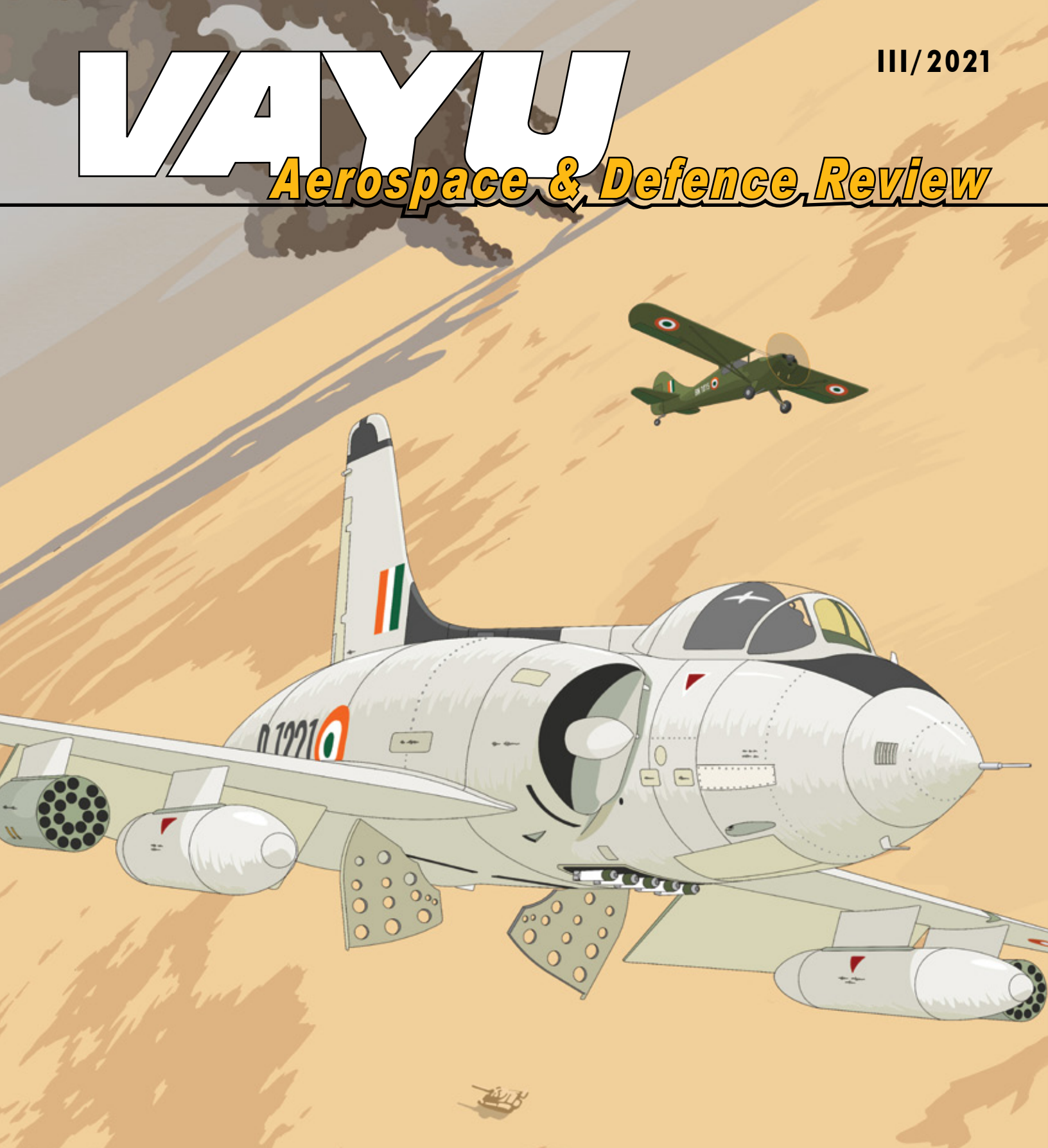
VAYU

Aerospace & Defence Review

III/2021



REMEMBERING PUSHPINDAR SINGH

MAKE IN INDIA

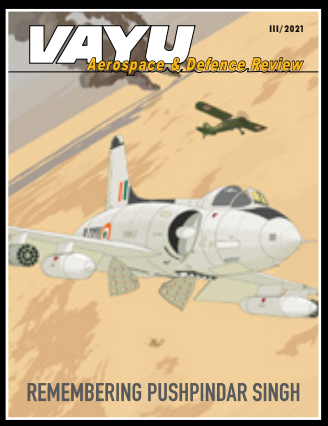
Strategic Partnership for a Secure Future

As a trusted strategic partner for 25 years, IAI is proud to implement the Government of India's Make in India vision. We develop and produce innovative solutions and best-in-breed capabilities tailored to Indian requirements and needs through powerful collaborations and joint ventures. We work hand in hand with our partners, harness Indian know-how, local technology, manufacturing excellence, and world-class skill-building. Reflecting the unique friendship between our nations, IAI is committed to lasting strategic cooperation with India to build a safe and secure future.

www.iai.co.il • corpmkg@iai.co.il

IAI

Where Courage Meets Technology



Cover design by Angad J. Maolankar (Twitter: @noncommunistmao)

VAYU
Aerospace & Defence Review

III/2021

Regular features :
Commentary, Opinion, Viewpoint, Aviation & Defence in India, World Aviation & Defence News, Ancient Aviator Anecdotes, *Vayu* 25 Years Back and Tale Spin.

Published By

Vayu Aerospace Pvt. Ltd.
E-52, Sujan Singh Park,
New Delhi 110 003 India
Tel: +91 11 24617234
Fax: +91 11 24628615
e-mail: vayuaerospace@lycos.com
e-mail: vayu@vayuaerospace.in

Printed at Aegean Offset Printers

Pushpindar Singh Chopra

Founder & Editor, VAYU Aerospace & Defence Review

Pushpindar Singh is internationally well-known for his research and writing on Indian aviation matters for over five decades, being regarded as virtual chronicler of India's aviation history and present times.

His 'Aircraft of the Indian Air Force 1933-73' became standard reference book on the IAF and was followed by an account of the Service on its Golden and then Diamond Jubilees. The definitive three-volume History of the Indian Air Force 'Himalayan Eagles' was officially released at the IAF's Platinum Jubilee in 2007.

His various publications include 'The Battle Axes', 'Fiz'aya', 'History of Aviation in India: Spanning the Century of Flight', 'Fly Navy', 'Diamonds in the Sky', 'Tigers in the Sky', 'Valiant to the Last', 'The Black Archers', 'The Fighting Fourteen', 'On the Wings of Gold', 'Dragon Fire', 'First to the Last', 'The First Supersonics', 'Tusker Charge', 'Fly Navy' plus two dozen more on military aviation history subjects. He also wrote many books on other matters including a biography of his late father Major General Mohindar Singh Chopra (1947: A Soldier's Story), a book on 'Neuve Chapelle' & The Jullundur Brigade, 'Portrait of Courage: Century of the 5th Battalion, The Sikh Regiment' amongst many others on varied topics.

He was the Founder-Editor of the Vayu Aerospace and Defence Review, now in its 47th year of publication and was Indian editor for the Air International, World Air Power Journal, Asian Defence Journal, Jane's Defence Weekly and Aviation Week & Space Technology. During an earlier Farnborough Air Show, he was given a special award for his breaking news story on the Indian LCA programme from the Royal Aeronautical Society of the UK. In 2015, at the Aerospace Media Awards held at the Paris Air Show, he was awarded 'Lifetime Achievement Award' for Outstanding Contribution to Aviation Journalism'.

In the year 2000, he also started another magazine The Nishaan, a non-political journal on Sikh culture, history and heritage.

Indeed, Pushpindar Singh's writings on the Indian aviation and defence matters, impacting too on the international stage for over five decades, have inspired and encouraged generations of those who later joined the industry and are continuing to serve the profession with honour.

एयर चीफ मार्शल आर के एस भदौरिया
पविसेमे अविसेमे वामे एडीसी
Air Chief Marshal R K S Bhadauria
PVSM AVSM VM ADC

Tel : (011) Off : 23012517
Res : 23017300
Fax : 23018853

वायु सेना मुख्यालय
नई दिल्ली-110106
Air Headquarters
New Delhi - 110 106

Air HQ/15028/5/CAS

05 May 2021

Mrs Deepak Chopra
E-52, Sujan Singh Park
New Delhi - 110003

Dear Mrs Deepak Chopra,

1. Please accept my deepest condolences on the sad demise of your husband, Mr Pushpinder Singh Chopra. It is a tragic loss and we have you and your family in our thoughts during this hour of grief.

2. Mr Pushpinder Singh was a highly acclaimed aviation historian and commanded great respect in his field. Over the past several decades, his path-breaking research and accounts of the history of air power in India and abroad, made him an authority on a subject; which characteristically is both technology-intensive and fast-evolving. He left an indelible mark with his works and I, on behalf of the Indian Air Force, pay tribute to his life and his accomplishments.

3. In this hour of sorrow, my wife Asha joins me in offering our deepest sympathies to you and wish you a speedy recovery.

In grief,

Encyclopedia of Indian aviation

Pushpindar 'Pushy' Singh Chopra. The name brings to mind a range of reference books scripting the aviation history of the subcontinent, capturing generations of aircraft flown, recording treasured history for posterity. It would not be an understatement to say that the work of Pushpindar Singh has been regularly used as official reference material by officers and airmen of all generations, looking to learn about the IAF's past and its journey. A renowned aviation historian, Pushpindar Singh's association with the IAF dates back to the period soon after the Indo-Pak war of 1965, when he interviewed aviators and IAF personnel in an effort to record the air operations as they happened, and also to refute enemy propaganda.

His write-ups and records of the air battles of 1965 are a valuable source of information for various authors who have written about the war. One recalls his article, 'Laying the Sargodha ghost to rest', in Vayu Aerospace Review in November 1985 as being a trailblazer amongst others, which led to debunking the myth of PAF's claim of shooting down five IAF Hunters on 7 September 1965. In the numerous books he wrote on the IAF, starting from Aircraft of the Indian Air Force: 1933-1973, and the coffee table books of squadrons, one finds diligent professional research on facts, anecdotes, pictures from archives, summing up history in a nutshell, which is something every official historian would aspire to deliver.

To converse with him was akin to engaging with a human encyclopedia of Indian aviation. It was perhaps for this reason that one mistook him for an Air Force veteran at many of the demi-official and social gatherings of the IAF that he was invited to. To his distinction, he published books on the occasions of IAF's Golden Jubilee, Diamond Jubilee and Platinum Jubilee. The definitive three-volume magnum opus titled Himalayan Eagles: History of the Indian Air Force, written for the Platinum Jubilee in 2007, occupies pride of place in every Air Force library and squadron crew room. His pioneering work, Vayu Aerospace Review, was one-of-its-kind aerospace journals when launched in 1974 and it continues to dominate readership amongst air warriors of today. The contribution of Pushpindar Singh towards recording the history and air wars of the IAF cannot be contained in a single article. He belonged to a rare category of passionate aviation enthusiasts, who of their own reckoning decided to become a part of the men and women in blue. We shall fondly remember him and treasure his works for future generations.

Air Marshal Anil Chopra (Retd)

Air Marshal Anil Chopra (Retd) and Pushpindar Singh along with DRDO scientists at Dexexpo 2020

Farewell Pushpindar 'Pushy' Singh Chopra

The sudden passing away of Pushpindar, better known as 'Pushy' to all his friends, on 3 May, 2021 was most unexpected and shocking, to say the least. He was so full of life and energetic despite his age; running up the steps instead of taking the elevator, that I personally never expected him to succumb to corona virus. Pushy always lived up to his shortened name and pet name; gently pushing everyone around to get things done in a hurry, particularly in aviation and military matters, all with the good intent of getting the right message to all concerned quickly for the benefit of the armed forces with special reference to the IAF. His bi-monthly magazine, Vayu Aerospace and Defence Review, was the vehicle he largely used to convey all the news and views for which he was always in a hurry to get folks to write, debate and discuss but contribute. That is how he got professionals like Air Marshal Brijesh Jayal, Admiral Arun Prakash and Air Vice Marshal Cecil Parker and many others to regularly contribute to the magazine to make it that much richer. In the early days before the internet, this was one indigenous homegrown magazine that we all looked forward to for catching up with the latest in aviation. The other magazines like Aviation Week & Space Technology, Jane's Defence and Air Clues et cetera were difficult to come by in Air Force libraries or prohibitively expensive to afford for individuals and, in any case, had a different and more western perspective.

I met Pushy a little late perhaps in 1988 when I was commanding 28 Squadron on the new MiG-29s in Poona. Pushy was obviously visiting and I got a call one afternoon from then Group Captain 'Mike' McMahon, commanding 6 Squadron on the base, that Pushy wanted to see me. Quite obviously, having heard of him and all that he had done for the Golden Jubilee of the IAF a few years before, I invited him home. He was with me in a jiffy and after gulping down the cup of tea that Malini made in a hurry, he said he wanted me to take him to the squadron and show him around. Once in the squadron, out came his camera and he clicked the MiG-29 from every possible outside angle including one with me in front of the aircraft. Cockpit photography then was a big NO-NO. We came back home to spend a little more time together and he borrowed a number of slides from me that I had personally clicked of the MiG-29 in various formations. Those days, all my squadron pilots got lots of formation flying practice in every ferry flight instead of just doing boring straight and level navigation while I carried my Cannon with a zoom lens clicking pictures for the squadron. With his affable personality, our friendship thereafter just grew and every time I dropped in on him in Delhi or we met somewhere, he behaved as if he was meeting a long lost friend and was quickly into a conversation about aircraft and aviation. On a personal level, his wife, Deepak, and Pushy were great hosts whenever I visited their home and both just bowled you over with their warmth and hospitality. The added advantage of visiting him was also that often you met one of his international friends and aviation enthusiasts with something new to hear and learn from them.

On a professional level, there was no denying that Pushy was a veritable walking encyclopedia on aviation matters in general and military aviation in particular. He always regaled one with nuggets of new information as also some of his stories about the various important personalities he knew, nationally and internationally or what he had picked up from his visits to various shows abroad. From his father, who was a senior army man, he obviously inherited a lot of knowledge about various arms and services of the Army including many individual regiments and their history. His first publication as a young aviation buff in the 1970s, 'Aircraft of the Indian Air Force', is still something worth referring to even today for information on the early days of the IAF. I still have personal copies of many of his publications including the 'Himalayan Eagles: History of the Indian Air Force', a trilogy that was published on the 75th anniversary of the IAF in 2007, 'First and the last: 50 Years of the MiG-21 in the IAF' co-authored with Air Marshal Phillip Rajkumar, the squadron histories of the First Supersonics, 28 Squadron and the one on 47 Squadron The Black Archers amongst some others. His collection of books, photographs and other memorabilia was like a treasure trove that I tried digging into every time I could while in Delhi.

With Pushy's untimely passing away, the aviation community in India has lost one of its most vocal stalwarts and he will be sorely missed by all of us even remotely connected with aviation in India. Om shanti, our friend.

Air Marshal Harish Masand (Retd)

He left his Nishaan

Sardar Pushpinder Singh Chopra 1943–2021

Pushpinder Singh Chopra (1943-2021), a bundle of energy bubbling with ideas—it is hard to write about him in the past tense. Yet, I must, because he is no more, another victim to the invisible enemy that is Covid 19.

A decades-long friendship and association is hard to sum up in a few words. A bon vivant, who lived life well, Pushpinder was a warm host and had a tremendous zest for life.

A proud product of the Doon School, where he was School Captain, Pushpinder seemed to known everyone and had a talent for putting together people and projects that he felt needed to be done.

He had graduated from Government College, Chandigarh. He worked with Gillanders Arbuthnot & Co Ltd in Calcutta, and later with Rallis, where he quickly made a name for himself. However, he would leave it all to devote time to his first love, aviation. He also headed Daimler Benz Aerospace in India.

For over four decades, since 1966, he had been engaged in researching, recording, and writing on the Indian Air Force, focussed on its history from the foundations till the present, virtually becoming the historian-emeritus of India's air arm. His books and papers on strategic issues are well known, not so well know is his role in the well-deserved recognition of Marshal of the Indian Air Force Arjan Singh.

He was the founder-editor of the well-regarded journal 'Vayu Aerospace & Defence Review', which is in its 47th year of publication now. Avi and Anne Sodhi were an integral part of Vayu.

His passion for the aerospace world and his journal took him places, especially to various international air shows, at some of which 'Vayu' would go on to win awards.

He was always a phone call away whenever a journalist wanted to check a fact, and you could rely on him, as I often did, to have the correct information on his fingertips. He also wrote books about the Indian Air Force, of which he was an unofficial historian. He co-authored 'The Indian Air Force and its Aircraft: I.A.F. Golden Jubilee, 1932-82, and wrote 'History of Aviation in India: Spanning the Century of Flight' (2003).

A project that brought him joy was '1947, A Soldier's Story'. It narrated his father's experiences while heading the Wagah border post at the time of Partition. Major General Mohinder Singh Chopra (then Brigadier) had left written notes that Pushpinder turned into a book.

Major General Mohindar Singh Chopra was a King's Commissioned Officer of the Indian Army. After retirement, he became India's Ambassador to the Philippines and Taipai (as Taiwan was known). Later, he was Director, National Institute of Sports, Patiala.

Pushpinder founded 'Nishaan Nagaara', to highlight Sikh issues and heritage in April 1999. The inaugural issue was released by Dr Manmohan Singh. My friends, Dr Inder Jit Singh of New York and Bhayee Sikandar Singh, guided the magazine, which is seen on many a Sikh home.

Pushi, my friend, we will remember you fondly and miss you a lot. You left your Nishaan in this world.

In remembrance
Roopinder Singh

(Roopinder Singh is an Indian journalist and author of 5 major books. He retired as the Senior Editor from the Tribune, published from Chandigarh)

My day started with a very sad note when I learnt that my very close and dear friend, my senior from Punjab Engineering College, and my perhaps the biggest well-wisher has been snatched away from all of us. What a man, full of boundless energy, who breathed only aerospace. He brought his star publication Vayu to commanding heights and all of us looked forward to receive our copy. He would never miss a chance to meet me whenever he was visiting Bangalore and I would always see him in his office during my visits to Delhi and have delicious home-made lunch. He published my first book which created a record of sorts in response.

My heart-felt condolences to the bereaved family.

Let his legacy move on with much more vigour.

Yogesh Kumar

Pushpindar Sir,

Thank you for the books, the stories, and for telling the Indian side of the story when so many others weren't - and above all, for making it clear that there is a body of such stories out of India, which can be told as well as any others. Blue skies always,

K S Nair

I am Philip Rajkumar, an old friend and admirer of Pushpinder's. My wife and I were very upset when we heard of his demise. Pushpinder and I go about 35 years to the early 1990s. I always considered him an authority on aviation history worldwide. He was a prolific writer and will be sorely missed by the aeronautical community in the world. I am happy he handed over Vayu to his son well in time and I am confident the magazine will improve on the high standards set by him.

Losing a father is always a wrenching event. Pushy was a proud father and loving husband and we understand what a bitter blow it must have been to the close knit family. Just a couple of months ago he called me from Kasauli where he and Deepak used to go to often for a break. We also enjoyed their parent's hospitality in 2013 when we stayed with them during the launch of the book Pushy and I compiled together on the history of the Mig-21 in the IAF. May Pushpinder's soul rest in everlasting peace.

Philip and Sheila Rajkumar

In 2015, at the Aerospace Media Awards held at the Paris Air Show, Pushpindar Singh was awarded 'Lifetime Achievement Award' for Outstanding Contribution to Aviation Journalism'.

The guru of aviation history. The encyclopedia himself is gone. A kind person, a generous soul and the gentleman personified. You are with the clouds now Pushpindar Singh Chopra. Wish I had spent more time with you - the wonderful tales and anecdotes. It's the end of an era.

Manu Pubby

One of my my most trusted friends, Pushy could generate a laugh in even the most trying circumstances. I can hardly believe he's gone. Pushy was a storehouse of military/ aviation knowledge. We all relied on him for perspective RIP, Pushy. Heaven is the richer for your presence.

Ajai Shukla

The greatest authority on Indian aviation with a canvas stretching across decades - without a shred of a doubt, our finest aviation historian. His contribution to the IAF over decades - simply phenomenal. Besides anything else, among the kindest souls, a guru for me.

Vishnu Som

Time with him was hilarious fun, & an education. The unending number of stories he told & the context he supplied for current events is irreplaceable. Nice, gentle, kind, wise and full of energy; PSC will be terribly missed. "What have you heard? I'll tell you what I've heard."

Saurabh Joshi

Tragic news. Pushpinder Singh Chopra, India's foremost Air Force historian & founder of Vayu Aerospace and Defence Review passes away in Delhi. A wonderful gentleman full of stories, insight & sparking wit. Entire generations will miss him. Blue skies, Pushi Sir!

Shiv Aroor

A giant tree has fallen and we are bereft of the shade of its knowledge and wisdom. RIP Pushpinder Singh Chopra (1943-2021) pioneering defence journalist, author, military aviation compendium and above all, a kind, gentle soul. Deepest condolences to his family.

Here he is, explaining to me the workings of the iconic Hawker Hunter- Swedish Air Force museum, Malmslatt, 2011.

Sandeep Unnithan

I cannot tell you how terribly saddened and shocked I was to hear that my dear friend, Pushpindar, had passed away. The international aviation and defence community, especially all his journalist and PR friends, will share my grief and greatly miss the warmth, humour and sheer depth of his knowledge on all things relating to Indian aviation. Pushpindar was a real joy to know, and made the global air and defence show circuit that much more endurable as he always had something new to discuss and his interests covered every possible aspect of aviation history. I was pleased to have had the honour to show him our museum at Farnborough and to welcome him to the Guild of Aviation Artists Annual exhibitions in London.

It was a privilege to have enjoyed his company and wisdom over the years, and I will always remember and retain the fondest memories of this truly great journalist, amusing companion and creator of so many wonderful books on India›s aviation history. His lasting legacy lives on, of course, in Vayu, which is in a class of its own.

My most sincere condolences to you and all the family and in the meantime keep safe during this challenging period.

Richard Gardner

Eulogy for Pushy

AN OLD SCHOOL GENTLEMAN

Pushy Chopra is no more. He had struggled with Covid.

I anchored many of Pushy's seminars on defence.

He was not only a valued colleague but one my closest childhood buddies since our schooldays.

He was ebullient, bubbly, outspoken, rambunctious, with a Falstaffian Hail of a voice. He suffered no fool gladly even while he remained ever the compassionate gentleman...and chivalrous to a fault.

He felt passionately for his family and was the eternal mother-hen.

He adored his childhood home in the misty effervescence in Kasauli to which he summoned me for a first visit many moons ago, where we consumed gallons of good Scotch and barbecued pork chops with his beautiful wife Deepak and sister the vivacious Gugu and her gentle giant of a husband, the expansive Anup (now also gone) son of the legendary Sardar Karnail Singh, former chairman of the Railway Board who had the most amazing wooden bar laden with foreign wines tucked away in his luxurious railways saloon.

Pushy was a diehard liberal who detested political tyrants, bigotry, intolerance.

Do you know that he loved Shakespeare and could quote from John Donne?

In the Doon School Pushy (74-T), Askari Imam (68-T), and I (155-T) were known as the "Tata House Trio", all of us unregenerate rebels. 74 and 68 now both gone.

My youngest daughter Samira was married at Piffer Post, Pushy's get-away spot from Delhi's madness, small farmhouse in the capital's outskirts where generals, air marshals and admirals rubbed shoulders with ruffian writers like me and Ajay Shukla and Hari Dang and Dilip Bobb.

Just as Pushy and I grew up together and reunited after my 20-year sojourn in the US, so did my children Arjun, Ayesha and Samira grow up with Pushy's kids, the "Choppy" boys, Vikram, Karan and Prem.

Cheers, Pushy! May you ever keep raging against the dying of the light.

Inderjit Badhwar

Dear Colleagues,

I am sure I speak for a lot of people when I say that The Great Pushpindar (hereafter referred to as TGP) was a fixture in the lives of all of us who - at least before the COVID destroyed this business - trot around the world to one defence expo or air show after another. You could always spot him with his distinctive turban - showing pride in his heritage but also in the Indian Armed Forces that he was always pointing out when and where they were failing and how they could do better.

Several aspects of TGP that I was fond of:

- This business is full of people who are living proof that God in all of his bounty and generosity created more horses' asses that horses to wear them. TGP was not one of them. He was never a know-it-all and was never afraid to show there was benefit in asking what another person had to say on a given subject. I think the phrase I heard from him most often was "I want to ask you something, what do you think about…" The mark of a truly great man is that he realises we never, ever stop learning.
- He was never afraid to throw the bullshit flag on the table and tell it like it is.
- In the same vein he was never averse from telling truth to power - separating him from the many yes-men whose numbers at the higher levels of India's government and armed forces seem to multiply geometrically.
- He was a consummate gentleman who never shed his coat and tie - even in some of the most unbearable heat that air shows are legendary for taking place in.
- He always loved a good drink of whiskey.
- He always had great jokes. One of the more recent ones I really loved that he told was "come to Dubai - it is the best city in India."

I will miss him and places like Le Bourget, Singapore, Dubai, etc. will never be the same without him.

For sure everyone is going to miss TGP and he is another in a growing list of persons who have left us thanks to what I refer to as "the Great Gift From China."

I remember more than 11 years ago and during the time that I would spend weeks upon weeks of time in China I was sitting in a pub/restaurant in the Sanlitun section of Beijing (where most of the embassies are) with the Canadian Defence Attache. As we were sitting there we reminisced about all of the examples of what we had seen in China which showed that they always operated on the basis of 80 per cent (or less) of what was considered the bare minimum safety margin anywhere else in the world was always regarded as adequate for their purposes. I remember him shaking his head and telling me "China is a disaster waiting to happen." I knew he was absolutely right at the time - what I did not know was that this disaster would take down the rest of the world in the process. I still cannot believe what we are living through these past 17 months now.

I pass on all of my very sincere condolences and ask for blessings for all of TGP's family and friends.

Reuben F. Johnson

We heard with deep sorrow the grave death of Pushpindar Singh. He was a wonderful and most appreciated person with whom we had the honour working closely for decades. He will be remembered as a great friend of Israel. Please pass our condolences to the dear family. Let us all cherish to what we have.

Dubbie & Ilan Shifrin, Israel

Brian made me aware of your Father's passing as well. He was a marvelous friend, always generous with his words and his smile. A very kind soul indeed. I hope this note finds you well. You and your family are in my thoughts.

Chris Chadwick

I just learned of Pushpindar's passing from Covid. I am truly sorry and my thoughts are with the family. I admired him very much, and recall being hosted in your family home in Delhi once along with Chris Chadwick. That was one of many fond memories I have which I treasure.

I pray that you can overcome the loss of this great man, and that you and your family stay safe during this terrible ordeal.

Brian Nelson

Journalist colleagues,

I have only just heard the sad news of Pushpinder's death and wish to convey to you my immense regrets at the passing of a fine gentleman and a thoroughly professional colleague.

Pushpinder was also a dear friend who, when we met at air shows around the world, was always full of enthusiasm for discussions on our favourite subject of aircraft. Never once did he give the impression that he was anything but overjoyed to see me again. Always a twinkle in his eye; always a happy or humorous remark to be made.

Our paths first crossed in the early 1980s when I was working for John Fricker—the author of a book on the 1965 air war with Pakistan. Pushpinder's view of events differed somewhat, but in public and private debates over the details, he argued his case with impeccable politeness and civility. In those pre-Twitter days, that is the way great men behaved.

So, farewell 'Pushy'. You elevated Indian aerospace journalism to world standards and lived a meritorious life which will be remembered by your many friends at home and abroad.

Paul Jackson (United Kingdom)

I was saddened to read today of the death of Pushpindar Singh Chopra. That tall figure with the turban was so much part of the airshow scene that Farnborough and Le Bourget will seem much smaller without him.

I have passed the sad news to our mutual friend Mike Gething. He and his wife were about to depart for a brief holiday, but he plans to get in touch with you as soon as they get back.

One of my amusing memories of your father was from Farnborough 2016 - the year that the opening day was washed out by heavy rain. He declared that the show was such a shambles that he'd never attend it again, and invited me to make the same pledge. If my memory is right (and given that I was born in 1943 it is getting a bit fallible) you, he, and I had met on the Saab exhibit, and your father declared that I was a near-perfect 'double' of some senior IAF officer whose name I have forgotten. But I can remember several of his fellow Indian journos agreeing, and a number of them wanted to be photographed next to me so that they could make jokes about it back home.

My wife was unwell in 2018, but I 'broke the pledge' and went briefly to Farnborough to get interviews for an article I'd been commissioned to write. I don't know if he was there, or had stuck to his idea of never returning...

I haven't done an air show since then. Jane's closed my magazine in 2013, and I parted company with them two years later. I did Eurosatory 2016 in order to let the industry know that I planned to work as a freelance specialising in missiles and defence electronics. But since magazines aren't commissioning enough show-related work to make a Paris trip economically worthwhile, I've been giving le Bourget and Eurosatory a miss. I was at DSEI 2019, and will probably do future UK shows if they help to provide material for forthcoming articles. As Mike Gething says, there is little point in going round a show saying "Remember me? I used to be a Jane's editor". But hopefully we will meet at one of the UK shows.

Doug Richardson

I condole the irreparable loss of your father and our well loved acquaintance- I speak for me. A true giant in Indian aerospace his contribution will perhaps never be assessed save for a few. A true giant. An oak has fallen.

Though I have written for Pushpindar since 1990 we rarely met. I do not know if Pushpindar got any awards but his life merits remembering the old wisdom "it is perhaps better to deserve an award and not get it than get an award and not deserve it". The growth of Vayu from "Vayuyaan" to Vayu Aerospace of today is his monument.

Prodyut Das

I was saddened at the news of Pushy's passing, since we had been friends for over 40 years. One of my many happy memories of you all was a lovely dinner at Friends Colony, many years ago – I have much to thank your generous and kindly father; I shall miss him. Hopefully one day when this disrupted world eventually rights itself, we shall all meet again – it will be an occasion to treasure.

I hope you and the family are safe and well, the situation in India being so tragic and unrelenting.

Meanwhile, my kindest regards and love to you all.

Mike Savage

I have known Pushi for many, many years and always remember the first time I meet him in my shop when I worked there as the boy! I was taken by his enthusiasm, knowledge, and passion for aviation and especially the India Air Force, which fascinated me. For many years he invited me to visit India and visit him and the air force...eventually I plucked up courage and packed up my cameras and film in those days and departed to India.

The first trip was a pioneering adventure, but was invaluable as we met many people and important Indian air force personal (as Pushi knew them all) who all helped pave the way for some 15-20 memorable trips to India to visit numerous Indian Air Force & Navy bases.

Whenever I visited Delhi, he always had time for me and insisted on meeting up (no matter what time of the day it was) and made me very welcome in the family home (and forced a vintage malt on me!)

I am so grateful for all the encouragement and support he gave me on my trips to India as without him none this would ever have happened.

May his legacy, passion and enthusiasm live on.

R.I.P Pushpindar

Simon Watson (The Aviation Bookshop, UK)

I am sad to hear about your uncle. Not only was he a brilliant academic who made lasting contributions to history, but he was a joy to be around. Talking with him reminded me of the banter of a gregarious junior officer in a fighter squadron! He was much younger in spirit and energy than his age would reveal.

His path in life and mine were destined to cross. Before I ever heard your uncle's name, I wrote a short paper about the Wagah-Attari border crossing (pictures attached) and the involvement of Major General Mohindar Singh Chopra, his father (picture attached). I cited A Soldier's Story and watched an interview of your uncle at the Partition Museum in Amritsar. Later on, I read *Vayu* extensively for my dissertation and contacted your uncle for an interview. We ended up spending an entire afternoon exchanging stories and talking about fighter aircraft; it was wonderful.

Even though we only met for a short time, Pushpindar left a lasting impression on me. It was unfortunate that we were unable to get our families together before I left Delhi. However, if you are ever visiting central California, I would love to show you around. Best wishes.

Fly Navy!

Lieutenant Commander Riley "Chlando" Walls, US Navy

How Uncle Pushi touched our lives

As a young schoolboy and an aspiring IAF pilot, one of the very first books I picked up was a second hand copy of "The aircraft of the IAF 1933 to 1973". That single book captured the ethos of the IAF so well, that it gave me the feel of almost actually being in the IAF. Over the years, even though I never actually flew with the IAF, I built up a considerable collection of aviation books including further books written by him on the IAF (including some very well produced squadron histories and unique tomes on indigenously built aircraft like the Marut).

But that original book continued to encompass my childhood aspiration to join the Air Force...and a journey that might have been. He provided a lot of us amateur/armchair "Air Warriors" a very significant virtual access to the IAF and I was definitely looking forward to it continuing for a long time to come. I guess now you folks at Vayu will have to carry forward that work.

Uncle Pushi ...you will be dearly missed by your innumerable nephews and nieces in the aviation community.

Ivan Jalaluddin

I no longer remember when I first met Pushpindar Singh Chopra, who for me was always Pushy. But he figures in the "Favourites" category of my mobile indicating our frequent interaction. He was a friend, though he was some years senior to me. But in terms of his enthusiasm for doing any anything and everything, he was decades younger.

Our connect came through the ruling passion in his life—aviation. In the 1980s, two of my journalistic beats—defence and civil aviation—benefited immensely from Pushy's knowledge. And yes, there were occasions where he tipped me off on good stories. At some point, I can't recall when, I was drafted into the editorial panel of the Vayu magazine that he had founded half a century ago. Over the years, the magazine, now edited by Vikramjit Singh, has improved in quality and style and is the premier publication of its kind in the region if not the country.

Pushy was the ultimate gentleman—kind, never intrusive and ever-helpful and an impeccable host. He never showed off his enormous knowledge of matters aviation and was not the one who would bore you with stories about it. In fact, his style was often to get you talking about an issue which he was quietly absorbing.

He was what in UK would be called the grand amateur—someone who had no direct training or connection to an issue but yet had, through his passion, developed an expertise way

Manoj Joshi, Capt. Shakti Lumba and Pushpindar Singh

beyond what trained experts often had. The books Pushy has edited or written, if placed end to end would probably exceed a foot. He was currently working on a book on naval aviation which will now be completed by his son and nephew. Such people went out of style a long time ago. But India was fortunate to have Pushy till his tragic and sudden demise.

Manoj Joshi

Pushpindar Singh Chopra shaped my life long before anyone might realise. Growing up, "Pushi mamaji" was the fun uncle for all us cousins, but my fascination for aircraft and aviation meant we shared a special bond. He would always remember to come back from air shows around the world with gifts of posters, magnets and models. In hindsight, my choice of the aviation and defence world for a profession was inevitable. But again, it was he who gave me my break, bringing me into the *Vayu* fold, where around the office we always referred to him by his initials – 'PSC'. Working with him on *Vayu* and the various aviation histories we published, from squadron books to the Battle of Laungewala, to the definitive history of the MiG-21 in IAF service, was the privilege of a lifetime.

His singular defining trait was a boundless reserve of energy and enthusiasm. One of my fondest memories was when just the two of us traipsed up and down the west coast of India covering Indian naval aviation in 2018. Those were long, humid, exhausting days, but he was a dynamo through them all, from sunup to late night shoots under stormy moonlit skies, and always, *always* closing the day out with a drink.

He nurtured my interests and skills, but also constantly pushed me to be better. The best of what I am is due in no small part to him.

Godspeed, and *ad astra*.

Angad Singh

Shall always miss you Pushpinder Uncle

As humans we all need a hand to guide us in the various stages of life. This hand is initially our parents, then our teachers and many a times we are blessed with hands which recognise our potential and guide us to the path of success. These are the hands of true mentors. And Pushpinder Uncle was one such guiding force for me, who always appreciated my effort, showered me with praises and loved me as a father would his daughter. For the last two decades there was never an airshow or a defence exhibition where we did not rush between conferences, visited display areas, met exhibitors and had coffee breaks at the media centre together. I was always in awe of his vast knowledge bank, his palpable enthusiasm, his abundant energy and his long list of admirers. For him age was only a number and more than a dozen times I got reprimanded for quoting mine. When I started ADU at 51, he was one of the few who told me it is never too late to chase your dreams. There are thousands of memories and words will always be short. Thank you Vikramjit for letting me share his love and blessings. Death has snatched him away but reminiscences will always be in my heart. Will always miss his love, affection and guidance. I end with an unknown poet's lines, "Your life was a blessing, your memory a treasure, you are loved beyond words and missed beyond measures."

Sangeeta Saxena
Editor, Aviation & Defence Universe (ADU)

Dear Sir,

On behalf of World Animal Protection, we offer our deepest condolences on the unfortunate demise of Pushpindar Singh Chopra, our founding Trustee and Chairman since 2007. During his Chairmanship, World Animal Protection has achieved many notable feats in the area of Animal Protection.

He was a philanthropist who had a great vision and under his guidance World Animal Protection achieved many milestones including interventions during many disasters, inclusion of animals in disaster management in the National Disaster Management Plan, the development of "The National Code of Practices for Management of Dairy Animals".

His support and thoughts to build a better future by raising awareness on the plight of animals and many other significant campaigns for ending the exploitation of wild animals in captivity and wildlife trade, will be always remembered.

The current pandemic has been devastating humanity and all of us are affected in one way or another. It is truly unfortunate that Mr. Chopra is no longer with us but his vision to protect animals will continue to inspire us to keep on the work to help and protect animals.

The Board of Trustee and staff would like to offer our heartfelt condolences to the bereaved family and pray to the almighty God that the great soul of Shri Chopra rests in eternal peace.

For and on behalf of Board of Trustee and staff,

Lt Gen (Retd.) Devraj Singh,
Trustee, World Animal Protection

Gajender K. Sharma, World
Animal Protection

I was very sorry to hear that Mr. Pushpindar Singh is no more. I was introduced to the esoteric niche Asian Air Forces History especially the Indian Air Force of which very little data or literature is available here in the States, through the various works of Mr. Singh and I had become a collector of his books.

Mr. Singh was a minefield of data and facts on your aviation history and it was a great privilege to interact with him. He had informed me of many book projects in-flight when we last interacted and I do hope some of these get completed in his memory!! Once again my heartfelt condolences to the family.

Robert Graeme
Chicago, USA

Pushpindar Sir "Uncle Pushy" was a trailblazer and a guru. I cannot forget the warmth and love he showed to us amateur historians or the encouragement he gave over the years. He was a doyen of Indian Aviation History and will be sorely missed.

Growing up in the 80s, with no internet and no good libraries to speak of in Hyderabad, it is easy to be ignorant of the body of work that Pushpindar Sir had generated over the 70s and 80s writing for noted publications for years. I came across my first reference to him in Air Chief Marshal P C Lal's book in the mid-80s which mentioned his first book "Aircraft of the Indian Air Force 1933-1973". Finding a reference to a "Civilian" who wrote a book about the Indian Air Force in itself was a fascinating fact. I subsequently found a copy of this book and it is not an exaggeration to say that I still keep referring to this book even to this day.

Ultimately, in the late 80s and early 90s, some stray copies of Vayu magazine made their way to local shops near me. Only then did I realise the groundwork Pushy Sir had laid in writing about Aviation in India and Aviation history. I was still unaware of his previous publications in Air Enthusiast, Air International, Air Forces Monthly etc - my respect for him increased exponentially when I ran into his articles later on.

My first contact with him started only sometime in 2000 or so, I mailed a printed draft of my first book dealing with the 1965 Air War to the Vayu address. Imagine my happiness when I got a glowing letter from him - he was thrilled that someone took an effort to put something about the war and though it needed more work, he encouraged me to continue working on it. For good measure, he added that he passed on the draft to Air Cmde Jasjit Singh and received positive comments about it. Needless to say, the boost that an amateur historian like me got out of that letter cannot be undervalued.

I met him in person for the first time at Aero India 2005, which is when I took this photograph. It was a moment that I cannot forget, framing two legends in the same photo. I have had the opportunity to interact subsequently multiple times. Once during a Delhi trip, while working on my second book, I gatecrashed the Vayu Office and I can never forget the warmth

Photo shows the number of books authored by him on the shelf (As indicated by the Red Bar) and I am sure there are at least half a dozen other books that are not part of the collection here like the unofficial brochures, articles etc are not represented. It would be a task to list the complete bibliography that he had produced over the years. But let me try anyway.

Pushpindar Singh with Marshal of the Air Force Arjan Singh

with which I was received. Of course, I have had the pleasure of meeting him quite a few times after that and we always kept in touch.

It is easy to overlook Pushy Sir's work. But put it all in one place, and it is astounding in the amount of work that went into it, and the size of shelf space it occupies. Apart from the numerous Squadron histories, the type histories on the Marut and Gnat, Who else can claim to have written a History of the Indian Air Force that spans nearly 700 pages? This is exactly what his 2007 magnum opus "Himalayan Eagles - History of the Indian Air Force Volumes 1-3" was about.

With his passing, We, the aviation historians, lost not only lost his vast knowledge but also his generosity and kindness. Rest in Peace - Pushpindar Sir.

PVS Jagan Mohan

Pushpindar Singh Chopra was one of the warmest persons I have ever met. He was larger than life with boundless energy & an unmatchable zest for life! He worked on a dozen projects at a time and had the incredible knack of getting others involved and passionate about them. Incredibly generous with sharing his knowledge as well as opening opportunities for others, he loved connecting with people and also connecting people he knew to others he thought they might get along with. He was a strong proponent of good relations with Pakistan & had friends both sides of the border. He had no compunctions about calling a spade a spade, no matter who he was challenging.

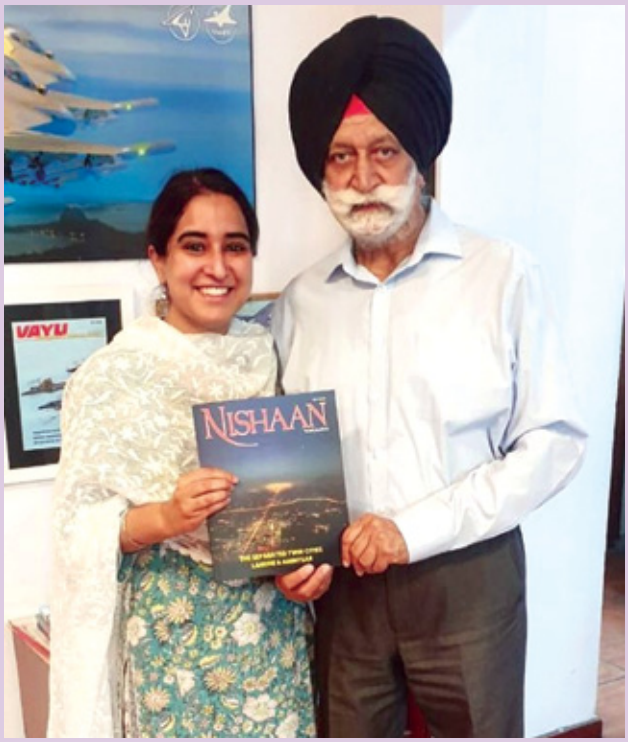
PSC was also one of the most interesting people you could ever meet - he had so many stories and first hand experiences and he loved sharing them! And what a raconteur he was - quite like the 1001 nights, each story nestled another which led to another, until the original was almost lost many hours behind, and almost every conversation ended with "remind me to tell you about that next time!"

Unlike many good talkers, he was also a great listener. And he remembered. He would ask after family and friends that you had once mentioned in a conversation six months ago.

He told me to think of him and Deepak Ma'am as my family in Delhi. Last year when I had Covid and quarantined alone, they sent across food and checked in every day.

Last April, he was extremely disturbed by the rising hatred in India vis-à-vis Pakistan; his response was to dedicate a special Nishaan issue to Punjabiyat-to celebrating cross-border connections and friendships & the oneness of our people and culture. Would I help him put it together?

It was a very delayed issue because of many reasons from both our ends, but we finally had it out in March this year (photo from that day)! I met him last in early April-we celebrated the



issue and the feedback we'd received and made plans for the future. Shall we cycle across Wagah? Knowing him, he would have made it happen.

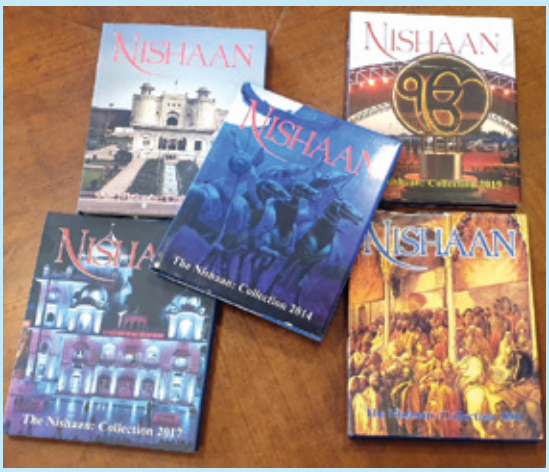
While I mourn him and keep his family and Deepak Ma'am in my thoughts, remembering him & sharing a sliver of the incredible man he was is my tribute to him. Sir, you will be missed.

Ganeev Dhillon

A MONUMENTAL LOSS

Pushpindar Singh Chopra is no more. The few years we knew each other were spent working and defining the role of the Nishaan magazine in the corporate life of Sikhs across the world -- irrespective of country, culture, language, and similar differences, even political that often define our communities. These different visions provide and enhance our strength, they are the base of Sikhi and its rich vision.

Pushpindar Singh with his better half Mrs. Deepak Chopra



The loss of Pushpindar Singh is critical and a painful one. But such is life. He is like a permanent and unforgettable stone in the worldwide modern reality of Sikhi. I was lucky to have been granted a niche in the works. And I will treasure my association with Pushpindar Singh Chopra.

Pushpindar began the magic of Nishaan. We need to continue and further develop the institution around the project.

I.J. Singh (New York)

Messages from Pakistan

PAF PRESS RELEASE

AIR CHIEF EXPRESSES GRIEF OVER THE SAD DEMISE OF AVIATION AUTHOR/ JOURNALIST PUSHPINDER SINGH CHOPRA

06 May, 2021: Air Chief Marshal Zaheer Ahmed Baber Sidhu, Chief of the Air Staff, Pakistan Air Force has expressed deep grief on the sad demise of renowned aviation author/ journalist Pushpinder Singh Chopra, who passed away in Delhi on 03 May, 2021 at the age of 77 due to Covid-19.

Pushpinder Singh was a renowned aviation author/ journalist and was famous for his dispassionate analysis. He was a great admirer of Pakistan Air Force and in 1991, he co-authored a book on PAF titled "FIZA'YA - PSYCHE OF THE PAKISTAN AIR FORCE" along with Ravirikhye and Peter Steinemann. Born in Sunny Bank Murree, he spent his early childhood in Lahore before his family migrated to India. In the year 2000, he visited Pakistan as a guest of PAF. Air Marshal Nur Khar former CAS, PAF also hosted a dinner in his honour at his residence.

The Air Chief has extended his heartfelt condolences to the bereaved family and acknowledged Singh's noteworthy contributions in the field of aviation journalism. He further said that his affiliation and admiration for PAF's professionalism would always be remembered.

PAF SPOKESPERSON

Air Marshal Zaheer Ahmad Baber Sidhu
Chief of Air Staff, Pakistan Air Force

DGPR (AIR FORCE) @DGPR_PAF · 2h

Air Chf Mshl Zaheer Ahmed Baber Sidhu, Chf of Air Staff, PAF expresses grief on the sad demise of renowned aviation author/ journalist Pushpinder Singh Chopra, who passed away in Delhi on 03 May, 2021 at the age of 77 due to Covid-19.

A Requiem for Friend,
The invincible iconic intellectual, intrepid historian with a midas touch when it came to flushing truth from fabrication of episodes of wars from the opposing air forces.

His sudden transit from terrestial to the celestial left me stunned, shocked just as thousands whose lives he touched.

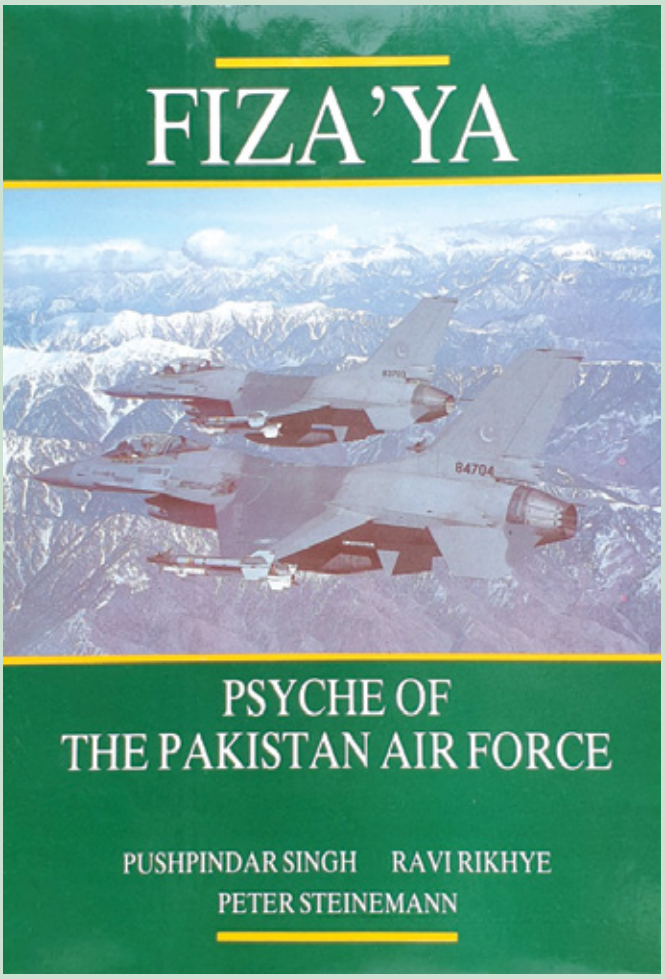
Two of us, represented opposing antagonist nations and air forces, different faiths and cultures, and each passionately loyal to our respective countries. So how did this incredible synergy exist between us? One factor was mutual respect to level of admiration, in ideals for peace not war as the panacea to co-exist. Also because to me he was a legend who neither suffered fools nor was self-opinionated. His words spoken and written had inimitable veracity; his stellar character oozed out like flashing beacon on a dark night in the Indo-Pak desert with Sirroco winds screaming across the two nations. Because he was a man of peace, truthful to a fault in his treatise about senseless wars in his magnum opus, Fiza'ya reflected his propensity for facts and veracity as his unshakable credo. With us PAF veterans searching for history with veracity, Pushpindar stands very tall and credible in comparison with the versions chronicled here. Our versions of History of the Air wars falls way short in substantiation. Typically, his generosity in accolades for the adversary was unmatched by any chronicle by our writers. The man Pushpindar was, had branded 1988 'Story of PAF' as unmatched compendium by any military in India & Pakistan, and deservedly so. Pragmatically, he opted not to critique the brazen fault lines on facts from the fiction, the unending bragging on both sides. But he would never be deficient in giving a firm whack where falsehood was obvious.

Every time we met, it was like tranquility had possessed those hours. We agreed that wars had caused irreparable damage not only materially, economically and in precious lives, owing to ignoble acts of behemoths on both sides, but it injected the incurable virus of hatred between nations. With an archaic ring and poignance, we would reminisce why IAF and PAF could not have spent valuable resources in virtual war exercises for enduring peace and not sparring and sabre rattling ad infinitum.

Such an approach by statesmen could thwart any threat to our two countries, while prosperity through trade for benefit of common suffering millions would have been the fall out, not massive casualties and threat of nuclear apocalypse hanging like the sword of Damocles.

Dear Pushpindar, you leave a deep bruise in my heart by flying away to higher firmaments, in total surprise. My world has suffered an irreparable loss of your poignant wisdom, deep sincerity, so rare. Time heals but the scar remains. You will always be a shining beacon for generation of both IAF and PAF for your indelible zest for truth, moral integrity, equanimity, deep compassion, sensibility and probity as I experienced in decades of mutually exclusive friendship. May your noble soul be flying with celestial birds of heaven and fortitude for your beloved deeply grieved, sterling family.

Air Commodore (R) Sajad Haider, Islamabad



In the photo: Pushpindar Singh flanked by Air Marshal (R) Malik Nur Khan and Air Commodore (R) Sayed Sajad Haider

Tributes from the Jullundur Brigade Association

JULLUNDUR BRIGADE ASSOCIATION

Words by email cannot adequately cover the loss we all feel.
I must inform you that this loss is also most keenly felt by Members of The Jullundur Brigade Association worldwide and I am receiving their condolences at the loss of their dedicated Vice President hourly. Once I have collated these expressions of affection and respect I will forward them to you for the family to retain. But it will be some time before I can do this in order to allow the sad news to reach all corners of the JBA. I have, of course, published a simple immediate statement on the JBA website. Finally for now, our deep sadness at the loss of one of the finest of men who was also one of my dearest friends,

Peter Davies
President, The Jullundur Brigade Association

The Inaugural Jullundur Brigade Association Dinner November 1989
Seated: Brig Fazle Qadir, Lt Col Roger Hislop, Lt Gen Ahmad Kamal, Maj Gen Peter Davies, Maj Gen Mohindar Singh Chopra, Brig Saeed Ismet, Lt Col Sadaqat Ali Shah
Standing: Maj L Taylor-Duff, Maj R Tranter-Owen, Gobindar Singh Chopra, Maj R Young, Capt Khalid Kamal, Maj BWR Baker, Capt D Chatterton, Capt Nadir Khan, Maj K Hastie, Maj FR Baker, Pushpindar Singh Chopra, Capt RA Bonner (photo: JBA)

Pushy's sad demise was unbearable. Not only was he a dear friend and highly respected professional colleague but the country has lost a worthy son. Pushy was undoubtedly one of India's best known authorities on aerospace, past and present, but also the Indian Air Force's trusted chronicler. Pushy's warm and humourous demeanor, on and off the field, won many hearts. I recall once, at Washington DC's new Air & Space Museum, how he regaled a whole bunch of American students on the history of aerospace - their minds boggled at this suave, turbaned gentleman displaying such a wealth of extempore knowledge.

Besides, Pushy and I shared a passion for military history, particularly the Indian Army. It was he who encouraged me, besides Peter Davies of course, to join the Jullunder Bde Assn. Here I am, a Hodsons Horse officer, with only a small link to the JBA (Hodsons were part of the Lahore and Ambala Bdes in France and Flanders) but it was Pushy's persuasive charm that won me over! He was so passionate in encouraging me to join this year's visit to the Battlefields. Alas!

Wonderful times!

Rest in peace good friend

Karun Khanna (Kinny)

Extracts from some of the many letters of condolences from members of the Jullundur Brigade Association on the announcement of the death of Pushpindar Singh. I send them to you in no particular order in the hope that they will give you an idea in what respect and friendship he was held by so many. You will, I am sure, have received many, many more.

1. From: Maj Gen AJS Sandhu Indian Army via Maj Mahin Malik late The "Piffers"
   "Even now it is difficult for me to accept that Pushy is no longer with us. Such an ebullient, kind and helpful person, full of zest. I loved my interactions with him. May his soul rest in eternal peace."
2. From: Maj Gen Mike Tennant CB late Royal Artillery
   "He was central to the JBA. He was utterly charming."
3. From: Rick Holt Late RAF
   "He was such a remarkable man. We were fortunate to have known him."
4. From: Christian Wragg
   "Terribly sad news. He was a lovely man. My thoughts are with his family."
5. From: Philippa Davies Widow of Lt Col Paul Davies The King›s Regiment (who first introduced Pushy to his brother Peter, now the JBA President, whilst being the British Assistant Military Attache in Delhi
   "I remember him as an outgoing, energetic and helpful person - he was the sort of person who made things happen. What resonated with me was his kindness and love of family, he was devoted to all of them."
6. From: Maj Mahin Malik late The "Piffers" Pakistan Army
   "I express, to his JBA colleagues, the condolences of all "Piffers" who knew him."
7. From: Rana Chhina
   "Pushy was a larger than life figure in many ways. Extremely knowledgeable, generous, a wonderful host and a good human being. He was the foremost historian of Indian Aviation."
8. From: Col Martin Amlot OBE OStJ DL Late The King›s Regt
   "I am very proud to have known him. We all owe him a debt for that he consistently promoted understanding between us all."
9. From: Clare Gorst
   "He was a man of such dignity, full of great intelligence and humour.
10. From: Maj Stephen Wright Late The Kings Regiment
    "The loss of Pushpindar is dreadful news".
11. From: Col Barrie Fairman late The Kings Regiment
    He was clearly a very special human being who made a great difference to the World."
12. From: Brig Peter Rafferty MBE DL late The King›s and Duke of Lancaster›s Regiments
    "Pushy leaves a huge gap in our ranks; he had such a positive impact on all who knew him. His dedication to defence now and in our shared history was an inspiration to us all. India has lost one of its finest gentlemen."
13. From: Maj Leslie Fox late The King›s Regiment
    "I am very saddened to hear of his passing."
14. From: Mrs Gita Bagai JBA Member and Family Friend
    "We are all devastated to hear the news."
15. From: Maj Taff Gillingham
    "What terrible news. I send my condolences and those of the Ipswich and Suffolk Regiment Association."
16. From: Iain Smith Secretary and Editor The Sikh Pioneers and Sikh Light Infantry Association
    "Terribly sad news."
17. Mr Peter Ginger JBA Member and Colleague
    "Sincere condolences."
18. Brig TIM Waugh late Royal Signals
    "The JBA Tour to India gave me an insight into an unique individual, respected and revered by all who met him."
19. From: Col Ian Paterson OBE TD late The King›s Regiment
    "So incredibly sad to read of his passing. Words fail me. How cruel this is. We are heart broken."
20. From Paddy Singh late Indian Army
    "We have lost a great colleague."

Peter Davies
President, The Jullundur Brigade Association

Association Meeting New Delhi 2009

Brig Clive Elderton UK DA India, Pushpinder Singh Chopra, Maj Gen Ashok Mehta 5RGR (FF), President, Lt Gen M.S. Bhuller former Colonel The Sikh Regiment, Sqn Ldr Rana Chinna, Mr Peter Williams. (photo: JBA)

Words cannot describe what I and Pushie's friends went through and are going through right now after hearing of what happened. No words can describe our feelings at his loss and even more that of you and your brothers. I can only recall the words of Elizabeth Frye, that so aptly mirror Pushie and our loss of him -

I am a thousand winds that blow.
I am the diamond glints on snow.

I am the sunlight on ripened grain.
I am the Gentle autumn rain.

When you awaken in the mornings hush,
I am the swift uplifting rush
of quiet birds in circled flight,
I am the soft stars that shine at night.

Do not stand at my grave and cry,
I am not there, I did not die.

I pray, and we, all his friends pray that your mother comes out of it and home to you all.

In sadness

Paddy Singh

Jacquie and I were so sad to receive your devastating news and have been in a state of shock really ever since. Please accept our most sincere condolences. I first met 'Pushy' many years ago at a JBA gathering in the North West when I commanded the Kings Ist Battalion and although I met him only on a few occasions since, he was the formidable link the Association needed to ensure it became such a successful and enduring organisation. Pushy epitomised all the best qualities we have come to admire and like so much in our Indian JBA friends. We will all miss his gentle charm and innate courtesy. He was a wonderful and fun companion.

Jeremy and Jacquie Gaskell

I do not think we ever met when I was in India, but I just want to tell you how sad I am to hear of the untimely death of your father. Have met your father on many occasions in London, Ypres and then in India when he arranges a JBA tour, it is hard to envisage that he has left us. I was always remember him as an individual with energy, respected by all and a real gentlemen. He will be sorely missed by all who knew him.

Brigadier Tim Waugh

HRH the Prince of Wales - Sikh Reception 2008

HRH the Prince of Wales speaking to Pushpinder Singh Chopra and Major General Peter Davies, both wearing the association tie, at a reception for members of the British Sikh community. Clarence House, London. (photo: JBA)

How does one pay tribute to a Jovial Giant of the obscure hobby that one pursues?

Someone who has been a Pathfinder, has laid foundations and offered solace?

Pushpinder Singh Chopra is that precise person who actually cannot be boxed in.

I met him at Aero India 2001- I was covering my first Air Show from Bharat-Rakshak.com, gaped at him because we sat next to each other at one of the Press Conferences, he asked a probing question about the LCA. I walked up to him later and introduced myself. He enveloped me in a hug, offered me refuge at the Vayu Stall and he was just a hover away. And then I ran into him at the International Fleet Review in Mumbai. Side by side seating again on the Presidential Yacht- and he asking me, a 22 year old goofy kid about ship names and making notes. I grew two sizes taller.

The next meeting was in June in Delhi. I rang him up and he invited me over to a house party. That was him - always there, always providing succour and shelter to whoever took the Indian Armed Forces seriously.

His work, his research, his efforts paved the way for so many. Today when everyone has a website, a blog, a social media blowhorn, it is significant to acknowledge and adore what Pushy Uncle did for everyone who has followed in his wake. His legion of admirers is multicultural, diverse and truly global. I was part of a Doordarshan panel show with him on the eve of Air Force Day in 2006. And before we could start recording- he told me that he will talk about the past- the RIAF- because he is from the past. I should talk about the IAF's future because I will be around to watch it.

I gaped again.

Farewell Pushy Sir- I can imagine the twinkle in your eyes as you wear your trademark bush-shirt and hang out with your friends in heaven's Great Fighter Pilot Squadron.

Kapil G Chandni

Tribute to Pushy

I'm going to miss Pushpindar. I didn't see him that often but when I did, it was always a great occasion. He was a man of style who endeared himself to anyone he spoke to, during any occasion.

Despite my many visits to the Pakistan Air Force he always remained fair-minded, which is what really caught my attention. Instead of treating me like the enemy, like so many of his compatriots Pushy would show me the utmost respect. Whenever we met he would always probe me about the JF-17 Thunder, for no other reason than his admiration for the PAF, which he had written about glowingly in the past. Yep, Pushy was in a class of his own.

It won't be me of course that misses this great man, there will be his family, his colleagues and of course his friends, like me. RIP Pushpindar.

Alan Warnes

Group Editor, Modern Military Air Forces Monthly, Air International (military) and Combat Aircraft Journal

The sad untimely demise of Pushpindar Singh, the doyen of Indian Aviation historians, is a big shock for us. His myth busting of the Sargodha incident was seminal and in a way coming of age of IAF historians. Uncle Pushy as he was affectionately known, was a big influence on how the global aviation enthusiasts perceived the IAF in the absence of published official IAF history. Many of his works grace my bookshelves including the first ever Aircraft of the IAF 1933 onwards. We will miss his generous and witty personality.

Krishna Jaga

Tributes from the "Dornier family"

We went a long way together. When I met Pushpindar Singh Chopra first, it is now nearly 40 years ago, my colleges at Dornier introduced me to "Pushy" and I soon understood that this nickname had a good reason. He pushed when others rested, he fought when others gave up, when there was success he planned already the next action.

He was obsessed with knowledge and with passing on this knowledge, I remember us visiting an aerospace museum in Bangalore and there was this class of 8 year old boys and girls with a teacher who obviously was not very knowing about the aircraft on display. Pushy took over and I have never seen young children listening with more attention to this man who was a stranger to them five minutes ago and explaining to them now not only technical items but also teaching them history.

Pushpindar was known not only all over India but also highly respected as aviation and history specialist in Europe and Germany. Without him the success story of the Dornier 228 would never have happened. This aircraft was his "baby" and there was no edition of his magazine "Vayu" without mentioning that another Dornier 228 has been handed over to the Indian Air Force, the Navy or the Coast Guard.

We all have lost a great man, an aviator, a historian. I have lost one of my best friends. He will live on in our memories.

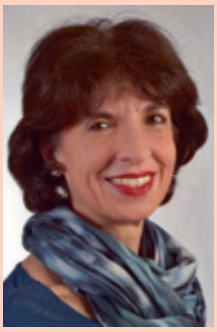
Peter Klonk

My deepest and heartfelt condolences to the entire family. Most shocking is your message and for the time being I cannot find any words. I will write you a letter soon. However I found a beautiful photo from around 1999 when your father visited us in our house in Stockdorf. See him smiling, such a beautiful smile and character, I will never forget him!

I will always remember Pushpindar as a cheerful enthusiastic friend and colleague, dedicated to his family and to the world of aviation. During and after our intensive 'Dornier days' together, it was always a pleasure and a highlight to meet him during the airshows here and there.

I have also informed the 'Dornier gang'.

Thomas Friedberger



Helga forwarded your e-mail to me, and I'm glad to have a direct way now to get in touch with you. Yet, it has taken me some time to write – it's not easy to find words in a situation like this.

I knew that your parents had fallen ill with Covid as I had been on a Whatsapp chat with your father just recently. But he sounded very optimistic: "… on the way to recovering soon". So it really came as a shock when Parbeen sent word of his passing away.

I'm still grappling with these sad news and I wish all this was just a bad dream that will vanish when you wake up. Yet I know it IS real and that for you and the family this nightmare is by far not over yet. Quite to the contrary, as you have to shoulder this double burden of coping with the loss of your father and at the same time fearing for your mother and fighting for her reconvalescence.

I do hope that she has improved by now and is out of hospital. She will need all your care and attention to get back to her old self.

You say that you are "trying to make sense of what is going on around" you. Actually, it does not make any sense, unless you believe in a kind of superior will. Who knows what the higher purpose of all this is...

With this in mind I wish you and your brothers as well as your families the strength it takes to overcome these bleak times. And – also on behalf of my husband and son as well as my sister, who all met your father at some stage and were impressed by him – I would like to express my/our sincere condolences to you all.

I'm proud to have known this wonderful person Pushpinder Singh Chopra and I will always keep him in my memory.

Martina Brückner

These are sad and difficult times to write to the family. They have kept me informed of the sad fate of my dear colleague of 40 years, best friend and older brother, and the terrible loss to your family. It is so shocking and we just couldn´t believe it, especially as Peter said he was feeling better in late April. I considered your father as my brother in arms, fighting odds, laughing, drinking and dancing at all these weddings in the past, introducing me around his many Coast Guard, Navy and other friends, always there. But no more.

Helga Driesen

Thinking of your dear father, whom we all from the "Dornier gang" and especially the Schönbuchners, loved and respected so much: we are extremely sad.

After all the turbulences of the last decade and in spite of them, the words your father found for Gerd, when he was gone, gave me so much of consolation - you cannot imagine. Only a noble heart like his could do so.

The last sentence in an email he sent me after Gerds passing away, was "...and, God willing, we will meet again." God was not willing. We have to submit. But every time I read these words since, grief came like a wave. And tears. I hope your family slowly can recover from that heavy blow. Please accept our deepest sympathy and warm regards from all of us!

Gisela and children

TO SIR WITH LOVE

It was in September 1986 when we first met. A tumultuous beginning resulting in an incredible journey of 35 years. PSC made me an integral part of Vayu Aerospace Review for which I am ever grateful.

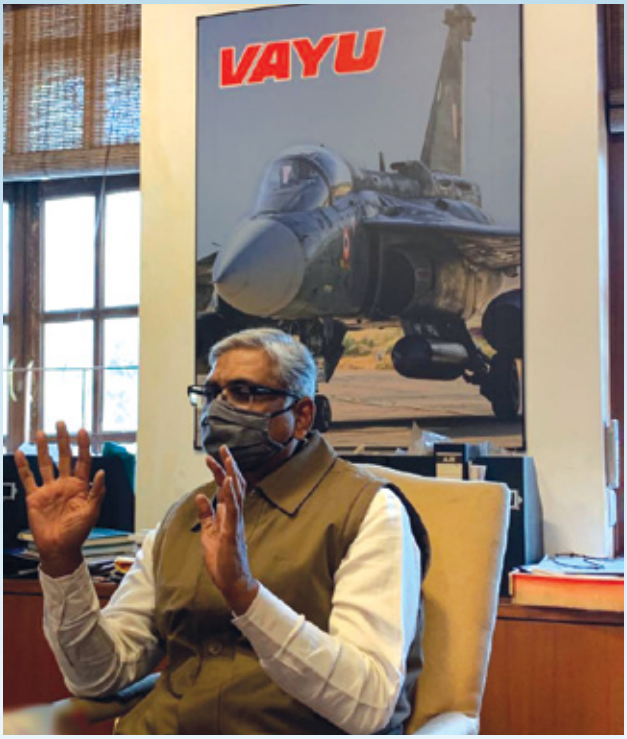


Photo by PSC in Vayu office, November 2020

In over three decades of our association, PSC played different roles in my life.

As a mentor, he was an inspiration. I imbibed his tenacity for hard work and his unwavering doggedness in pursuit of excellence.

He was a friend and a father figure. He graciously assimilated my family into his own. We admired not just his humility and generosity but his effortless ways of making you feel valued.

PSC was my benefactor. What I am today is in large measure because of him. I am forever indebted to his magnanimity. For that I salute him.

Personally, this loss has left a deep chasm. An emptiness which can never be filled, like a loss of a parent.

Sir, your influence in my life will remain unparalleled. I truly did enjoy and appreciate your Friendship.

With Respect, Gratitude And Affection

Arun Singh

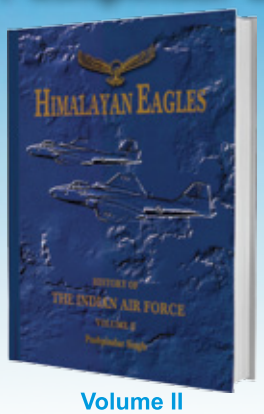
THE IAF's HISTORY ENSHRINED

HIMALAYAN EAGLES

by Pushpindar Singh

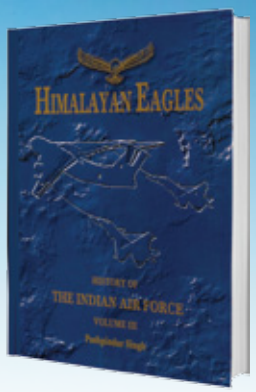
Volume I

Foundation



Volume II

Consolidation and Expansion



Volume III

World Air Power

IAF Squadron Histories

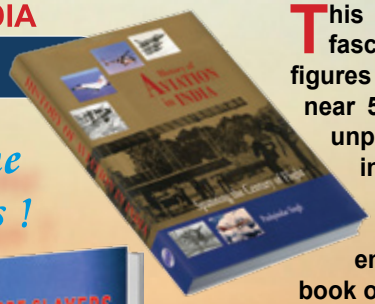
by Pushpindar Singh

Tigers in the Sky	The Battle Axes	First Supersonics
Tusker Charge	The Fighting Fourteen	Black Archers
Dragon Fire	When Lightnings Strike	Valiant to the Last

Publications by The Society for Aerospace Studies

HISTORY OF AVIATION IN INDIA

Spanning the Century of Flight
by Pushpindar Singh



This unique publication presents much fascinating history, with facts and figures embellished with a feast of images, near 500 of them, many rare and hitherto unpublished. The History of Aviation in India is a veritable treasure trove of aeronautical history that will assuredly become both the air enthusiast's and aviation professional's book of reference as the world continues on the second century of flight.

All time Classics !

Spirits of the Wind

by Pushpindar Singh

Sabre Slayers

by Pushpindar Singh

First to the Last

by Pushpindar Singh

The First Supersonics

by Air Marshal Philip Rajkumar and Pushpindar Singh

Limited Stocks!

Enquiries to:
The Society For Aerospace Studies
D-43, Sujan Singh Park, New Delhi 110 003, India
Phone: +91- 11-24626183, Fax: +91 11 24628615
Email: vayu@vayuaerospace.in

Air Marshal Brijesh Jayal says

Deploy strategies of war-fighting ingeniously to overcome the once-in-a-lifetime Covid-19 crisis

Reflecting on the unfolding pandemic, in a blog over a year ago, this writer had rued–'Make no mistake, this is nothing short of a war'. At the time, one naively believed that this challenge could be overcome by leaders and elected representatives uniting as one and fanning out to be amidst the people who had elected them. As events have unfolded, not only has this hope been belied, but sharp political divisions resulting in claims and counter-claims have resulted in an already anxious people, both divided and confused.

Today when the second wave of the disease surpasses previous records almost on a daily basis, bringing in its wake endless suffering and tragedy, riding rough shod over herculean efforts by all those physically and mentally battling it, it is the social media comment by a veteran General that appears to have hit home. The Army Chief who led the nation's successful war in Kargil, has sombrely reflected in a tweet, "Our nation is at war. Is the nation focused on this war? Election rallies, faith events, farmer agitation, in-fighting over resources going on …wake up India!"

Judging by editorial and electronic media response to this appeal, it appears that there is much sympathy with this sentiment. To heed this wake-up call perhaps it is time now to look for strategies not in books relating to our democratic system of governance, but ones relating to war-fighting and how these can ingeniously be applied to overcoming this once-in-a-lifetime crisis.

War manuals lay foremost emphasis on morale of the fighting force, because devoid of this and indeed morale of the population backing this force, the best of strategies and plans will come to nought. Morale is a positive state of mind derived from inspired leadership, a shared sense of purpose and values, well-being and team cohesion. The biggest attribute of any leader civil or military to lead in a crisis situation should be to lead by example and shore up the morale of all those being led. Morale is that rare attribute that perceptible military leaders can feel in their bones and should it begin to evaporate amongst their troops, even the finest of them will need godly qualities to revive it.

In a democracy, where of necessity, there are diverse shades of opinion and ideology, with different parties, interest groups and leaders espousing each, the challenge is how best to uplift the morale of a people as one. Looking at the landscape of how our democratic institutions are faring in this war against Covid, one thing is certain. There appears no visible effort on the part of diverse shades of opinion, political or otherwise, to set aside legitimate ideological and other differences and present a united face to confront this deadly common threat. Without this unity of leadership and purpose, society will remain fragmented with national morale being the first casualty. If there is one lesson of warfare that is worth emulating at this critical juncture, it is for our polity and diversity of opinion to shed differences and stand united such that national morale is strengthened.

Another principle of war allied to morale is one of the spirit of cooperation and team work. This entails sharing of threats, challenges, dangers, risks and burdens in every aspect of military life. How this can be applied to the democratic landscape where the very idea of a vibrant democracy is for diverse and opposing ideals to harmoniously co-exist, is the challenge that our mature democracy and its various constituents are expected to find answers to. Surely in this battle for survival, our democratic polity has the will and sagacity to shed political or personal self-interest at the altar of the larger common good — that of the people it professes to serve?

The third principle of war that is relevant in today's context is that of unity of command where a single commander is designated with requisite authority to direct forces in pursuit of a unified purpose. One had hoped that in keeping with our federal democratic structure, where each state has its elected leader, the initiative for determining the best model to emulate this principle of unity of command would have voluntarily originated from this collective leadership. In practice, alas, what we have witnessed during the present crisis, is quite the opposite.

In fairness to democratic ideals, and in keeping with military norms, when the battle ends must come time for lessons to be learnt by revisiting the entire operation, the tactics adopted, successes or failures and the lessons learnt. This is what war histories are meant to do and indeed was the experience post the Kargil conflict although our record of not publicly sharing the report of 1962 conflict, is not a worthy example! In a similar spirit, one would expect defeat of Covid to be followed by an objective assessment of how Indian democracy responded to the challenge, to be shared with the people of India who in true traditions of democracy will then judge by the power of their ballot.

And finally, this is the first time that democratic India is faced with a peace-time threat that is more menacing than the wars the country has fought. The military played its part when so directed; it is now to the genius of Indian democracy to find the best way to respond and do so in haste. Let the veteran General's 'wake up India' call be the catalyst.

MoD and export of defence equipment

"The important defence equipment exported during last 5 years include Weapon Simulators, Tear Gas Launcher, Torpedo Loading Mechanism, Alarm Monitoring & Control, Night Vision Monocular & Binocular, Light Weight Torpedo & Fire Control Systems, Armoured Protection Vehicle, Weapons Locating Radar, HF Radio, Coastal Surveillance Radar etc. Export leads/interest for Indian defence equipment from small components to major defence platforms are being received from all over the world including Asian, European, North American, African, Latin American and SAARC countries. Presently defence items from India are being exported to more than eighty four countries. Names of the countries cannot be divulged due to strategic reasons".

New Defence Production Policy

A Draft 'Defence Production & Export Promotion Policy (DPEPP)' 2020 has been placed in public domain by the Department of Defence Production, Ministry of Defence. This draft policy is positioned as Ministry of Defence's overarching guiding document to provide a focused, structured and significant thrust to defence production capabilities of the country for self-reliance and exports. It envisions to make India amongst the top countries of the world in the defence sector, including aerospace and naval shipbuilding sectors, from design to production, with active participation of public and private sector. This policy, inter alia, aims to create an environment that encourages R&D, rewards innovation, creates Indian Intellectual Property (IP) ownership and promotes a robust and self-reliant defence industry.

MoD on modernisation of the naval fleet

"The Indian Navy remains operationally ready and maintains combat ready platforms with additional forces in readiness at various bases/ports. Indian Navy is always ready to address any eventuality posed by the adversaries in its area of operations. It also diligently follows the Maintenance, Training, Operations and Deployment Cycle ensuring a high state of material as well as combat readiness encompassing all spectrums of maritime operations.

Modernisation of Indian Navy is an ongoing process, and is undertaken in accordance with Long Term Integrated Perspective Plan which is reviewed from time to time".

BEL achieves record turnover of Rs. 13,500 Cr

Bharat Electronics Limited (BEL) has achieved a turnover of about Rs.13,500 Crores (Provisional & Unaudited) during Financial Year 2020-21, against previous year's turnover of Rs.12,608 Crores in spite of the "challenges posed by COVID19 Pandemic & intense competition in business". BEL's Order Book as on 1.4.2021 is around Rs.53000 Crs and in the year 2020-21, BEL secured significant orders worth Rs.15000 Crs. Some of the major orders acquired during the year are ICU Ventilators, Software Defined Radios & Communication equipment, various types of radars, sonars, torpedo decoy systems, electronic warfare systems, networking & encryption products, and smart cities etc.

BEL receives 12 Green Channel Certificates for 41 products

It was a moment of pride for Bharat Electronics Limited (BEL) when a year back it received the Directorate General Quality Assurance (DGQA)'s Green Channel Status certificate for supply of Spares for Flycatcher Radar, manufactured at its Military Radar Strategic Business Unit (SBU) in Bangalore. It was the first time any organisation in India was issued this coveted certificate, ever since the Green Channel Policy was formulated.

Now, the PSU has received 12 Green Channel Certificates for a total of 41 products manufactured at 10 SBUs/Units: Ghaziabad Unit and Military Radar SBU for Radars, Naval Systems I and Naval Systems II SBUs for Naval products, Military Communications SBU and Panchkula Unit for Communication equipment, Machilipatnam Unit for Opto Electronic products, Navi Mumbai Unit for spares for Mast, Pune Unit for batteries for communication equipment, and Chennai Unit for gun upgrade.

ALH demonstrates deck operations capabilities in ship-borne trials

HAL's Advanced Light Helicopter Dhruv Mk III MR has successfully demonstrated its deck-operations capabilities that included landing on deck, folding of blades and storing the

helicopter inside the onboard hangar. The recently concluded ship-borne trials off Chennai coast in collaboration with the Indian Coast Guard also covered maintenance activities inside the hangar and on the deck, hot refueling with engines running on the deck. The helicopter is equipped with Shakti engines and an advanced glass cockpit. HAL had recently delivered ALH Dhruv Mk III MR to Indian Coast Guard as part of its 16 ALH Contract.

Indian Army Formally Closes Down Military Farms

Military Farms were set up with sole requirement of supplying hygienic cow's milk to troops billeted in various garrisons across British India. First Military farm was raised on 1 Feb 1889 at Allahabad. Military Farms were even established in Leh and Kargil in late 1990s, with the role of supply of fresh and hygienic milk to troops at their locations on daily basis. After 132 years of service to the nation, curtains were drawn on this organisation. All the officers and workers have been redeployed within the ministry to continue providing service to the organisation.

Mr. Rajnath Singh and his Korean counterpart to strengthen ties

Raksha Mantri Rajnath Singh and Minister of Defence of Republic of Korea (RoK) Mr Suh Wook successfully concluded their bilateral talks on defence cooperation in New Delhi on 26 March 2021. The defence and security engagements between India and RoK have grown exponentially over the last few years. Latest talks explored new domains of bilateral defence cooperation and avenues to strengthen the long-standing bilateral defence partnership.

Indian and US Special Forces conclude joint training exercise

The 11th edition of Indo-US Joint Special Forces Exercise VAJRA PRAHAR 2021 was conducted at Special Forces Training School located at Bakloh, HP in March 2021. The joint exercise by the Special Forces of both the countries is conducted alternatively between India and the United States to share the best practices and experiences in areas such as joint mission planning and operational tactics as also to improve interoperability between the Special Forces of both nations.

Exercise SHANTIR OGROSHENA 2021

Multinational Military Exercise SHANTIR OGROSHENA 2021 (Front Runner of Peace) commenced on 4 April 2021 at Bangabandhu Senanibas, Bangladesh to commemorate the birth centenary of Bangladesh's 'Father of the Nation' Bangabandhu Sheikh Mujibur Rahman and mark glorious 50 years of liberation.

Indian Army contingent of 30 personnel are participating along with contingent of Royal Bhutan Army, Sri Lankan Army and Bangladesh Army from 4-12 April 2021. Military observers from USA, UK, Turkey, Kingdom of Saudi Arabia, Kuwait and Singapore were also in attendance throughout the exercise.

MDSL to supply Light Specialist Vehicles to Indian Army

Providing further boost to 'Make in India', Ministry of Defence (MoD) signed a contract with Mahindra Defence Systems Ltd (MDSL) for supply of 1,300 Light Specialist Vehicles to the Indian Army, at a cost of Rs 1,056 crore, in New Delhi on 22 March 2021. The induction of vehicles is planned to be completed in four years. The Light Specialist Vehicle is a modern fighting vehicle and will be authorised to various fighting units for carriage of medium machine guns, automatic grenade launchers as well as anti-tank guided missiles.

BEML rolls out MMME – MKII

BEML Limited, one of the leading public sectors under Ministry of Defence, GoI, has rolled out the first prototype of Mechanical Minefield Marking Equipment Mk-II, built on BEML TATRA 6x6 an 'Aatmanirbhar' product, developed through TOT from R&D E Engineers, DRDO.

Mechanical Minefield Marking Equipment MK-II developed by R&DE (Engineers) would greatly benefit Indian army to mark/fence minefields and is designed for marking the mine fields at faster rate, semi-automatically with minimal human intervention.

The equipment is capable of marking/fencing at a minimum rate of 1.2 km/hr with inter-picket spacing of 15 m. The system has capability to place the pickets at 10 – 35 meters spacing in the step of 5 m. The picket can be driven to a maximum depth of 450 mm by this system. MMME Mk-II system is designed to operate in plains of Punjab, as well as semi-desert & desert of Rajasthan, in all weather conditions. The system can store 500 numbers of pickets and polypropylene rope of 15 km in length.

Inauguration of extension of naval jetty phase-II

A major naval project of ‹Extension of Jetty› at the Naval Wharf was inaugurated by Vice Admiral SR Sarma, Chief of Materiel of Indian Navy, on 22 March 2021. Rear Admiral Suraj Berry, Chief of Staff, HQ Andaman and Nicobar Command and Shri TN Krishnamoorthy, Chief Engineer, Andaman & Lakshadweep Harbour Works were present for the event. The 230 metre long jetty is one of the larger marine infrastructure projects being undertaken at Andaman and Nicobar Command both in terms of magnitude and technical complexity. The jetty will enable mooring alongside of the Floating Dock and will significantly boost the ship berthing and maintenance capability of the Tri Service Command.

French naval ships in Kochi

French Naval Ships Tonnerre (Amphibious Assault Ship) and Surcouf (Frigate Class Ship) were on a two day good will visit to Kochi. The ships arrived at Cochin Port Trust on 30 Mar 21 and were received by senior naval authorities in the background of fanfare by the naval band. The French delegation comprising Mr Emmanuel Lenain, French Ambassador in India at New Delhi,

Rear Admiral Jacques Fayard, French Joint Forces Commander in the Indian Ocean (ALINDIEN) and Mrs Lise Talbot Barre, Consul General of France in Puducherry were also present, as part of the visit.

GRSE's FPV handed over to Seychelles

In line with India's vision of 'SAGAR' (Security And Growth for All in the Region) that puts 'Neighbourhood first', Fast Patrol Vessel (FPV), SCG PS Zoroaster built by Garden Reach Shipbuilders and Engineers Limited (GRSE), Kolkata, a leading shipyard of India was handed over to the Seychelles Coast Guard by the Prime Minister, Mr. Narendra Modi in the presence of His Excellency Wavel Ramkalawan, President of the Republic of Seychelles. The handing over ceremony was conducted in virtual mode in presence of senior dignitaries of both countries.

Commissioning of ICGS Vajra

Indian Coast Guard Ship 'Vajra', the sixth in the series of seven Offshore Patrol Vessels (OPVs) constructed by Larsen & Toubro Ltd., was commissioned at Chennai by General Bipin Rawat, Chief of Defence Staff on 24 March 21. ICGS Vajra, the 98 metre OPV, has been designed and built by Larsen & Toubro Ltd

at Kattupalli, Chennai and is fitted with state-of-the-art navigation and communication equipment, sensors and machinery. The ship will be equipped with 30mm and 12.7mm guns with Fire Control System for enhancing its fighting efficiency. The ship draws 2100 tons (GRT) and is propelled by twin MTU 8000 series engines of 9100 KW each, capable of achieving 26 knots of top speed and endurance of 5000 nm at economical speed.

Air Force Commanders' Conference Apr 2021

Defence Minister Mr. Rajnath Singh addressed the biannual IAF Commanders› Conference (AFCC-21) on 15 Apr 21 at Air Headquarters. Air Chief Marshal RKS Bhadauria, Chief of the Air Staff (CAS) welcomed the Minister, Gen Bipin Rawat, Chief of Defence Staff (CDS) and other senior officials from the MoD. During his address the Defence Minister expressed happiness that the conference coincided with the birth anniversary of the Marshal of the Air Force Arjan Singh, DFC. The Minister congratulated IAF for ensuring a timely and befitting response to the sudden developments in Eastern Ladakh. He advised the Commanders to draw up long term plans and strategies for capability enhancement to counter future threats. He appreciated the critical focus of IAF towards reorienting for the future.

Ashok Leyland delivers LBPV to IAF in collaboration with Lockheed Martin

Ashok Leyland, the flagship company of the Hinduja Group and the largest supplier of logistics vehicles to the Indian Army, has strengthened its Armoured vehicle platform by delivering first of its kind «Light Bullet proof Vehicles» (LBPV) to the Indian Air force. Ashok Leyland delivered first lot of these modern vehicles on 13 April. LBPV is an adopted version of Lockheed Martin›s CVNG (Common Vehicle Next Gen) and has been developed under TOT from LM to Ashok Leyland. It is completely indigenised and developed in India.

Indian Navy deploys INS Nireekshak for underwater search

Consolidating the ongoing Search and Rescue efforts for the missing fishermen at sea off the coast of New Mangalore, the specialised Diving Support Vessel - INS Nireekshak was pressed into action by Indian Navy to undertake deep sea diving operations using specialised equipment and naval divers on 16 Apr 21. The ship was able to recover three bodies the same day and handed them over to local authorities at New Mangalore on 17 April 2021.

INAS 323 commissioned at Goa

Indian Naval Air Squadron (INAS) 323, the first unit of the indigenously built ALH Mk III helicopter, was commissioned into the Indian Navy in the presence of Raksha Rajya Mantri Mr. Shripad Naik and Vice Admiral R Hari Kumar, Flag Officer Commanding-in-Chief of Western Naval Command, at INS Hansa, Goa on 19 Apr 21. INAS 323 is commanded by Cdr Samik Nundy, an accomplished and experienced ALH pilot with extensive operational experience.

Thales Airborne Anti-submarine Warfare Sonars for the Indian Navy

Thales has signed a contract with Lockheed Martin as a tier-one supplier for the delivery of up to 55 airborne anti-submarine warfare sonars. The ALFS (Airborne Low Frequency Sonar) dipping sonars will be installed on the MH-60R platform for the US Navy and three additional navies including the Indian Navy. Delivery of the first 42 systems will occur over the next five years with a delivery of 13 optional systems to occur in year six. The navies of India, Denmark and Greece will receive their first deliveries of the ALFS sonar system through direct US Foreign Military Sales of the MH-60R platform.

IndiGo signs LOI to bring freighters on board

Building on the success of the CarGo business in recent years, IndiGo has initiated a freighter programme and is in the process of sourcing 4 A321ceo aircraft each of which will be converted from passenger jets to a full freighter configuration. A Letter of Intent has been signed with a lessor for two aircraft already, and IndiGo expects to reach agreement for the next two shortly. The initiative will make best use of the natural synergies that IndiGo offers, using the same pool of pilots and engineers that fly and service its current fleet.

DSM and MKU Ltd cooperate

Royal DSM together with armour manufacturing partner, MKU Ltd, has provided next generation armour technology with Dyneema unidirectional (UD) material to support the Sao Paulo police. The hybrid vest solution developed MKU for the Sao Paulo police utilises predominantly Dyneema UD material to reach new levels of performance and protection while simultaneously enhancing user comfort and mobility.

Chief of Army Staff visits Siachen and Eastern Ladakh

Gen MM Naravane, Chief of Army Staff visited Siachen and Eastern Ladakh on 27 April and reviewed the operational situation in the sectors. He was accompanied by Lt Gen YK Joshi, Army Commander, Northern Command and Lt Gen PGK Menon, GOC, Fire & Fury Corps. Gen Naravane interacted with the troops and complimented them for their steadfastness and high morale, while being deployed in some of the harshest terrain, altitude and weather conditions.

Rolls-Royce and HAL MoU for Supporting MT30 Business

Hindustan Aeronautics Limited (HAL) and Rolls-Royce have signed an MoU to establish packaging, installation, marketing and services support for Rolls-Royce MT30 marine engines in India. Through this MoU, Rolls-Royce and HAL will expand their long-standing partnership in India and work together in the area of marine applications for the first time. Mr. R Madhavan, CMD, HAL stated, "Rolls-Royce has been our valued partner for several decades. We now look forward to working together to explore business opportunities in marine applications. This partnership will leverage the rich experience of HAL's IMGT Division that works on marine gas turbines with Indian shipyards. Further, we are also exploring the option of using MT7 marine engine on the hovercraft being planned by the shipyards in India."

Mr. Kishore Jayaraman, President, Rolls-Royce India and South Asia stated, "We are excited to bring together Rolls-Royce's experience of over five decades in developing naval propulsion solutions and HAL's in-market expertise in working with marine gas turbines to support our MT30 engines. We look forward to building on this partnership to provide solutions in the area of naval defence."

India and P-8I plus Associated Support

The US State Department has made a determination approving a possible Foreign Military Sale to the Government of India of six P-8I Patrol aircraft and related equipment for an estimated cost of $2.42 billion. The Government of India has requested to buy six 6 P-8I Patrol aircraft; eight (8) Multifunctional Information Distribution System-Joint Tactical Radio Systems 5 (MIDS-JTRS 5) (6 installed, 2 spares); forty-two (42) AN/AAR-54 Missile Warning Sensors (36 installed, 6 spares); and fourteen (14) LN-251 with Embedded Global Positioning Systems (GPS)/Inertial Navigations Systems (EGIs) (12 installed, 2 spares). Also included are CFM56-7 commercial engines; Tactical Open Mission Software (ITOMS) variant for P-8I; Electro-Optical (EO) and Infrared (IR) MX-20HD; AN/AAQ-2(V)l Acoustic System; ARES-1000 commercial variant Electronic Support Measures; AN/APR-39D Radar Warning Receiver; AN/ALE-47 Counter Measures Dispensing System; support equipment and spares; publications; repair and return; transportation; aircraft ferry; training; US Government and contractor engineering, software, technical, and logistics support services; and other related elements of logistical and program support.

First batch of women military police inducted into the Indian Army

The Corps of Military Police Centre & School (CMP C &S) at Bengaluru held the attestation parade of the first batch of 83 women soldiers at the Dronacharya Parade Ground on 8 May 2021. The Commandant of the CMP Centre & School while reviewing the parade complimented the newly attested women soldiers for their impeccable drill and congratulated them on their successful completion of the intense 61 weeks of training on aspects related to Basic Military training, Provost training to include all forms of policing duties and management of prisoners of war, ceremonial duties and skill development to include driving and maintenance of all vehicles and signal communications.

INS Rajput decommissioned

On 21 May 2021, a glorious era came to an end with the decommissioning of the first destroyer of the Indian Navy, INS Rajput. INS Rajput, the lead ship of the Kashin-class destroyers built by the erstwhile USSR was commissioned on 4 May 1980 and rendered yeoman service to the Indian Navy for over 41 years. INS Rajput was constructed in the 61 Communards Shipyard in Nikolaev (present-day Ukraine) under her original Russian name 'Nadezhny' meaning 'Hope'. The keel of the ship was laid on 11 September 1976 and she was launched on 17 September 1977. The ship was commissioned as INS Rajput on 4 May 1980 at Poti, Georgia. Over her four decades of glorious service to the nation, the ship has the distinction of serving in both Western and Eastern Fleets.

Pratt & Whitney GTF's now power more than 1000 airliners

Pratt & Whitney recently celebrated delivery of the 1,000th aircraft powered by GTF engines. GTF engines power three aircraft families in service today that include the Airbus A320neo, Airbus A220 and Embraer E-Jets E2. "Pratt & Whitney invested $10

billion and twenty years to develop the revolutionary geared architecture of the GTF engine," stated Ashmita Sethi, President and Country Head for India at Pratt & Whitney. «This award-winning design has changed the game in commercial aviation and is the kind of innovation that will continue to deliver economic value to airlines and passengers, while also dramatically reducing our environmental footprint.»

SpiceJet in MoU with Avenue Capital Group

SpiceJet has signed a Memorandum of Understanding (MoU) with Avenue Capital Group, New York for a strategic alliance in respect of the financing, acquisition and sale and lease-back of 50 new planes to be ordered by the airline. The MoU sets out the next steps and conditions upon which Avenue, as part of the strategic alliance with SpiceJet, will assist with placing of SpiceJet's new aircraft portfolio including sale and lease-back of and also assumption of ownership of potentially up to 50 of these aircraft.

Skyborne launches DGCA CPL Pilot Programme

Skyborne Airline Academy is launching a DGCA Pilot Programme offering dual US Federal Aviation Administration (FAA) and Indian Directorate General of Civil Aviation (DGCA) Commercial Pilots Licences at its new Vero Beach training base in the United States. Trainees will undergo 272.5 hours of commercial pilot training over 14 months. The programme is split into two phases: the first phase, at Skyborne Airline Academy Vero Beach, Florida, provides training to obtain a US FAA Part 141 Commercial Pilot License (CPL) with Instrument Rating (IR). The second phase enables trainees to take the DCGA-examined flight test to convert their US flying licence to a DGCA CPL with IR. This part of the programme will be completed in India with a recognised Skyborne partner.

IndiGo in CFM LEAP-1A agreement for A320neos

IndiGo has announced that it has selected CFM International LEAP-1A engines to power its fleet of 310 new Airbus A320neo, A321neo, and A321XLR aircraft. This agreement includes 620 new

installed engines and associated spare engines, as well as a long-term, multi-year service agreement. In 2019, IndiGo selected LEAP-1A engines and signed a long-term service agreement for engines to power 280 A320neo family aircraft. This new agreement, therefore, secures the LEAP-1A engine and its long-term service agreements for a total of 590 IndiGo A320neo family aircraft.

Air Works to offer 3D printing for aerospace & defence market

Air Works, India's largest independent MRO and aviation services major, has joined hands with leading additive manufacturing-engineering services (AM-ESP) provider, Objectify Technologies, to serve the global aviation, aerospace, and defence industry by leveraging 3D technologies. As part of the collaboration, both Air Works and Objectify Technologies will identify and pursue business opportunities in the aerospace and defence industry, including the requirements of commercial, private jet owners or operators, globally.

Vistara's first purchased Airbus A320neo arrives

Vistara on 29 May welcomed its first purchased Airbus A320neo powered by CFM LEAP engines, strengthening its operational assets and further growing its modern fleet. The aircraft, registered VT-TQE, arrived in Delhi from Airbus' production facility in Toulouse, France. It is one of the 13 Airbus A320neo that Vistara had purchased in 2018 as part of a larger order totaling 50 aircraft from the Airbus A320neo Family, including the Airbus A321neo aircraft as well.

APPOINTMENTS

Vice Admiral Ravneet Singh assumes charge as Deputy Chief of Naval Staff

Vice Admiral Ravneet Singh assumed charge as Deputy Chief of Naval Staff on 1 Jun 2021. Vice Admiral Ravneet Singh was commissioned into the Indian Navy on 1 Jul 1983 and specialised in aviation. The Flag Officer is a Qualified Flying Instructor with Master Green instrument rating and has flown HT-2, Kiran HJT 16, TS 11 Iskra, Hunter, Harrier Gr 3, Jet Provost, Chetak, Gazelle, Hawk and MiG-29KUB aircraft during his career.

Vice Admiral Ravneet Singh was awarded Commendation by the Chief of the Naval Staff in 2000 and has been decorated with the Nausena Medal (Gallantry) in 2004 and Ati Vishisht Seva Medal in 2017.

Vice Admiral Kiran Deshmukh assumes charge as the Controller Warship Production and Acquisition

Vice Admiral Kiran Deshmukh assumed charge as the Controller Warship Production and Acquisition on 31 May 21. Vice Admiral Kiran Deshmukh, who is alumnus of VJTI, University of Mumbai, was commissioned as an Engineer Officer into the Indian Navy on 31 March 86. The Flag Officer has held various important appointments in the Staff, Personnel and Materiel Branch at Naval Headquarters, trial agencies, MO, Naval Dockyard and Command staff at HQENC. The Flag Officer has served onboard frontline ships like Rajput Class, Delhi Class and Tabar Class in various capacities.

Vice Admiral Sandeep Naithani assumes charge as the Chief of Materiel

Vice Admiral Sandeep Naithani assumed charge as the *Chief of Materiel,* of the Indian Navy on 1 June 2021. A graduate of the National Defence Academy, Khadakwasla, Pune. He was commissioned into the Electrical Branch of the Indian Navy on 1 Jan 1985. The Admiral is a Post Graduate in Radar and Communication Engineering from IIT Delhi and a distinguished alumnus of the Defence Services Staff College (DSSC) and the National Defence College (NDC).

Lt Gen Ajai Singh takes over as 16th C-in-C, Andaman & Nicobar Command

Lt Gen Ajai Singh assumed charge as the 16th Commander-in-Chief of the Andaman & Nicobar Command (CINCAN) on 1 June 2021. The Andaman and Nicobar Command (ANC) is the only tri-service theatre command of the Armed Forces, based at Port Blair .A fifth generation Army as well as Cavalry/Armoured Corps officer, with family service of over 162 years since 13 September 1858, Lt Gen Ajai Singh is an alumnus of The Lawrence School, Sanawar and NDA & IMA.

The General officer has held sensitive posts at the Army HQ as the Additional DG at the Military Operations Directorate and was DG, Financial Planning and DG, Military Training. Other than a Rifle Company in active operations, Lt Gen Ajai Singh commanded an Armoured Regiment, Brigade & Division and a Corps deployed on the border in Punjab and Rajasthan.

Developments at DRDO

Successful tests of weapon systems

Twenty eight successful tests have been carried out by DRDO in the last one year. The major weapons and other systems that have been handed over to the armed forces by DRDO are: Astra Beyond Visual Range Missile System, 10 m Short Span Bridging System, Indian Maritime Situational Awareness System (IMSAS), Heavy Weight Torpedo (HWT) Varunastra, Border Surveillance System (BOSS) and Arjun Mk-1A. The development cum Production Partner (DcPP) policy for DRDO developed systems ensures involvement of industries from the beginning of development cycle, thus enabling industries and facilitating hand-holding throughout the development phase.

Maiden trial of Python-5 air to air missile

Tejas, India's indigenous Light Combat Aircraft, added the 5th generation Python-5 Air-to-Air Missile (AAM) in its air-to-air weapons capability on 27 April 2021. Trials were also aimed to validate enhanced capability of already integrated Derby Beyond Visual Range (BVR) AAM on Tejas. The test firing at Goa completed a series of missile trials to validate its performance under extremely challenging scenarios. Derby missile achieved direct hit on a high-speed maneuvering aerial target and the Python missiles also achieved 100% hits, thereby validating their complete capability. The trials met all their planned objectives.

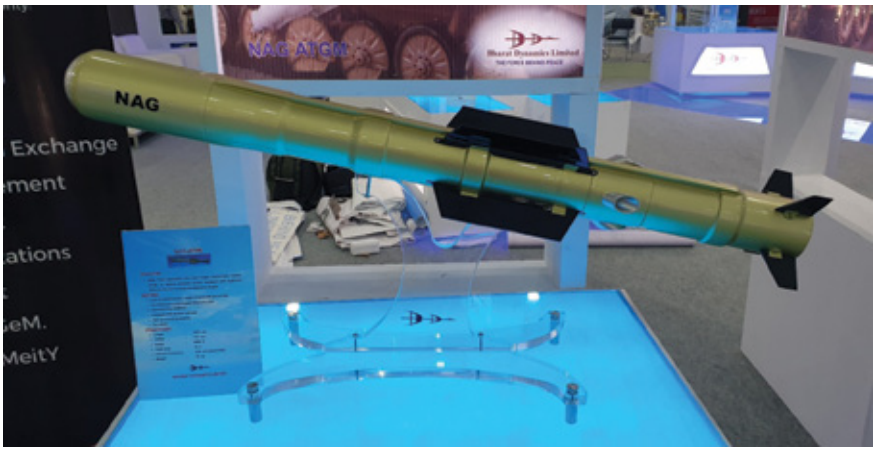
The missiles were fired from the LCA Tejas of Aeronautical Development Agency (ADA) flown by the Indian Air Force (IAF) Test pilots belonging to National Flight Test Centre (NFTC). The successful conduct was made possible with years of hard work by the team of scientists, engineers and technicians from ADA and HAL-ARDC along with admirable support from CEMILAC, DG-AQA, IAF PMT, NPO (LCA Navy) and INS HANSA.

New projects by DRDO

During the past 3 years, 79 projects amounting to Rs.8201 Crores directly pertaining to development of new defence equipments i.e. cruise missile, anti-ship missile, surface-to-air missile, air-to-air missile, extended range anti-submarine rocket, mounted gun system, ammunitions, electronic warfare system, radars, torpedoes, high endurance autonomous underwater vehicle etc. have been undertaken.

Many DRDO developed technologies such as Battle Field Surveillance Rader (BFSR), Joint Venture Protective Carbine (JVPC) Jammers, 5.56 mm rifle, 40 mm Under Barrel Grenade Launcher (UBRL), Oleo Resin (OR) Grenade etc are being utilised by the State Police.

Upgrades to some of the systems have been developed by DRDO such as the Arjun Mk-1A, Akash-NG, Light Combat Aircraft Mk-1A, Medium Power Radar-Extended Range, PINAKA- Extended Range/Guided, Electronics & Communication System, unified mission computer for SU-30 MKI aircraft, internal EW System for MIG-29UPG and EW systems for naval platforms.



DRDO lab develops light weight Bullet Proof Jacket

Defence Research and Development Organisation (DRDO) lab Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur has developed light weight Bullet Proof Jacket (BPJ) weighing 9.0 kilogrammes, meeting the qualitative requirements of Indian Army. The Front Hard Armour Panel (FHAP) jacket was tested at Terminal Ballistics Research Laboratory (TBRL), Chandigarh and met relevant BIS standards. The importance of this vital development lies in the fact that each gram of BPJ weight reduction is crucial in enhancing soldier comfort while ensuring the survivability. This technology reduces the weight of the medium sized BPJ from 10.4 to 9.0 kilogrammes. Very specific materials and processing technologies have been developed in the laboratories for the purpose.

Advanced Chaff Technology for naval ships

DRDO has developed an Advanced Chaff Technology to safeguard the naval ships against enemy missile attack. Defence Laboratory Jodhpur (DLJ), a DRDO laboratory, has indigenously developed three variants of this critical technology namely Short Range Chaff Rocket (SRCR), Medium Range Chaff Rocket (MRCR) and Long Range Chaff Rocket (LRCR) meeting Indian Navy's qualitative requirements. The successful development of Advanced Chaff Technology by DLJ is another step towards Aatmanirbhar Bharat.

Critical Near Isothermal Forging Technology for aeroengines

The organisation has established the near isothermal forging technology to produce all the five stages of high-pressure compressors (HPC) discs out of difficult-to-deform titanium alloy using its unique 2000 MT isothermal forge press. To meet the bulk production requirements, DMRL technology was transferred to MIDHANI through a licensing agreement for technology transfer (LAToT). Using the isothermal forge press facility available at DMRL, Hyderabad, bulk quantity (total of 200) of HPC disc forgings pertaining to various compressor stages have been jointly (DMRL & MIDHANI) produced and successfully supplied to HAL for fitment in to Adour Engine that powers the Jaguar/Hawk aircraft.

Single Crystal Blades for helicopter engine application

Defence Research and Development Organisation has developed single crystal blades technology and supplied 60 of these blades to Hindustan Aeronautics Limited (HAL) as part of their indigenous helicopter development programme for helicopter engine application. It is part of a programme taken up by Defence Metallurgical Research Laboratory (DMRL), a laboratory of DRDO, to develop five sets (300 total) of single crystal high pressure turbine (HPT) blades using a nickel-based super alloy. The supply of remaining four sets will be completed in due course.

Single Crystal Blades for Helicopter Engine Application

Some IAF Rafale updates

On 31 March 2021, the 4th batch of three IAF Rafales landed on Indian soil after a direct ferry from Istres Air Base, France.




Additionally, images by B. Laurent & M. Laurent of IAF Rafale BS 014 seen during test flights at Istres, France on 15 March 2021.








On 21 April 2021, Air Chief Mshl RKS Bhadauria went on an official tour to France and saw off the next batch of Rafales on a non-stop flight to India with mid-air refueling by the French Air Force & UAE.


INAS 310 celebrates its Diamond Jubilee

Indian Naval Air Squadron (INAS) 310, *The Cobras*, a maritime reconnaissance squadron of the Indian Navy based at Goa celebrated its Diamond Jubilee on 21 Mar 21. Commissioned at Hyéres, France on 21 Mar 61, the squadron holds the distinction of being the most decorated unit of the Indian Navy.

INAS 310 has rendered yeoman service to the nation in numerous operations since 1961 and continues to carry out daily surveillance operations over the coastline. The squadron operated the carrier borne *Alize* aircraft until 1991 and subsequently migrated to the shore based Dornier-228 aircraft.

In the last one year, amidst the COVID-19 pandemic, flying across the length and breadth of the nation, the aircraft of the squadron has delivered critical medical supplies, COVID test kits and transported medical teams and samples round the clock.

(All images: Indian Navy)

Boeing: India Air Travel Expected to Double in Next Decade

Boeing forecasts strong aviation growth in India due to the country's growing economy and an expanding middle class, fueling demand for more than 2,200 new jets valued at nearly $320 billion over the next 20 years.

Boeing shared its India forecast on 7 April as part of its annual Commercial Market Outlook (CMO), which anticipates resilient long-term demand for commercial airplanes and services.

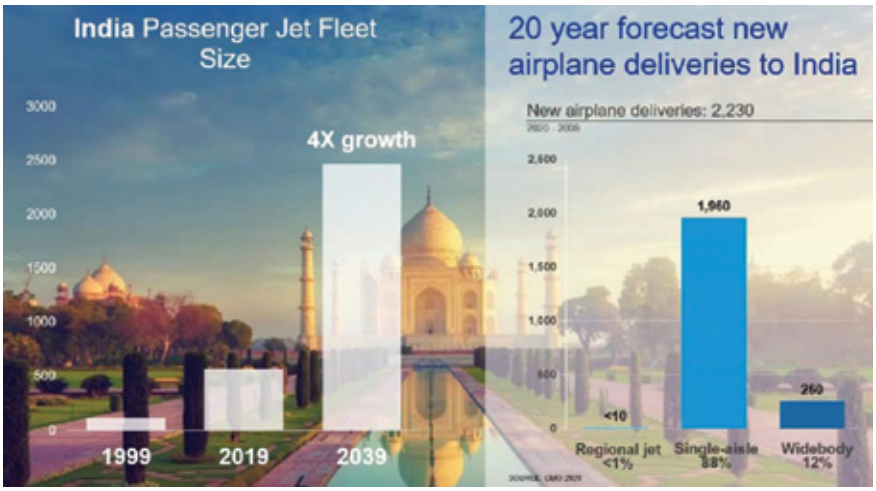
Although the COVID-19 pandemic sharply reduced Indian air travel last year, the country's domestic passenger traffic is recovering more rapidly than in most other countries and regions, recently reaching 76% of pre-pandemic levels. While COVID-19 remains a near-term challenge, the country's passenger traffic is forecast to outpace global growth, doubling from pre-pandemic levels by 2030, according to the CMO.

India's passenger market is the world's third largest. Its economy is predicted to grow at 5% annually through the forecast period, the highest of any emerging market.

"Many more Indians will travel by airplane for leisure and business as incomes rise tied to industrialisation and an economic growth rate in South Asia that leads all emerging markets," stated David Schulte, Managing Director of Regional Marketing, Boeing Commercial Airplanes. "With greater demand for domestic, regional and long-haul travel, we anticipate India's commercial fleet will grow four-fold by 2039."

Indian carriers have opportunities for growth in international markets, according to the Boeing forecast. Several airlines have started or plan to start non-stop routes between India and North America to serve a passenger preference for direct service flights, Schulte said.

"India's burgeoning manufacturing and services business means the region is uniquely positioned to become a major aerospace hub," stated Salil Gupte, President of Boeing India. "We remain committed to partnering across India to develop the nation's aerospace ecosystem, as continued investment in the civil aviation infrastructure and talent will enable sustained growth."



Other insights from Boeing's market forecast include the following:

- In India, single-aisle airplanes such as the 737 family will continue to serve growth in domestic as well as regional markets, such as short-haul flights from India to the Middle East and Asia-Pacific regions. Indian operators will need 1,960 new single-aisle airplanes over the next 20 years.
- To meet long-term demand for long-haul connectivity, especially to North America and Europe, Boeing forecasts a 20-year market for 260 new widebody airplanes such as the 787 Dreamliner, an increasingly popular model in India.
- India air cargo growth is expected to average 6.3% annually over the next 20 years, driven by India's manufacturing and e-commerce sectors. The "Make in India" initiative is expected to support the above-global average cargo traffic growth in the Indian domestic market.
- India's civil aviation industry will require nearly 90,000 new pilots, technicians and cabin crew personnel during the 20-year forecast period, with a growing number of women choosing to pursue aviation careers.

Salil Gupte, President of Boeing India

IAF Su-30MKIs, USN EA-18G Growlers and an IAF Jaguar fly in formation

Passage Exercise with the US Navy

Consolidating synergy and interoperability was achieved during Malabar 2020 and now INS Shivalik with integral helicopter and Indian Navy's Long Range Maritime Patrol Aircraft P8I participated in a Passage Exercise with the US Navy's USS Theodore Roosevelt Carrier Strike Group on 28 March 2021 in the Eastern Indian Ocean Region. In a first, IAF fighters were also included in the Exercise affording the IAF an opportunity to practice Air Interception/Air Defence with the USN.

Exercise Varuna 2021

The 19th edition of the Indian and French Navy bilateral exercise VARUNA-2021 was conducted in the Arabian Sea 25-27 April 2021.

From the Indian Navy's side, guided missile stealth destroyer INS Kolkata, guided missile frigates INS Tarkash and INS Talwar, Fleet Support Ship INS Deepak, with Seaking 42B and Chetak integral helicopters, a Kalvari class submarine and P8I Long Range Maritime Patrol Aircraft, participated. The French Navy was represented by the aircraft carrier Charles-de-Gaulle with Rafale-M fighters, E2C Hawkeye aircraft and helicopters Caïman M and Dauphin embarked, Horizon-class air defence destroyer Chevalier Paul, Aquitaine-class multi-missions frigate FNS Provence with a Caïman M helicopter embarked and Command and supply ship Var. The Indian side was led by Rear Admiral Ajay Kochhar, Nau Sena Medal, Flag Officer Commanding Western Fleet, while the French side was led by Rear Admiral Marc Aussedat, Commander Task Force 473.

The three day exercise saw high tempo-naval operations at sea, including advanced air defence and anti-submarine exercises, intense fixed and rotary wing flying operations, tactical manoeuvres, surface and anti-air weapon firings, underway replenishment and other maritime security operations.

Initiated in 1983, Indo-French naval cooperation plays a key role in the two countries› joint vision for a free, open and inclusive Indo-Pacific. It has intensified in recent years with increasingly ambitious joint exercises that have raised the degree of the two navies› interoperability to a new level. In early April, the Indian Navy took part for the first time in the France-led naval exercise «La Pérouse» with the navies of the United States, Australia and Japan.

IAF participation in 70th Anniversary

SRI LANKA AIR FORCE
GUARDIANS OF THE SKIES
1951-2021

The Indian Air Force aerobatic display teams, the fixed wing Suryakirans and rotary wing Sarang, along with the Light Combat Aircraft Tejas arrived at Colombo, Sri Lanka, on 27 February 2021 on an invitation from Air Marshal Sudarshana Pathirana, Commander of the Sri Lanka Air Force (SLAF). The Suryakirans, Sarang and LCA Tejas participated at the Air Show at Galle Face, Colombo which took place 3-5 March 2021 as part of the 70th anniversary celebrations of SLAF.

Celebrations of SLAF

The IAF and SLAF have seen active exchanges and interactions for a number of years in diverse fields like training, operational exchanges and through professional military education courses. IAFs participation in the 70th anniversary celebration of SLAF is "a further manifestation of the strong professional bonds that the two Air Forces share". The IAF Suryakiran Aerobatic Team (SKAT) had earlier toured Sri Lanka in 2001 for the 50th anniversary celebrations of SLAF.

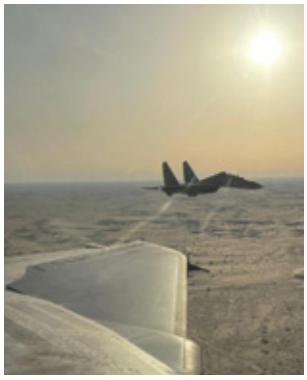
A day before the event, Air Chief Marshal RKS Bhadauria, Chief of the Air Staff of the Indian Air Force arrived at Colombo on an invitation from Air Marshal Sudarshana Pathirana, Commander of Sri Lanka Air Force (SLAF). During the course of the two day visit, CAS interacted with various dignitaries and the heads of Services of the Armed Forces of Sri Lanka.

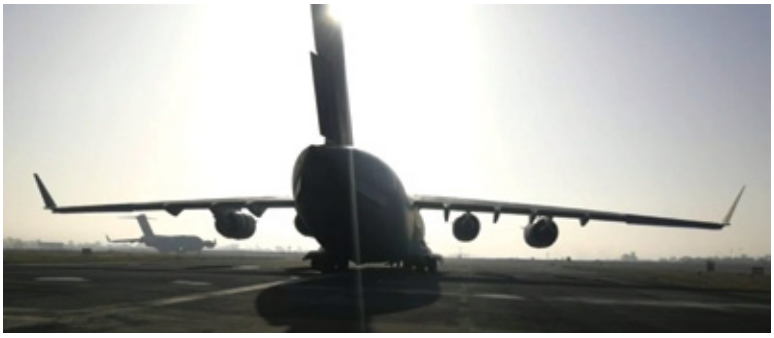
IAF participation in Ex Desert Flag VI

Exercise Desert Flag –VI successfully culminated with de-induction of the Indian contingent from UAE. Ex Desert Flag is an annual multi-national large force employment warfare exercise hosted by the United Arab Emirates Air Force. The Indian Air Force participated for the first time along with air forces of United Arab Emirates, United States of America, France, Saudi Arabia, South Korea and Bahrain. The exercise took place 3-27 March 2021 at Al-Dhafra airbase, UAE.

The IAF participated with six Su-30 MKI, two C-17 and one IL-78 tanker aircraft. C-17 Globemasters provided support for induction/ de-induction of the IAF contingent. Su-30 MKI aircraft undertook the long range ferry, routing direct from India to the exercise area with aerial refueling support from IL-78 tanker aircraft.

The objectives for the exercise were to expose coalition participating forces to large force employment, sharpen tactical capabilities and enhance interoperability along with fostering closer relations between the participating forces. The aim for the participating crew and specialist





observers was to expose them to operational environment in scenarios requiring multinational forces working together.

During the exercise IAF flew Large Force Engagement (LFE) missions in near realistic environment involving many aircraft of varied types. IAF successfully undertook all the planned missions, both by day and night, without any mission abort. All possible assistance was provided by UAE Air Force ensuring that all planned activities were completed in time.

Indian Army tanks to get APS

Leopard 2A7A1 with Trophy

The Indian Army has invited an expression of interest for procurement of armoured fighting vehicles protection and counter measure systems for the T-90S Bhisma tank fleet; 818 such systems are to be procured. T-90 tanks are the mainstay of the mechanised forces and are likely to remain in service beyond 2050. The fleet is to be periodically upgraded to meet the futuristic war fighting capabilities. Currently there are many projects ongoing to modernise Russian origin tank fleet and to combat obsolescence firepower, protection and situational awareness are to be enhanced.

An active protection system currently is the most potent way to protect an armoured vehicle from the enemy HEAT projectiles. World's first operational active protection system Drozd was developed by Soviet Union in late 70s. Since then many nations have developed APS successfully. As the Indian Army is witnessing the rapid change in armoured warfare to defeat new threats, in lieu of heavier armour to protect their assets have turned towards cutting edge solutions for the protection. At the moment only the T-90S Bhisma fleet (while light tanks too to get similar upgrades) is desired to be equipped with a potent system.

The active protection system with 360° coverage must brave adverse weather situation and should be in working situation during temperature ranging from -5° C to +45° C. A light system with maximum weight of 1000 kg is desired with a service life in excess of 3000 hours. It must have both the Soft Kill and Hard Kill capability. The Soft Kill capability should provide an audio visual warning on being laser tagged or engaged by a hostile system and will use decoy or smoke to defeat it. It must be able to defeat or at least degrade in-coming anti-tank guided missiles (laser/ IR/Radar guided) by means of electro optical signals and IR jamming. The hard kill system must be capable of defeating all kind of incoming anti-tank guided missiles and 125 mm HEAT (High Explosive Anti-Tank) rounds, rocket propelled grenades and smaller anti-tank shells from rocket launchers by means of intercepting and defeating or at least degrading their lethality. Capability to intercept enemy KE tank rounds (APFSDS) by upgrading the system in future is desired as well. The safety parameter has been given utmost importance. The radiation from the

Afghanit on T-14

system must be low enough and danger zone must be small enough for protection of dismounted troops. As use of counter systems and means to fool APS is gradually increasing, Indian Army wants a system immune to such jamming and capable to identify "false projectiles" (i.e splinters, artillery shells, small arms).

Development of indigenous Active Protection System was announced some years ago under Make-II category. The idea was to develop a potent system consist of both the Soft Kill and Hard Kill capability to defeat HEAT rounds and future KE rounds as well. The timeline for commencement of development envisaged as 2022 while procurement would be in phased manner. In some past years many Indian companies have made partnership with foreign OEM to offer an Indian customised version of the system.

In the late 90s when T-90 came first time to India for trials offered with Shtora 1 active protection system. However, it was a soft kill platform. The EO/IR dazzlers help in defeating incoming enemy missiles. Russia has now developed two newer APS with hard kill capability. First one is Arena. Unlike Shtora it releases 26 projectiles once the multi-function Doppler Radar detect an incoming threat. However as the shortcomings of the developed systems like Drozd, Drozd 2 and Arena was coming forward through experience of Afghan War and Chechen Wars, Russia started to develop an advanced new generation APS resulting Afghanit. Afghanit includes both soft kill and hard kill capability. And soft kill capability is claimed to be capable of defeating even top attack ATGMs (ex- Javelin). While hard kill capability is achieved by intercepting incoming threats with large caliber projectiles. This system is capable of defeating KE threats as well. But currently this system is fitted with only T-14 MBT and T-15 AFV. A new variant of Arena series, Arena 3 is developed for export purpose which is light and gives 360° coverage without any hindrance. Unlike its predecessor it overcomes several shortcomings.

The LEDS from SAAB Avitronics was displayed at DefExpo 2016 on board a T-90 model. At the time it was announced that TATA Power SED would manufacture large part of this system in India and would steer marketing it for domestic use. Two years later Rafael showcased a T-90 model equipped with Trophy active protection system. Besides Elbit Iron Fist has also been offered to India.

As the threat against the armoured vehicles are increasing day by day, nations around the world have started delevoping several APS to protect their platforms. Varta and Zaslon from Ukraine, Pulat and Akkor from Turkey, MUSS and AMPADS from Germany, Quick Kill and Iron Certain from US, GL5 from China are worth mentioning. Trophy currently is the most successful active protection system around the world and is fitted on three main battle tanks- Merkava Mk. IV, M1A2SepV3 and Leopard 2A7A1.

Pakistan has been offered Varta APS by Ukraine. Besides China is using GL5 on two of its platforms- Type-99 and Type-15. Obviously, India does not want to lag behind in the race of modernisation and hence started working in full swing. Hopefully, this time a solution will come out.

Sankalan Chattopadhyay
(Twitter @vinoddx9)

Light Chariot Heavy Punch


Sprut SD

The Indian Army released an RFI on 22 April for the procurement of 350 light tanks in a phased manner. It is not the first of such kind. Some years ago another RFI was released for the procurement of both the wheeled and tracked version, but this time exclusively tracked light tank is desired, though later a wheeled version might be procured as well. India was engaged in a serious stand-off with China which months ago attempted to usurp swathe of Indian land with brute force. The ongoing disengagement process has done a little to decrease the tension between the two Asian giants. The Red Army deployed various armoured vehicles including light tanks to make a psychological impact on deployed Indian Armed Forces. To counter Chinese deployment India wants similar platform to have an edge in any future confrontation.

Though the Type-96A is the mainstay of the PLA armoured concentration and Type-99A1, unarguably the best tank currently deployed in Tibet, it was the light Type-15 tank which gave China potential advantages in some areas. Unlike the main battle tank, the light tank to be deployed in such terrain where the opponent has least chance to counter it. At high altitude, where a main battle tank can't be deployed due to narrow navigable terrain and limited air transportability, the Indian Army best could deploy BMP-II Sarath which is infact an infantry combat vehicle and can't match the sheer fire power of the Type-15 and Type-88A.

The desired platform has to be a 25T vehicle. The platform must be deployable in the high altitude as well as in the desert and light enough for rapid overseas deployment. The IAF uses two heavy transport aircraft, the Il-76MD and C-17 Globemaster III. It is obvious the weight category has been sought to match the payload capacity of IAF transport aircraft as well as to maintain amphibious capability. It will be a modular design, two (or three) crew platform. The main armaments hasn't been specified but it must be capable of firing smart anti-tank ammunition and anti-tank guided missiles. It must have automotive gun control system with auto-loader. There will be multiple secondary armaments including a remote control weapon system capable to neutralise various grounds and aerial threats including UAVs and PGMs. The modular design will allow upgrades of armaments according to necessity. The platform must have ERA coverage for the protection against HEAT warheads. And to augment further protection, an Active Protection System with Soft Kill and Hard Kill capability is desired. The vehicle will be equipped with CBRN protection, IFDSS and CABIS enhancing crew survivability. ECM and ECCM will protect the platform from electronic attack. The power to weight ratio must be at least 25:1 hp/t.

Currently there are only a few manufacturers capable of manufacturing light tanks. Most notable of them is Russia's Volgograd Tractor Plant which makes the famous Sprut SD light tank. This is unarguably the lightest tank currently available anywhere around the world. With just 18T weight it carries a 125 mm smoothbore gun and provide the same firepower of T-72 main battle tank! With 510 hp water cooled diesel engine and hydro-pneumatic suspension it has an excellent mobility as well as credible amphibious capability. The platform is based on BMD-3 chassis which is a light air transportable infantry fighting vehicle. According to some Russian sources, a better variant of it is being developed where a new modified chassis will be mated with the latest 2A46-M5 gun thus enhancing the firepower significantly. Just for reference, it is the same gun used by the advanced T-90MS.

Another potential offer can be from Hanwha Defense of South Korea. It has a 105 mm rifled gun with Cockerill XC-8 turret on a K-21 infantry fighting vehicle chassis. This version weighs just 25T and is a three man crew platform. Moreover, the gun can fire Falarick 105 anti-tank guided missile at a range of 5 km and can defeat up to 550 mm of rolled homogeneous armour.

DRDO is supposed to be working with L&T to develop two different platforms optimizing the K-9 chassis. The first option will see a 34T platform with 105 mm rifled gun with Cockerill modular turret. While the second option explores opportunity by mating 125 mm smoothbore gun to have a 38T 'beast'. Prototypes will be readied in three years while production rate is expected to be 100 per year.

But as the new RFI was released, it is obvious there will be now some significant changes in the project. In the past a home grown platform was developed by placing GIAT 105 mm turret on BMP-2 chassis. But it couldn't convince the army at that time. This time, facing an adversary, superior in both technology and numerical strength, India is trying to cover the gap as fast as possible. As modernisation of the armoured forces is in full swing, the Indian Army is hoping to dominate the heights by Light chariots with Heavy punch!

Sankalan Chattopadhyay
(Twitter @vinoddx9)


K-21-105

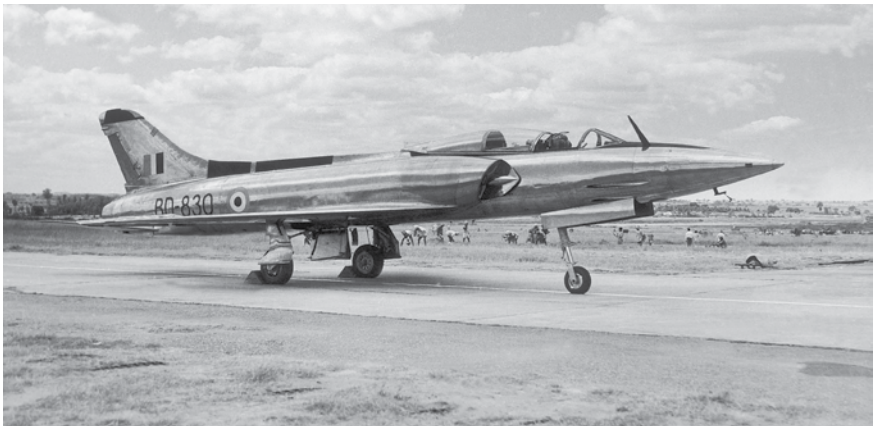
Prof. Prodyut Das and ...

... An inquest into the HF-24 Marut

The Rafale has been a very excellent and welcome addition to the IAF fleet but to change the game we shall need a platform that has the following attributes. It should be available in numbers, it should be affordable in numbers and it should be *aatmanirbhar*. This word does not simply mean self-reliant; it means self-confident self-reliance. This translates into being master of the design its manufacture and our ability to continue to boldly tweak the design expeditiously to suit the ever changing needs of operations. In this context should we not re-look at the HF 24 which as a platform is the finest the Indian Air Force has ever had.

I mentioned the Rafale as an illustration. I put to you the case that we order the Rafale but do not buy the afterburner fuel pumps –to save foreign exchange- never mind the aircraft would never reach full potential. Then, say to save engine TBO or some such reason, the engine throttles were wire locked to give only 73% of the design's cold thrust. Instead of working to get rid of the "wire locks" on priority, long term programmes are undertaken to design entirely new engines to replace what was available and ready to be modified. The benighted aircraft are sent war where they perform very reasonably suffering a lower actual loss rate than the Su-7. Subsequently the aircraft are often AOG'ed for weeks for lack of tuppence worth of Bostik or a packet of AGS split pins. Finally the Rafales are deemed unsatisfactory and retired with alacrity after only fifteen years of colour service. Despite failing to improve the existing aircraft it is thought eminently sensible to launch an entirely new programme with all its brand new uncertainties! "Wait a minute! " I can hear you remonstrate "No one sane will do a thing like that!" Well that is actually what we did to the Marut. Should we not re-examine the brilliant airframe for fulfilling the MWF role as it would be a solution brilliant in its fasibility and simplicity.

If you are ab initio on the Marut there is much material on the web. I would suggest that you look up www. Marutfans or go to Pushpindar Singh Chopra's "The Spirit of the Wind" to hear all the anecdotes lovingly recounted. It was a wonderful aeroplane and



to me if you tabulate the jaldi five (term in used in India for Bingo or Housie games for the quick five) of fighter evaluation –wing loading, T/W, Kg. of fuel per Kg. thrust, AR, Top speed at low level- you would probably conclude that the original HF 24 with the B.Or.12 of 6160/8160 lbs. (27.4/36.3kN) st. thrust was the best of its distinguished contemporaries. The F 104 Starfighter was faster, the SAAB Draken was STOL, the Mirage III had outstanding high altitude performance and the MIG 21 was unbeatable if the task was to hunt down B 52s marauding over the Rodinya but for sheer heft and haft, blade and balance the HF 24 was the best of them all, a masterpiece by a master Swordsmith. The HF 24 showed all the attributes of its great predecessor the Focke Wulf FW 190- ease of manufacture, great visibility, pleasant handling and ease of piloting, strength of structure, devastating armament and outstanding performance from relatively modest engine power. Compared to its contemporaries the HF 24's balance of properties and its upgradability are features that makes the aircraft relevant even today- sixty years after the first flight- and at a time when the concept of the fighter is beginning to look also back!

All fighters have faults and the HF 24 was no exception. The Marut's faults, left uncured were used to "board out" the aircraft's considerable capabilities. The following are based on notes made whilst I was a Trainee PGET.

Vibrations

The HF 24 suffered from severe to unacceptable cockpit vibrations and general vibrations during 4 gun firing which often led to aileron locking. These were both attributed to "'gun firing". Actually the two vibrations had different root causes and needed two different solutions.

The cockpit vibration was caused by the Aden muzzle blast hitting the deflector baffle. The blast force was sufficient to shear off the blast tube attachment screws in the prototypes. The tube was slid into the fuselage and was secured to the structure by AGS (Aircraft General Standard) 8G screws which attached the flange to the cockpit frames 7, 8, 9. Unfortunately these were the very frames on which the cockpit dashboard and many of the flight and attack equipment were fitted. I do not recall any form of "staking" the flange to the fuselage frame so the vibration patterns would depend on which frame was taking the maximum brunt though I would not expect the shaken pilot to have noted the difference! The force twisted the three cockpit frames to varying degrees. In addition the blast tube acted as a "column in bending" and would buckle elastically under pressure and in between the rounds the tube would whip back into shape setting up lateral vibrations. The technically correct solution would be to anchor the blast tube "by the tail". This would eliminate the buckling and keep the load under stable tension and the forces would not reach the cockpit area. Double walling the area of the mounting flanges inside the cockpit would be also another possibility as it would create, as in the Hunter, a rigid box which would average out the vibrations. The Hunter has exactly the same arrangement in principle but because of the "subsonic contours of the fuselage nose the blast tube was less than a meter long and so the "whip" was about eight times less, In addition the forces were taken up by a very thick walled rigid "box" (Fig1) consisting of the 10 swg cockpit floor and a 8 swg outer lower cockpit skin and it was enormously stiff with very strong diaphragm walls front and back. Rival aeronautical companies used to say that Sir Sydney Camm's designs were fine examples of Victorian Railway Engineering but handsome is as handsome does! It is to be noted that solutions to the problems are both simple and often "lying around". Most solutions do not need equipment or complex mathematical analysis.

The aileron locking during four gun firing full fire out was due to the Aden's recoil – about 25kN after buffering-was taken by two very narrow based (about 30mm) brackets riveted on frame 19 of the gun bay (fig.2). Each bracket would experience recoil of 1.3 tons to the rearward followed by a turning moment of 10 kN.M about ten microseconds later when the Aden's revolver indexed-causing these brackets to twist and turn. Unfortunately the aileron jack was mounted opposite on

the other side of the same structural panel and using, if I remember correctly, the same rivet holes! The claws of the aileron jack sometimes got stuck "half cock" causing a jammed aileron circuit. The solution would have been to simply extend the bases of the bracket or connect the two brackets to form a wider base to reduce the amplitude and the flexing of the bracket. The Hunter of course used a gun pack which though it weakened the structural rigidity of the fuselage at that point it also isolated the vibrations. I would note that the HF 24s gun layout was technically perfect in terms of maximizing the "area of lethal density". If you still want four guns the HF 24s arrangement was mathematically the best and it can be made to work!

Why did the Germans not correct these simple things? I think they were packed off quite early –before the IOC flying trials began- no doubt to save precious foreign exchange required to import complete aircraft! The other possibility could be that the consultant would always leave some "bugs" in the design to extend their tenures. The Chinese of course routinely complain of getting doctored drawings from their collaborators and routinely tinker around with whatever they get. Sometimes they manage to "stir fry" their engines but usually tinkering led to happy results.

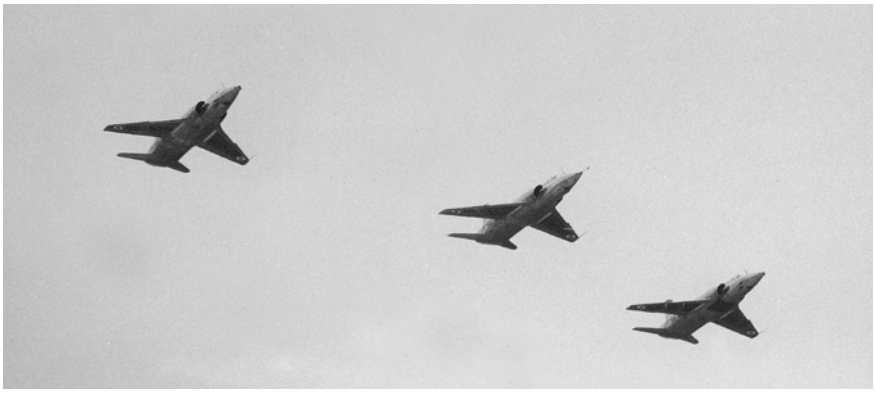
Judder during turns

All aircraft will judder during turns. The Boeing or Airbus turning into Finals for landing will tremble and judder during the turn. This is because the inner wing tip is flying at a much lower Reynolds number than at the roots-at least four times less in the case of the Marut. The Marut juddered in a 4G turn as the power available struggled with the power required. Kurt Tank used a laminar flow six percent NACA aerofoil which he modified with a cropped trailing edge and called it the Ta-006. The aerofoil had a sharp leading edge which is prone to flow separation. The usual corrections- many used by Free flight aero modellers -are a turbulator on the tip leading edge, in practice a 3mm dia. wick glued to the tip leading edge, "washout", conical camber on the LE or as in the Gnat a combination of conical camber and a cambered "lifting" aerofoil towards the tip. The other possibility is that the span wise flow is separating. This happened on the early Vulcans and a kink on the leading edge cured it on the Vulcan B2. We could do the same or look at re-locating the "dog tooth". With more power the judder would be at higher "g"s.

One interesting point is that the wing design of the HF 24 had a 20mm extruded alumimium LE. This was an excellent feature because in case of a bird hit the stout LE extrusion would break up the bird and prevent damage or jamming of the aileron control rods as happened in the case of the loss of a SU7 to a bird strike at Hindon in the '80s. The extruded LE is mentioned because in the HF 24s personally examined fairly deep extrusion marks were noticed on the leading edge which would certainly unhelpful. I wonder if there is any connection to the problem.

Stall spin and roll coupling.

I have not heard if the HF 24 was spun but the design has the potential to be very spin resistant going by the similarities between the layout and that of the Northrop F5. With more power and L.E. flaps and small tweaks, the Marut can be made to sit and beg before stalling and snapping into a spin. Spin recovery will be crisp and certain given the low set tail plane but developing of a full spin may take time given the high fuselage inertia and damping. Considering the half a ton of Aden gunnery so far forward it is not surprising that there would be roll coupling. Using of the Russian GSh 6-30/ GSh2-30 underbelly on the centre line as in the MiG 27 or Su 25 for example would reduce the magnitude of the problem. Judicious use of composites in items like the fin would help.



Internal fuel capacity

Specific fuel availability i.e. kg. fuel per 10 N/1Kg. cold of thrust is an indication of combat sustainability and an important factor in gauging the efficacy of a type. The HF 24 had an internal fuel capacity of 2067 kgs which was carried in the two wing

tanks, a central collector tank and a saddle tank strapped over the c/s. The internal fuel capacity can be increased to 3300 kgs using integral tank technology (Fig 3) once the uprated engines are fitted. Going beyond 3300 kg is avoided because the HF 24, thanks to lower drag, can do on 3300kgs what others will need much more to do.

I have written in some detail the past problems and their possible solutions/ improvements to illustrate that the cure to the problems is less of "technology" and more of "caritas" an untranslatable word meaning love, care, compassion and interest.

The HF 24 Chronology

To understand the failure of the Marut programme to achieve its full potential one has to follow the historian's method of noting down of the chronology of events and then to add, as Hercule Poirot would recommend, important contemporary events which may not seem to have a direct connection.

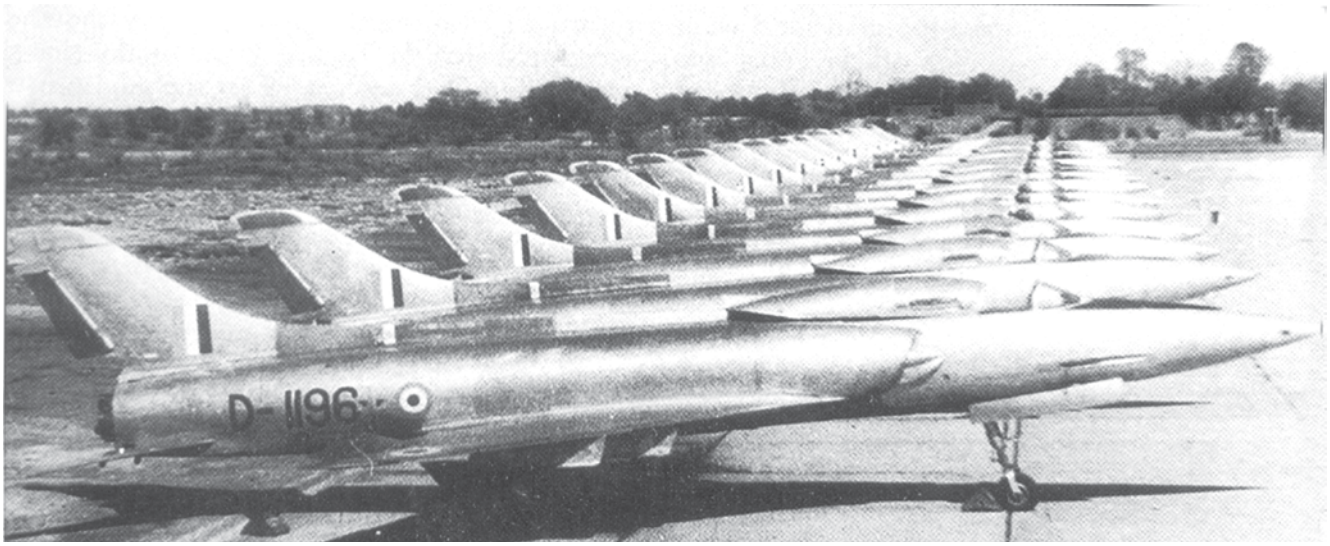
1. In 1955 Nikita Khrushchev and Bulganin arrive in India to tumultuous welcomes in a first outside visit of any Soviet Head of State.
2. In 1956 India adopts an Industrial Policy Resolution that gives "the commanding Heights of the Economy" to the Public Sector. Since the Armed Forces were supposed to be plotting coups when not on parade, the Industrialist were Capitalists, the businessmen were hoarders, the Politicians were impermanent and the general public the Great Unwashed the country slips into the hands of the Bureaucracy. The senior echelons of the Bureaucracy are packed with jumped up-due to the partition- young Cambridge Communists more inclined to prove Marxist Economic Theories are workable rather than achieve set targets. Industrially it is a disaster. Whether their political leanings had any aims towards bringing India into the world's leftist bloc is not known.
3. Mahavir Prasad Tyagi one of the unsung Ministers of India is Defence Minister from 1952 to 1957. During his tenure the Indian Armed Forces are greatly expanded the Air Force is doubled in size and the twenty squadrons re equipped with the latest combat jets worth approximately *GBP 120 million.* More importantly he is in touch with three great Chief Designers- Messerschmitt, KW Tank and Petter who is of course known for the Lysander, the Gnat and the Canberra of the IAF. Petter is keen to settle in India which he feels is his spiritual home. Tank is recruited.
4. Tank arrives in India to lead the design of the HF 24 in September 1956.
5. Krishna Menon, a theosophist and a staunch Communist takes over the Ministry Defence in 1957. He is a keen advocate of the MiG 21. Though the MiG 21 had advanced facilities such as autopilot and radio altimeter the HF 24 was, as a "Super Hunter" much better suited for the Indian scenario.
6. The offer to develop the Orpheus 12 to suit the Marut for GBP 100,000 (Rupees 11 lakh) is turned down. A later offer to develop the required engine for GBP 1Million is also turned down. Even when the quote is reduced to GBP 300,000 it is still turned down. Foreign exchange however is available to set up a Shaktiman truck line which the private sector could have easily handled but "then-a-days" it was a case of Marx! Marximus! Uber alles! Men had lost their reason.
7. Petter is prevented from building a house in Poona where he had reportedly acquired a plot of land for the purpose and leaves India.
8. Air Chief Mukherjee dies suddenly in 1960 in Tokyo. Reportedly there is no autopsy or inquest.
9. The first prototype of the HF 24 is ready for first flight within 240 weeks of project start to an expenditure 14 crores which includes building up of facilities,
10. The first flight in May 1961 end in ignominy as the pilot retracts the undercarriage to abort the takeoff damaging the aircraft but it is a tribute

to the aircraft's sturdy construction that it is quickly repaired. Incidentally the same officer, when Base Commander Pathankot delayed apparently through indecision the launching of a Gnat CAP until too late and "Nosey" Hyder's famous strike got off scot free.

11. Menon is retired after the '62 debacle and YB Chavan is the Defence Minister from December 1962. It was during his tenure that the offer for the Russian RD 9F is declined.
12. The HF 24 handling flight is raised in 1964 with four aircraft.
13. Thinning out of the German Consultants begins even before the flight trials are completed.
14. The first Marut squadron is raised on 1st April 1967. The first Night fighter variant with Ferranti Airpass III radar is lost within the month when both engines run dry. The wreckage-the aircraft "bellied in" and landed on its own near the airfield after the pilot ejected- shows about sixty gallons remain- about five –six minutes flying at low speeds for the Marut. I would have examined if the fuel pump quill shafts had been tampered with. It is *very unusual* to have both engines stop within a minute of each other.
15. A HF 24 is lost at Goa during a ferry flight in May 1970. The press described that the aircraft was engaged in four gun firing at that time the wreck of the aircraft and the pilot's body is not recovered.
16. Two Squadrons of the aircraft are in service by 1971 being posted in the arduous Western Sector and often operate from austere newly established air force bases.
17. A word about people: Aircraft design requires high capability people. In 1971 an IIT B. Tech with a postgraduate degree wishing to join HAL could expect a joining salary of around Rs. 460 with two increments. If he joined the State Trading Corporation with just a B. Tech his joining stipend was Rs. 950. EIL, BHEL all offer similar pay packets. Contemporary private sector jobs range from 1200 to 2200 per month. Nevertheless many IITians join but the marginal salary surplus meant few can continue. Things are not helped when many of the "next promotion" openings- 174 or so in Lucknow, as I remember, in the 'seventies- goes to re-employ retired Wing Commanders which is a social obligation- but why HAL? Promotions came only after five years.
18. An attempt to clear the aircraft for four gun firing in late 1971 ends in the loss of the aircraft and the pilot. Again the aircraft is trialed over the sea and recovery is impossible. Our planning of development testing was always and everywhere a "going through the process" rather than a technical cause finding exercise- it always left much to be desired. High altitude air to firing using auto destruct ammunition over the Thar would have given the pilot bigger margins for safety and assured recovery of the wreckage in case of accidents which is always a considerable possibility.
19. The aircraft performs creditably in the 1971 war suffering fewer losses/sortie than the Hunter or the Sukhoi but the evidence builds up against the aircraft which is often AOG-ed for lack of trivial spares and stores.
20. HAL proposals during 1973-1980 to upgrade the aircraft with the RB 199 or the R25 are turned down. The budget asked for was around 56 crores to be spent over 3 years.
21. The aircraft is retired from service in 1983 with some airframes having less than 100 hours. The Navy is reluctant to cast "cast offs".
22. In the same year 1983 the LCA project is sanctioned 560 crores with an all new organization *de facto* under the direct control of the South Block.

It is up to the reader to form his conclusions.

The LCA project was sanctioned showing Raj Mahindra the designer of the very successful HJT 16 Kiran jet trainer as the Chief Designer. He was replaced, shortly after the project was sanctioned, by Dr. Kota Harinarayana who lacked the earlier designer's experience. Dr. Kota was a graduate of engineering from BHU (Benares Hindu University) and joined HAL as a trainee in 1967; few details are known about this (1967-1985) phase of his career, the high points being that he then shifted from HAL to DRDO/Govt. of India working in Delhi and with Chief Resident Engineer (CRE) office in Nashik. CRE/CRI are the

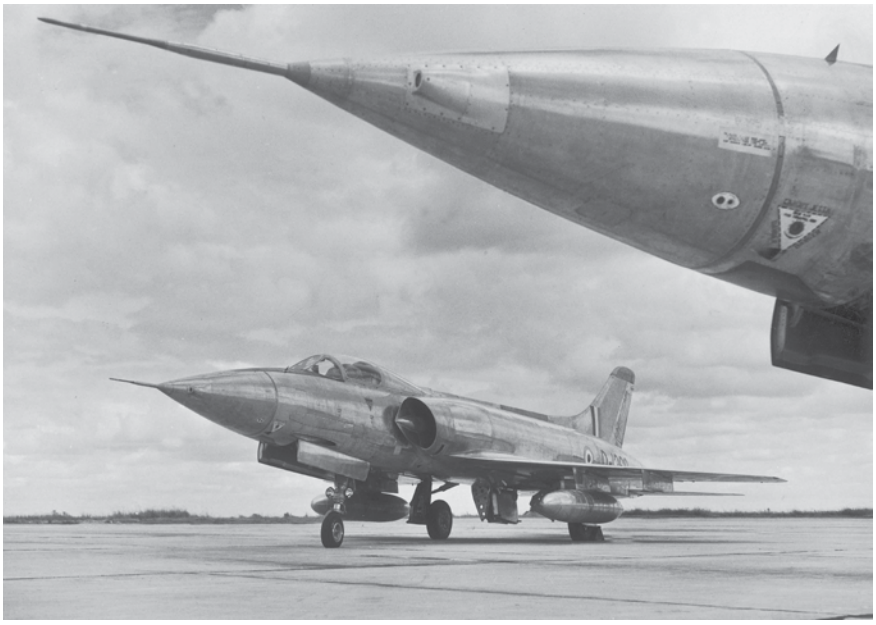


customer's representative and deals mainly with the resolution and documentation of concessions raised by the factory if there is any deviation from the drawings. It was mainly documentation work. He also did his M. Tech (I.I.Sc.) and Ph. D (from IIT Bombay) during this period. Circa 1982 he reverted, from Head of CRE office Nashik, to HAL as Chief Designer Nashik for about two years before taking over the LCA programme. His remarkable progress from fresh graduate to Chief Designer via two organisations and two universities in about eleven years is noted because it is so unusual.

The engine problem

The problem of the Marut not having the selected Orpheus 12 engine is well known. It cut the tendons of the aircraft's abilities.

We turned down offers from Bristol Siddeley not once but twice in 1958 and in 1961. This was then compounded by refusing to accept in 1963 the Tyumanski RD 9F which was the power plant of the MiG 19 which was being phased out and we could have got it including the tooling for the proverbial song. The RD 9F was within 5% of the Orpheus 12 thrust and, being smaller, was a "drop fit". It was our last chance with the original HF 24 airframe. The excuse was that the RD 9F had a compressor stress limit of Mach 1.3 and we wanted Mach 2! Who wanted this? That makes three times we turned down feasible solutions –one is reminded of Goldfinger's/ Felix Leiter "third time is enemy action" applicable?!



The Orpheus was numerically the most important engine for the Indian Air Force and the industry of that time. Instead of beavering away trying to improve the Orpheus and having refused foreign help both GTRE and HAL Engine Design Department sat around doing nothing until 11 years after the first Orpheus arrived in India GTRE "developed" an afterburner –a science lab contraption without a variable area exhaust nozzle! This meant that not only the aircraft base drag would go up but there would be thrust loss when the A/B was off. How this crude device was certified for flight is a wonder and an indictment of our sanctioning process but its only achievement was to kill of a highly dedicated

and *enthusiastic* test pilot. Having achieved that the project was promptly closed thus dishonoring his bravery and sacrifice. Now when the Kaveri is within an ace of achieving its potential in terms of dry thrust we are seeking collaboration with Snecma- at a cost reputedly of 750 crores- to carry us over the last mile. Let us examine how our presumptive "rescuers" got their capabilities.

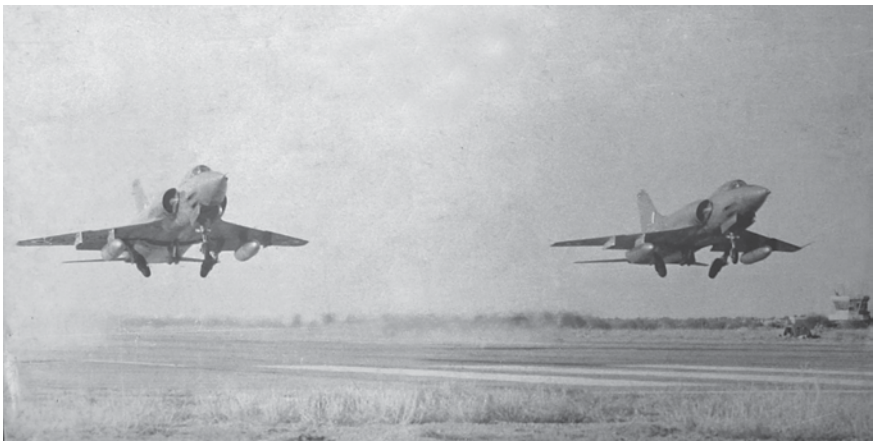
France, under German occupation for most of the war, had no jet engine technology. They took up the BMW 003 (apparently Brandenburgerische Motoren ("Bramo") and not the more popular "Beymeywa" Bayerische!). The engine was a pretty crude device with a TBO of 10 hours and was so sensitive that in Luftwaffe service the German pilots were extremely cautious when handling the throttle for fear of flaming out the engine. It is not possible here to detail all the small but fascinating steps the French took to make the basic engine into a fully competitive product- these are available on the web and make fascinating reading but the summary below shows the extent of improvement in that is possible on axials given love and caritas.

The ATAR begins as a BMW 003 and gives 7.8kN -9.02 kN for 30secs- on a 7 stage axial compressor and a single stage turbine at 8050 rpm. By 1948 it was giving 16.5kN on a piston engined flight test bed. By 1949 it was, as the ATAR 101B2, giving 24.5kN and by 1953 as the ATAR 101C it was delivering 28kN the rpm having gone up to 8500 rpm. The 101D finally got rid of the typically early German translating "onion" type nozzle area control and enlarged the turbine and by 1957 the ATAR 101E added a zero stage, increased the mass flow to 60kg./sec. Designed for 33.6kN it gave 36kN in production -a particularly relevant lesson for us! By 1957 a totally redesigned (in detail) ATAR but of same overall configuration had gone into production with increased mass flow and pressure ration giving about 42 kN.

The hidden lesson is that Snecma having got a fairly crude design as a base tackled the problem with caritas multiplied the power by five times and managed to make a commercially competitive jet engine. In achieving the above gains no major changes were made to the design. Most of it can be described as creative tinkering- fit, finish, tolerance, polishing and changes to sub-assemblies, at the most-perhaps just the blading at one of the stages-or some tinkering with the combustion chamber finish- small things like that. How much improvement are we needing in the Kaveri? Ten to fifteen percent! We need "collaboration" for that!

The lessons for us are we do not need much. Whilst basic facilities are essential, imagination, interest and a willingness to think freely or in retrograde can be useful in problem solving of axials. One example of willing to be regressive, patient and flexible- to flow past the problem - will make the point: The BMW 003 used hollow turbine blades which were made by press working in fourteen stages a nickel alloy steel tube- rather like a "conformal transformation" of circle into a Joukowski aero foil if you know what I mean! Though a splendid idea- the process wasted no material, the resulting blade was air cooled and worked well at thrusts of 7.8kN of the original 003 engines. They began to create problems when thrusts rose to 30kN.The French engineers were able to detect the fact that the blades were buckling and fluttering using a mixture of quick calculations, and 1950s technology instrumentations. Having identified the problem they reverted to solid blades which were naturally stiffer though the weight must have gone up which was tackled separately. The point I want to make again is that what is needed at the last mile is not technology but a spirit of enquiry and initiative springing from caritas- a love for the engine or product. I don't see how a consultant will give us that. I wonder, in mischief of course, whether the foreign interest in collaborating to get the Kaveri right is because they will have to do so little and earn so much!

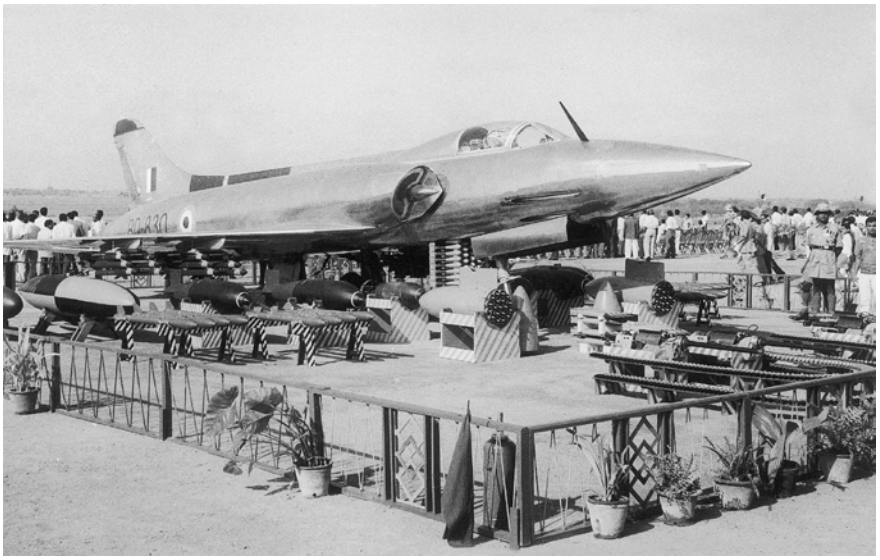
With that as an introduction to the mental makeup if we re-examine the Marut's engine problems this should have been the proposed route. The Orpheus though old is



well known to us, cheap, simple, responsive (single shaft) and will do even today –we do not yet need an expeditionary Air Force. We needed 27.4 kN in dry and 36.5kN in afterburner and we had an engine that was giving us 21.6kNs. Simply by changing the fuel pump from "B" to "C" we would have picked up another 100N i.e. 21.7kN. Changing the fit finish and possibly the tip clearances- remember the Chinese and their worry of "doctored" drawings or Snecma's experience with the ATAR 101E -we could have reached 25.36 kN. Even if this rating was not quite 27.4kN cold thrust required by the design if held for three minutes/sortie it would have given the Marut a 17% decrease in its take off length which was always quite critical under certain conditions as well give it advantage in combat well beyond the percentage increase in thrust. ! It would have cost us nothing to try this out on the test bed. By 1967 this uprated engine would have been ready for the first production Maruts. By then the Tyumanski R 11 had brought air cooled turbine technology into Koraput. With a small increase in TET allowed by the R11's technology we could have hit the 27.4 KN mark which was what was originally required and even without an afterburner the additional 20% power would have transformed the Marut with energy related performance such as climb and turn seeing a hundred percent improvement. With such a performance we would have a breathing space in which to continue production in volume whilst an afterburner was under development. There was no need for foreign collaboration, or high technology whatsoever at any time. What was lacking was a spirit of curiosity and failure. Unless we can rectify this "spirit", further research funds/consultancies will be wasted and timely results improbable. Also to be mentioned was that GTRE and HAL Engine Design Bureaus were trying, so I have heard, to close each other down-apparently GTRE succeeded-and no one would talk to Koraput which had the technology for air cooled blades.

A future for the Marut?

Normally any design that first flew sixty years has no prospects but the aeronautical scene in India is not normal. Given the need for a fifty squadron Air force, the HF 24 is a godsend. The LCA project is skating on thin ice- two unpainted aircraft are flown just a few days the financial year ending is



the usual "nautanki"- more "bean counting" – and a symptom of illness rather than of progress. Twenty years after the first flight if the Company has to do this then things are wrong! It is likely that the LCA Mk 2 or even the Mk1A etc will disappoint. Even if the LCA Mk IA /2 aircraft is ready on time ADA will turn up then i.e. in 2025 and ask for two more years to validate the FBW software. You read it here first!

In the LCA we are in a situation where we have developed good systems have but the airframe is bad- made worse by being uncertain. In the HF 24 we have a proven airframe. A man from Mars would say that a combination of the two to produce alternative solutions is natural and logical. It therefore makes sense to look at the HF 24 Marut as it will meet all the Tejas/MWF requirements and on time. A technical note is under preparation but below is a summary:

The following about the Marut are undeniable:

1. The Marut airframe is proven aerodynamically and structurally and has over 100,000 hours of "un-mollycoddled" IAF service.
2. The prototype was built from scratch within five years for a sum of 15 crores using 'sixties technology of drafting and prototyping.
3. Even with a B.Or.12 type engines the aircraft would behave like the "big wing" Jaguar proposed by BAC in the '80s.
4. The entire upper deck of the fuselage is free of a spine and control runs making area ruled conformal packing very simple. Even without the above pack the Marut, at present has, 91% and 62% more storage volume than the LCA Mk1 and the MWF.
5. The radome (frame 5B) diameter will permit for radar antennae approximately 10 centimeter greater than the LCA's.
6. The aircraft is available as both a two and single seater.
7. The aircraft is designed for mass production and is cheap and low cost to tool up and produce.

These are strong reasons for an independent, unbiased re-examination of reviving the Marut airframe to meet the MWF/LCA requirements.

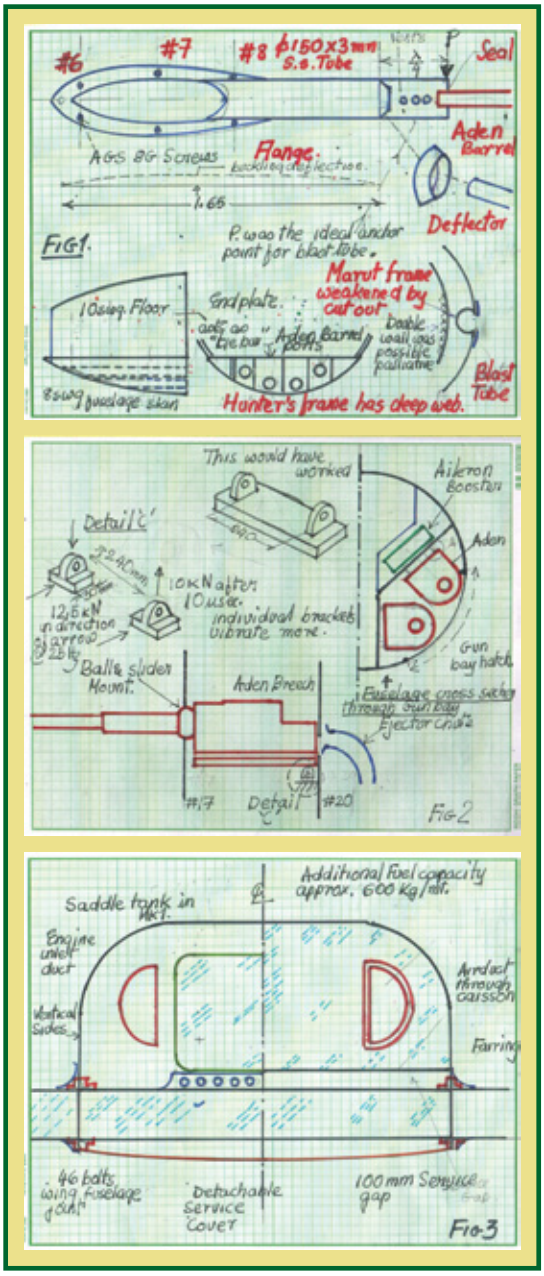
Somewhat surprisingly the HF 24 was lighter than the Hunter though both had the same level of equipment and gunnery because the Hunter's engine was about 400 kg heavier than the two Orpheus. The rest was I suppose Hawker engineering! With the obsolete 4x30 mm Adens and the 114 kg ballast weight removed and two B.Or12 equivalent engine we are looking at a flyable airframe weighing about 5350 kilos leaving a one ton and a half margin for upgrade equipment without using a gramme of composites. "New technology"- 115 v electricals or carbon brakes will give us another two hundred kilos and composites when introduced will save perhaps another 300 kilos so we have by and by a margin of about two tons of new equipment and systems whilst keeping the empty weight at around 6800 kilos. The ease of production and the use of conventional materials would

result in rapid production and modifications for the initial batches as well as the ability to withstand sanctions on raw materials supply. The original aircraft cost little to produce from scratch in 1960. Even less will be needed to revive the HF 24 airframe and develop a NMG. Sufficient information exists in India to extract the DNA of the superb HF 24 airframe. We are rich in upgrade skills and this time we will do it on a near bare airframe.

The vexed problem of the engine has to be tackled by a multi-pronged exploration for the best solutions. The aircraft should be re-examined for both single and twin engine configurations. The Honeywell F 124, The Ukrainian AI 222-22As, the Adour are all contenders for the twin engine configuration. The HF 24s vertical sides at the center fuselage means that a small deepening of the fuselage (50-80 mm depending on the engine-(the Motor Sich Ivechenko AI222-22 will need no change) will cause minimum disturbance to the aerodynamics- talk about a brilliant airframe!

The second line of exploration will be a single engine to use the F 414/F 404 engines because it can then use directly most of the systems developed for the LCA. The Marut, thanks to its aerodynamics, does not need 78/90kN. The F 404/Kaveri may just do what the more powerful F 414 needs to do for the "blunter, draggier" LCA. Though the HF 25 as proposed by SC Das in 1978 is aerodynamically superior and lighter it would better to configure the HF 24/ F 404/414 in the style of the Northrop F 5E to F 20 transformation because a lot of the spinning and high AoA test flying will not be required. Incidentally the capture area of the intakes in the existing Marut is just about right for the F 404/414 needing only the usual "blow in" and dump doors.

For true Atmanirbharata (self- confident self- reliance) I would strongly pitch for developing the Orpheus B.Or.3 into the B.Or.12 equivalent. For our operational scenarios the Orpheus has a lot to recommend it. It is simple, it is cheap, responsive and light and it will do. No major airframe changes are needed. The original Orpheus was designed and certificated within one year- that too on a 1955 base of knowledge and technology. Not only is such a development within our engineering and technology capabilities we have not one but two possible "dark horse" engine candidates ready and waiting. The first is the core of the Pegasus two- spool turbofan used on the Indian Navy's Harriers. A quick bench check will confirm my guess that the core develops around 31.2 kN-33.7 kN (7000-7500 lbs.) which is more than enough to do the trick for the HF 24. With that kind of power the Marut would be able to super cruise i.e. without a/b, at Mach 1.2 at 10,000mts. With a smooth running basic engine developing the afterburner to get around 40 kN (9000lbs) will be easy. Even if my sanguine guess is wrong the engine has much to teach us- an additional stage, higher compression ratio and being about a decade later it will have features useful to us. The same must be said for the Kabini core which given the very low by pass ratio of the Kaveri, must be quite powerful and very suitable even without a/b. The HTFE 2500 and the Kaveri are also very suitable for consideration. There will be usual problems but I am convinced these can be tackled to a tight timescale. We are spoilt for choice in terms of imported and local engines!



Going about it

The development of aircraft is a high attention task. Remaining in power in multi part democracy is another high attention task and the two do not co-exist. It is no coincidence that successful state run aeronautical industries exist only in "single party" democracies. When the State developed the HF 24 the polity was close to a single party democracy.

Waiting for the Government will be in vain. It is too busy to run an aerospace industry. The private sector automobile (sic) and aerospace industry must form a consortium to see how the Marut airframe with the two engine options- Kaveri and Orpheus- can be produced and how much it would cost. The automotive sector must be brought in because it is highly experienced in presswork, electrical rotating machines, wiring looms and its quality standards and procedures are equal to aerospace. Also having been liberalised earlier they would have a bigger talent pool of creative people. The private sector consortium should co-ordinate with the Government to see how much equity- in the form of capital, knowledge, facilities and legacy resources can be organised. The concept of the fighter is changing and the Marut Airframe is the best right thing in the right time. The Dog's name may yet be redeemed.

Prof Prodyut Das

(All images taken from the book 'Spirits of the Wind: The HAL HF-24 Marut' by Pushpindar Singh)

V-22 in 600,000 fleet flight hours

The Bell Boeing V-22 Osprey has logged more than 600,000 flight-hours, providing continuous customer support to maintain mission readiness and transport critical cargo and personnel. Built by Bell Textron Inc., a Textron Inc.company and Boeing, the V-22 fleet has grown to more than 400 aircraft and is operated by the United States Marine Corps, US Air Force, US Navy and the Japan Ground Self-Defense Force.

Gulfstream marks 100th delivery of next-generation aircraft

Gulfstream Aerospace Corp. announced it has made the 100th customer delivery of the next-generation Gulfstream G500 and Gulfstream G600 programme. The 100th aircraft is a G500. The G500 entered service in September 2018, with the G600 following in August 2019. Before the aircraft entered service, Gulfstream ensured the G500 and G600's maturity with exercises that went beyond the rigorous flight-test programme, including a high-speed G500 world tour spanning nearly 130,000 nautical miles and achieving 22 city-pair speed records.

Airbus qualified as bidder for Canada's strategic tanker replacement

Airbus has been qualified by the Government of Canada as a bidder for the Strategic Tanker Transport Capability (STTC) project, a procurement process launched to replace the Royal Canadian Air Force (RCAF) Airbus A310MRTT (CC-150 Polaris) multirole tanker fleet.

Elbit J-MUSIC DIRCM for MRTT

Elbit Systems will supply an additional J-MUSIC DIRCM (Direct Infrared Countermeasures) self-protection system to the Multinational Multi-Role Tanker Transport Fleet (MMF). This time for the ninth Airbus A330 MRTT aircraft, the last addition of the fleet, to be equipped with Elbit Systems› J-MUSIC DIRCM system.

Embraer successfully concludes aerial refueling qualification

Embraer reached another important milestone in the development of the KC-390 Millennium multi-mission military freighter programme with the successful conclusion of the aerial refueling qualification between two KC-390 Millennium, proving, for the Brazilian Air Force (FAB), this new operational capacity of the aircraft.

Singapore receives its first H225M

The Republic of Singapore Air Force (RSAF) has taken delivery of its first H225M helicopter in Singapore. Singapore's fleet of H225Ms is expected to assume a wide range of roles, including search and rescue, aeromedical evacuation, as well as humanitarian assistance and disaster relief operations.

Japan Coast Guard adds two H225s

Japan Coast Guard (JCG) will expand its fleet with two new H225 helicopters, taking its total Super Puma fleet up to 17, comprising two AS332s and 15 H225s. The largest Super Puma

operator in Japan received its tenth H225 in February this year. The new helicopters will join its growing fleet to support territorial coastal activities, security enforcement, as well as disaster relief missions in the country.

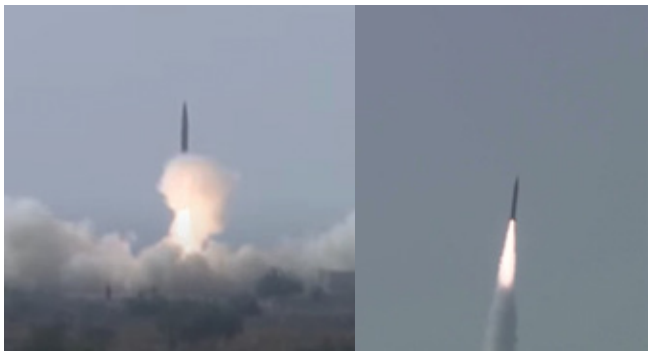
Contract to upgrade F-16 aircraft

Kongsberg Aviation Maintenance Services (KAMS) has contracted with the Norwegian Defence Material Agency to maintain and make ready for sale two F-16 aircraft that have been taken out of service in the Norwegian Armed Forces. The aircraft will be made ready for sale to new owners, and the Norwegian Defence Material Agency expects to achieve commercial re-sale agreements for the upgraded aircraft.

GA-ASI Gray Eagle surpasses 1 million flight hours

General Atomics Aeronautical Systems, Inc. (GA-ASI) announced that the family of Gray Eagle Unmanned Aerial Systems (UAS) surpassed 1 million flight hours on March 16, 2021 during US Army flight operations. Since that first flight, GA-ASI and the US Army have fielded over 250 Gray Eagle-type aircraft, including the new Gray Eagle Extended Range (GE-ER) aircraft. Over 80% of the 1 million flight hours were flown in support of deployed operations with a better than 90% Mission Capable Rate.

Pakistan test fires Shaheen 1-A



On 26 March 2021, Pakistan conducted successful flight test of Shaheen-1A surface to surface ballistic missile, having a range of 900 kilometers. The test flight was aimed at re-validating various design and technical parameters of the weapon system including advanced navigation system. The launch test was witnessed by Lieutenant General Nadeem Zaki Manj, Director General Strategic Plans Division, Dr. Raza Samar, Chairman NESCOM, Lieutenant General Muhammad Ali, Commander Army Strategic Forces Command and the scientists and engineers of strategic organisations.

Pakistan Navy Ships ALAMGIR & AZMAT participate in Asad Al Bahr-II

Ships of Pakistan Navy and Qatar Emiri Naval Forces (QENF) during bilateral exercise Asad Al Bahr-II. (Source ISPR)

Pakistan Navy Ships ALAMGIR & AZMAT during Overseas Deployment visited port HAMAD (Doha), Qatar and participated in bilateral exercise Asad Al Bahr-II with Qatar Emiri Naval Forces (QENF). Upon arrival at Doha, PN ships were warmly welcomed by senior officers of QENF and Defence Attache of Pakistan. During the visit the Mission Commander of PN Flotilla called on various dignities of host country. In addition, the planning and coordination of bilateral exercise was undertaken with Qatar Emiri Naval and Air Force officers. On completion of port visit, the bilateral exercise Asad Al Bahr-II was undertaken between PN and QENF ships HUWAR, DAMSAH and KAAN participated in the exercise along with aircraft of Qatar Emiri Air Forces (QEAF). The exercise was aimed to strengthen bilateral ties, enhance naval collaboration and interoperability among the two navies.

Boeing orders for more P-8A Poseidon's

The US Navy has awarded Boeing a $1.6 billion production contract for the next 11 P-8A Poseidon aircraft. Nine aircraft will join the US Navy fleet and two will go to the Royal Australian Air Force (RAAF), a cooperative partner in the P-8A joint programme since 2009. The contract brings the total number of US Navy P-8A aircraft under contract to 128 and the RAAF total to 14.

Bell and US Army advance development of V-280 Valor

Bell Textron and the US Army have agreed to terms on the execution of the second phase of the Competitive Demonstration and Risk Reduction (CD&RR) contract that was awarded in March 2020 for the Future Long-Range Assault Aircraft (FLRAA) programme.

LM and Danish AF celebrate 1st Danish F-35

Danish and American officials celebrated the rollout of the first F-35A Lightning II for the Royal Danish Air Force (RDAF) at Lockheed Martin in Fort Worth, Texas. This major F-35 programme milestone strengthens national defence and global partnerships between the United States, Denmark and other F-35 partner and buying nations.

F-15EX Eagle II unveiled as newest fighter

8 April marked the unveiling of the name and the official role of the US Air Force's newest fighter, the F-15EX Eagle ll. Lt. Gen. Duke Richardson, Office of the Assistant Secretary of the Air Force for Acquisition, Technology and Logistics military deputy, presented the F-15EX during an unveiling and naming ceremony at Eglin Air Force Base on 7 April. The Air Force will procure up to 144 F-15EXs from Boeing, to replace F-15C/D models. The goal is to increase the F-15 fleet fighter readiness.

Bahrain delegation commemorate first production AH-1Z

Bell hosted a delegation from the Kingdom of Bahrain to mark the start of production of AH-1Z Viper attack helicopters built as part of the Foreign Military Sales (FMS) programme. The US Department of Defense awarded Bell a contract to manufacture and deliver 12 Lot-16 AH-1Z aircraft to the Kingdom of Bahrain. Bell projects production deliveries to begin in late-2021.

Airbus integrated support contract with Egypt for C295

The Egyptian Air Force, the largest C295 fleet operator worldwide, has recently signed a five-year services contract with Airbus for the performance-based support of its fleet, composed of a total of 24 aircraft.

France orders H225Ms and VSR700

The French Minister of Armed Forces, Florence Parly, has announced that the Armament General Directorate (DGA) has signed an order to purchase eight additional H225Ms and a second VSR700 prototype. The H225Ms will be operated by the French Air and Space Force. The VSR700 is an unmanned aerial system being developed for the French Navy in partnership with Naval Group.

HENSOLDT radars for Quadriga Eurofighters

Sensor systems supplier HENSOLDT has been awarded a contract worth approximately 200 million euros in the frame of 'Quadriga' procurement programme of 38 Eurofighter/Typhoon combat aircraft by the German Air Force. The contract placed by Airbus Defence and Space comprises production and delivery of radar systems and core electronics components which will be produced at HENSOLDT's site in Ulm and at consortium partner Indra's site in Spain.

NHIndustries selects Thales's TopOwl

NHIndustries has chosen the new-generation TopOwl Digital Display helmet from Thales for the Special Forces variant of the NH90 helicopter. This variant has been developed at the request of the French defence procurement agency (DGA) to meet the requirements of France's Special Forces, and is also available to partner countries and other NH90 customers.

Safran, MTU and ITP Aero cooperation to power NGF

Safran Aircraft Engines, MTU Aero Engines and ITP Aero came to an overall agreement on the cooperation to provide a jointly developed, produced and supported engine to power the Next-

Generation Fighter (NGF), which is a core element of FCAS (Future Combat Air System). ITP joining the programme as a main partner of MTU's and Safran Aircraft Engines' new joint venture EUMET will allow an equal workshare between France, Germany and Spain.

Aeronautics unveils Orbiter 4 for maritime missions

Aeronautics Group has introduced its Orbiter 4 small tactical UAS, capable of performing long-range, long-endurance maritime patrol missions. The Orbiter 4's high-performance EO/IR and MPR payloads are ideal for maritime monitoring, gas and oil rigs protection, illegal activity tracking, and search & rescue. It has already been fully integrated into the operational environment of navy vessels, and meets the requirements of navy operations.

LEAP engine fleet surpasses 10 million flight hours

The CFM LEAP fleet has surpassed 10 million engine flight hours and five million flight cycles in less than five years of commercial service. Since the first LEAP-powered flight entered commercial service in August 2016, the engine programme has grown exponentially. Nearly 1,400 LEAP-powered aircraft have been delivered to some 136 operators on five continents to date. CFM is actively working to deliver on its clear ambition to build a more sustainable future, leading with the LEAP engine, which is providing operators a 15 percent improvement in fuel consumption and CO2 emissions compared to previous generation engines.

Safran to provide landing gears for Bell V-280 Valor

Safran Landing Systems has reached an agreement with Bell Textron Inc. to provide the landing gear system for the V-280 Valor aircraft. Bell's V-280 Valor is a next generation tiltrotor aircraft proposed for the US Army's Future Long-Range Assault Aircraft (FLRAA) Programme. Based on the agreement, Safran Landing Systems will develop and manufacture a fully integrated Landing Gear System consisting of the Main Landing Gear, Tail Landing Gear, Wheels and Brakes, Extension/Retraction System, Steering System, Brake Control System and Indication sensors.

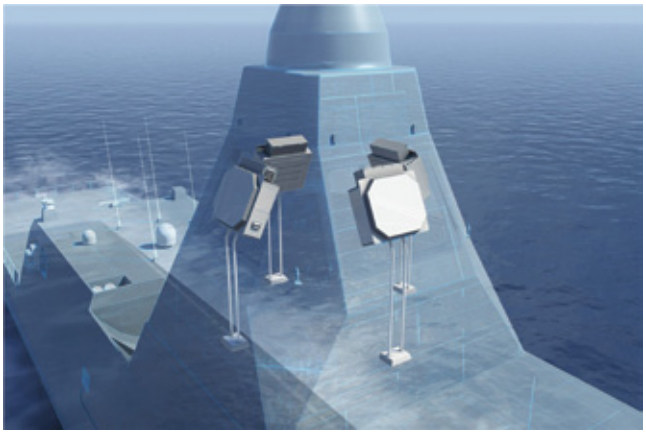
SkyWest orders 8 E175s

Embraer has agreed to the sale of eight new E175 jets to SkyWest for operation with Alaska Airlines, adding to the 32 SkyWest E175 jets SkyWest already flies for Alaska. The E175 aircraft will fly exclusively with Alaska Airlines under a Capacity Purchase Agreement (CPA).

Airbus resumes work on modernised A320 Family FAL

Airbus has resumed work on the modernisation of its A320 Family industrial capabilities in Toulouse. This will provide Airbus with increased flexibility throughout its global industrial production system to respond to market recovery and future demand.

Thales delivers 1st Sea Fire fully digital radar



Launched in 2014, the first of the five Sea Fire AESA digital radars for French Navy's future Frégate de Défense et d'Intervention (FDI) arrived at the Lorient shipyard on 27 April for integration on the first vessel. Today's naval forces face faster, more manoeuvrable and increasingly complex threats. Vessels need protection from conventional ballistic or air threats, surface and asymmetric threats, but also from high-velocity and saturation attacks. At the same time, they have to take into account reduced crewing requirements, the need for improved maintenance and the imperatives of cybersecurity.

Airbus delivers 100th A400M

Airbus has reached 100 A400M deliveries with MSN111, the tenth A400M for the Spanish Air Force. The aircraft performed its ferry flight on 24 May from Seville to Zaragoza, where the Spanish A400M fleet is based. In the same week, the A400M global fleet also achieved the 100,000 flight-hours landmark performing missions worldwide for all eight customer nations. All A400M operators have been able to operate the aircraft intensively for Covid-19 emergency response missions, as well as conduct joint, collaborative operations. These milestones clearly demonstrate the maturity of the A400M programme on all fronts.

Norway and Netherlands partner on Thales Ground Master 200 MM/C

Building on the strong international NATO cooperation within the Ground Based domain, as well as strategic bi-lateral defence ties, the Norwegian Defence Materiel Agency (NDMA) has signed an agreement with the Netherlands Defence Materiel Organisation (DMO) for the acquisition of five Thales Ground Master 200 Multi-Mission Compact radars (GM200 MM/C). The agreement also includes an option for three additional systems.

Eve in 200 eVTOL order

Eve Urban Air Mobility Solutions and Halo have announced a partnership focused on developing Urban Air Mobility (UAM) products and services in the United States and the United Kingdom. This partnership includes an order for 200 of Eve's electric vertical takeoff and landing (eVTOL) aircraft.

Saab programme successes

Third GlobalEye delivered to the UAE

Saab delivered the third GlobalEye aircraft to the United Arab Emirates on 20 February 2021 which follows Saab's previous deliveries of GlobalEyes in April and September 2020. The United Arab Emirates has ordered a total of five GlobalEye aircraft, Saab's new generation airborne early warning and control solution.

Contracts for 'Next Gen' Corvettes for Sweden

Saab and the Swedish Defence Materiel Administration, (FMV), have signed two agreements concerning the next generation of surface ships and corvettes. A Product Definition Phase for the Mid-Life Upgrades (MLU) of five *Visby*-class corvettes, as well as a Product Definition Phase for the next generation; *Visby Generation 2* corvettes, value of the contracts being 190 MSEK.

Norwegian order for Carl-Gustaf M4

The Norwegian Armed Forces has signed a framework agreement with Saab for the Carl-Gustaf M4, an initial order for the weapons with deliveries in 2021. The

Norwegian Armed Forces has been a user of the Carl-Gustaf M2 system since early 1970s, the M2 and the M3 versions now used by Norwegian Armed Forces.

Carl-Gustaf M4 Trainers to Sweden

Saab has received an order for the Carl-Gustaf M4 Ground Combat Indoor Trainer (GC IDT) with deliveries to take place in 2022-2023. The order is placed within a framework agreement which allows Swedish Defence Material Administration (FMV), together with the Estonian and Latvian Armed Forces, to place orders for Carl-Gustaf M4 weapons, training systems and associated equipment during a 10-year period.

Royal Navy order Digital Towers

Saab has signed a contract with the UK's Royal Navy to provide a Digital Tower solution at Air Station Culdrose's satellite airfield at Predannack. Following a competitive procurement, the Royal Navy has become the fourth UK customer to select Saab's Digital Towers as part of a framework contract. The technology, which enables air traffic services to be conducted remotely, will also enhance the controllers' situational awareness, through video, automatic tracking, graphic overlays, and enhanced safety tools.

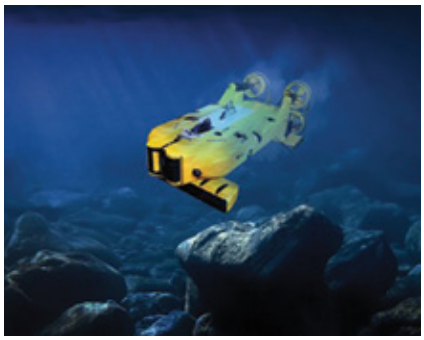
Saab leads development of Detect and Avoid Capabilities

The European Commission has selected the EUDAAS (European Detect and Avoid System) consortium, with Saab as leading partner, to develop Detect and Avoid capability for large military Remotely-Piloted Aircraft Systems (RPAS) within the European Defence Industrial Development Programme.

Upgrade of German Tornados' Radar Warners

Saab has received an order from Panavia Aircraft GmbH to upgrade the radar warning equipment on the Tornado aircraft operated by the German Air Force. The order value is approximately 400 million SEK. Saab will supply modern digital components, which will enhance the processing power and extend the lifetime of the Tornado's radar warning equipment. Deliveries will take place between 2021 and 2025.

Contract for Poland's Double Eagle systems



Saab has signed a contract with the Gdynia Naval Port Command to deliver integrated logistics support for Double Eagle Mk III and Double Eagle SAROV systems. The contract's value is PLN 14.7 million, and it will be will be executed in the years 2021-2023. The scope of deliveries in individual years will include the supply of spare parts, special tools, technical documentation and training.

Bulgaria orders Saab's Deployable Maintenance Facility

Saab has signed a contract to deliver the Deployable Maintenance Facility (DAM) for use by the Bulgarian Air Force. The system will provide the Bulgarian Air Force with an 'efficient and flexible' way to optimise their infrastructure capability. DAM will be used at numerous air bases throughout Bulgaria. It will provide a complement to existing permanent infrastructure and provide sufficient capability for parking, protection and maintenance of a variety of fixed and rotary wing aircraft in the Bulgarian Air Force.

Saab makes first T-7A delivery

Saab has shipped its first aft airframe section for the T-7A Red Hawk programme. This is a key delivery in the Engineering and Manufacturing Development (EMD) programme to its T-7A Red Hawk advanced trainer aircraft partner, Boeing.

Saab delivers its best and final offer for Finland

Saab has, with strong support from the Swedish Government, submitted its Best and Final Offer (BAFO) to the Finnish defence procurement agency for the Finnish HX fighter procurement. The proposal comprises 64 Gripen E fighter aircraft and an extensive weapons package, as well as two GlobalEye Airborne Early Warning & Control (AEW&C) aircraft. This constitutes the response to the customer's January 2021 request for a BAFO.

MBDA technology advances

First firing of MMP

MBDA has fired an MMP missile from a remotely operated turret mounted on a 4x4 land-vehicle for the first time. Carried out in 'fire and forget' mode, the firing consisted of engaging a target representing another armoured vehicle located approximately 3,500 meters away. Ending with a direct hit on the target, the firing confirmed the

precision of the aiming and 'locking-on' for a long-range target from the turret, as well as the quality and robustness of the guidance chain.

MBDA and Rheinmetall for high-energy laser system

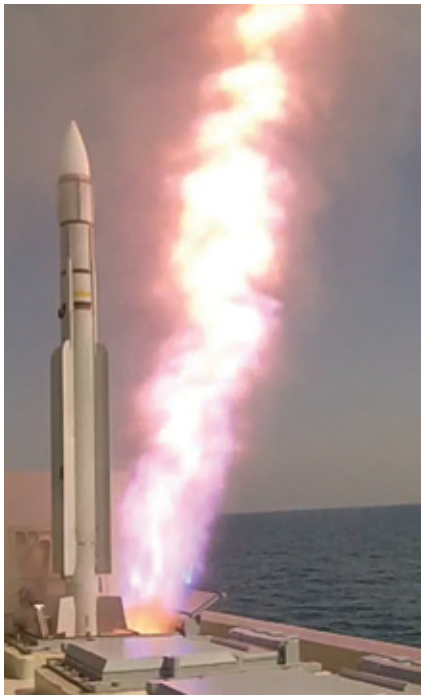
Germany's Federal Office for Bundeswehr Equipment, Information Technology and In-Service Support (BAAINBw) has awarded a consortium, or ARGE, consisting of MBDA Deutschland GmbH and Rheinmetall Waffe Munition GmbH a contract to fabricate, integrate and support testing of a laser weapon demonstrator in the maritime environment.

MMP firing linked with Novadem drone

MBDA has carried out demonstration of the operational capabilities of LYNKEUS Dismounted, comprising the MMP system in "infantry" configuration and a Novadem NX70 drone linked via radio to its weapon terminal. Carried out with support of the French Army and of the *Direction Générale de l'Armement* (DGA - French Procurement Agency) at the Canjuers military camp in France, this firing was to confirm 'beyond Line of sight' (BLOS) engagement.

Egypt orders VL MICA system

MBDA has been awarded a contract from the Egyptian Navy for the VL MICA NG (New Generation) air defence system to equip its corvettes. Officially launched in October 2020, the VL MICA NG system is based on integration of the MICA NG (New Generation) missile in the existing VL MICA point and close area air defence system. "The VL MICA NG system offers improved capabilities to handle atypical targets (UAVs, small aircraft), as well as future threats characterised by increasingly low observable infrared and radio frequency signatures. Additionally, VL MICA NG will be able to intercept conventional targets (aircraft, helicopters, cruise missiles and anti-ship missiles) at longer distances."

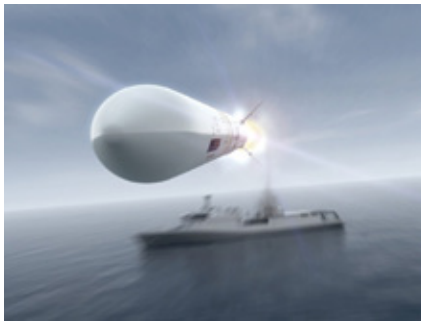


Tawazun and MBDA cooperate on SmartGlider development

Tawazun and MBDA have signed a *head of terms agreement* with the intent to cooperate in the field of smart guided weapon systems. The aim is to create a long-term partnership between Tawazun and MBDA, for development of the SmartGlider weapon systems from design to production phase. A joint team of engineers from both sides, the majority from Tawazun, will be in charge of development efforts, operating from MBDA's first regional Missile Engineering Centre established in the United Arab Emirates (UAE).

Sea Ceptor to protect Royal Navy's new Type 31 frigates

MBDA's Sea Ceptor system will protect the Royal Navy's new Type 31 frigates under a contract awarded by the UK Ministry of Defence. The system will allow the Type 31 to protect simultaneously both itself and vessels near it from attack from current and future threats, including high-speed missiles, attack aircraft and fast inshore attack craft.



First firing of MMP from a Jaguar armoured vehicle

On 14 April, MBDA and Nexter participated in the first lock-on firing of an MMP medium-range missile from a Jaguar armoured reconnaissance and combat vehicle (EBRC). The integration of MMP onto Jaguar is being carried out in stages during qualification. This firing is the first stage, successfully demonstrating hitting a fixed target. The system will offer the capability to destroy fixed or mobile hardened land targets, including up to the latest generation of tanks. Targeting will be direct or beyond-line-of-sight (BLOS). It will also be precise and with minimal collateral damage, qualities that characterise the MMP.

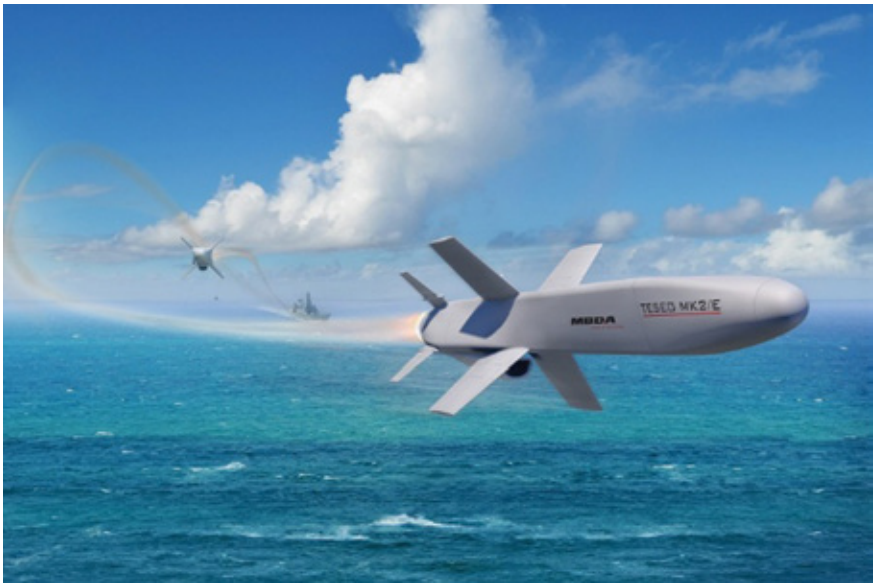
MMP's capabilities – integrated into the Jaguar's turret by Nexter, alongside the remote controlled weapon station developed by Arquus, the Scorpion common vetronics solution developed by Thales and the 40mm cannon developed by CTAI, gives the Jaguar a key role in collaborative combat.

First contract for the new Albatros NG system

MBDA has been awarded a first contract for Albatros NG, a brand new CAMM-ER based air defence system. This first order, from an undisclosed international customer, marks a further validation of the wide appeal of the CAMM air defence family on the global marketplace and paves the way to further acquisitions by the same customer and other Navies. Albatros NG is a new generation Naval Based Air Defence (NBAD) system, based on the CAMM-ER, which is the extended range variant of the Common Anti-air Modular Missile (CAMM) family already delivered to customers around the world for both ground based and naval air defence.

MBDA to supply new Teseo Mk2/E to Italian Navy

MBDA will provide the Italian Navy with the new Teseo Evolved Weapon System, namely Teseo Mk2/E. This new generation system builds on the legacy Teseo family, known worldwide as OTOMAT, and will bring a substantial improvement in anti-ship capabilities. Teseo Mk2/E will efficiently engage both sea and land targets at very long range, with full mission control throughout the missile flight. The system will have an innovative integrated mission planning and a new RF seeker, with options for additional features and capabilities in the future.



Rafale F3-R to now be used in operational service

Admiral Pierre Vandier, Chief of Staff of the French Navy and Air Force General Philippe Lavigne, Chief of Staff of the French Air and Space Force, jointly approved the entry into operational service of the Rafale F3-R fighter jet on 8 March.

The upgrading of the French combat aircraft capacities ranks high on the list of priorities of the French military expenditure plan (LPM) which provides for a 2.7 billion euro investment in the development of the new versions of the Rafale over the 2019-2025 period. The French Navy and the French Air and Space Force are now authorised to make operational use of all the capacities that are developed around the F3-R standard, which is already installed in half the French fleet and will eventually be installed on all Rafale aircraft in service. Both forces now have a world-

class multirole fighter aircraft at their disposal capable of operating in the most contested environments.

The decision also applies to the Rafale aircraft of the GAE (carrier air wing) operated from aircraft carrier Charles-de-Gaulle, or those of the French Air and Space Force that are deployed from the forward air base in Jordan within the framework of operation Chammal.

The entry into operational service is the culmination of a process, which within both armed forces consisted of determining and disseminating the applicable operating tactics defined for the new capacities of the multirole aircraft, as made possible by the F3-R standard, and particularly those offered by the long-range air-to-air Meteor missile and the TALIOS land-based target designator.

The combination of the AESA RBE2 radar and the long-range Meteor missile gives the Rafale the air superiority it needs for beyond visual range engagements in all weather, as required for handling a wide variety of targets. The F3-R Rafale is now capable of using the TALIOS high-resolution laser designation pod, which can generate images in both the visible and infrared ranges, and will benefit from largely improved capacities that will enable it to perform intelligence and target acquisition, and tracking and designation missions. In particular, the Rafale will feature new and more efficient fixed or moving target tracking capacities, as well as an automatic moving target detection capacity and a new human-machine interface that will make it easier to use.

In the new standard, the Rafale F3-R will also offer an enhanced ground attack capacity. It will now be possible to control the munition flight time, the laser illumination and the in-flight weapon settings, including for the terminal laser guidance AASM (modular air-to-ground weapon system).

From 2022 onwards, new capacities will be added to the Rafale, with the F4 standard. The aircraft will include innovative connectivity solutions offering enhanced networked combat operation capabilities. Enhanced radar sensors and forward optronics will also be added, as well as a helmet-mounted display and new integrated weapons, such as the air-to-air MICA NG missile and the modular 1000-kg air-to-ground weapon.

Dassault in 2020

"As guided, we delivered 13 Rafale Export and continued to explore new export opportunities. This led to the successful sale to Greece in January 2021 of 18 Rafale (6 new aircraft and 12 aircraft recently put into service with the French Air and Space Force). Following the sale, France announced the order of a further 12 Rafales to replace those to be delivered to Greece. We also successfully delivered 34 Falcons (despite the travel restrictions), continued working on the Falcon 6X which completed its virtual rollout in December 2020 and that is expected to enter into service in late 2022 and continued to develop the future Falcon to be announced in the first half of 2021", stated company officials.

The 2020 order intake amounted to EUR 3,463 million, versus EUR 5,693 million in 2019. This year, it included the integrated support contract for the Atlantique 2 (OCEAN) for France and 15 Falcon, including the "Albatros" maritime surveillance aircraft programme for the French Navy. In 2019, it chiefly comprised the RAVEL contract and 40 Falcons. Net sales in 2020 amounted to EUR 5,489 million, versus EUR 7,341 million in 2019. This reduction, as planned, was mainly due to a lower number of Rafale Export deliveries (13 vs. 26 in 2019) and Falcon deliveries (34 vs. 40 in 2019).

Israel Aerospace Industries delivers first Oron to IDF

Israel Aerospace Industries (IAI) has delivered the 'Oron' aircraft to the Israel Defence Forces (IDF). The 'Oron' is the first wide area persistent surveillance, multi-sensor aircraft and will provide the IDF with 'unprecedented' Intelligence, Surveillance and Reconnaissance (ISR) capabilities. Its groundbreaking sensors and pioneering data processing capabilities will enable multi-domain coverage of vast areas in real time for ground and maritime surveillance, regardless of weather or visibility conditions. The development of this programme is led by the Directorate of Defense R&D in the Israel Ministry of Defence (IMOD), in collaboration with the Israeli Air Force (IAF), IDF Intelligence Directorate, Israeli Navy and IAI.

The groundbreaking ISR systems developed and integrated in 'Oron' will enable the IDF to generate comprehensive, real-time intelligence assessments, including detailed assessments of the deployment of enemy forces and terrorist organisations at short and long ranges, during routine and operational activity. Developed based on lessons learned in past conflicts by IDF and MOD, the 'Oron' will also be equipped with a data processing mechanism based on advanced data science and artificial intelligence (AI) capabilities.

The 'Oron' aircraft is based on the Gulfstream G550, known for its 'excellent' flight performance and low maintenance costs. The aircraft will be equipped with cutting edge sensors, and advanced radar systems developed by IAI. The 'Oron' aircraft is the first of its kind in the world and joins the family of Strategic Special Mission Aircraft that IAI has provided the IDF over the past two decades, including the 'Eitam' (AEW&C) and 'Shavit' (SIGINT) aircraft.

"The 'Oron' aircraft is yet another testimonial to IAI's experience in developing strategic systems for the State of Israel and our customers worldwide" President and CEO of IAI, Boaz Levy said in a statement**.** **"**Our expertise in bringing end-to-end solutions to answer operational needs is clearly demonstrated through the 'Oron' aircraft initiative. IAI is honored to bring intelligence, communication, multi sensors and operational know-how to fruition to help guard Israel's borders."

The 'Oron' aircraft landed in Nevatim Airbase in April and was received in a ceremony held in the presence of IAF Commander, Maj. Gen. Amikam Norkin. The aircraft will be operated by the IAF's 'Nachshon' Intelligence Squadron and will enable the IAF to further its operational edge and intelligence capabilities in the face of emerging threats and security challenges.

IAI's OPAL decentralised Battle Management Solution

Israel Aerospace Industries' (IAI) OPAL decentralised battle management solution enables interconnectivity and real-time data sharing, allowing military forces worldwide to meet the challenges of the modern combat arena.

First unveiled in April 2019, OPAL is designed to allow warfighters to respond effectively to combat threats characterised by time-critical targets (TCT) as well as for forces that operate both in conjunction with other units and in remote areas, away from C2 coverage, according to Barak Israel, Product Line Manager, Aviation Group, IAI.

"Modern warfare is very dynamic. If you don't respond immediately, the target will disappear," Barak stated. According to Barak, it's a current pain point for military forces that combat platforms are not able to directly communicate with one another due to the lack of connectivity that exists between fourth and fifth-generation fighter jets.

The need to share information among various forces, see the same situational picture, and speak the same language was the driving force behind OPAL's development. OPAL enables users to share a common picture of the battlespace in real-time, to connect not only through verbal descriptions but through image, video sharing, or data exchange as well.

OPAL creates networking connectivity and enables data sharing among all members of a fighting force, regardless of whether they are airborne, or naval, or land-based. It uses software-defined radios and existing data links to share large amounts of real-time data, in line with operational needs, enabling end-users to take swift and relevant actions.

One of the unique capabilities in the OPAL networking layer is that it enables real-time communication. Unlike traditional datalinks that provide update rates of several seconds, OPAL's real-time network is being used to prevent mid-air collisions between fighter jets flying in close formations, among other time-critical use cases.

(Image: IAI)

Developed over the past 15 years using open architecture, OPAL was inspired by Android open architecture, rather than legacy military systems that employ stovepipe hardware-based resources, each requiring dedicated software development. "We took the Android concept and brought it to network-centric warfare. OPAL can be installed on any platform – aircraft, helicopters, UAVs, vehicles, C2 centers, or ships. Using user-developed apps, OPAL can bring new operational capability though this infrastructure, and make it shareable, similar to how smartphone applications function," Barak said.

OPAL includes a range of hardware solutions, depending on the platform and end-user requirements. These hardware platforms rely on optimised software middleware architecture, named Application Framework. The Application Framework provides standard services that cater to different operational capabilities (a.k.a applications) requirements. The system connects to the platform's data bus and shares the platform's data via integral or add-on radios that link-up end users. OPAL features high processing and graphics capabilities, delivering essential battlefield services to the participating members. OPAL ensures that information reaches the target endpoint in real-time, regardless of range, physical or electromagnetic interference, weather conditions, or operational load.

Sharing accurate data in real-time significantly improves the efficiency and survivability of the fighting forces. The implications for complex, inter-force applications, such as close air support, are immense. "It changes the doctrine completely," Barak stated.

OPAL provides customers with a high degree of operational independence. Following the initial system deployment, customers can use operational capabilities from IAI, or independently develop their own applications relying on the OPAL application development infrastructure provided by IAI. Customers have the option of ordering IAI's radio systems and datalinks as a part of the OPAL battle management system, or acquiring OPAL while utilising their indigenous existing communications radios, datalink networks, sensors, and systems.

"In terms of operational doctrine, a major feature of OPAL is the ability to introduce new capabilities in a very short time," said Barak "Once the system is deployed, clients are able to independently develop and implement their own capabilities."

OPAL is proven and operational on fighter jets, training aircraft, tankers, helicopters, mission aircraft, command and control centers and ships, as well as other platforms.

IAI news and updates

IAI demonstrates extended air defence capabilities

Israel Aerospace Industries (IAI) has completed a series of successful live firing trials with the Barak Air Defence System. The trials tested the system's capabilities in a range of scenarios and threats, including the interception of an assaulting ballistic target by the Barak ER (extended range) interceptor. The Barak ER missile, developed by IAI, combines the capability to intercept air defence threats at a long range of 150 kilometers and ballistic targets as part of IAI's Barak interceptors' family of various ranges. The extended range capability is made possible in part by adjusting the interceptor and MMR radar capabilities to a 150 km range.

IAI and GECAS Making Progress on "Big Twin"

Israel Aerospace Industries (IAI) and GE Capital Aviation Services (GECAS) have now passed the planned halfway phase of the Supplemental Type Certificate (STC)

Development Programme for the 777-300ERSF. This is a key milestone for "the Big Twin," the GECAS-IAI Co investment for the passenger-to-freighter conversion program of the GE-90 powered 777-300ER, as it now moves beyond planning into the phase of physically modifying the aircraft

IAI Concludes Independence Day Flyover

On 16 April, Israel Aerospace Industries (IAI), concluded its first Israel Independence Day flyover in 33 years. As part of the flyover IAI flew two Gulfstream 280 business jets as well as the Boeing 777-300ER "Big Twin" passenger-to-cargo conversion prototype aircraft.

BARAK ER 150 km range interceptor completes a series of successful trials

Having completed a successful series of trials of the BARAK Air and Missile Defence System, Israel Aerospace Industries (IAI) has unveiled documentation of the challenging trials, which tested the system's capabilities in a range of scenarios and threats, including the interception of an assaulting ballistic target by the BARAK ER (Extended Range) interceptor. The BARAK ER Air Defence System, developed by IAI, combines the capability to intercept airborne threats at an extended range of 150 kilometers and ballistic targets. The ER interceptor is part of IAI's BARAK Air Defence System's family, capable of various ranges.

IAI to Provide the Z-MAG to the IDF

Israel Aerospace Industries (IAI) and Israel's Ministry of Defence (MOD) Office of Production and Procurement have signed an agreement to manufacture the Z-MAG, a unique all-terrain vehicle for the Israel Defence Forces (IDF). IAI has recently acquired the rights to the Israeli Z off-road vehicle family. Israel's MOD Sub Department for Land Production and Procurement and IAI's ELTA Group signed an agreement to manufacture and supply nine Z-MAG all-terrain vehicles to the IDF, with an option to order 21 additional units.

IAI delivers 100s of O2 concentrators to support India

Israel Aerospace Industries (IAI) has delivered hundreds of oxygen concentrators to India, to support the COVID-19 crisis. In addition, IAI responded promptly to India and the Israeli Embassy in India's request to fly the remains of Soumya Santhosh, back to her hometown in Kochi, India. Ms. Santhosh was a devoted caregiver to an Israeli elderly, and was killed by rocket fired from the Gaza Strip in to the State of Israel. Ms. Santhosh's remains were dispatched on the same flight along with humanitarian aid sent to help India through the COVID-19 crisis.

IAI has been working with India's Government, defence industries and armed forces for more than three decades as part of their strategic cooperation with the Indian Navy, Air Force, Army and Coast Guard.

Boaz Levy, IAI's President and CEO stated, "Through these difficult times, on both sides, in India and Israel, we felt the need to support our friends and partners during the COVID-19 crisis. Unfortunately, as we packed the oxygen aid, we heard Soumya Santhosh had been killed by rockets shot from Gaza into the State of Israel and were able to send her remains back to her home country. We are closely following the health crisis in India and hoping for a swift recovery. IAI wishes India blessings for good health, peace and prosperity."

News from Rafael

Rafael and the I-Derby ER AAM

Rafael Advanced Defense Systems Ltd. has completed the development of the ground-based Air Defence version of the I-Derby ER (Extended Range) air-to-air missile. During the test series concluded in southern Israel, Rafael performed a ground launch to test the missile's command and control, navigation, and flight trajectory capabilities. These tests serve as a significant milestone in I-Derby ER's development, which is the newest and most advanced of Rafael's electromagnetic air-to-air missiles, and it marks the completion of the missile's ground-version development.

Rafael's I-Derby ER missile is a an over 100 km long-range air-to-air missile with a dual-pulse rocket motor and an active radar seeker, providing combat aircraft with 'exceptional' performance advantages both at short ranges or beyond visual range. The missile has fire-and-forget capabilities, allowing the operator to tackle multiple targets simultaneously. The missile's light weight allows it to be adapted to a variety of modern fighter jets, including the F-16, F-15, F-18, Gripen, LCA, Typhoon and more.

The I-Derby ER Missile is identical in shape and size to the Derby missile currently in service worldwide. The ground-based air defence version of the missile can be integrated almost immediately onto air defence batteries such as Rafael's SPYDER system, which provides air defence for ranges between 20 to 60 km. Launched from the ground, the I-Derby ER missile doubles the existing missile range, and allows target interception within a range of up to 40 km without a booster, and 80 km with a booster.

Rafael marks 10 years since Iron Dome's first combat interception

With over 2,500 combat interceptions, at a success rate of 90%, Rafael has marked the 10th anniversary of the first combat interception of Rafael's Iron Dome Air Defence System. Iron Dome's development began in December 2007, and was completed in less than 3 years.

Within less than a month after being deployed in Israel, on the evening of 7 April 2011, the system was challenged in combat for the first time. A rocket that was launched from the Gaza Strip was detected by Iron Dome's radar. Within seconds, the data transmitted to the BMC (Battle Management Center) was processed, and the battery operators needed to decide whether to activate an interceptor against the threat. With precise impact location provided by the BMC, pointing to the

southern Israeli city of Ashkelon, with a population of more than 130,000 civilians, the crew decided to launch an interceptor, and made combat history by intercepting the threat, preventing civilian injuries and significant damage to property.

Iron Dome's first massive and dramatic performance took place during operation Pillar of Defence in 2012, when it intercepted over 500 different threats fired from the Gaza Strip onto different parts of Israel, including heavy rocket barrages.

Iron Dome had become a game-changer, earning it the Israel Security Award in 2012.

Iron Dome has played an instrumental role in every conflict since then, by stopping thousands of rockets from hitting Israel, spanning small to large mortars and rockets with varying ranges and warheads.

Iron Dome serves as highly mobile, dual mission systems, designed to defeat Very Short Range (VSHORAD), as well as rocket, artillery and mortar (C-RAM) threats, aircraft, helicopters, UAVs, PGMs, and cruise missiles.

In August 2019, Israel›s Ministry of Defence and the US Defence Department signed an agreement for the purchase of two Iron Dome batteries for the US Army. Both batteries have now been delivered to the US. In May 2020, Rafael and Raytheon Technologies Corporation signed a joint venture agreement to produce Iron Dome interceptors and launchers in an all-up-round facility in the US. The partnership is called Raytheon Rafael Area Protection Systems (R2S).

Rafael has developed additional variants of the Iron Dome system, to form a family that consists of the naval variant C-Dome, providing protection of strategic naval and land assets against advanced ballistic, aerial and surface-to surface threats, including saturated attacks. C-Dome is operational with the Israeli Navy. Iron Dome is also offered as an integrated, all-in-one air defence (I-Dome) system for maneuvering tactical forces in the field on a single vehicle.

ALLTEC and Rafael sign MoU

ALLTEC Composite Material of Brazil and Rafael Advanced Defense Systems of Israel have signed a Memorandum of Understanding (MoU) for cooperation on passive add-on armour solutions, their maintenance and life cycle support. Rafael's Add-On Reactive Armour and Passive Armour defends against a wide range of threats such as anti-tank rockets, small firearms, AP projectiles, high-speed fragments of artillery, mortars, and high explosives.

Under this MoU, ALLTEC and Rafael will cooperate on business opportunities and projects for the supply of passive add-on armour solutions from STANAG Level 4 and above, its maintenance and life cycle support for the Brazilian Ministry of Defence and auxiliary forces.

Rafael's Add-On Reactive Armour and Passive Armor (easily installed or removed quickly according to mission needs), defend against a wide range of threats such as anti-tank rockets, small firearms, AP projectiles, high-speed fragments of artillery, mortars, and high explosives.

INIOCHOS 2021

After the cancelation of last year's edition due to COVID-19 and despite the on-going threat, the Hellenic Air Force organised the 6th international edition of the exercise INIOCHOS. The Hellenic Air Force participated with all fighter and support squadrons including UAV and Joint Terminal Attack Controller (JTAC) teams.

Canadian Armed Forces made their debut in this year's edition as they participated with highly experienced Joint Terminal Attack Controller (JTAC) teams.

The Cypriot National Guard participated with an AW139 helicopter belonging to 460 MED, Paphos AB. They took part in Combat Search and Rescue (CSAR) missions as well as in Special Forces missions with the objective to position JTAC teams into "hostile" territory. The squadron made an excellent impression at all stages of the exercise while maintaining high accuracy and professionalism during all the missions.

France also made their first appearance in this year's edition and with the help of this exercise, they showcased the advanced capabilities of the Rafale to the Hellenic Air Force, who recently ordered 18 examples. All Rafale were of F3-R standard, equipped with AESA radar. The Aéronautique Navale participated with 5x Rafale M from Flottille 12 based in BAN Landivisiau. The Armée de l'Air joined the exercise with with 3 & 3 Rafale B & C from Escadron de Chasse 1/4 "Gascogne" and 2/4 "La Fayette" based in BA113 Saint Dizier-Robinson, Escadron de Chasse 2/30 "Normandie-Niemen" based in BA118 Mont-de-Marsan and 5x Mirage 2000D from EC 2/3 "Champagne", EC 3/3 "Ardennes" and ETD 4/3 "Argonne" based in BA133 Nancy-Ochey.

The Israeli Air Force marked their presence with the 69 Squadron "The Hammers" and 107 Squadron "The Knights of the Orange Tail", with 6 F-15I Ra'am and 6 F-16I Sufa respectively. Further, INIOCHOS 2021 witnessed the participation from 1 Gulfstream G550 Nachshon Eitam Conformal Airborne Early Warning Aircraft (CAEW) from 122 Squadron, Nevatim AB and 1 KC-707 Re'em Aerial Refuelling Aircraft from 120 Squadron, Nevatim AB.

The third newcomer to INIOCHOS 2021 was the Spanish Air Force. The Spanish contingent consisted of 3 EF-18A and 1 EF-18BM from Ala 12, Torrejon and 4 EF-18A from Ala 15, Zaragoza.

The United Arab Emirates Air Force participated again, but this time with 5 F-16E and 1 F-16F Desert Falcon from the 2 Squadron, Al Dhafra AB.

The United States Air Forces Europe (USAFE) participated with 13 F-16C Block 40 and 1 F-16D Block 40 from the 510 Fighter Squadron, Aviano AB (Italy). Participating in the exercise was also 1 KC-135R Aerial Refuelling Aircraft from the 351 ARS, RAF Mildenhall (United Kingdom) based in Souda AB, Crete (Hellas) and JTAC teams. Apart from these heavy flying machines, INIOCHOS 2021 also witnessed the participation of 1 MQ-9 Reaper UAV from the 31 EOG, based in Campia Turzii, Romania.

The Exercise

Designed to simulate complex and intensive air operations, day and night, INIOCHOS 2021 was framed to test skills and capabilities of participating personnel and aircraft. This frame gave all participants a unique opportunity: To exercise inside a layer of multiple, unexpected threats against RED Forces consisting of some of the best pilots in the world and a multitude of modern short- and long-range A/A-systems.

A fully simulated combat environment was provided to all participants which was coupled with the opportunity of using different kinds of target ranges (over land and sea) for absolutely realistic training conditions. The training area included the whole of Athens Flight information Region (Athens FIR).

The Hellenic Air Force 330 M from Nea Anchialos AB and the 337 M from Larissa AB, ground-based air defence systems of the Hellenic Army and the anti-aircraft capabilities of the Hellenic Navy acted as RED Forces. Both 330 M and 337 M brought to the exercise their vast experience and sophisticated tactics, collected after thousands of live scrambles over the Aegean Sea against the Turkish Air Force. More than 1100 sorties were flown during the exercise with an availability rate of almost 100%, including the air refuelling, early warning, transport and helicopter missions.

Lessons learned & future

According to Lt. Col. R. Barrois, commander of the Armée de l'Air detachment, "Our goal is to train and develop our interoperability with our allies present at Andravida. Our presence is also an opportunity to develop our cooperation with the Hellenic Air Force. Especially now, after being accepted into the Rafale community. During the exercise, we also had the opportunity and pleasure to exchange our experiences with the Rafale crews of the Aéronautique Navale. This strengthens the bonds within the Rafale community, not to mention the work with the Mirage 2000D." By projecting 6 Rafale and 5 Mirage 2000D as part of the exercise, the Armée de l'Air also demonstrated "its force projection capability, a demanding prerogative that requires a lot of skill and specialisation."

"This exercise is an opportunity to get out of our comfort zone, in order to learn to function properly in an environment where everything is unknown, as in war" stated Lt. Col. A., Commander of 69 Squadron from Hatzerim AB.

"INIOCHOS is an important opportunity for us to train alongside and learn from our Hellenic and other allies" said US Air Force Gen J. Harrigian, USAFE-AFAFRICA commander. "It improves the relationships that underpin our military alliance and creates opportunities to refine skills that enhance our interoperability. The friendship, understanding and cooperation that is being made here is an important military asset for us."

Exercise INIOCHOS is steadily transforming itself into a major air-exercise in Europe and the Middle East, covering a broad spectrum of operations. A testament to this is the growing number of countries wishing to take part. Andravida AB is currently being expanded with additional apron space and accommodation buildings.

Article by Marcus Vallianos
Pictures by Philipp Vallianos

The authors wish to thank Col. (P) K. Gkoumatsis, HAFGS Spokesman, for his invaluable help for the preparation of this article. Also, a special thanks to all the personal of 460 Squadron, Cypriot Air Force for their kindness and precious input!

4th A330 MRTT for Netherlands

On 1 April 2021, after completing a two hour flight from the Spanish airport Getafe, the 4th Airbus A330 MRTT was delivered to Eindhoven AB, Netherlands. The new owner is the consortium of "NATO Support and Procurement Agency" and the aircraft will be transferred to the VLB Eindhoven based "Multinational Multirole Tanker Transport Unit". The Airbus A330 MRTT aircraft (or KC-30M) are

registered in the Netherlands by the Royal Netherlands Air Force. MRTT is an acronym of "Multi Role Tanker Transport" which indicates its dual role of a tanker and a transport aircraft. A total of nine aircraft will be delivered which will be stationed at VLB Eindhoven and at the German airport Cologne-Bonn.

(Text and photo by Joris van Boven and Alex van Noije)

CH-47F Chinooks of the Dutch Royal Air Force

On 14 April 2021, the first of the new CH-47F Chinooks of the Dutch Royal Air Force ("Koninklijke Luchtmacht") was delivered to the 'Defensie Helikopter Commando' at Gilze-Rijen AB. Due to Corona/Covid, the media moment was very limited.

One week later, on 22 April 2021, the first official mission of the new Chinook helicopter was flown and Chinook CH-47F with registration D-427 flew in the GLV5 low-flying area, close to Eindhoven AB.

In 2015, the Dutch Air Force decided to buy 14 new CH-47F helicopters since its CH-47D models were reaching their retirement period after completing 25 years in service. The 6 existing CH-47F helicopters will be upgraded to the same CH-47F MYII CAAS version.

CH-47F is officially known as "CH-47F MYII CAAS" (MYII= Multi Year batch, CAAS=Common Avionics Architecture System) and this helicopter is more or less the same as the US Army's models. With only some minor Dutch modifications, compatibility with future US Army upgrade packages remains possible.

15 CH-47F helicopters will be flown operationally from Gilze-Rijen AB and 5 CH-47F helicopters will be used in the USA at Fort Hood Army Base for training and instruction purposes.

Photos and text: Joris van Boven and Alex van Noije

USAF CN235 visits Volkel Air Base

A CASA CN235 aircraft of the United States Air Force landed at Volkel Air Base of the Royal Netherlands Air Force. Since this type of aircraft can rarely be admired or seen in Europe, many spotters had come see to it. After an hour, the plane left for the next destination. This aircraft belongs to the 427th Special Operations Squadron, based at Pope Air Force Base in North Carolina (US).

Photos and text: Joris van Boven

101st CAB helicopters at Eindhoven airbase

At the end of April, the 101st Combat Aviation Brigade (CAB), called "Wings of Destiny", returned to the United States with 35 helicopters via the Netherlands. In addition to Blackhawk helicopters (UH-60 and HH-60), Chinook transport helicopters (CH-47) and Apache attack helicopters (AH-64) flew from Eindhoven Air Base to Rotterdam, Netherlands. 101st CAB is part of the 101st Airborne Division which became famous after the liberation of Eindhoven in September 1944.

The brigade of the 101st Airborne Division was in Eastern Europe for over nine months. There it was a part of American contingent to strengthen their presence in Europe. Among other things, training was conducted with NATO partners, especially in Eastern Europe. Simultaneously, with the departure of 101st CAB, the successor 1st CAB arrived in France to start practicing in (Eastern) Europe for another nine months.

Text and photos: Joris van Boven and Alex van Noije

Cyclone comes ashore

Rare Canadian CH-148 visits The Netherlands

During April, a Royal Canadian Air Force (RCAF) CH-148 "Cyclone" visited The Netherlands for two weeks. For this region, this seldom seen helicopter came over from a Canadian navy vessel which had a port call for a crew swap and scheduled maintenance. The ideal location for this Canadian frigate HMCS Halifax, was found in Den Helder, a seaside town with a large military port for the Dutch "Koninklijke Marine" (Royal Navy) and nearby "Marine Vlieg Kamp" (Naval Air Station) De Kooij.

HELAIRDET

The HMCS Halifax (FFH 330) is flagship for Standing NATO Maritime Group One (SNMG1), fulfilling NATO tasks in the Baltic Sea region and participates in multinational training exercises in north-west Europe. The frigate carries one CH-148 assigned to HELAIRDET (Helicopter Air Detachment) during the stay onboard. The Cyclone's home base is 12 Wing Shearwater Air Base, Nova Scotia, where it is assigned to 423 Maritime Helicopter Squadron. The CH-148 is the military variant of the Sikorsky S-92 and designed for shipboard operations. For Canada, it replaced the CH-124 Sea King and was chosen to become the main ship-borne maritime helicopter providing air support to the Royal Canadian Navy. The Cyclone is capable to execute a variety of missions such as Anti-Submarine Warfare (ASW), Search & Rescue (SAR), surface and sub-surface surveillance, tactical transport and marines Special Operation Forces (SOF) support.

On Dutch soil

The visit to the Netherlands started early morning of 12 April, when the CH-148 lifted of the Halifax rear deck, shortly before the frigate entered the military port of Den Helder. By coming ashore, the Cyclone flight crew was able to continue their training flight operations, while the Halifax received its maintenance at port. In the two weeks, ship pause a RCAF CC-150 "Polaris" flew to Royal Netherlands Air Force Base Eindhoven to pick up the Halifax ship crew and bring in a complete new crew. In parallel to the Polaris flight, a CC-177 "Globemaster II" executed a logistic flight, carrying essential equipment and materials.

NAS De Kooij

Arriving at NAS De Kooij, the CH-148 met its Dutch military naval rotor counterpart, called 860 squadron. The Dutch unit flies the Airbus NH-90NFH (NATO Frigate Helicopter) since 2010 when it succeeded the aged SH-14D "Lynx" helicopter. The navy had ordered 20 NH-90s for the Dutch Helicopter Command (DHC) and deliveries were completed in 2015. Last year, 860 squadron lost one of its NH-90s in an incident when detached in the Caribbean. Tragically, 2 of the 4 crew members did not survive the crash into the sea. Sad coincidence was that the RCAF 423 squadron also lost one if its Cyclones in 2020, while detached to the HELAIRDET at HMCS Fredericton during a NATO Reassurance operation in

the Mediterranean, "Stalker22" crashed in the Ionian Sea, 220 NM east of Catania, Italy. The CH-148 was in a final complex manoeuvring turn close to the ship, where the aircraft did not respond as the crew would have anticipated. While at low altitude, the Cyclone became unrecoverable, entered a high energy descent and impacted the water astern the ship. The CH-148 was destroyed and all six occupants deceased.

With an approximate runway length of 4100 feet, NAS DE Kooij is mainly used for helicopter aviation. Next to the based military 860 squadron, NAS DE Kooij is also host for a civil aviation under the name of "Den Helder Airport", serving as hub station for the offshore industry. The main civilian operators are currently CHC Helicopters, a Dutch company with several red-white-blue coloured Leonardo AW-139's, Bel Air with a mix of Danish registered AW-139 and AW-189 helicopters and finally the Belgian company NHV with some AW-139s, all active for the North Sea offshore industry. NHV is also present at De Kooij with 2 Airbus AS-365N3 "Dauphin" helicopters, contracted for 24/7 Search And Rescue duties under Dutch Coast Guard command. Under the same contract, another 2 Dauphins can be found near the port of Rotterdam, to cover the complete Dutch North Sea coastal lines.

Continued training

During the two weeks stay, the RCAF CH-148 regularly flew its day and night missions that included VFR and IFR navigation flights leading to the east and southern parts of The Netherlands. The majority of flights were executed with a crew of 3, first being the pilot then co-pilot and an Air Combat Systems Officer (ACSO) serving as Tactical Coordinator (TaCo). Sea based flight operations were executed with a four member crew, the Airborne Electronic Sensor Operator (AES OP) in control of the Cyclone's sensors such as radar and sonar. Additionally, the Cyclone executed local training at NAS DE Kooij, making use of some elevated slopes to practice terrain landings. The CH-148 crew also made use of the Naval Air Stations' dummy ship deck facility where it simulated deck landings with the use of a signal officer as well as practicing hoist operations. By 29 April, the Cyclone took off for the final time from NAS De Kooij and flew towards the sea where it reunited with the HMCS frigate Halifax, which had left the port of Den Helder at an earlier stage. Later that day, a memorial took place onboard of HMCS Halifax to commemorate the crash of "Stalker22" which happened exactly a year ago.

Text and photos by Peter ten Berg

European military Covid-19

Since late April, numerous international military flights between Europe and India have been executed to provide additional medical aid in an urgent response to the Covid-19 outbreak. Indian Air Force with their C-17A Globemaster III's of 81 squadron "Skylords" based at Hindon Air Force Station flew number of flights to ramp up the procurement process.

One of the first was flight "IFC6721" of C-17 with serial CB-8009 to Hahn Airport (EDFH), Germany on 2 May. A day later, flights "IFC7121" (CB-8004) and "IFC7221" (CB-8001) flew to RAF Brize Norton (EGVN), UK. On 5 May, "IFC8821" (CB-8009) arrived at Oostend Airport (EBOS), Belgium. Three days later, Frankfurt Airport (EDDF), Germany was visited by flight "IFC8721" (CB-8003), while "IFC6621" (CB-8002) went to Bordeaux Airport (LFBD) in France. On 10 May, CB-8009 arrived at Schiphol Airport Amsterdam (EHAM), as flight "IFC1C21" and a day later CB-8003 came to Frankfurt Airport again, now as "IFC 1D21". Oostend Airport was visited for the second time by CB-8001 as flight "IFC1E21" on 12 May. The majority of the Indian C-17 flights had probably a double crew, as most of the visits lasted no longer than four hours.

GAF/Luftwaffe Airbus A-400M from Wunstorf air base

Other military flights involved a German "Luftwaffe" Airbus A-350 with code 10+03 from Cologne Air Base on 29 April and two Airbus A-400M's from LTG-62 unit at Wunstorf Air Base on 5 (54+05 as "GAF517") and 6 May (54+30 as "GAF126"). On 11 May, a Royal Netherlands Air Force KDC-10, with serial number T-235, from 334 squadron

Royal Netherlands AF KDC-10 from 334 Sqn at Eindhoven air base

aid flights

Indian AF C-17 on approach at runway 27 of Schiphol airport

at Eindhoven Air Base flew to New Dehli as "NAF40".

While the Indian C-17's flew their flights to Europe non-stop, the foreign aid flights made a stop-over in Dubai.

The medical aid focussed on oxygen provisions such as oxygen generating equipment, concentrators, cylinders and ventilators. Further shipments included other medical equipment, medicines and protective means like hospital wear and facemasks.

Text and photos by Peter ten Berg

Indian AF C-17 taking off from Schiphol Airport, Amsterdam

Indian AF C-17 taking off from Schiphol Airport, Amsterdam

Helicopters at the World Ski Championship at Cortina

This year, the World Ski Championship's edition took place in Cortina d'Ampezzo, surrounded by the wonderful Dolomiti's mountains in the eastern part of Italian Alps, probably one of the best landscapes in the world. As a part of the event, numerous helicopters from all the national law enforcement agencies, Polizia di Stato, Guardia di Finanza and Carabinieri were flown to Cortina. All of them showed up with their latest fleet additions, produced by the Helicopter Division of the Italian state-run company Leonardo.

Polizia Di Stato sent both of its new AgustaWestland UH-139E, MM81978 PS-116 and MM81879 PS-118 based respectively at Milano Malpensa and Firenze Peretola. Delivered few weeks ago, both of them were temporary deployed at Venezia Tessera airport at X° Reparto Volo and they operate daily sorties from there. One of them, POLI 116, was tasked on anti-terrorism duty, ready to deploy NOCS Special Forces (Italian acronym of Central Operational Security unit) over Cortina to ensure high level of security required for this event. The other one, equipped with camera system, provided support for law enforcement officers on the ground with live streaming of the entire Cortina's Valley, focusing on the ski track and the access

routes to the red area surrounding the most sensitive sites.

Guardia di Finanza guaranteed HEMS (Helicopter Emergency Medical Service) with a dedicated helicopter operating close to the ski tracks, together with a civilian Airbus Helicopter H135, and a backup machine based in Fiames ready to assist if the primary one had some issues. For this purpose, AgustaWestland AW169, MM81966 GF-503, and AgustaBell AB-412EP Grifone, MM81505 GF-217, both belonging to the "Sezione Aerea" of Bolzano, flew daily from their base to the operational area. An extra AgustaWestland AW139, MM81964 GF-414, usually operating out of Pratica di Mare (Roma), joined the team in Bolzano. For VIP transportation and general purposes, two AgustaWestland AW109N Nexus based in Venezia, MM81680 GF-302, and MM81685 GF-307 were occasionally used.

Carabinieri moved to Belluno, their closest helicopter base, from there, their two recently acquired AgustaWestland UH-139D (MM81967 CC-02, and MM81968

CC-01) were used as transport helicopter to carry military police team to operational area. They also carried a Carabinieri parachuters team, that together with an Italian Army team operating from AB205, MM80606 EI-315, took part in the Closure Ceremony.

The Italian Law Enforcement agencies selected old Cortina's airport as forward operating base which is located in Fiames, 6 km north of the city and is normally used only by private helicopters. At the base, they set up a mobile control tower, a refueling point with dedicated personnel and fuel truck, and finally prepared an ad hoc landing area clear of snow to permit continuous daylight operations with multiple helicopters. The operations were carried out even during the most hostile situations such as heavy winds, temperatures dropping below -18° C etc. Everything worked perfectly, despite the difficulties caused by the pandemic situation, thanks to the professionalism of all the personnel involved, and it was a great test for the upcoming Olympic winter games that will take place in the same area in 2026.

Text and images: Marco Papa

F-16s return to Volkel AB

Due to too much crosswind at home base Volkel (ICAO:EHVK), 8 F-16s from the Royal Netherlands Air Force diverted to nearby Eindhoven airbase (ICAO:EHEH). The limits for safe landing were exceeded at Volkel AB due to the strong winds. But because the runway of EIndhoven AB has a different orientation, it was still safe to land there. The 8 F-16s returned to their home base Volkel later that day. When the afterburners hit the wet runway, vapour and steam was produced.

Text and photos: Joris van Boven and Alex van Noije

Den Helder and Eindhoven

In mid-April 2021, the Halifax Class frigate HMCS Halifax visited the Dutch military port Den Helder in the Netherlands for maintenance. During the two week maintenance period, HMCS Halifax went for a major overhaul with some of its spare parts being replaced along with its crew members. To get these spare parts from Eindhoven AB, various logistical operations were carried out by two A310 (CC-150 'Polaris') and one C-17 (CC-177 'Globemaster III') visited Eindhoven AB.

The onboard helicopter CH-148 'Cyclone' (a military variant of the Sikorsky S-92), with serial 148805 flew to the nearby Naval Air Station "De Kooy". During the stay at De Kooy, several local missions were flown by the Canadian crew in their CH-148 helicopter.

This was the second 'Canadian invasion' of the Royal Canadian Air Force (RCAF) to the Netherlands. In 1944/1945, after the liberation of Eindhoven, Royal Canadian Air Force fighter aircraft were based at Eindhoven AB (then named airbase B73).

Photos and text by: Joris van Boven and Alex van Noye

Team Tempest

Future Combat Air continues to drive economic advance across the UK

Seven companies representing the breadth of innovation across the UK have signed agreements to progress opportunities to work on future combat air concepts and underpinning technologies across Team Tempest.

The companies involved include Bombardier Belfast, Collins Aerospace in the UK, GE Aviation UK, GKN Aerospace, Martin-Baker, QinetiQ, and Thales UK. This is the first phase of organisations to sign such agreements, with more to be announced.

The announcement represents a significant step forward by bringing additional expertise into the *Team Tempest* project. *Team Tempest* is a collaboration between BAE Systems, Leonardo UK, MBDA UK, Rolls-Royce and the UK Ministry of Defence, working together to develop game-changing technologies at pace and in an affordable manner.

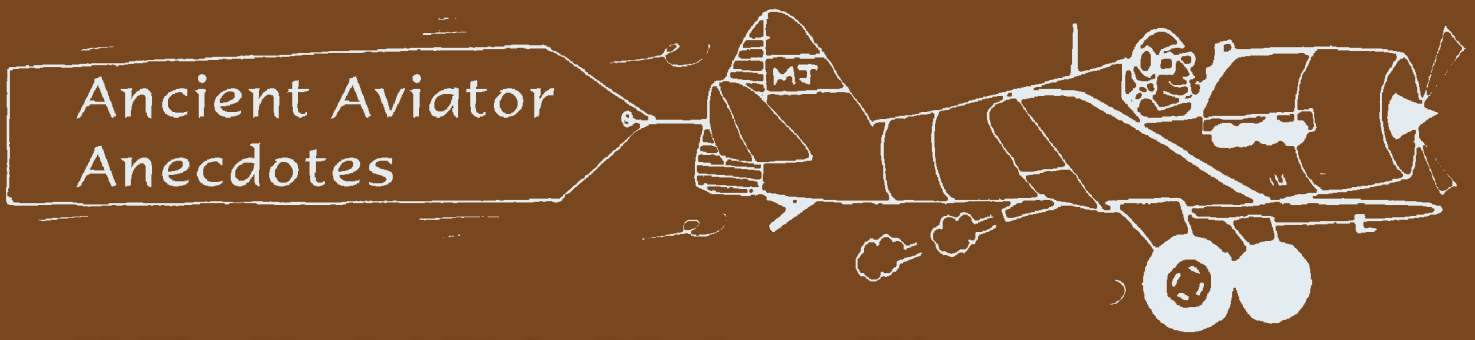
Dave Holmes, Manufacturing Director for BAE Systems' Air sector, stated, "We are delighted to have signed the first phase of these new agreements, which are transforming our traditional relationships with partners. We are seeking opportunities to widen the *Team Tempest* project and bring in the very best of UK capability and expertise, from both inside and outside of defence. They will work alongside us as we seek to develop the generation-defining combat air capability which will help safeguard the security of our nation and our allies to the end of this century."

"In addition, by developing the wider industry team, we will help contribute to the retention, growth and investment in a wider world-class UK skills base. Collaborations, with some of the brightest and best across the country, show that *Tempest* is becoming a truly national endeavour and we are delivering on our promise to take new approaches to drive significant pace and efficiency into the programme."

The companies will now seek opportunities to join forces on established projects and developments with the core *Team Tempest* partners, bringing the best of British expertise and ingenuity to optimally designing, manufacturing and operating combat air systems through life.

Jeremy Quin, the UK Minister for Defence Procurement, stated, "This announcement demonstrates further progress in delivering the UK's combat air strategy, with more companies collaborating on the future of the UK's Air Defence. This is a highly innovative project based around cutting-edge technology and drawing on a skills base where the UK excels. I am delighted that the success and strengths of *Team Tempest* are being enhanced through drawing on UK expertise; working with industrial partners and highly capable international team we are configured for future success."

Collectively, the companies will look to support more than 60 technology demonstration activities which are currently underway, which will demonstrate and de-risk world-leading processes and technology in half the time and at significantly lower cost than previous complex combat air programmes.



Air Vice Marshal (R) Cecil Parker and his.....

SWARNIM VIJAY VARSH

(The Vijay Mashaal in Hyderabad)

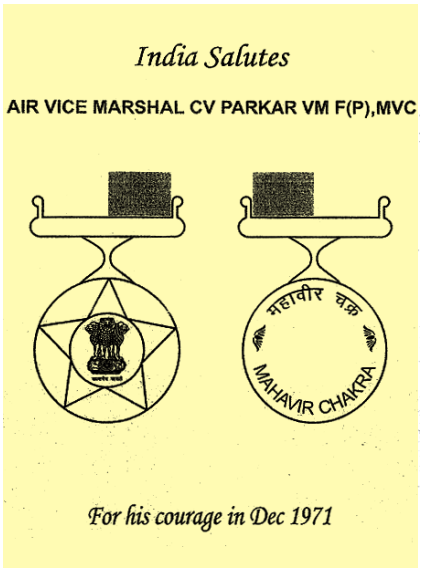
Vijay Mashaal : To mark the 50th year since India's victory in the 1971 indo-Pak war, the Prime Minister lit four Vijay Mashaals on 16 December in Delhi. Each of these Victory Torches was carried by runners to the home of every recipient of the PVC, MVC, and VrC gallantry awardee of that war wherever located, ie North, South, East or West of the country. The southern Vijay Mashaal reached Hyderabad on 8 February 2021.

11.2.2021: The felicitation ceremony was organised by the army and held in the central parade grounds in Secunderabad. There was a display of weaponry and the function was open to the public. It commenced with wreath laying at the Martyrs Memorial, reception of the Vijay Mashaal by the Governor, felicitation of five awardees by her Excellency Governor of Telengana and included a band concert, cultural programme and speeches. The awardees comprised one MVC (Air Force) and four VrCs (two each from the Air Force and the Army including three NOK widows). Citations were read out and each awardee was presented a commemoration plaque by the Chief Guest. (see images).

12.2.2021: A single-service felicitation ceremony was held at the air force station Begumpet, where 70 years ago, this writer had been a pilot trainee! The three air force awardees (one MVC and two VrC NOK widows) were joined by 47 air warriors who had participated in the 1971 war. The Victory Torch was jointly received by the three gallantry awardees who then inaugurated the Vijay Vatika and planted saplings. Thereafter there was a documentary film on the war, a performance by the air force symphony band, an audio visual of each of the three gallantry awardee and felicitation of all 50 air veterans by the Commandant Air Force Academy along with the gift of a shawl.

13.2.2021: Mid-morning saw the lit Vijay Mashaal, carried by a team of runners escorted by outriders and accompanied by the air force symphony orchestra brought to 'Parkhaven', 25 Vayupuri AFOCHS Ltd where it was received by this writer. A short ceremony was held for the small group of attendees (neighbours, friends and managing committee members of our society) all of whom were sanitized, masked and socially distanced. After this brief but very emotional ceremony, the Vijay Mashaal was taken by its escorts for its onward journey down south and its eventual meet-up with the other three in Delhi on 16 December 2021 on Vijay Diwas.

14.2.2021: Not part of the foregoing three functions, but following immediately thereafter, was the 65th wedding anniversary of a very tired couple who did manage to host a small tea party to friends to celebrate the occasion in the evening. The three outings of the Vijay Mashaal had been widely covered by the media; we were flooded with congratulatory messages from family, friends and old colleagues. It needed a few days rest before my wife and I could return to the routine of our normal, quiet pace of retired life in Vayupuri. What a wonderful experience of being remembered and honoured it has been for this old pilot now in his 89th year!



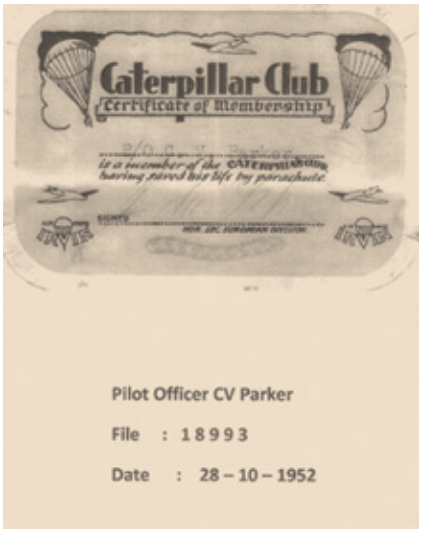
FORGETTING TO REMEMBER

Tempest II (photo: Colin Cooke)

Seventy years ago this writer was a flight cadet undergoing pilot training at No 1 AFA Begumpet and was commissioned there on 30 August 1952. On 12 February 2021, three of us Hyderabad based air force gallantry awardees/ NOKs from the 1971 Indo Pak war, were invited to Begumpet to be felicitated in commemoration of Swarnim Vijay Varsh. As we drove through air force station Begumpet, I recognised an old building which had housed our Parachute Section; it was still standing and my memory went back to an incident there 69 years ago.

Post-commissioning, 14 of us went to nearby Hakimpet to undergo our fighter conversion. On 28 October1952 the Centaurus aero engine of the Tempest IIA aircraft I was flying burst into flames; after a traumatic struggle I managed to bale out and on landing became the youngest Indian member of the Caterpillar Club. My instructor, Flt Lt Hosali, familiarised me with the tradition that all members of the club were expected to make a cash gift to the SEW (Safety Equipment Worker) who had packed the parachute, and host a party for the Section. (All this was in the pre ejection seat era when parachutes were packed and operated manually). He suggested that a gift of Rs. 50, plus a tea party would demonstrate my thanks and that he would make the necessary arrangements.

We had drawn our first salaries so I still had about fifty rupees when he dropped me



off at the old barrack building in Begumpet where I was received by the Sergeant-in-Charge and introduced to Corporal Jaiswal who had packed my parachute. Both in age and service he was my senior and seemed a trifle embarrassed to receive a cash gift from a young newly commissioned pilot officer! The arrival of tea and snacks lightened the atmosphere in our small gathering of five persons. We soon discovered that Jaiswal belonged to Ranchi (then in Bihar) where I myself had studied in the 1940s and were soon communicating quite freely. The tea bill of Rs. 7 was handed over to me and I was deeply embarrassed to find that I had only Rs. 5 in my wallet! I had to borrow Rs. 2 from Cpl Jaiswal who cheerfully loaned me the amount with a laugh.

A few days later one of my coursemates visiting Begumpet offered to take my Rs. 2 and hand it over but returned saying that Jaiswal was on leave outstation. Meanwhile, owing to a series of conrod failures in the Centaurus engine, the Tempest was grounded, our training was curtailed and we were posted to our very first squadrons. I was to report to No 7 Squadron which was equipped with Vampires and was delighted as I had never even seen a jet aircraft before! In all the excitement, I completely forgot my debt.

A decade later I was a flight commander in a squadron based in Palam and attended the Air Force Day function of inviting all the SNCOs to the Officers Mess for a glass of beer. One of our guests peered at my name tab and asked politely if I was the same pilot who had bailed out at Hakimpet in 1952. I said I was and he smilingly responded, "In which case Sir you still owe me two rupees!" I was happy to meet up with Flt Sgt Jaiswal again; much laughter (and beer) covered my apologies and his protests while I insisted upon repaying my debt immediately! We caught up with our respective news and I learned that, having completed his service, he would soon be leaving the air force. We never met again.

On our return drive from Begumpet after the felicitation function I related this anecdote to my wife. Unfortunately, in the dark, I was unable to identify or point out the old barrack building where this story had begun near seven decades ago.

25 Years Back

From Vayu Aerospace Review Issue III/1996

Sukhoi Su-30 programme in political crossfire

The formalisation (including initial payment) of a massive Sukhoi Su-30 aircraft contract between Russia and India has so far been thwarted by political challenges starting with the Indian national election in May 1996 which resulted in a "hung-parliament" where the largest party (BJP) were voted out within 12 days of assuming reins of the government and the longevity of the new, multi-faced, splintered United Front (with left-of-centre inclinations) tenuously supported by the Congress party, is fraught with uncertainty.

Alliance Air into service

On 15 April 1996, with an ex-Indian Airlines (IA) Boeing 737-200 painted over and the new logo depicted on its tail, Alliance Air (AA), a subsidiary of IA, flew its first commercial service from Delhi-to-Goa and onto Cochin. In December 1995, PC Sen, Managing Director of the Indian Airlines approached the board to revitalise the airline. It was decided that instead of trying to cut costs in an unwieldy airline, it would make more sense to form a subsidiary to complement the parent company, but at the same time, function as an independent unit.

TransIndia Airlines

A new private operator, Bangalore-based TransIndia Airlines Pvt. Ltd., intends to start scheduled air services later in 1996. TransIndia will operate as a regional airline in the South, according to Kesani Chadrasekhar, Chairman and Managing Director, looking at destinations which promise at least one flight a day.

Air-India's on-time performance

Air-India has commenced the financial year 1996-97 on a promising note in regard to on-time departure of flights. Its April 1996 achievement of 83.01 per cent is the national carrier's finest on-time performance in the recent years.

The improvement in on-time performance, which started from the month of March 1996, is the direct outcome of several management decisions including creation of Control Cells at the airports, close monitoring of each and every flight, analysis of causes leading to delays elimination of factors like delaying a scheduled flight for a delayed connection flight from a domestic point etc. The trend for the month of May indicates that the performance is set to improve still further.

Blue Dart Cargo freighter service

Blue Dart Aviation, a subsidiary of Blue Dart Express Ltd. and a licensee of Federal Express, has started its exclusive air cargo operations from May 1996. The company will operate the two Boeing 737-200s already purchased from Indian Airlines, for the purpose.

HAL highlights of 1995-96

Hindustan Aeronautics Ltd. the biggest defence public sector unit under the Department of Defence Production and Supplies, Ministry of Defence has met its targets of 1995-96, achieving a turnover of Rs. 1404 crores against a target of Rs 1350 crores and has posted a profit of Rs 75 crores against a target of 68 crores. Both the sales and profits are highest so far. The exports during the year were Rs 32.5 crores.

40 more Mirage IIIs for PAF

Thwarted over the past many years in its endeavor to procure more F-16s from the United Sates, the Pakistan Air Force has sought to build up its combat aircraft strength with additional, second hand, MirageIII/5s. This French-origin delta-winged fighter now constitutes the second largest aircraft inventory of the PAF, with nearly two hundred aircraft on strength or in the pipeline. In 1989, Pakistan bid for and bought some 50 ex-Royal Australian Air Force Mirage IIIs. After overhaul and some updating, at least 30 of these aircraft have gone into the squadron service, the balance being cannibalised for providing spares. Another dozen odd Mirage IIIBLs were bought from Lebanon some years back and now, according to the Defence Ministry sources at Islamabad, Pakistan has bought 40 Mirage IIIs from the French firm for a total of $120 million. The Company will be overhauling and refurbishing the Mirage IIIs at a cost of $3 million per unit, the PAF will have a fairly potent additional force of Mirage IIIs in front line service for the next decade.

F-16s for Indonesia

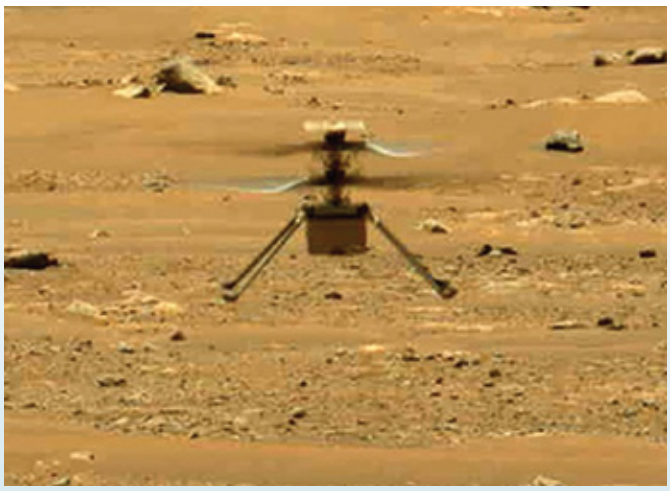
According to "Defence News", the final price is the only stumbling block to selling nine of the 28 US F-16s to Indonesia, which Pakistan had orginally bought from the US but which were embargoed. It has been reported that the Indonesian Military would spend around $8-9 million per aircraft in a deal expected to be completed in June. (Pakistan had paid $23 million each for the airplanes). Pakistan officials want the US to make up the difference between the price at which the F-16s can be sold now and what Islamabad had originally paid. (The Pentagon has already paid $124 million to Pakistan as a partial refund for the F-16s).

Malaysia rejects F-5 upgradation

The initiative by the local industry to upgrade the remaining Nothrop F-5E/F fighters of the Royal Malaysian Air Force has been rejected by the government. The plan costing $200 million is considered to be too expensive by Malaysia's Defence Minister Sayed Hamid Albar. The upgrade proposal had come unsolicited from Malaysia Airlines Aerotechnology (MASA) in conjunction with the Bristol Aerospace from Canada. The available funds, feels the Malaysian government, should be utilised for meeting the "heavy commitment" to absorb 18 Mikoyan MiG-29N/NUBs, 28 British Aerospace Hawk 100/200s and, from 1997, 8 McDonnel Douglas F-18s.

Tale Spin

The advancement- then and now!
And how!!



From Kitty Hawk in 1903 to Mars in 2021 - a piece of fabric from the original Wright Flyer has now made the first controlled powered flight on TWO planets

Then in the 1930's and now in 2021

On the left, flypast at Her Majesty's 55th Superb Owl pageant, Hendon, 1931 - featuring a half-time performance by Noël Coward and the Reg Williams Weston-Super-Mare Big Band.

On the right, USAF's "trifecta flyover" over Raymond James Stadium (Tampa) in February 2021 with the B-1B Lancer, B-2 Spirit, and B-52 Stratofortress during the Super Bowl game

Meanwhile,

SpiceJet partners with Karim's to serve the iconic Shan-e-Tandoor platter at 35,000 ft. The airline is all set to take the culinary experience a notch above by introducing the delicious platter, from Old Delhi's iconic Mughlai restaurant, Karim's. The Shan-e-Tandoor platter will include Mughlai delicacies like Chicken Reshmi Kebab, Chicken Shami Kebab, Chicken Malai Tikka and Chicken Tikka.

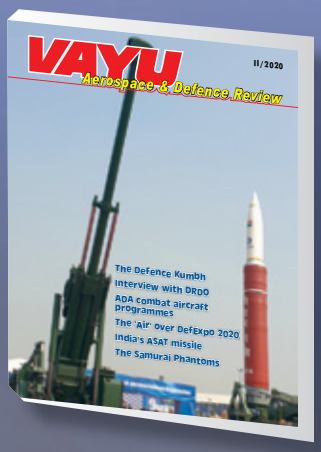
When can we book our tickets?

Afterburner

VAYU

Aerospace & Defence Review

47th year of Vayu



Continuously, ASIA's finest aerospace & defence magazine

Visit us at www.vayuaerospace.in

Vayu Aerospace Review, D-43, Sujan Singh Park, New Delhi 110003 India
Tel: 91 11 24626183, 24617234 Fax: 91 11 24628615 • E-mail: vayuaerospace@lycos.com

F/A-18 BLOCK III

THE ADVANCED SOLUTION TO DEFEND INDIA TODAY AND TOMORROW

Boeing's F/A-18 Block III Super Hornet delivers affordable, next-generation warfighter technologies and advanced capabilities to meet the requirements of virtually any naval mission. Combat-proven and carrier-compatible, this platform builds upon our over 75-year history in India and proves our commitment to the Indian Navy.

boeing.co.in

BOEING