircraft delivery.

Sustainment at the Forefront. Sustainment was a programme priority throughout the B–21 programme's design phase. In addition to driving efficiency over the long term, this approach yields more near–term benefits and sets the B–21 further along on tech data, materiel readiness and training which will benefit the user community upon fielding.

Global Reach. The B–21 Raider is pivotal to supporting the nation's strategic deterrence strategy. In addition to its advanced long–range precision strike capabilities that will afford Combatant Commanders the ability to hold any target, anywhere in the world at risk, it is designed as the lead component of a larger family of systems that will deliver intelligence, surveillance and reconnaissance, electronic attack and multi–domain networking capabilities. In a dynamic global security environment, the B–21 will provide the flexibility and deterrence critical to the security of the US and allies.

Continuing the Legacy. The B–21 Raider is named in honour of the Doolittle Raid of World War II when 80 airmen, led by Lt. Col. James "Jimmy" Doolittle, and 16 B–25 Mitchell medium bombers set off on a mission that changed the course of the war. The raid was a catalyst to a multitude of future progress in US air superiority and serves as the inspiration behind the Raider name and the pioneering, innovative spirit instilled across the workforce bringing the B–21 to life.

Courtesy: Northrop Grumman Corporation

Right–sizing the Sri Lanka Air Force

All three types of the 1 Flying Training Wing Ce.150, PT–6A and K–8.

Although Sri Lanka is nowadays an island paradise, the country was torn apart during a civil war for multiple decades not too long ago. During that period, the Sri Lanka Air Force (SLAF) had a large budget, and therefor over the years many aircraft and helicopters were acquired. In 2009 the Liberation Tigers of Tamil Elam (LTTE, or Tamil Tigers) were finally defeated and peace prevailed. Obviously a lot of damage had been done over the years, and the economy had to be rebuild. As a side result of this, the following years large cutbacks had to be made by the SLAF, resulting in the withdrawal of several aircraft types (like the MiG–23/27 'Flogger') while

4 Squadron operates 8 Bell 412s that all carry the same serial number outside to confuse potential terrorists when transporting a VIP.

An F–7 is doing an engine run, while on 24/7 standby for air defence.

Beechcraft 200T that has been upgraded for maritime reconnaissance.

Both brand new Y–12 IVs arrive at their platform (photo credit SLAF).

others were placed into storage (like the Mi–24 'Hind'). A new balance had to be sought and the SLAF is currently getting there.

Air Marshal Udeni Rajapaksa, commander of the SLAF since last summer, explains, "At the end of the conflict, the composition of the air force was a bit different. We had a larger number of ground troops than we had technicians and pilots. Now we are trying to get back to the role of an air force. For that, we will change the composition and we will restructure. We will not downsize the air force but we will right–size it. That is currently being done." As a part of this right–sizing, the fleet of active aircraft is slowly expanding again. On the one hand via much needed maintenance, getting aircraft back in the air, and on the other hand by new acquisitions as well.

Airbase China Bay, nicknamed 'the cradle of flight', houses the 1 Flying Training Wing. Pilots–to–be get their first flying experience here. To be able to train more pilots, in 2018 six brand new PT–6A were bought. All have recently been painted in an attractive blue and yellow colour scheme, including the national flag on the belly, and as such they are also flown with the recently erected national demonstration team Blue Eagles.

Also based here is 3 Maritime Squadron, that was resurrected in 2021. Main task is maritime reconnaissance, for which a Beech 200 is being used. Neighbour India also stepped in, and supplied a locally built Dornier Do–228 for free in 2022. This has recently returned to India because of scheduled maintenance and has been replaced by another Do–228 of the Indian Navy. The aircraft is flown and maintained by SLAF crews under the supervision of Indian engineers. This lease is a temporary arrangement, while two Indian built Do–228 are on order. One of those will be a gift from the Indian government while the other one will be paid for by the SLAF.

Next to the Do–228s the squadron will soon receive a large upgrade in the shape of a Beechcraft Be.350 King Air, donated by the Australian Air Force, and a brand new Beechcraft Be.360ER donated by the US government. As part of the gift of their aircraft, the Australian Government will first refurbish it and also provide support for a period of 12 months. The Beech 360ER turboprop will be delivered via a Foreign Military Sales (FMS) contract. As part of this deal, the aircraft will be handed over to the US Army first, where the sensors will be installed before it will be delivered to the SLAF.

Air Marshal Rajapaksa states, "The one that will come from the US will have a Highly Integrated Surveillance and Reconnaissance System or HISAR, it will have equipment on board for long time surveillance. Conversion will be easy for us, as we already have the Beech 200 which is quite similar, so it is easy for us to acquire the technical knowhow. After delivery the current Beech 200 will be used for training and VIP flights."

No less than 14 Mi–171s were acquired to give the helicopter fleet a boost.

The Australian Be.350 is expected early 2024, while the Be.360ER is probably ready in 2025. Both the Do–228 and the King Airs will be used to conduct maritime and coastal surveillance operations within the Exclusive Economic Zone (EEZ), aimed at drug and human trafficking, but also perform Search and Rescue operations (SAR), Casualty Evacuation (CASEVAC) and Maritime Pollution Monitoring and Control.

Responsible for training helicopter pilots is 7 squadron at Hingurakgoda, who have both the Bell 206 JetRanger and Bell 212 Twin Huey in the inventory. With no less than three JetRangers being heavily damaged or written off during training over the last few years, the acquisition of an additional B.206 was very useful for the unit. This second hand JetRanger III was found in the USA and was added to the fleet in 2022. The intention is to get up to three more, probably from the civilian market as well.

The transport fleet has also received a boost. Three out of four remaining An–32 'Cline' heavy transport aircraft of Katunayake based 2 squadron have received a major overhaul in Kiev in 2021/2022. Luckily they had just returned to Sri Lanka before hostilities broke out in the Ukraine. The units two C–130 Hercules are stored while waiting for overhaul. Furthermore two brand new Y–12 IV Short Take Off and Landing (STOL) light transport aircraft were delivered in December 2023, supplementing a fleet of another eight Y–12 serving with 8 squadron at Ratmalana. This particular model incorporates extended wing tips and an increased takeoff weight, enhancing its performance capabilities. The Panda, as it is called, will not

One of the Kfirs of 10 squadron basking in the sun, before they were stored. 5 of them are currently being overhauled.

only be used for military transport duties, but also support tourism promotion. The new aircraft have a capacity for 15 passengers. Commander Rajapaksa highlighted the ability of the Y–12 IVs to land on 90% of Sri Lanka's runways, making them ideal for promoting tourism in remote and picturesque locations.

The fleet of Kfir multi–role combat aircraft has been grounded some years ago, but five of them are being overhauled to get them back in the air. Currently 5 squadron, based at Ratmalana, is guarding the Sri Lankan skies with their F–7, performing Air Defence duties 24/7. The Kfir pilots from 10 squadron also fly the F–7 to keep

One of the new batch of PT–6A's takes off for a training flight.

current. Work on the Kfir also includes a large upgrade. The deal with Israel Aerospace Industries (IAI) includes replacing the aircraft's basic avionics with the advanced 4+ generation fighter aircraft avionics in order to one day integrate advanced radar, sensors, communication systems and new helmets. Air Marshal Rajapaksa sats, "Due to the economic downfall and Covid there were some delays, but we are catching up and there are only some 6 months delay in the whole process now." Early 2024 the first refurbished Kfir is expected to fly again. The upgrade process will also include transfer of knowledge and skills for refurbishment to Sri Lankan Air Force personnel. The upgrades will be completed in cooperation with Sri Lanka's Air Force and in their local facilities. "Overhauling the Kfir is not done by the SLAF alone, that we do with IAI. We do it here, so our technicians can get involved in the process. They do it, together with us." It will give the existing Kfir fleet another 15–year life cycle.

The SLAF has also entered the UAV era. They already use multiple hand held drones and also the Searcher Mk.II UAV, but a new indigenous UAV is currently being developed. Air Marshal Rajapaksa elaborates, "We have a project that has been there for over 15 years and we want to further develop that. It is called Lihiniya, named after a local bird. It is built by the Research and Development Unit of the SLAF." At the moment there are two flying

One of the recently overhauled An–32s taxiing back to its platform in the pouring rain.

One of the Y–12s is awaiting its turn for overhaul at the Aircraft Engineering Wing, with three decommissioned MiG–27s in the background awaiting their fate.

The newest addition to 7 squadron hovering in front of their hangar and one of their Bell 212s.

This Bell 206 JetRanger III has recently been added to the fleet of training helicopters.

This Mi–17V–5 still shows the white colours and titles from when it served with the United Nations in Africa.

prototypes. "We have about 20 km range, but we want to increase that to 150 km. If it works well, we will invite somebody to invest. We have the technical capacity right now, we need the capital investment." He continues, "We are not looking for an armed version. The purpose is for survey, for weather information and handling traffic. And also to face the threats of drugs, human smuggling and pirating. We can counter those with the use of UAVs. The UAV is a good platform, because it means less costs and less risks." Commander Rajapaksa is very clear on the motivation for developing a UAV instead of buying an existing type: "The Sri Lanka Air Force does not believe in purchasing things anymore. We want a technological transfer. We want to develop, with the support of somebody, so that we can consolidate our strong capacity for the future. Otherwise we purchase something and maybe after six months they say 'sorry sir, we can't support your software, or your hardware, because we don't produce that anymore, you have to purchase the next generation instead'. The other thing is, if you develop it yourself, even with the support of somebody else, it is more customised. Otherwise if we purchase something, it is always produced for some other country."

And looking further to the future, Commander Rajapaksa continues, "The other sector I am very much keen to invest in and expand are the UN missions. We already have one UN mission in Central Africa where we have three Mi–171 helicopters and some 120 people. We are fighting there for peace. And apart from that this is a good platform for our pilots and technicians to gain experience. For this we don't have enough aircraft and helicopters. So we try to get those helicopters serviceable as soon as possible. And for this we are looking for an investor." 62 Flight of the SLAF is involved in the UN mission in the Central African Republic, called MINUSCA, since 2014. The involvement in the mission in South Sudan (UNMISS) ran from 2015 but has ended in 2021. These missions are an important way of generating money for the SLAF, next to the commercial charter flights mainly with tourists.

Further development of the Aircraft Overhaul Wing at Katunayake is another way of investing in the future. Commander Rajapaksa explains, "There we undertake a lot of repairs and major overhaul of PT–6, Y–12, K–8, F–7, Bell 206, Bell 212, Bell 412." A Chinese contingent of technicians helps with the Chinese types.

"We do complete overhauls with them. So we try to develop our capabilities, through that we can reduce the foreign input." Last year for example three K–8 trainers went through an aircraft life extension programme and one Y–12 has been converted into an air ambulance. Also a Bell 212 that was written of in 2007 is currently being rebuild.

Commander Rajapaksa concludes, "We have very good facilities, so if somebody wants to work with us…"

Text and photographs by Patrick Dirksen & Frank Mink of Tristar Aviation

Baltic return of the Cigognes

Since the war between Russia and the Ukraine started tension along the European borders has grown. Therefore NATO had to scale up as a protective organisation of the Allied grounds. The organisation is nowadays much bigger than the Initial Baltic Air Policing mission which started in 2004 when the three Baltic States (Estonia, Latvia and Lithuania) became members of NATO. The current Baltic Air Policing detachment at Siauliai is led by the Italian Air Force and will be taken over by the Belgian and French Air Force. Colonel Pierre Gaudilliere is a spokesperson for the French Defense and is a former fighter pilot in the French Air Force. The Baltic Air Policing (BAP) is executed by the lead nation at Siauliai and is constantly present since 2004, and is currently handed over from Italy to Belgium. The Enhanced Air Policing (eAP) for the northern region is executed by the supporting nation at Siauliai, which is currently taken over by France.

Colonel Pierre Gaudilliere states, "I will clarify what the lead nation (BAP) and supporting nation (eAP) are here at Siauliai Air Base. Here at Siauliai there is space for both the lead and support nation. The lead nation here at Siauliai is using the hangars and squadron building close to the head of the runway. The supporting nation is located halfway the runway in a complex next to the control tower

of Siauliai. Currently a lot of our people are preparing this area for their upcoming deployment as a supporting nation. Our Mirage 2000–5F unit is well prepared to take over this mission from the Italians. The 2e Escadre de Chasse (2nd Fighter Squadron) also nicknamed as the 'Cigognes' (Stokes) are in France tasked with the same air defence mission. The Belgians will take over the lead nations role (BAP) here at the airbase. Our Mirages arrived here today under the guidance of an Airbus A330 MRTT Phenix

tanker of the French Air Force. During this flight, we also supported the Finnish Air Force by refueling them during their Air Shielding training. This shows immediately how flexible the units in NATO are".

The Italian Baltic Air Policing Detachment

The Italian detachment is led by Colonel Federico Sacco Maino who is also a very experienced F2000 Typhoon pilot. The Colonel started his career as an F–104 Starfighter pilot in 2011 and flew from 2004 the F–16 Fighting Falcon. Since 2008 he has flown the F2000 Typhoon and since 2017 he is also an instructor in the Italian Air Force. He is by flying these types mainly an air defence specialist as he says, but since his period on the Typhoon he is also experienced in the swing role. The Colonel continues his explanation with a brief history of the Italian Air Force in the region; "We are here in the Baltics mainly present to handle air to air systems and to fly air defence sorties. The Baltic Air Policing has been active since 2004, and since 2015 we as Italian Air Force conducted our first mission here. Currently we are here for our fifth tour in the Baltic area and it is the second time after 2021 that we brought fifth generation fighters for the deployment by bringing the F–35 to Malbork currently". The Colonel said that this tour was a busy deployment as the Italians are the only unit currently at Siauliai. Italy was the only nation at Siauliai for the last 120 days and therefore executing both the BAP and eAP missions; "In the last part of 2023 we had to take care of the entire mission and operation for 120 days as a single nation. That is pretty a busy job, because we took just four aircraft from Italy as planned. We were here with just a few pilots, namely less than 10, and we stayed hot for 120 days executing a lot of activities". The mission for the Italian Air Force was built up in two major tasks according to Colonel Federico, "The vision for the BAP mission and for Italy itself is to assure a common security model for NATO airspace. Our mission is to contribute to the air defense and integrity of NATO airspace obviously in the framework of the BAP Mission. Our main objective here is to maintain a full air policing capability in our time frame starting from 1 August to 30 November 2023".

Real Scrambles

The Colonel is very clear about the Italian QRA activation. The Italians were the only task force in this period on active duty at Siauliai. The Italians had in this period the biggest number of QRA activation. In total, the Italians had 35 Alpha Scrambles during their 120 days deployment where they intercepted a total amount of 60 Russian aircraft. Also the Spanish team in Ämari had a busy

period as they had a total of 22 Alpha Scrambles. “This is probably the biggest number of intercepts that I know at this place”.

The Belgian Baltic Air Policing Detachment

It was the Belgian F–16 fighters, which almost 20 years ago started the seamless sequence of Allied fighter deployments that have since ensured the territorial integrity of the Baltic Allied airspace. Hours after the signature of the accession of Estonia, Latvia and Lithuania to the NATO Alliance, Belgian F–16s flew into Siauliai Air Base beginning the NATO Baltic Air Policing mission safeguarding the airspace in the region. Now many years later, the Belgians are returning again for the mission. Belgium will take over the Baltic Air Policing mission from the Italian detachment as the lead nation at Siauliai Air Base. The Belgian detachment at Siauliai is led by Commander Petitjean Renaud of the 350 Squadron from Florennes Air Base. The Commander has more than 2000 flight hours of experience on the F–16 Fighting Falcon. He has the qualifications of force leader and tactical instructor at the 350 Squadron. The Belgian detachment consists of four F–16 Fighting Falcon fighters. In total an amount of 80 employees will be detached in Lithuania. The detachment will consist of five fighter pilots and 75 ground crew members like technicians, crew chiefs, fire brigade employees, safety personnel and planning personnel. The Belgians will have a rotation of personnel half way through the detachment according to Renaud, “The detachment of the 350 Squadron from Florennes will do the first two months of the detachment. After that a detachment from Kleine–Brogel Air Base will do the last two months of the Belgian presence”.

According to the Commander everything went very well with respect to the preparations for this deployment, “All preparations were good, because our people are usually specialists who always remain ready to be deployed. Our pilots of the 350 Squadron trained in an international environment during the Dutch exercise Frisian Flag. It’s really important to participate in such big exercises, because we need to practice our tactics on a large scale. Collaborating with other air forces such as France or Poland for example has therefore become easier for our pilots”.

The French Enhanced Air Policing Detachment

The French Air and Space Force has been a regular contributor to the rotating BAP and eAP missions since their inception and is currently conducting a further turn of quick reaction duty in Lithuania, beginning on 1 December 2023. The current French rotation is succeeding the Italian detachment and will stay for a period of approximately 4 months in the role of enhanced Air Policing (eAP). The French Mirage 2000 detachment at Siauliai is led by Lieutenant Colonel Georges Abihanna. He is a very experienced Mirage 2000–5F pilot in the French Air Force and is the commander of 2e Escadre de Chasse at BA116

Luxeuil Saint–Sauveur in France. Abihanna gives a brief overview of the French detachment at Siauliai, “It is the French mission to bring four jets for the NATO air policing over here to Lithuania. We are currently here with almost 100 airmen and four Jets and we are working here with the Belgian detachment during the entire air policing mission”.

Major Sid is one of the Mirage 2000 pilots who flew along in the formation from France to Lithuania. He is based at Luxeuil Air Base in France and is assigned to Escadron de Chasse 2 (2nd Fighter Squadron) on that base. Sid gives a small sum up of his mission in the Baltics, “I’m a four ship leader on the Mirage 2000. I’m a flight Commander as well and I have the rank of major. In total, I have 1100 hours of flight time on jets. I have been flying for more than 6 years in the French Air Force. In total, we will stay for a total length of four months during our deployment as squadrons, but as pilots we stay between one to two months. For the second half, we will be relieved by our colleagues who will take over the second half of the mission”. Sid explained his experiences during the flight with the French A330 tanker, “So today we took off from Luxeuil Air Base in order to deploy here in Siauliai in Lithuania. We are here for an air policing Mission as part of the NATO mission to secure this area. The goal is to be ready for the mission on 30 November”.

NATO E–3 deployment to Lithuania

NATO will temporarily deploy Airborne Warning and Control System (AWACS) surveillance planes to Ssiauliai, Lithuania. The two aircraft arrived in September 2023 and the E–3s will fly missions to monitor Russian military activity near the Alliance’s borders.

“Russia’s war of aggression against Ukraine has increased our focus on the security environment in the Baltic Sea region,” stated acting NATO Spokesperson Dylan White. “Our AWACS can detect aircraft and missiles hundreds of kilometers away, making them a key early warning capability for NATO. I thank Lithuania for hosting the aircraft. This is an important contribution to our shared security,” Mr. White added.

Text and photos: Alex van Noije & Joris van Boven

NATO Lightning strikes
F–35 operators integrate further in Dutch exercise

Photo: Finnish Defence Forces

Last year saw, almost as usual, a new edition of the annual NATO exercise Frisian Flag (FF). Normally the large scale multinational exercise is running in spring time, however in 2023 an exception had to be made to change it into an autumn edition. The reason for this switch could be found in a base closure of Leeuwarden from spring to late August, as both runways were scheduled to receive a complete new surface. According planning the F–35's of 322 squadron returned to their home base from Volkel Air Base, where they were detached during the closure, by the end of August.

Although all the operational flight activities at Leeuwarden were reduced to zero during the construction work, the preparations for the exercise were in full swing as Major Marcel van den Burg, Frisian Flag Project Officer, explained. According the FF project script, the first preparations for the exercise do start almost a year ahead and in that term the complete plan cycle with all their different deadlines is executed. Therefore it was no surprise that Lt Col Johan "Cake" van Deventer, Dutch Air Combat Command Commander, could welcome all arriving Frisian Flag participants as scheduled. The week prior the exercise, which started on 2 October, German Eurofighters, Belgian F–16's, USAFE F–35's and F/A–18's from new NATO member Finland touched down at the new paved runway and joined the resident F–35's from 322 squadron. Lt Col van Deventer added further that RAF F–35's would conduct their FF missions from HMS Queen Elizabeth, sailing at the North Sea, while Danish and Dutch F–16's would join daily from their home bases. The Dutch fighters, which operate under their readiness motto "fight tonight, fight tomorrow, fight together" were completed with several F–35's of Volkel 313 squadron, the squadron which is currently in transition to the 5th generation platform. Additional aircraft support for FF came from a variety of tanker aircraft for aerial refuelling, "slow mover" C–130's from Norway and The Netherlands, as well as several helicopters.

One cannot neglect the growing importance of the F–35 in NATO, as several members are well underway implementing the "Lightning II" in their flight operations, while others are preparing for initial deliveries or in a selection process of a new fighter with the F–35 on the short list. This tendency is clearly visible at Frisian Flag 2023 with a robust number of participating F–35's representing the US, the United Kingdom and The Netherlands.

Grim Reaper

We talk further with USAFE Detachment Commander for Frisian Flag, F–35 pilot Lt Col Greg Schroeder. Lt Col Schroeder, callsign "Voodoo" is the Operations Officer of 493rd Fighter Squadron "Grim Reapers" based at RAF Lakenheath, UK, the squadron which is currently in transit to the F–35A. "It is great to be in round 2" as Lt Col Schroeder recalls his 2nd time participating in Frisian Flag. In 2012 he joined also with 493 FS from RAF Lakenheath the exercise but than flying the F–15C "Eagle". After assignments in Japan and the US on the F–15C, he transitioned to the F–35A and now again returning to RAF Lakenheath. "For us it has always been a highlight to participate in FF as the Dutch offer a fantastic airspace over the North Sea, providing enhanced training with all mission scenarios", as Lt Col Schroeder declares. "In 2012 with the F–15C we all had the air–air focus as that was the Eagle C model been built for. Now that we fly the F–35 we expanded the missions we are executing to include air–ground, air–air and that makes it a more dynamic and interoperable platform. The world has become more complex and the threats we face are more complex. At the other hand also our 5th gen capabilities have expanded so that we can enhance our interoperability capabilities together with the Dutch and RAF F–35 partners that are here together. Additionally we can also integrating further with the Hornets and Eurofighters as there is more that we can do for them and more different things that they can do for us" as pilot Greg explains.

USAFE Detachment Commander for Frisian Flag, F–35 pilot Lt Col Greg Schroeder.

"At FF we are with about 10 pilots and I want them to learn more about the airframes that are here and learn more about their tactics, how they train, how they operate. I want us to be more interoperable and to learn of the tactic mistakes we make and do not make them again in combat. I also want to establish that the pilots need to know the Finnish and Dutch pilots and to understand the way they are doing their business, but also form

relationships and connections they can draw on for future exercises to help us to work more effectively together. Last FF goal for us, is building tactics together, cause when we are in the mission planning room I want the pilots to optimise the way we conduct air operations to be as lethal as possible. That requires a discussion and understanding of the different platforms and the different tactics to choose and to build and shape them to meet the mission objectives" as Lt Col Schroeder continues. "In FF we fly 'Defensive Counter Air' (DCA) and 'Offensive Counter Air' (OCA) missions. In DCA we see scenarios where red forces attack a country and hit several targets within our NATO border. Our focus is than purely air–air: we want to knock down whatever they are sending in our way. Therefore we built multi discipline forces with interoperable tactics to maximise our strengths. For example with our F–35 we can maximise the weapon capabilities of platforms like the F/A–18, Eurofighter and F–16 and balance those to get the most combat capable option to prevent the red forces intentions. OCA is different as we are now looking to move into a threatening country taking out their surface–air missiles. If they have fighter aircraft airborne we want at least to push them back out of our way, so we can get our strike aircraft to the target to accomplish our mission".

The mix of flying 4th and 5th generation aircraft in FF remains of high interest for Lt Col Schroeder and his colleagues. "Our F–35 advanced technology brings significant advantages, but I want the F–16's, Eurofighters and FA–18's to be there, because they bring the capability that is very helpful in accomplishing the mission goals. As a former 4th generation platform pilot I recognise from both generation types of aircraft the strengths and weaknesses and that is also the reason that I like to put them together in the same piece of sky to train together so that we can help to mitigate the weaknesses of other platforms and they mitigate our weaknesses" as Lt Col Schroeder concludes.

New in NATO

Finland has always been a regular FF contributor throughout the years, however this time significantly different as, since a half a year, being a full NATO member. As Finland also selected the F–35 to replace its current fleet of F/A–18 in a few years, it was interesting to meet the Finnish detachment commander at Frisian

Flag, Lt Col Juuso Ilkka, who is the commander officer of the Air Combat Centre (ACC), based at Tampere. Lt Col Ilkka explains that the ACC is a squadron of test pilots, responsible for Developmental Test & Evaluation (DT&E) and Operational Test & Evaluation (OT&E) projects. Further unit assignments include the setting of Tactics, Techniques and Procedures (TTP's), research & development, modelling & simulation and do analysis for the Finnish Air Chief. "The ACC is no large front line squadron which has its focus at training and operational readiness. In contrary, the ACC is a smaller unit with more experienced pilots and only several aircraft in the inventory to fulfil the requirements and projects as set by the Air Force Command Finland (AFCOMFIN) and often in support for the operational squadrons. For example, our pilots do all the TTP's for Hornet squadron's 31 at Rissala and 11 at Rovaniemi. Another running ACC project is on behalf of the F–35 programme we are in, being responsible for the integration of operations of the new 5th gen F–35 platform together with our 4th gen Hornet as well as the development of a new F–35 simulator", as Lt Col Ilkka explains.

Finnish detachment commander at Frisian Flag, Lt Col Juuso Ilkka.

"For FF our Air Chief wanted us to test our minimum footprint, which makes our detachment approximately 25 persons in total. That includes pilots, technicians, security, Comm's, flight gear and mission support. This aim is to actually check when we are deployed with 2 jets, for example for the Vilnius summit, what would be the good nr of people we would have to send. This under the condition that we receive Host Nation Support (HNS) like here at Leeuwarden and that we don't have to bring in all the equipment. For our required personnel, we want to approach it in the same way as the USAF, by having multi capable airman. Example is that a technician makes sure that the pilots' flight gear is okay early in the morning, then he goes to the flight line to launch and recover the aircraft and then in the afternoon he might do some ComSec stuff. Here at Leeuwarden we have only 2 technicians per jet, so they are capable from "nose to tail", even to change an engine or tyre, or do whatever the jet requires. Our other goal is to enhance more knowledge and experience in how we actually integrate fighter operations and make the F/A–18 airborne together with the F–35. This is something we will have during an approximate 5 years period from 2026 to 2030 and here at Leeuwarden it is great to have the opportunity to gain experience on that. The F/A–18 pilots we took to FF are all in the F–35 programme and here we all can go to the F–35 building and discuss all kind of subjects with the Dutch and Americans to share insight's back and forth. This is a big thing for us; what is the optimum way for the Hornets to work with the F–35" as Lt Col Ilkka declares.

"We are here with 8 pilots for 2 jets and 1 jet in spare. Roughly everyone flies every 1,5 days and in meantime you'll be at the F–35 building or have other duties like ops officer. Due to our priority to focus at the future integration of F–18 and F–35 operations, we are not taking the opportunity to have a FF Mission Commander assignment, however we assume other mission roles, for example a DCA or OCA team lead. The responsibility of a Mission Commander, a daily rotating role where you have to plan and prepare a mission is very comprehensive and would take too much capacity of our small detachment that it cannot be combined with our goal on focus of integration between 4th and 5th generation platforms. It was a specific desire to participate in Frisian Flag due to the presence of the F–35 and the close interaction with all participants during mission planning and de–briefs. This exercise was considered to bring more added value for this process we are in, than for example the Air Defender and Arctic Challenge exercises would do, were operations took place from multiple bases and de–briefs were executed remote and online. Frisian Flag is normally a great exercise for pilots to gain experience in large missions or new wing leads of multinational aircraft formations, however this

time our focus on integration is over pilot training" as Lt Col Ilkka explains.

He continues: "now that we are new in NATO, we try to figure out what would be the best exercises for us in Europe and US. As a consequence, by acting more internationally within NATO, it will likely reduce somehow our presence in national exercises and therefore we have to find a new balance between both". Lt Col Ilkka believes that Frisian Flag is, with their assured F–35 participation, one of the future exercises which will remain of interest of the Finnish AF in the years to come. "We have already a longer traditions coming here as Frisian Flag participant and I do not see reason why not in the future".

Being in the F–35 family and also as a NATO member feels for Lt Col Ilkka almost as a gamechanger, when asked for the difference before April 2023 (no NATO). "With only a small Hornet community in Europe it is less easy to find your way comparing to how (for example) the multi nation F–16 users does experience. Therefore it is now great to step into the NATO community and the F–35 family, as many things appear to come together and opening new doors, new opportunities. There are also improvements noticeable on information sharing, back and forth with NATO. So yes, there are differences, but we are that new that we are still in the phase where there is more focus on political and strategic finetuning. At squadron level the differences are not yet that big. What we see is that more visitors now train in Finland and we are also more participating in Europe" as Lt Col Ilkka explains.

"In previous Frisian Flag exercises our missions concentrated on Defensive Counter Air (DCA), as we were used to as a PFP country and considered ourselves as first in line when it would come to crisis and should take care of national defence accordingly. But now with the F/A–18 MLU 2 with its wider weapon selection range we fly in all types of Red– and Blue Air missions, DCA or OCA. During

Frisian Flag we also participate in Personal Recovery (PR) scenarios, so in basic there is no limitation in mission types for the more experienced ACC pilots and that is also because the fact that we don't train anybody here in this year's edition of Frisian Flag" as Lt Col Ilkka concludes. In 2024 no Frisian Flag exercise is scheduled, however a comprehensive and intensive Fighter Weapon Instructors Course (FWIC) will be running at Leeuwarden for several months. It appeared that available weeks for a FF exercise were showing already other European exercises on the agenda, which made the Dutch air force decide to plan again a new edition for 2025.

Text and photos by Peter ten Berg

Athens Flying Week

Phantom departing for its role demo and fighter formation flight.

The Athens Flying Week air show is organised annually at Greek Air Force Base Tanagra. The organisers offer paid access to the base in the days prior to the air show weekend to capture arrivals and rehearsals. The same applies to witness the departures for the participants. The first AFW was organised in 2012. Only in 2020, due to the worldwide corona pandemic, the show was cancelled.

Tanagra Air Base

Tanagra Air Base, located roughly 80 km North of Athens, is home to the 114th Combat Wing (114 PM). Two squadrons are assigned to the wing. 331 All Weather Squadron equipped with the Mirage 2000–5BG/EG and 332 AWS operating the Rafale DG/EG. The Air Base also accommodates Hellenic Aerospace Industry (HAI) with its facilities located in the Southeast. HAI supports aircraft and helicopters of all Greek armed forces as well as international C–130 and F–16 programmes.

Greece's aviation modernisation

The Greek armed forces are in the process of modernising their equipment. The Air Force currently operated a fleet of F–4E AUP Phantom II, F–16C/D block 30/50/52/52+ Fighting Falcon, Mirage 2000–5BG/EG and Rafale DG/EG fighters. Greece purchased 56 F–4E's of which 24 were upgraded to the AUP (Avionics Upgrade Package) variant and these are all assigned to 338 MDV, 117 PM. These will be replaced by 20 F–35A Lightning II aircraft, expected to be received from 2028. The Greek Air Force is in the process of converting 84 F–16's to block 72 standard, more commonly known as F–16V. Its block 30 aircraft will be withdrawn form service. In total 24 Rafales were bought, 12 former French Air and Space Force aircraft and 12, consisting of two orders of six aircraft, directly from Dassault. Of these, 19 have been delivered including all former French AF aircraft. These are assigned to 332 AWS with their sisters of 331 AWS operating the remaining Mirage 2000s in service. The Greek Navy has seven MH–60R on order, having 11 S–70B in its inventory. On 15 December 2023, the Defence Security Cooperation Agency notified US Congress they approved the purchase of 35 UH–60M Blackhawks for the Greek Army. These will replace the remaining operational AB205 and UH–1H helicopters. Turning back to the Air Force its T–2C/E Buckeye trainers are in the final days of service. Exact numbers are unknown but only a handful remain operational. Its successor the M346, is being delivered by Leonardo who will deliver 10 aircraft.

Participating at the static display along its predecessor was one of the then two delivered M–346s.

Rafale GR 419 RafaleEG 332MPK 2023–09–01 Tanagra 4H7A5156.

By the end of 2023 four have been delivered to the 120 Air Training Wing at Kalamáta Air Base. 120 ATW also operates 45 T–6A trainers.

Note: The Phantom numbers do not include F–4E's and RF–4e's purchased from the United States and German Air Forces which have all been withdrawn from service.

The Air Show

On the Saturday and Sunday, the public could view the flying display and two static displays. One presented the Greek Army displaying an UH–1H Huey, CH–47D Chinook, OH–58D Kiowa Warrior and AH–64DHA Apache. The other presented fighter and training aircraft from the Austrian (PC–7), Greek (Mirage 2000, Rafale, M–346, T–2C), Germany (Tornado) and USAFE&AFA (F–35A) air

T–2 GR 158910 T–2C 362–363MEA 120PEA 2023–09–04 Tanagra 4H7A6077.

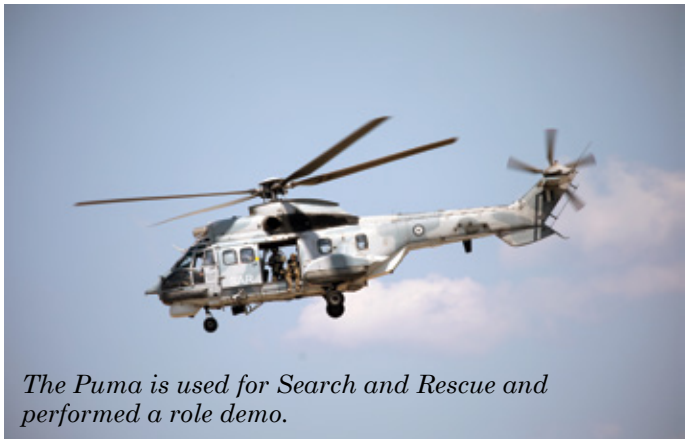
Support of the Saudi AF delegation in departure day was one the two KC–130Js in service.

The 388th FW F35A demo team arrived from Hill AFB for three European air shows starting at Tanagra.

The Greek Army operates a mix of AH–64AD Apaches. AH–64A+ ES1001 during its rehearsal flight.

forces. The demo and solo displays teams were parked on several ramps. These taxi in front of the crowd line before their take–off or after finishing their display depending in their parking positions.

On Friday most of the Greek Army helicopters arrived and the ones being part of the flying programme rehearsed their show. During the day a Rafale EG was delivered from France. A nice surprise was the participation of a T–41D Mescalero. These were reported to be withdrawn from service by the end of 2022. The trainer with anniversary markings applied flew together with its successor the Tecnam P2002 Sierra from their home base Dekelia – Tatoi. Other flying display participants flying from their home base was the sole Navy S–70B participant, Army CH–47 Chinook, NH90, and Air Force AS332 Puma.



The Puma is used for Search and Rescue and performed a role demo.

The Mirage 2000 is also in the twilight of its career within the HAF. A dual seat Mirage 2000 taxies in front of the crowd line back to its shelter.

During the Friday and both show days a formation fly past took place. From Tanagra one Rafale, two Mirage 2000 and two Phantoms took off. The later performed a role demo and then departed to a holding area. The first formation consisted of an EMB145H AEW&C with a Rafale on its right and F–16 (out of Nea Anchialos AB) on its right wing. The second formation saw a C–130H Hercules escorted by both Mirage 2000s. Both the "AWACS" and Hercules flew from their home base Elefsis. After the fly past all fighters joined into one formation splitting up over the base. On the Sunday both Phantoms did not land at Tanagra but returned to Andravida AB. Three F–16's displays were flown, the Belgian and Danish teams and of course Greek AF "Zeus".

The Saudi Arabian AF is a regular visitor at AFW. This year the Saudi Hawks and the Typhoon display team participated.

Saudi Arabia send its Saudi Hawk team as well as two Typhoon F.2s one being the special marked aircraft. It was placed on static display on the Saturday but swopped with its colleague on Sunday to participate in the flying programme. Another participant from the Middle East was United Arab Emirates Air Force Al Fursan (MB–339). The Rafale display was flown by the French Air and Space Force ETR03.004. The USAF F–35A demo team (388th FW, Hill AFB, Utah) travelled to Europe to display at three air shows. AFW was the first to host the team who borrowed three Lightnings from the 48th FW, RAF Lakenheath, UK.

Athens Flying week will return to Tanagra in the weekend of 14–15 September 2024.

Text and photos: Manolito Jaarsma
(Instagram: Phantomaviation Twitter: @Phantomaviation)

Esquadrilha de Helicopteros da Marinha, Portuguese Naval Aviation

Always Ready, Any Time, Anywhere

History

The Portuguese Naval Aviation constituted the Air component of the Portuguese Navy, from 1917 till 1952. The Portuguese Air Force maritime patrol squadrons and the Navy's helicopter squadron (EHM, Esquadrilha de Helicopteros da Marina) are the present successors of the former Portuguese Naval Aviation. Although generically referred as "Naval Aviation" the air component of the Navy was officially successively designated "Navy Air Service" (1917), "Naval Aeronautical Service" (1918–1936) and "Navy Air Forces" (1936–1952). In 1958 The Navy Air Forces, which were already part of the Air Force although still under the Navy's operational control and operated by naval personnel, were disbanded and its assets were fully integrated in the Portuguese Air Force.

This all changed in the early 1990s when the Esquadrilha de Helicopteros da Marina was created as part of the Navy's acquisition programme of the new 'Vasco da Gama' class frigates which included a helicopter as an anti–submarine warfare system. After evaluation of the Kaman SH–2 Seasprite and Westland Lynx, the Westland Lynx was chosen as the most suitable candidate and the order was placed with Westland Helicopters (now Leonardo Helicopters) for 5 Super Lynx helicopters in 1990, for operation from the new Portuguese Navy frigates which were under construction at that time. During June 1992 the Naval Air arm was formally established and Portuguese pilots and maintenance engineers were trained by Westland Helicopters and the Royal Navy in Great Britain. The EHM, Naval Helicopter squadron was officially formed during September 1993 at Base Aérea 6 (BA6) Montijo Airbase. The EHM consists of 130 personnel and operates independently without Air Force personnel and has its own facilities at Montijo Airbase. The squadron is led by Commander Hugo Miguel Baptista. He has been in charge of the squadron since mid July 2021.

Between February and July 1995 the first embarked helicopter deployment took place on the Frigate NRP F330 Vasco da Gama. This deployment was dedicated to Operation 'Sharp Guard`. With this first embarked

helicopter deployment a new era started for the Portuguese Navy. Until today, the EHM has provided no less than 27 embarked Flight deployments and has been active in 52 countries with a variety of missions for the UN, EU, NATO and Portugal. The Squadron recently reached the number of 24,000 flight hours with '0' incidents which can be called an exceptional achievement, something the squadron can be very proud of.

Pilot training

After the Naval Air arm was formally established, it was decided to use the Air Forces training construction. This to reduce cost and improve the overall unit performance. Navy officers are selected from the Naval Academy, after that they start their theory course at the Military and Technical Training Center in Ota. After that, they will start to undergo flight training at Beja Airbase (BA11) on the Aerospatiale TB–30 Epsilon with 101 Squadron, in the past this course took place at Sintra Airbase (BA1) but some years back 101 Squadron relocated from Sintra Airbase to Beja Airbase. After finishing their flight training on the TB–30 they will move on to 552 squadron were they will conduct further flight training on the AW–119 Koala. Most Navy pilots have learned to fly helicopters in the Alouette 3. After years of loyal service, the Alouette 3 was retired from active service with the Portuguese Air Force and replaced with the new AW–119 Koala, selected officers from the Navy therefore learn to fly helicopters on the AW–119 nowadays.

Having completed their flight training in the Air Force, the Naval pilots than return to the Navy to start their operational conversion on the Super Lynx Helicopter at the Helicopter Instruction Centre (Centro de Instrução de Helicopteros CIH) of the EHM. This phase lasts about 150 flight hours. In addition to train both flight pilots and tactical pilots, the CIH also gives instruction courses to maintenance personnel, system operators and rescue swimmers.

Furthermore the Portuguese Navy is also a member of the Joint Lynx Simulator Training Establishment (JLSTE). Portuguese cockpit integration on the simulator took place in 2011. The Portuguese Navy is an active

member since 2012 and trains 240 hours on the simulator every year. The JLSTE is based at Naval Air Station Nordholz in Germany, and is used by the German and Portuguese Navy to train their Lynx aircrews. Denmark was also an active member of the JLSTE until they retired their Lynx Helicopters some years ago. The CAE built Lynx simulator entered service in 1988 and has delivered more than 100,000 hours to Lynx aircrews. The simulator was upgraded by CAE in 2020. This was funded by the NATO Support and procurement agency (NSPA).

Helicopter Underwater Escape Training (HUET)

The Navies aircrews must be ready to face any emergency situation, because missions are often flown over water. To establish this, the aircrews follow the Helicopter Underwater Escape Training (HUET). The HUET course combines practical exercises with learning about helicopter safety emergency procedures, underwater escape techniques and sea survival. The practical elements are conducted in a pool utilising a specially designed HUET module and life raft. The HUET module represents the cabin of a helicopter which is held by a lifting system and operated by a crane operator. The module has the ability to rotate at least 180 degrees, while being submerged in water to simulate a helicopter ditching resulting in capsize. While in the module participants put into practise such skills as brace positions, escape plans and the operation of emergency exits. The aircrews of the Portuguese Navy undergo a HUET course twice every year.

Missions and deployments

At the time the Super Lynx helicopters were acquired their main tasks were to carry out Anti–Submarine Warfare (ASW), Anti–Surface Warfare (ASUW) and Naval interdiction missions. Next to that they also carry out secondary missions like Search and Rescue (SAR), Medevac, Patrol, VIP air transport and Cargo missions, however the situation in the world has changed a lot since then and so have the tasks and missions for the Super Lynx, today the aircraft performs several other missions. They still carry out the Anti–Submarine Warfare, Anti–Surface Warfare and Naval Interdiction missions for which they were initially purchased, these are still one of the units main tasks, but slightly fewer of these operations take place today, apart from that the EHM also concentrates on other operations, one of these are the so called 'Fast Action' missions in close cooperation with special units of the Portuguese Maritime Police and the Marine Corps in the fight against drug trafficking and the smuggling of immigrants in the Marine environment.

Furthermore the EHM also focuses on various coastal operations and is also tasked with anti–terror operations. Normally the EHM provides two embarked Helicopter deployments at all time, however this has been brought back to just one deployment as at the moment two of the units helicopters are still in the UK with Leonardo Helicopters.

The EHM operates the Super Lynx helicopters from the 'Vasco da Gama' class and 'Bartolomeu Dias' class frigates. Each embarked deployment consists of 13 persons; 2 pilots (1 flight pilot, 1 tactical pilot), 1 system operator (operating sonar, winch and retriever) and 9 maintenance

engineers. The frigates have hangar space for 2 helicopters but normally only 1 is on board during deployments. The Super Lynx can carry the Torpedo MK.46 and is equipped with the Herstal FN M3M fast firing machine gun, and operates as an integrated part of the frigates weapon system.

Aircraft overview

19201 Super Lynx MK95 delivered July 1993 with Leonardo helicopters for MLU upgrade.
Note: ex Royal Navy Lynx HAS3 rebuild to Super Lynx MK95

19202 Super Lynx MK95A delivered July 1993 MLU upgraded active
Note: ex Royal Navy Lynx HAS3 rebuild to Super Lynx MK95

19203 Super Lynx MK95 delivered November 1993 with Leonardo helicopters for MLU upgrade

19204 Super Lynx MK95A delivered Nov 1993 MLU upgraded active

19205 Super Lynx MK95A delivered Nov 1993 MLU upgraded active

Overview helicopter carrying ships of the Portuguese Navy

F332 Corte–Real

'Vasco da Gama' class – Meko 200 Type:

Pennant Number NRP (Name)	Commissioned
F330 Vasco da Gama	November 1990
F331 Alvares Cabral	January 1991
F332 Corte–Real	February 1992

F330 Vasco da Gama

F331 Alvares Cabral

Bartolomeu Dias' class:

Pennant Number NRP (Name)	Commissioned
F333 Bartolomeu Dias	January 2009
(Note: Former Karel Doorman class F833 HNLMS van Ness of Royal Netherlands Navy)	
F334 Dom Francisco de Almeida	November 2009
(Note: Former Karel Doorman class F833 HNLMS van Ness of the Royal Netherlands Navy)	

Both of the Bartolomeu Dias class frigates sailed to the port of Den Helder in the Netherlands for an extensive MLU modernisation programme, the MLU programme took place between 2018 and 2022 and was carried out by the Dutch company Alewijnse Marine, this included the service life extension of both frigates and the modifications of the weapon, sensors and communication systems while work was also undertaken on propulsion and power distribution.

F333 Bartolomeu Dias

Upgrades

The EHM has been operating the Super Lynx already for three decades and celebrated its 30th anniversary in June this year. After all those years of loyal service, the engines and various other legacy systems of the Super Lynx were getting outdated, therefore it was decided to modernise the helicopters. In July 2016 Leonardo Helicopters was awarded a EUR 69 million contract to modernise the five Super Lynx MK95's to MK95A through an extensive midlife upgrade programme. The MLU programme started in September of the same year, and includes introduction of AW159 Technology, the original Rolls–Royce GEM 42 engines are replaced with the much more powerful LHTEC CTS800–4N Turboshaft engines, a new glass cockpit with integrated display units, a tactical processor, upgrades to the avionics an weapon suites and a new state of the art electrically powered rescue hoist were installed.

Portuguese navy pilots and engineers underwent aircraft qualification in the United Kingdom that same year, initially it was planned that all 5 helicopters would have completed the MLU programme before the end of 2021. The last of the 5 helicopters would then be delivered back to the unit at Montijo airbase in December 2021, unfortunately the MLU programme was delayed a lot due to the Corona virus and several setbacks in the upgrade programme.

In February 2020 the first MLU upgraded Super Lynx took the skies for the first time at Leonardo's Helicopter plant in Yeovil, Somerset, UK. The first upgraded aircraft was delivered back to the EHM in July 2021 while the second aircraft was delivered back in February 2022, the third Super Lynx was delivered to the unit in December 2022.The last two helicopters are currently still with Leonardo Helicopters, the fourth will be delivered back to the unit at the end of 2023, while the fifth and last upgraded Super Lynx is expected back by the end of 2024.

Future

The upgraded aircraft provide the Portuguese Navy with significant capability enhancements from the original Super Lynx MK95. With the introduction of AW159 technology the modernised Super Lynx MK95A has changed into a modern, much stronger weapon system which is a real step change for the Portuguese Navy and will see the aircraft in service far into the 2030s. It will further provide much relief when the last two helicopters of the squadron finally have completed their MLU upgrades and can be operationally deployable again with the squadron. One of the priorities then is to go back from one to the required two embarked deployments. The upgraded aircraft will enable the EHM to undertake their missions safely and effectively for years to come, 'Anytime Anywhere'.

The authors of Lowpass Aviation.com would like to thank all the involved personnel of the Esquadrilha de Helicopters Da Marinha of the Portuguese Navy for their hospitality, time and help during our visit at BA6 Montijo. Special thanks go to Squadron Commander Hugo Miguel Baptista and Lieutenant Carlos Andrade da Cunha.

Article & photos: Bram Marijnissen & Rene Sleegers
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News from Boeing

Canada selects P-8A Poseidon

Canada has signed a Foreign Military Sales Letter of Offer and Acceptance for up to 16 Boeing P–8A Poseidon aircraft, as part of the Canadian Multi–Mission Aircraft (CMMA) project. First delivery is expected in 2026.

1st T–7A to begin flight testing

The first Boeing T–7A Red Hawk advanced trainer for the US Air Force has completed its 1,400–mile cross–country flight to Edwards Air Force Base in California to begin its next phase of flight testing. The aircraft, known as APT–2, is the first production representative jet off the assembly line and was piloted by a joint US Air Force and Boeing aircrew.

Additional USAF KC–46A tankers

Boeing will build an additional 15 KC–46A Pegasus tankers under a Lot 10 contract awarded by the US Air Force valued at $2.3 billion. One hundred fifty–three KC–46A multi–mission aerial refuelers are now on contract globally.

Contract for 6 MH–47G Block II's

The US Army Special Operations Aviation Command (USASOAC) has awarded Boeing a contract to produce six remanufactured MH–47G Block II aircraft as a part of the Army's modernisation efforts.

With the deal valued at $271M, Boeing has 42 MH–47G aircraft under contract with USASOAC.

Avolon for 40 737 MAX jets

Boeing and Avolon announced the Ireland based lessor intends to purchase 40 more 737–8 airplanes to expand the lessor's 737 MAX portfolio (consisting of 737–8 and 737–10 variants) to more than 110 jets. Avolon also ordered 40 737–8s in June 2023.

MDA conducts early release intercept test

The US Missile Defence Agency and a Boeing led industry team successfully intercepted an intermediate–range ballistic missile in space during the latest test of the Ground based Midcourse Defence system.

Mass take–off of F–16s at Volkel air base

On 8 December 2023, a mass take–off was held at Volkel air base with the last Netherlands Royal Air Force F–16s. There were 16 F–16s on the flight line, of which 13 aircraft ultimately took to the airspace. Two F–16s remained behind on the flight line and one aircraft ultimately did not participate in the flight. This was done to test the readiness and to demonstrate the operational strength.

"Good to show how much air power we can generate in this transition phase," stated the commander of 312 Squadron Lieutenant Colonel Patrick Vreeburg. "It is the last year of the F–16. Furthermore, it is important to monitor the readiness of these devices. The employability is still very high. Not only for this transition phase, but I have never seen it this good in the last twenty years."

Before take–off, a so–called 'Elephant Walk' was organised, during which 14 F–16s slowly drove over the entire runway, before the 13 aircraft finally took off from Volkel air base. The aircraft that took part in the Elephant Walk flew a 'standard mission' to training areas above the

North Sea and the Danish areas. To manage all of this, a team effort was required from all 270 men and women who make up the 312 Squadron. The unit has had this size since the 313 Squadron and most of the 900 Maintenance Squadron were integrated into the 312 Squadron in 2021. According to Vreeburg, "The merger has really paid off in terms of the deployability of aircraft".

The very first Lockheed Martin (General Dynamics) F–16 was delivered to the Royal Netherlands Air Force in 1979. The 312 squadron at Volkel air base will fly the F–16 until approximately September 2024, after which the aircraft will be permanently taken out of service.

This gray day was a bit hampered by low clouds and a light ground fog.

Text: Joris van Boven and Alex van Noije
Photos: Joris van Boven

Leonardo – Complete helicopter solutions

A HH–139B crew member is hoisted back on board of the rescue helicopter after finding a victim and bringing the victim safely on board

Over the past 100+ years, Leonardo as a company has changed names many times to become the company it is today. Dating back to 1864, expertise from many businesses eventually converged into a single entity. Going back to the roots of Leonardo, the company can be split into four main business sectors: Helicopters, Aeronautics, Space and Defence Electronics & Security. Each of these sectors has its own companies or subsidiaries working under their own name or under the Leonardo name. The Vergiate area plays a critical role in the Helicopter Division's manufacturing operations, being home to the final assembly lines for some helicopter models like the AW109, AW139, AW149, AW169 and AW189. Finished helicopters exit the same assembly line that was used during the early 20th century, to the nearby flightline, where they undergo preparations for delivery and the customer acceptance. But there is a lot more happening at Leonardo which is vital to keep the finished helicopters flying as well as the pilots and crew trained with the latest technology.

Logistics experts

Situated close to the Leonardo factory in Vergiate is the main headquarter for customer support of the Leonardo helicopter division. The site, at Sesto Calende, has been part of aviation history for a long time and today it is a facility that has over 500 employees. Mr Fabrizio Peano, head of Leonardo Helicopters Training Academy explains, "Worldwide, our division employs over 2000 people. We have more than 100 facilities spread out over the world, which provide 24/7 support to 1500+ customers. This widespread presence is key for us as this enables us to support the high number of customers which operate a combined fleet of over 4500 helicopters. Being able to provide customer service and logistics solutions in all the operating areas of our customers enables Leonardo to provide best in class service. Each customer has their own requirements and specific needs, which makes our job very specialised and we have to adapt to the ever changing environment our customers operate in."

The customer support division is obviously important from a customer point of view as being able to get crucial support and spare parts is key to stay operational under every circumstance. From a company point of view, for Leonardo, the customer support division provides roughly 40% of the revenue, which makes it a key part of the organisation. Mr Peano continues, "When we talk to our customers, we talk about a long–term partnership.

24–7 support centres analyse data constantly to provide support to the customers as well as be ready for phone and online support (Leonardo)

When the work ends at the manufacturing division at the final assembly line, with the delivery of a new helicopter, for us it is just the start of a long journey together. The numbers speak for themselves, but this is a result of the investment made by Leonardo and for a big part also comes from the passion of our employees to provide best in class customer support."

The worldwide presence is divided into different centres around the globe, which enables Leonardo to provide their 24/7 support. Mr Peano explains, "We operate in three fleet operations centre, of which we have one here in Sesto Calende in Italy. The other two are in the UK and the US. These are all interconnected between themselves to support 24 hours a day, seven days a week. We manage the materials and spare parts through our 13 logistic centres. The main one is in Vergiate in Italy, with additional centres in the UK, Poland, US, Brazil, Belgium, China, Malaysia, Australia and UAE. The concept is to be as close to our customer operations as possible. So whenever there is a need for a material we always look to our material service centres where we have stock so we can deliver it to the customer as soon as possible. Over the past years, we have also invested a lot of time and money in local repair centres. Especially for major components, like blades or gearboxes, management of the logistics can be a challenge. To reduce the turnaround time and the cost, we established these repair capabilities to optimise our support to the fleet of helicopters. There are in total ten general repair centres and eleven blade repair centres. On top of these, we have established service centres providing a maintenance network, which are set up with partners. We select customer operators that we are partnering with, who often already have a local capability in terms of maintenance or support. We establish our footprint through them and introducing our highest level of standards in those countries. We are currently operating 90 such centres, but we are continuously expanding our network and looking for further partners."

Another example of the way Leonardo is providing training. An AW169 in Emergency medical services configuration can be used to train paramedics

Training solutions

The first Leonardo Helicopter Training Academy opened in Sesto–Calende, Italy, in 2006 and in its inaugural year provided training to 600 students. Towards 2020 that number grew to an average of 10,000 annually across the growing global training network also including similar facilities in the United Kingdom, Poland and Malaysia as well as authorised training centres. The training solutions range from simple desktop E–learning courses and in–house maintenance training to complex simulators.

Mr Peano explains, "In terms of training, our main training headquarters is in Sesto Calende. The footprint has been spread over the world in recent years. We operate in four other domestic markets, which are the UK, US, Malaysia and Poland. We have set up the organisation of these training academies in such a way, so they operate as a single training academy. This means that all the certifications are centrally managed from the headquarters in Italy. From the headquarters, we have the relationship with the different authorities and we deliver training with the same level of standards throughout all our academies. On top of these academies we have created additional training centres in eight additional countries. In partnership with our customers and operators we set up training facilities for local needs. As example we have a full flight simulator for the AW189 in Aberdeen for a customer in the oil and gas market. Different operators in that area are now able to have training facilities in close proximity which enables them to be more efficient in their training programmes. We are always looking for further investments by Leonardo in this area together with our partners where there is a need."

The flight simulators of Leonardo are providing a very realistic experience to new pilots as well as experienced pilots (Leonardo)

Leonardo provides a broad range of training solutions to pilots, crew and maintenance personnel. The main and core activities are to deliver the conversion to type training for pilots and technicians for the different helicopters. Mr Peano continues, "In the past years we have invested a lot in what we call the operational training. We see an important need coming from the customer and the operators not only to train pilot and co–pilot, but also to train the rear crew members. Because the mission is executed by the full crew and coordination within the helicopter is crucial for the success of the mission. So, we have developed a unique capacity here in

The AW169 has been created with the latest technology and a variety of new systems.

Sesto Calende to provide operational training for rear crew. This includes medical personnel as well as hoist and rescue operators using in house developed technology. In addition, we have our own instructors that go to the customer premises and continue the training path for the rear crew members at the home base of our customers and operators. That is something rather unique for us as a training organisation. What we provide here at our facilities is the beginning of the path of each crew member. Then everything is complemented at the customer premises in order to complete the training activity. We can execute all these different training activities thanks to custom, inhouse build training devices. We also provide these training devices to our customers where needed. We are fully independent today and we have a unique capability to design and develop these training devices. This can be something very simple, like a Virtual Interactive Procedural Training up to the highest level of full flight simulator as well as the latest technology of the Virtual Reality. We produce all devices here at Leonardo, but we are not looking to lead the technology as this changes at a very rapid speed at the moment. We are aiming in leading the integration of the systems and the implementation of the technology to the specific helicopters. Our advantage in this area is that we have the source data, which we start to gather at the point of the first drawing of our new helicopters, combined with data gathered during the further development and test flights as well as during the operational use. Starting from this date we can really develop all the systems and training needs that are very accurate to the real–life scenarios that our customers and operators experience in the field."

Leonardo has been developing their simulators for a long time and this enables them to create new solutions in a shorter timeframe. This is beneficial as there is constantly new technology introduced on the market that can be integrated into new simulators and solutions. For the past 15–20 years the teams developing these systems have gathered a lot of experience in this area. Initially Leonardo started supporting third party simulators, after which they started developing their own systems. Six to seven years ago Leonardo started doing everything in–house. The intention is not to sell simulators, but to support the customers and operators. The safety of the helicopter and crew on board is the most import part during the development of these simulators.

The development of new technologies is changing at a fast pace. Virtual Reality technology is currently going through

Two of the three full flight simulators that are used at the Sesto Calende site are in use almost hours a day, seven days a week

a very fast changing pace. Leonardo initially started with rear crew training devices as in their opinion the technology some three years ago was not good enough for pilot training. With the technology of today the VR systems can show a real cockpit with very realistic imagery which benefits the pilot in their training. They way Leonardo is developing these new systems is by using bricks, where different bricks depending on the needs are combined to create the new simulator. Each brick consists of specific technology developed over the years and can interact with each other. This way the cost can remain as low as possible and it is easier to build smaller simulators that can be installed at the customers premises.

Leonardo is currently developing new concepts which combines different aspects to create a simulator for the full mission. This enables the training to be done not only for the pilots, but operational flight training devices for the rear crew are included at the same time. This provides a possibility for the full crew to train together, interact with each other in the same way as they would in actual flights and be better prepared for real life missions. The possibilities of such systems are endless when you start connecting other simulators, like a boat, to enable full mission training systems for integrated use.

Text and photos: Erik Bruijns and Lex de Kort

The Leonardo AW139 is a versatile helicopter very well suited for SAR missions. All armed forces in Italy are using these helicopters

Host Nation Support: everybody needs a friend

In October 2023, the harbour of Vlissingen in the south of The Netherlands got even busier than it normally already is. But instead of ships, the place was buzzing with helicopters and vehicles of the United States Army.

The 1st Infantry Division Combat Aviation Brigade or 1 ID CAB of the US Army is deploying to Europe in support of European allies and partners. They will be replacing the 3 ID CAB that is currently in Europe. In 2021 1 ID CAB was on deployment in Europe for the last time. "We have trained diligently over the past year in preparation for our deployment" said Col. Chad Corrigan, the commander of 1 ID CAB. "The Demon Brigade is more than ready to deploy to support this mission and continue to strengthen our established relationships with our European allies." Already since World War II the United States have had multiple military bases and deployments in Europe. Since 2014, when the Crimea was annexed by Russia, the number of military units has increased again. This increased presence is part of operation Atlantic Resolve, which provides rotational deployments of combat credible forces to Europe to show American commitment to NATO while building readiness, increasing interoperability and enhancing the bonds between allies and partner militaries. As part of this a Combat Aviation Brigade is deployed to Europe continuously, rotating every nine months.

Deploying some 50 helicopters, 1,400 vehicles and shipping containers and supporting personnel is quite an undertaking. And it can't be done without help from other nations. That's where Host Nation Support comes into play. All NATO members made a commitment to support other members when they are deploying troops via their country if necessary. This support is called Host Nation Support, which is defined as 'civil and military assistance rendered in peace, crisis, and war by a Host Nation to Allied forces and NATO organisations which are located on or in transit through the Host Nation's territory'. During such a transport or a deployment, the host country is responsible for the safety and security all the time. But also all logistics are organised by the host nation, like supplying fuel and food, but also locations to stay overnight.

An AH–64E Apache is being returned to flying status. Sixteen of these battle helicopters have been unloaded in Vlissingen.

An HH–60M MEDEVAC Black Hawk is moved to a spot for maintenance.

The Netherlands plays an important part in military deployments to Europe, acting as 'gateway to Europe'. This because of its strategic location on the Western coastline, but also because of its good infrastructure and knowledge of logistics. For this Autumns deployment, the Dutch formed a team of some 75 people, consisting of both air force and army staff. In charge is Col. Michiel Verlinden, "After we receive a request from the US government, we start coordinating. What gear do you need, what will you bring yourself, what do we supply. We arrange a fitting location, in this case the shipping terminal of Verbrugge." The whole area is turned into a temporary military establishment that is secured by the Dutch army. Sniffer dogs have checked the area for explosives and divers of the Dutch navy did the same under water. The terrain is fenced off and additionally two layers of empty shipping containers restrict the field of view from outside. Both reserve and active duty military guard the terrain day and night. Inside the harbour area the Koninklijke Luchtmacht (Dutch air force) have created an FOB (Forward Operating Base) and they supply the necessary services for the aviation part: a fire crew, a Mobile Air Operations Team (MOAT), a flight safety officer and a meteorological officer.

The 1 ID CAB normally flies from Marshall Army Airfield in Kansas, in the heart of the USA. Their helicopters were flown the 1,200 km to Beaumont in Texas where they were prepared for a sea journey. The vehicles and all other equipment were moved there by train. Transport to Europe went by ship, on the American Roll–On Roll–Off Carrier (ARC) Endurance. This enormous ship has some 25.000 sqm usable floor surface divided over 12 decks, of which some 7 are used during this trip. All the staff that is necessary for the unloading of the cargo and the preparation for flight of the helicopters, in total some 300 men and women, were flown by commercial airline to Eindhoven airbase and from there transported by bus to Vlissingen. Responsible for the American part of the preparations is the US Army Military Surface Deployment and Distribution Command (SDDC). In the USA this was done by the 597th Transport Command while on the European side this was done by the 598th Transport Command, both part of the SDDC.

Unloading the ship took some 5 days, working 24/7, and the first helicopter took off from the harbour within 36 hours after arrival. In total 27 H–60 Black Hawks of different subtypes, 16 AH–64E Apaches and 6 CH–47F Chinooks have arrived in Vlissingen. Next to these, another batch of some 30 helicopters followed another route into Europe via a Greek harbour. In Vlissingen harbour no fuel is supplied due to environmental risks. The helicopters are ferried during regular working hours to nearby Woensdrecht airbase, that is designated an Intermediate Support Base (ISB) for the operation, by a few dedicated ferry crews. There they are all fuelled up and checked again and if necessary repairs are done by US maintenance crews with Dutch support. When ready, their own crews pick the helicopters up and fly them first to Illesheim in Germany and then forward to their temporary homes in Germany, Poland or Latvia. The other vehicles and equipment continue their journey from Vlissingen by road, mostly on low loaders. This is also done on a 24/7 basis, but is limited by the German law that forbids heavy transport by road on Sundays. Only when the helicopters and vehicles have crossed the

One of the first Black Hawks is put outside for a ground run.

The red cross clearly shows this is an HH–60M Medical Evacuation (MEDEVAC) version. This helicopter is equipped with an integrated MEDEVAC Mission Equipment Package kit, providing day, night and adverse weather emergency evacuation of casualties.

German border, the Dutch responsibility for their safety and security ends.

UH–60M Black Hawk copilot Jerome explained they have specifically trained for the circumstances here in the harbour. "At home, we followed academic lessons with senior aviators. These consisted of rehearsals with terrain modes assisted with iPads. The take–off will be performed through a high hover and during take–off several high obstacles will be avoided." The deployment will last for nine months and Jerome sees it as a great way to discover and travel through Europe, while reaffirming NATO presence in Eastern Europe.

When the 1 ID CAB have left Vlissingen and have reached their temporary homes, the 3 ID CAB will start their journey in the opposite direction, bringing some 55 helicopters to Vlissingen and further towards their homebase in Savannah, Georgia. One could wonder why they don't leave all equipment behind and just rotate the personnel after a deployment. But this has a simple operational reason: it is a way of practising and also testing relocating large amounts of troops and equipment, this to be prepared would that be necessary one day. Therefore in the past different harbours have been used, and onward transport has been done via the road, by train and over water as well.

But make no mistake, despite this training effect, the Americans and the Dutch consider this whole deployment an operation, not an exercise. And one that could not be done without Host Nation Support.

All text and photos by Patrick Dirksen and Frank Mink of Tristar Aviation
www.tristaraviation.org

While this CH–47F is still waiting to be assembled, in the back one of the Black Hawks is almost ready for its flight to Woensdrecht airbase.

The first helicopter to leave Vlissingen is this UH–60M Black Hawk, seen here arriving at its next stop Woensdrecht. Here it will be refuelled before it continues into Germany.

Richard Gardner writes on....
Royal Navy carrier trials uncrewed aircraft

The Royal Navy has completed initial operating trials of a General Atomics MQ1C Grey Eagle uncrewed aircraft from the four acre flight deck of HMS Prince of Wales, during exercises off the US East Coast. A member of the Protector/Reaper family, this aircraft was the largest UAS ever launched and recovered from a UK aircraft carrier and was described by the Service as paving the way for the next generation of UK naval air power.

Known as Project Mojave, the specially modified MQ1C, weighing more than one and a half tons, with a wingspan of 17 metres, was operated remotely at a computer terminal and took off and landed safely on deck. Apart from the US Navy's own UAS trials, no other navy until now has flown such a large remotely operated operationally capable aircraft on and off a carrier deck. The RN described the trial as further unlocking the potential of the two Queen Elizabeth class carriers demonstrating how an operational UAS can work alongside fifth generation crewed combat jets such as the F–35B. Rear Admiral James Parkin, RN Director Develop, whose team planned the trial, stated, "This is another exciting step in the evolution of the Royal Navy's carrier strike group into a mixed crewed and uncrewed fighting force. The RN's Second Sea Lord, Vice Admiral Martin Connell, added that embracing autonomy was the next logical step to ensuring that the RN can continue to fight and win in an increasingly complex operating environment." He said, "With so many international partners interested in the results of the Mojave trials I am delighted that we are taking a lead in such important work."

The longer term potential of adding UAS capabilities to those provided by onboard F–35Bs is seen as one way of restoring more critical mass and operating flexibility to

the UK's carrier air groups. The QE Class carriers were designed to operate up to 60 aircraft, but a shortage of UK frontline F35Bs, shared by the RAF and RN in the joint No 617 Squadron, has to date underutilised such huge ships, with the addition of embarked US Marines F–35Bs making up numbers. The standing up of No 809 Naval Air Squadron will help expand the UK F–35B fleet and ease this problem. The MQ1C trial has shown that a short–take–off and landing UAS can safely operate in a naval role alongside F35Bs and helicopters, as well as V–22 aircraft. This UAS is capable of performing numerous long endurance missions from medium height, and the UK has already built up considerable combat experience using Reaper UAS platforms in the Middle East and Afghanistan, and is preparing to replace them with the more advanced Protector RG Mk1.

Having a capability to maintain very extended surveillance missions, over many thousands of square miles, with an armed option, will greatly increase the utility of a large aircraft carrier where the deck width and length is not a restriction for a STOL design.

Months of planning by the Royal Navy and General Atomics went into the at sea trials aimed at pushing the boundaries of operations.

This was the first carrier trial involving this particular UAS design from an aircraft carrier. Commander Martin Russell was in charge of carrier operations aboard HMS Prince of Wales. He said, "Integrating the Navy Develop and General Atomics personnel into the Mojave team was key to enabling such a large UAS aircraft type to give us this glimpse into the future of these ships."

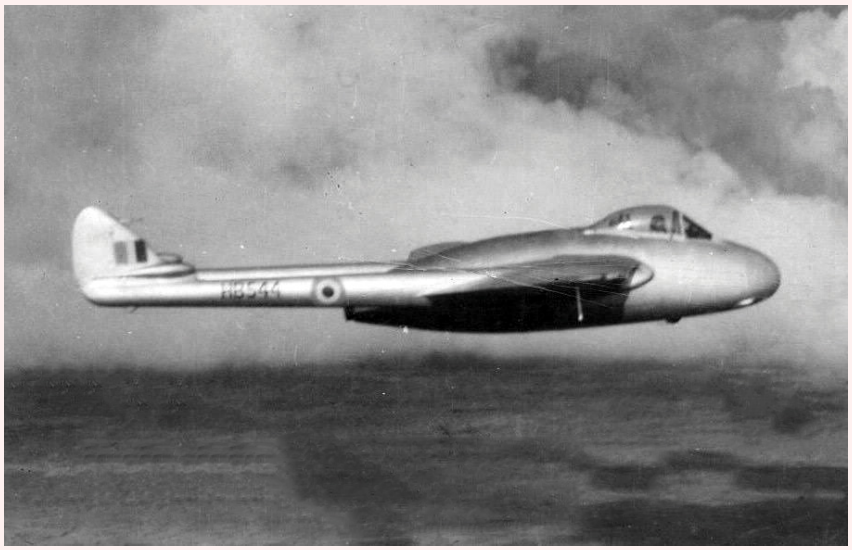
Air Marshal (Retd) Shashi Ramdas recounts....

....My First Squadron "The Flaming Arrows"

One of the pleasures of retirement is being able to sit back and relax in a comfortable chair, close ones eyes and let the mind drift back into the past. I was doing just that when my mind went back to a day in early February 1957.

I was, at that time, posted as a supernumerary at the Armament Training Wing, Jamnagar. A young Pilot Officer in the Technical branch of the Indian Air Force, the lowest form of human life, as I was repeatedly reminded. But I was on cloud nine and had stars in my eyes. I had just received my posting orders to a new fighter squadron that was being formed, 27 Squadron.

It had always been my dream to be the Engineer Officer (EO) of a fighter squadron and I was on top of the world. Packing my personal belongings was no particular problem. Two steel trunks and a holdall were all the worldly possessions I had.



So, it was on a bitterly cold winter morning that I found myself at Jullunder railway station, clambering into the back of a 3 tonner for the 15 mile drive to Air Force Station Adampur. It was my first time ever, in the Land of the Five Rivers, and I was going to join my very first fighter squadron. What more could I ask for?

Adampur was a non–family station and living conditions were fairly primitive. Everyone lived under canvas. The Station Commander had a 1,000 pounder tent, the Squadron Commander and senior Flight Commanders had independent 240 pounders, and the rest of us junior officers shared 240 pounders, two to a tent. The SNCOs and airmen were also in tents of varying sizes. The Officers' Mess consisted of two mud walled, thatched roof huts, one being the bar cum anteroom and the other the dining hall. Toilet facilities were equally primitive (dry sanitation, euphemistically termed Deep Trench Latrines) and were, for a very good reason, situated downwind of the living quarters.

But it was great fun. Firstly, we were all very young with an insatiable zest for life. It was a time when the Station Commander was a Wing Commander, the Squadron Commander was a Squadron Leader, and the Flight Commanders were Flight Lieutenants. Our Squadron Commander was the very epitome of a dashing fighter pilot, all of 31 years old. Secondly, we had very little worldly possessions. Our Squadron Commander was the only one who owned a vehicle, a BSA Gold Flash motorcycle. The rest of us made do with cycles. And, most importantly, we all lived, worked and played as one close knit family. We worked hard all day, played hockey or football with our airmen in the evenings, and beat it up in the Mess after the sun went down. Life couldn't have been better.

Money was never of any concern. As a Pilot Officer in the Engineering branch, my salary was the princely sum of Rs 450/– per month, more than enough to meet my needs. What was most important was that I was working at something I enjoyed tremendously.

Our Squadron was equipped with Vampires. Not one of the latest fighters but, nevertheless, a very elegant and agile aircraft. The piercingly loud whine of the Goblin jet engines was music to my ears. During summer, flying would start at first light, well before the sun came over the horizon. We would merrily pedal to work while it was still dark. During winter, we had to wait till the inevitable fog lifted. Having got the aircraft ready, we would then stand in the weak sun, hands clutched round glasses of hot tea, swapping tall yarns.

For me, it was one of the most rewarding and thrilling periods of my life. Though just a Pilot Officer, I was posted as the Engineer Officer of the squadron (designated as 'C' Flight Commander), responsible for maintenance of the aircraft and support equipment. It was a job I loved. And the icing on the cake was that, once in a while, my Squadron Commander would take me up for a flight, in a Vampire trainer aircraft. Those were the days when there was only one Engineer Officer in a fighter squadron and it was a heady experience. It was there that I got a nickname that stuck with me ever since; "Spanner"!

Air Marshal (Retd) Shashi Ramdas

25 Years Back

From Vayu Aerospace Review
Issue I/1999

India & Russia sign "Declaration on Strategic Partnership"

The 2 day visit to India of Russian Prime Minister Yevgeny Primakov concluded on 22 December 1998 with both countries affirming their decision to move towards formalising a strategic partnership.

"LCA will fly in mid–1999"

Indian Defence Minister George Fernandes has stated that the Light Combat Aircraft (LCA), being developed as a replacement for the ageing MiG–21 fleet of the Indian Air Force, "is likely to have its first flight in 1999".

Indian signs MoU on 'Admiral Goshkov'

Indian has signed a Memorandum of Understanding with Russia for possible purchase of the 44,500 tonne aircraft carrier Admiral Gorshkov. The MoU was signed by then Defence Secretary Ajit Kumar and his Russian counterpart in New Delhi late on 21 December.

AJT decision "On The Threshold"

Answering a volley of cryptic questions about the inordinate delays in the decision on the long pending Advanced Jet Trainer (AJT) requirement of the Indian Air Force, Defence Minister George Fernandes stated that the Government was now "on the threshold of taking its decision". Asked about the time frame, Fernandes reiterated that "it would not take much longer".

Minister disbands Air India/Indian Airlines Boards

India's state–owned airlines, (Air India and Indian Airlines) were in for a rude surprise when on 12 December 1998 their Boards of Directors under the common Chairmanship of PC Sen (an IAS bureaucrat) were disbanded, without any feelers or premonition.

HAL and NAL sign MoU on Saras

HAL Chairman, Dr CG Krishnadas Nair and Director NAL, Dr TS Prahlad have signed an MoU for cooperation between Research and Industry to develop and produce the 14 seater Saras light transport aircraft.

Funds for defence R&D projects

Defence Minister George Fernandes has stated in Lok Sabha that no disparity has been noticed in the financial disbursement resulting in suspension of some important projects.

Pawan Hans in Antartica

Pawan Hans Helicopters has won a contract for providing two Bell 407 helicopters for the XVIIIth Antartica Expedition being undertaken by the Department of Ocean Development.

BAeHAL and Sextant Avionique to develop aviation software

BAeHAL and Sextant Avionique have announced an extensive partnership covering the development of avionics software. Sextant Avionique is joining BAeHAL to set up an integrated software development team at the latter's facility in Bangalore.

HAL and Airbus to study A320 Freighters

Hindustan Aeronautics Ltd (HAL) and Airbus have signed a memorandum of understanding to study freight carrying versions of the A320 Family. Under the terms of the MoU, HAL and Airbus will work together in an initial phase to explore the commercial, technical and financial aspects of such a partnership.

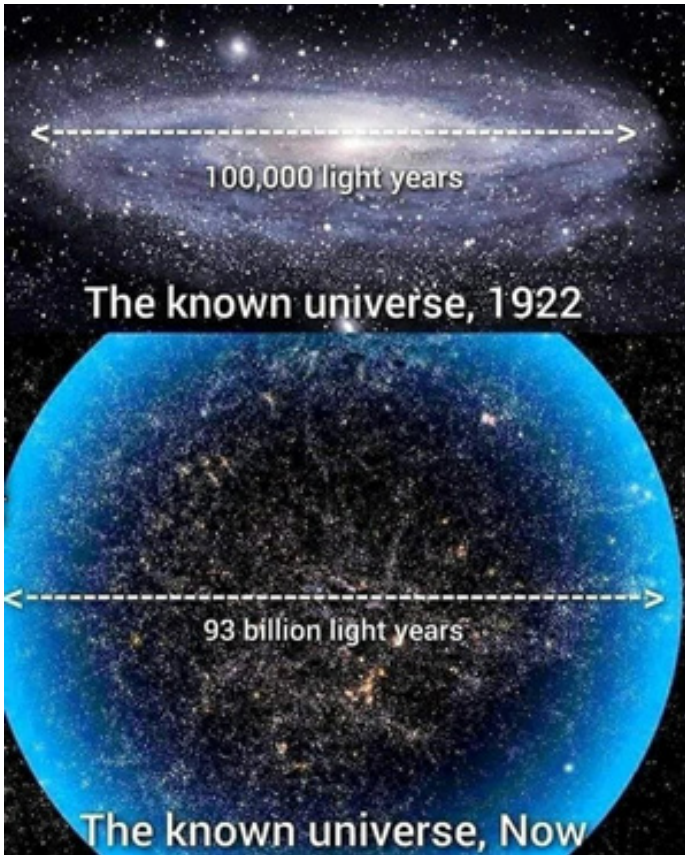
MiG–21bis upgradation delays

Defence Minister George Fernandes has stated that, as per the original plan, the upgradation of the IAF's MiG–21bis was to be completed by 2002. This has been delayed by another year owing to delays in completion of design and development work on the aircraft by the Russians.

COAS Citation for 666 R&O Squadron

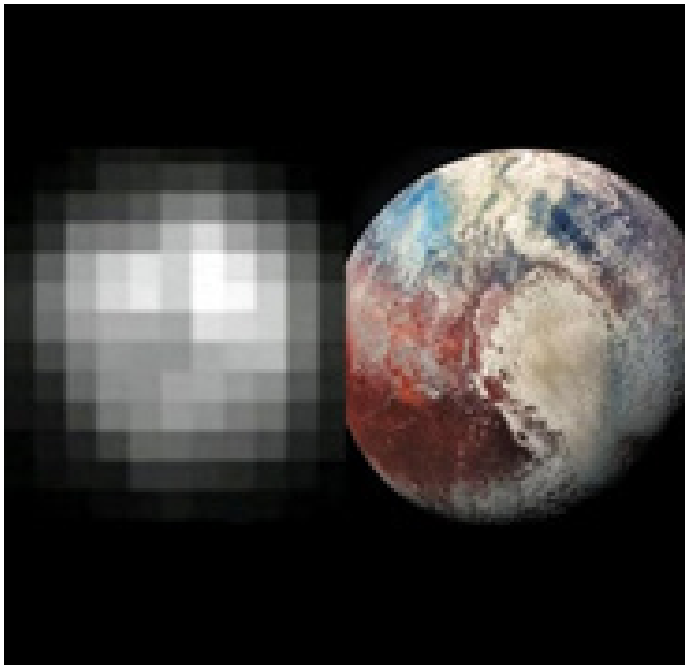
For the first time in its relatively young history, the Indian Army Aviation Corps have been honoured by the award of the Chief of Army Staff's "Citation" which was given to 666 R&O Squadron. Announced on 15 January 1999 (Army Day), the citation was given for the Squadron's outstanding operational service, which continues in the very difficult conditions of northern Ladakh and the Siachin Glacier.

Scary and mind boggling



Are we just scratching the surface of what we know?

Pluto as seen in 1994 vs 2019



Stunning advancements in technology here on Earth!

Then and now

"120 years after the Wright brothers took to the skies in, we're still pushing the boundaries of flight—on Earth and beyond", says NASA. From the Wright Flyer to the Ingenuity Mars Helicopter, we truly have come a long way. (Images: NASA)

From Millets to Uber

After the millet excitement and millet mania whole of December 2023 (including a full symposium on it!!) to the Indian Coast Guard announcing a partnership with Uber ridesharing app for "efficient, reliable and secure transportation of its officers, staff and families". Dec'23 can surely be classified as a dull month for the Armed Forces.

Afterburner

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Aerospace & Defence Review

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