



CURRENT AFFAIRS



ISRO's new station in Bhutan to counter China's Tibet facility

Drone Olympics to debut at Aero-India



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Bangalore Branch Building
New Thippasandra Post
Bangalore 560 075
Karnataka, INDIA
Telefax: +91 80 25273851
Email: editoraesi@yahoo.com
Website: www.aerjournalindia.com

Publication Team

Dr R Balasubramaniam
Dr S Kishore Kumar
Dr P Raghothama Rao
Mrs Chandrika R Krishnan
Mr Hemanth Kumar R
Mr Kumaran A K M

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Head Quarters

The Aeronautical Society of India
13-B, Indraprastha Estate
New Delhi 110 002, India
Tel: +91 11 23370516
Fax: +91 11 23370768

Paper Entitled : Inattentive Blindness and Bias During Visual Scan -

Capt Amit Singh

EVENT

A Student Competition to Exhibit Products/Technologies on Aerospace Technologies During Forthcoming Aero India 2019 Scheduled to be Held in Bengaluru During February 20-24, 2019. The Concept Note and Notice for Proposals From Students Has Been Uploaded on MHRD Website : http://mhrd.gov.in/sites/upload_files/mhrd/files/wero_2019.pdf

Now, IAF wants new canopy for LCA

The Light Combat Aircraft (LCA) Tejas aircraft, in its final operational clearance (FOC) configuration will have a new, thicker canopy with the Indian Air Force (IAF) having demanded the same. The same canopy is also to be used in the Tejas Mk-1A aircraft, which will be more advanced. The Aeronautical Development Agency (ADA) and Hindustan Aeronautics Limited (HAL) team has already begun work on redesigning the canopy and put it on the test bed, sources working on the project said. The Tejas R&D team has reworked the frame to accommodate the new canopy for the advanced model of Tejas, which will measure 24 mm as opposed to the existing 16 mm. “The existing canopy lining could only hold a 16 mm glass, which had to be changed to accommodate 24 mm. Now the challenge would be to procure fresh glasses, as HAL had already

made some purchases of the 16 mm glasses for the canopy, which is of no use now,” a person working on the LCA project said. Since the changes were made to the structure, Tejas will have to be certified by the Centre for Military Airworthiness and Certification (CEMILAC), which a



senior official from the LCA project said will not be a problem as the reworked canopy has tested well on the test bed. “The IAF has said that they now want the canopy to be able to negotiate a 40gm bird-hit as opposed to the 20gm that Tejas offered earlier. We will have to achieve as part of the FOC,” a senior member privy to

developments said. Besides, the IAF has also asked for mid air-refuelling capabilities in the night, which will see Tejas get another addition: a drogue light at the end of the refuelling probe. “These refuelling tests will also take a few months, as we have only recently achieved the wet tests in the day,” another source said. While some of these changes has allowed HAL to begin manufacturing of the FOC configuration aircraft—orders for 20 of which have been placed—the defence PSU is banking on new orders of the 83 Tejas MK-1A to revive itself. HAL is staring at a depleting order book, with most of the major orders scheduled to be delivered by March 2020. Defence Minister Nirmala Sitharaman had recently said that the orders for 83 Tejas worth Rs 50,000 crore are in the pipeline. However, with cost negotiations still ongoing, HAL was unsure when the actual orders might be placed. **Source:- TOI**

CURRENT AFFAIRS

This Indian startup is cutting the cost of putting satellites in space, making them last longer

For decades, space exploration has been the domain of government agencies across the world. Only nodal agencies or government-backed institutes like the NASA, ESA and our very own ISRO have had that privilege. Of late, private companies such as Mr Elon Musk's SpaceX, and Mr Jeff Bezos' Blue Origin have entered this area in the past few years. Now, Indian companies too are entering the niche area of space technology. The big challenge, of course, is the cost of sending anything into space. A big part of that cost is the price of fuel and its weight. The lighter a satellite, the lower the cost. And a lighter satellite can carry more into space. Mr Rohan M Ganapathy, an aeronautical engineer, realised the potential in this area and wanted to develop an alternative solution to existing satellite fuel propulsion. However, this was not something he could do on his own. The team soon expanded to include Mr Yashas Karnam, a family friend of Mr Rohan's, as well as two juniors from college, Mr Saagar Malaichamy and Mr Vivek Murugesan. Together, they founded Bellatrix Aerospace in 2015. Today, its claim to fame is an indigenous electric propulsion system for satellites, called Microwave Plasma Thrusters (MPT). Through the MPT, Bellatrix offers its customers the ability to take bigger payloads into space at a reasonable cost. The founders claim it is also eco-friendly and a cleaner alternative to the existing electric propulsion. The need for a Microwave Plasma Thruster (MPT) Let's dive into a little background to understand why this is such a big deal: there are two types of satellite propulsion systems - primary propulsion and secondary propulsion. A propulsion system is a way to accelerate the speed of a satellite. The primary propulsion lifts the rocket and positions the satellite in the orbit. The secondary propulsion system, which is made up of either chemical or electric thrusters, helps the satellite maintain its position and its orientation in orbit. When it comes secondary propulsion, electric thrusters are more efficient compared to chemical ones. This is because an electric propulsion system uses only 200-250 kg of fuel when compared to two tonnes that a chemical propulsion system needs. This drastically brings down the fuel weight and the overall payload weight. So the satellite has more space on board for transponders (communication devices) on satellites for the same amount of fuel at the same price as a chemical one. The MPT from Bellatrix is an advanced type of electric propulsion system. It is zero-corrosion, so it solves one of the biggest problems in existing electric propulsion systems. Corrosion erodes the electrodes on the thrusters, which reduces its lifespan when in orbit. Overall, the MPT is lightweight and possesses a lifespan that is 3x longer, which makes it more efficient and cost-effective. How the journey to space began Mr Rohan, an aeronautical engineer from Hindustan College of Engineering and Technology, Coimbatore, was keen on working on a satellite propulsion system during his college days itself. In 2012, while in his second year, he took up the project and started developing an MPT. That year, he was fortunate to get an opportunity to meet the head of the R&D department of the Jindal Group during an event. Later, he also got to meet Mr Sajjan Jindal, Managing Director of the JSW Group, and explained the technology behind his project. Impressed by the idea, the conglomerate gave Mr Rohan a grant. That's when the team of four came together and set up an office in Coimbatore. In 2016, Bellatrix Aerospace moved to Bengaluru when the team got a space at the Indian Institute of Science (IISc), through the Society for Innovation and Development (SID). Here, the team got access to the labs and the machines required for their research to work on their electric propulsion system. Today, it also has a strong advisory board with M Srinivasan, a nuclear scientist and a Padma Vibhushan awardee; Mr Ugur Guven, an Aerospace and Nuclear Engineer; and Dr Guru Prasad, President of Aximetric Inc, USA. Bellatrix had another stroke of luck when they met then ISRO Chairman A S Kiran Kumar at an event and showed him their concept on paper. The Chairman responded by calling them over for a presentation. Several rounds of review later, ISRO onboarded Bellatrix as a supplier. Competition and challenges in aerospace Bellatrix Aerospace is emerging as a one-stop solution to cater to the entire market, says Mr Yashas. He adds, "If you are a satellite manufacturer and make satellites that weigh 10 kg, and tomorrow you want to build a satellite that weighs much higher, you can come to us for all the propulsion requirements. We want to be that one reliable stop for all the satellite manufacturers for their propulsion requirements." The space market in India Apart from Bellatrix Aerospace, startups such as Dhurva Space, Team Indus, Astrome, Satsure, and Astrogate have come up in the last five years. However, these startups are working on different segments of the space market. Apart from ISRO, the space market in India is very niche and nascent. Mr Rohan says, "It may take at least another five years for the Indian ecosystem to mature. Despite the presence of foreign players, we have a good chance of selling our propulsion systems to ISRO, owing to government policies favouring Indian companies over foreign counterparts." The team declined to speak about any potential international expansion plans. Nevertheless, in addition to the development of satellite propulsion, the team looks forward to building launch vehicles, which are in the initial stages of development. At present, Bellatrix's reusable launch vehicle Chetak is also set to disrupt the micro launcher industry. "Our goal is to become leaders in spacecraft propulsion and small satellite launch vehicles. By pushing the boundaries of innovation,

we are working towards bringing down the cost of access to space to prepare for a future where space tugs and lunar mining are a reality,” says Mr Rohan.

Source: <https://yourstory.com/>

‘AI will drive aerospace sector in the next 15 years’

Artificial Intelligence (AI) will be the key driver of fast-paced developments in Aerospace sector in the next 15 years, said Dr VK Saraswat, member, NITI Aayog. At the Annual General Meeting and National Conference of the Aeronautical Society of India (AeSI), he said it would play a significant role in cutting down costs, reduction in cycle time of design, optimisation, simulation, prototyping, manufacturing, maintenance and product updates. Disruptive technology AI will be one of the disruptive technologies which will impact efficiency, productivity, speed and innovation in the emerging industries, he added. Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman of the DRDO, said that unmanned vehicles will play a major role in both defence and civilian sector. Therefore, there is an urgent need to gear up in the area. Highlighting the contributions of the DRDO in design and development of state-of-the-art UAVs, he said that the Ministry of Defence is organising a contest, Drone Olympics, during the forthcoming Aero India event in Bengaluru. He said, “Indigenous development of sensors will play a major role and will revolutionise applications like UAVs for commercial and defence applications and will greatly impact our daily lives in future.” Mr VV Rao, Outstanding Scientist and Programme Director, Agni and Chairman, Organising Committee, said: “Aerospace sensor technologies will play a vital role in futuristic unmanned systems. The scenario is changing fast with the emergence of nano technologies and miniaturised embedded systems. Unmanned Systems will revolutionise agriculture, medical, space, defence and environment management.”

Source: <https://www.thehindubusinessline.com/>

ISRO eyes kerosene to boost GSLV Mk III's lifting power to 6 tonnes

Highlights

- Rocket with the semicryogenic stage won't be used for the Gaganyaan mission
- Current GSLV Mk III with L110 stage will only be used for the manned mission with some modifications
- Advantage of using kerolox is that it is 10 times dense — meaning the same volume of kerolox will generate more thrust than the same volume of hydrolox

Indian Space Research Organisation (ISRO) is working on upgrading its heavy-lifter GSLV Mk III where the upper stage of the rocket will have highly refined form of kerosene as fuel in order to increase its payload capability. Talking to TOI, ISRO chairman Dr K Sivan said, “To increase the payload capability of GSLV Mk III from 4 tonnes to 6 tonnes, we are in the process of making some improvements in rocket stages. First, we are working on enhancing the cryogenic stage fuel loading from 25 tonnes to 30 tonnes. Second, we are also working on changing the core stage L110 — which has 110 tonnes of unsymmetrical dimethylhydrazine (UDMH) and dinitrogen tetroxide (N₂O₄). We want to replace L110 stage with semicryogenic engine that will carry liquefied oxygen and highly refined kerosene called kerolox (aka RP-1) instead of liquefied hydrogen.” Dr Sivan said, “The first test of the advanced version of Mk III will take place in December 2020. With upgrade in Mk III, we will also have to upgrade the launchpad facility at Sriharikota. We have therefore issued a tender notice recently inviting quotations for infrastructure upgrades at the second launchpad.” However, the chairman clarified the rocket with the semicryogenic stage won't be used for the Gaganyaan mission. The current GSLV Mk III with L110 stage will only be used for the manned mission with some modifications. The advantage of using kerolox is that it is 10 times dense — meaning the same volume of kerolox will generate more thrust than the same volume of hydrolox. It is also cheaper, more stable at room temperature and less hazardous than hydrolox. Mr Elon Musk-promoted Space X currently uses kerolox in its Falcon 9 rocket for launching heavy payloads. “With increase in payload capacity, the advanced GSLV MK III will help ISRO cut expenses and save time,” Dr Sivan said. Currently, India uses the services of Arianespace to launch its heavy satellites weighing over 4 tonnes. Last year on December 4, ISRO had used the services of Arianespace for launching its heaviest satellite Gsat-11 weighing over 5.7 tonnes from French Guiana.

ISRO tastes first success of 2019, places military satellite Microsat-R in orbit

Under a starry night and a waning gibbous moon, ISRO's PSLV C-44 broke the silence over a brimming Pulicat lake as it lifted off from Satish Dhawan Space Centre, SHAR, to successfully place in orbit military satellite Microsat-R. The

mission, with a modified PSLV with just dual strap-on motors (PSLV-DL), marked another first for ISRO - it provided an alternative to its normal six strap-on motors. This will enable the rocket to carry slightly higher payloads than its Core-Alone version. Towards the end of the first stage, the rocket's plumes were white with its tail end burning bright red even as a large flock of birds passed on the horizon. A second later, as the rocket soared further into the night sky, the second stage ignition burned a bright orange propelling the rocket ahead.

In low orbit

Microsat-R was placed in orbit 13 and-a-half minutes after lift-off. It is the first time an Indian satellite was being placed by ISRO in a low orbit at an altitude of 274 km. ISRO also used this launch as an opportunity to demonstrate the usability of the fourth stage of the rocket after the satellites are ejected into orbit. The fourth stage used to just become yet another piece of space debris. However, ISRO has found a way to make use of this stage with student satellite Kalamsat, made by Space Kidz India, weighing just 1.26kg, attached to it. "The first mission of 2019 is a grand success," ISRO Chairman K. Sivan said from Mission Control. "Another innovation is making the fourth stage an experimental platform to do technology demonstrations and carrying out science experiments by students," he said.

For experiments

This would enable any agency that wants to conduct experiments in space to use the fourth stage till it disintegrates naturally. The fourth stage may be orbiting in space for six months to a year. ISRO is aiming to use this time-frame to enable agencies to run short time experiments. Dr. Sivan asked students in India to develop such satellites and ISRO would take care of the launches. He also said ISRO was developing a Small Satellite Launch Vehicle (SSLV), smaller than the PSLV. The first SSLV launch would take place this year, he added.

Source:<https://www.thehindu.com/>

The LCA Tejas is on time

The December 2018 deadline for the Light Combat Aircraft (LCA) Tejas to attain Final Operational Clearance (FOC) has been partially met with the Aeronautical Development Agency (ADA) handing over FOC related documents to the Hindustan Aeronautics Limited (HAL). The documents (drawing applicability lists) were handed over by ADA on December 31 after it was vetted by Centre for Military Airworthiness & Certification (CEMILAC), the certifying agency for military aircraft in the country. "The documents were handed over on December 31 to start the FOC process. The handing over of the drawing applicability lists assumes significance as it signals that HAL can go ahead with the production of the FOC standard aircraft,". The FOC complaint Tejas would incorporate Beyond Visual Range (BVR) missiles, improved and better stand-off weapons and air to air refueling capability. The Indian Air Force and HAL has so far signed two contracts for procurement of 20 Initial Operational Clearance (IOC) standard aircraft and 20 Final Operational Clearance (FOC) standard aircraft. As per the initial order of the 20 IOC aircraft 16 were meant to be fighter jets and four were to be trainers. However the IAF now wants all the trainers in FOC configuration. The production of all the IOC aircraft is expected to be completed by March 2019. Recently ahead of the FOC the Tejas programme attained a significant milestone as it successfully completed the Wet (actual) engagement by transferring 1900 Kgs fuel from IAF IL78 mid-air refueling tanker. The 45 Squadron of the IAF "The Flying Daggers" which was the first squadron to be equipped with LCA-Tejas is stationed in an IAF base in Sulur, near Coimbatore. Apart from the 40 IOC and FOC standard aircraft HAL has received Request for Proposal (RFP) to supply of 83 Tejas and the production is planned from 2019-2020. The production of these 83 aircraft will start after the completion of the 20 LCA. Recently the Public Accounts Committee criticised the HAL and ADA over failure in timely delivery of the Tejas. In its report it was also critical at FOC not been met "The Committee are aghast to note that as July 31, 2018, IAF has only got nine out of the 200 fighter and 20 trainer aircraft envisaged in ASR. These six aircraft have been productionised after only Initial Operational Clearance (IOC) and are not combat ready, as yet. The committee are perturbed to note that the FOC has still not been achieved by the LCA even after more than 5 years of IOC," it stated.

Source:<https://bangaloremirror.indiatimes.com/>

ISRO's new station in Bhutan to counter China's Tibet facility

India is building a satellite tracking and data reception centre in neighbouring Bhutan. A report published stated the centre will strategically serve to counter a similar Chinese facility in the region. As per the report, people who are aware of the matter that the ground station of the Indian Space Research Organisation (ISRO) in Bhutan is likely to double up as "a strategic asset" for the country, given its location between India and China. It may be mentioned that

China has already set up an advanced [satellite](#) tracking centre and astronomical observatory at Ngari in Tibet Autonomous Region, about 125 km away from the Line of Actual Control. It has been learnt that the Chinese facility in Tibet is so advanced that apart from tracking Indian satellites, it can also “blind” them. According to the report, although the ground station of ISRO in Bhutan has been planned to help the Himalayan state take advantage of the South Asia Satellite, it is also India’s way of counterbalancing the Chinese station in Tibet. In the backdrop of the Doklam crisis, the Indian strategy has been considered significant at a time when China has tried to construct a road at a tri-junction between India, Bhutan and China. It is a known fact that Bhutan maintained good bilateral relationship with India during the 72-day face-off between the Indian Army and People’s Liberation Army at Doklam in western Bhutan in June-August, 2017. In the PM-level talks in New Delhi during Bhutan’s new Prime Minister Dr Lotay Tshering’s India visit, Prime Minister Narendra Modi had said construction of the ISRO ground station in Bhutan would be completed soon. “Space science is the new dimension of our cooperation (with Bhutan),” Modi had said in a statement after meeting Bhutan PM Tshering. “With the completion of this project, Bhutan will get help in tasks such as weather information, tele-medicine and disaster relief in the far-flung areas of the country,” he further said in the statement. The South Asia Satellite was launched by ISRO on May 5, 2017. In 2014, Prime Minister Modi mooted the idea of a satellite for members of the South Asian Association for Regional Cooperation so that India could share the benefits of advances in space technology with its South Asian neighbours. India also assured of Rs 4,500 crore as assistance to Bhutan to support the neighbouring country’s 12th Five Year plan for development.

Source: <https://economictimes.indiatimes.com>

Space Diplomacy with Neighbours

While the launch of Chandrayan-2 scheduled on January 3 was postponed a second time for unexplained reasons, media headlines of January 4 announced India setting up five ground stations and over 500 terminals in neighbouring countries; one each in Bhutan, Nepal, Maldives, Bangladesh and Sri Lanka. “To counter China’s sphere of influence in Asia” the Indian government has been taking several steps as part of its neighbourhood-first policy and one such tool in its arsenal is space diplomacy, and that the MEA has been using space diplomacy to counter China by helping its neighbours in various ways, and that this move will also help India put in place strategic Indian assets in these countries. These ground stations and terminals that ISRO is putting up will help in applications like disaster management, television broadcasting, telephony and internet and telemedicine. Additionally, ISRO will be able to use these stations to communicate with its own satellites in space. In addition to the five ground stations, India will also set up over 500 VSAT terminals. Bhutan, Nepal, Maldives, Bangladesh and Sri Lanka will each get 100 VSAT terminals. These are two-way terminals that allow telephony and internet. The first station reportedly being set up in Thimpu, Bhutan is expected to be inaugurated by January 15. Alpha Design Technologies, an indigenous firm implementing the project, is also to set up 100 VSATs (Very Small Aperture Terminals) connected to the ground station, taking TV broadcasting to many remote areas in Bhutan. The ground station is seen as India’s move to counter the advanced satellite tracking centre and astronomical observatory set up by China in Ngari, Tibet. In addition to the 100 VSATs, Bhutan has also requested for 35 terminals with only receiving capability. These terminals work like set-top boxes that only receive information; ROTs (Receive only terminal). Apart from these countries, India has also received a request from the Maldives for establishing disaster management centres in 100 of the 200 inhabited islands on the country. Afghanistan too is interested in getting a ground station and 100 VSATs but their installation would be possible only after the security situation stabilises. It may be recalled that on May 5, 2017, India had launched GSAT-09 or SAS (South Asia Satellite) bringing on the same platform India, Afghanistan, Bangladesh, Bhutan, Maldives, Nepal and Sri Lanka (Pakistan having opted out); operating in the Ku-Band, the 12 transponders of SAS offer a range of services including banking networks, weather forecast, telemedicine, disaster management, tele-education and broadcasting services such as television, DTH and the works. India had also promised to aid participating nations in developing ground stations to access the data relayed by the satellite. Ambassadors of all the six participating nations were invited to witness the lift-off of SAS from the Satish Dhawan Space Centre, Sriharikota given the geo-political value of the event. While India has capitalised on its low-cost space technology, the SAS venture is without parallel in the world; as per BBC, no country ever has funded an entire space program itself and then ‘gifted’ the satellite services free of cost to other countries, as India has done. In his fortnightly radio address ‘Mann Ki Baat’ to the nation on May 7, 2016, Prime Minister Narendra Modi referring to the SAS had said, “The capacities of this satellite and the facilities it provides will go a long way in addressing South Asia’s economic and developmental priorities.” No doubt SAS has geo-strategic importance but India is not looking at countering China’s strategy in this sphere. To this end, we need to develop a habit of more responsible reporting. To say that the ground station being set up in Bhutan is to counter the advanced satellite tracking centre and astronomical observatory set up by China in Ngari, Tibet is hardly in order since the latter

reportedly also can 'blind' our satellites and missiles. The ground station in Bhutan is going operational shortly, but with respect to the other countries it would have been prudent to announce them when completed or nearing completion as well. We could learn from the recent lunar landing by China in an unexplored moon surface that surprised the world. It is not known whether ISRO has commenced setting up ground stations in the other above mentioned countries, but China can be expected to put roadblocks when it comes to a competing in terms of 'influence', for example in a country like Nepal. Post meeting with the visiting Prime Minister of Bhutan, Lotay Tshering in December 2018, PM Modi had said, "Space science is the new dimension of our cooperation (with Bhutan). Overall, the GSAT-9, the ground stations and the VSATs in neighbouring countries is an excellent initiative integrating SAARC countries.

Source:<http://sps-aviation.com/>

ISRO developing technology to reuse first & second stages of rocket

In a bid to cut cost of satellite launchers, Indian Space Research Organisation (ISRO) is working on reusable launch technology for using the first and second stages of a rocket multiple times. To master this technology, ISRO is going to conduct an advanced version of the reusable launch technology (RLV) test in June-July. ISRO chairman Dr K Sivan said, "We are working on a reusable launch technology in order to recover the first and second stages of a rocket so that we can reuse them to cut cost and carry heavier payloads. The first rocket stage will be recovered on a vertical landing spot on the sea like SpaceX has been doing it with its Falcon rocket. However, recovering the second stage is not simple. We are, therefore, developing a winged body like a space shuttle. This shuttle will be attached as a second stage in a rocket. It will carry the top portion of the rocket comprising a satellite or spacecraft to space. Once it injects the satellite in its orbit, the shuttle will glide back to the earth and land on an airstrip like an aircraft." He said the "second stage recovery has never been tried by any other space agency in the world, not even SpaceX". ISRO had conducted the first demonstration test of India's winged body vehicle on May 23, 2016. Then, the RLV had reached a height of 70 km and was manoeuvred back to earth where it glided down into the Indian Ocean and disintegrated. On the June-July test, Sivan said, "The test will be different this time where a helicopter will take the shuttle to a considerable height and from that height, the winged body will be dropped. The shuttle will then glide back to earth and land on an airstrip." ISRO is also planning to conduct a third test of the RLV from the orbit. There is speculation that the landing strip could be made in Andaman and Nicobar islands. However, no final decision has been taken yet. Currently, SpaceX rules the Rs 39,000-crore global market of satellite launches. The Mr Elon Musk-promoted US company which had 0% market share in 2009 gobbled up over 50% (projected) of the market share in 2018 mostly because of its reusable technology where it uses first stage rocket multiple times. On the other hand, ISRO's share is just 0.6% in the global market. In 2018, ISRO had launched PSLV just thrice for foreign satellites. Instead, SpaceX launched Falcon rocket 20 times for commercial purpose. As the market is set to grow to \$7 billion (Rs 49,000 crore) by 2024, ISRO can grab a significant share if it is able to master the RLV technology

ISRO is working on reusable launch vehicle technology for using the first and second stages of a rocket multiple times.

1. ISRO has successfully developed a scaled down (1:5) technology demonstration version of Reusable Launch Vehicle – Technology Demonstrator (RLV-TD) vehicle and carried out the first experimental mission in 2016
2. ISRO plans to conduct an advanced version of the reusable launch technology in June-July 2019

What is Reusable Launch Vehicle Technology Demonstrator (RLV TD)?

1. The RLV TD is a hybrid vehicle that combines the technologies of an aircraft and launch vehicle, one on top of the other
2. The main objectives of the RLV TD are to reduce cost of launch by increasing reusability and to increase reliability by achieving a Two Stage to Orbit (TSTO) capability.

Global Market

1. At present, SpaceX dominates the global market of satellite launches and has more than 50% share primarily because of its reusable technology where it uses first stage rocket multiple times
2. However, ISRO's share in the global market is only 0.6%. Mastering RLV technology is expected to increase ISRO's share significantly

Source:<https://blog.forumias.com/>, <https://timesofindia.indiatimes.com/>

IAF to fly an aircraft on biofuel on Republic Day

On Republic Day 2019, the IAF will create history by flying an AN-32 transport aircraft on biofuel over the Rajpath. This will be the IAF's second biofuel flight and comes more than a month after the successful maiden AN-32 sortie in Chandigarh. A part of the Republic Day parade flypast will be a three aircraft-vic-formation of AN-32 aircraft, considered

the workhorse in Indian military transport. The lead aircraft, to be piloted by Sqn Ldr Mehtab Sond, will be flying utilising aviation turbine fuel, blended with 10% bio-fuel. The bio-fuel has been extracted from Jatropa plant seeds using a technology patented by the Indian Institute of Petroleum, Dehradun—one of the constituent laboratories under the Council of Scientific and Industrial Research, said an IAF official. Last year, IAF Chief Air Chief Marshal B S Dhanoa announced that the force's plan to fly one of its aircraft with bio-fuel on the Republic Day, 2019 in tune with the government's plan to use fuels with low carbon footprint more. The test flight took place on December 17 2018 when pilots from Aircraft System Testing Establishment, Bengaluru, took to the skies with metal birds carrying 10% biofuel along with the ATF. However, the credit to fly the first Indian aircraft with biofuel went to Spicejet, which last August flew a 75-seater Bombardier Q400 aircraft that took off from Dehradun's Jolly Grant airport and successfully landed in Delhi with 25 people on board... The IAF flypast on the Rajpath will have 33 aircraft including 18 fighter jets. The combat aircraft participating in the parade are Jaguars, upgraded MiG-29s and Su-30 MKI.

Source:<https://www.deccanherald.com/>

ISRO to use PSLV stage four as orbital platform, create history

When India's Polar Satellite Launch Vehicle (PSLV) with its new configuration — PSLV-DL — is launched from Satish Dhawan Space Centre in Sriharikota later this month, Indian Space Research Organisation (ISRO) will aim to achieve a first in the history of satellite technology. Unlike other launch vehicles, where each stage of the launcher plunges back to Earth, the last stage of this launcher will serve as an 'orbital platform' and will help in a variety of tasks designed for the satellite mounted on the platform. The newly configured PSLV C-44 will be launched into orbit carrying two satellites on January 24 2019. Describing the development, an ISRO scientist, on condition of anonymity, said that this was the first time in the world that such a technique is being used. "Only India could have done it as our primary objective is to maximise the benefits with the resources available with us," he said.

HOW DOES IT WORK?

In a normal launch vehicle, each stage falls off after fuel completes burn-off, triggering the burn in the next stage. The PSLV-DL, which is a four-stage launcher, will follow the same pattern, except for the fact that the fourth stage won't fall off after launching the satellite into its orbit. "The fourth stage will serve as a platform or a vehicle for the satellite. For instance, we can deploy solar panels or other tools to aid the satellite riding on the platform or to manoeuvre it to different positions along its orbit," he said. The new variant will have alternating solid and liquid stages, with the last stage of the launch vehicle containing both solid and liquid fuel. PSLV-C44 will launch KalamSat — a student satellite — and Microsat-R — an imaging satellite. While Microsat-R will be launched into a different orbit, KalamSat, designed for communication capabilities, will be the first to use the fourth stage as a platform.

MAKING HISTORY

-After launch, when the rocket lifts off for a few kms, the first stage detaches and falls back to earth.

Second and third stages too fall off one after the other.

Normally, the fourth stage firing takes the satellite close to its orbit and releases before falling back to earth.

For the first time, the fourth stage will remain with satellite throughout its mission life

Fourth stage will be provided with solar panels and will use its boosters for any changes in orbit.

No space agency in the world has ever used a fourth stage booster for this purpose.

Source:<http://www.newindianexpress.com/>

ISRO launches India's first student-made satellite in its first space programme for 2019

ISRO will start off India's space programme account on January 24 2019, with the launch of Microsat-R, an imaging satellite for DRDO, and Kamalsat, a small communication satellite developed by students and Space Kidz India. The

satellites will be carried by a new variant of India's Polar Satellite Launch Vehicle (PSLV) rocket. "We will be launching 700-kg Microsat-R and Kalamsat with a new variant of Polar Satellite Launch Vehicle (PSLV). In order to reduce the weight and increase the mass, an aluminum tank is used for the first time in the fourth stage," Dr K Sivan, Chairman of Indian Space Research Organisation (ISRO).

Details about Kamalsat created by students

- Kalamsat-V2 is a communication satellite with a life span of two months
- The nanosatellite is a 10cm cube weighing 1.2 kg
- The student-made satellite cost was about Rs 12 lakh
- Kalamsat will be the first to use the rocket's fourth stage as an orbital platform. The fourth stage will be moved to higher circular orbit so as to establish an orbital platform for carrying out experiments
- It is named after former Indian president Dr APJ Abdul Kalam and was built by an Indian high school student team, led by Rifath Sharook, an 18-year-old from the Tamil Nadu town of Pallapatti
- The satellite made by students is the world's lightest and first ever 3D-printed satellite
- The PSLV launch by ISRO will take place 90 km off Chennai — from the first launchpad at the Satish Dhawan Space Center at Sriharikota.
- Srimathy Kesan, Founder CEO of Space Kidz India, told IANS that her dream of putting a satellite built by students will become a reality tomorrow night with the launch of Kalamsat.
- Space Kidz India is working towards promoting art, science and culture for students of India, and to create an international platform for them.

Plans to make Vikramsat for biological experiments in space

Chennai-based Space Kidz India now plans to build another student-made satellite - Vikramsat - to do some biological experiment in space, said a top official.

How was the satellite launch vehicle changed?

The PSLV launch tomorrow is a special event because of the multiple utility of the rocket and its configuration. The PSLV is a four-stage engine expendable rocket with alternating solid and liquid fuel. In its normal configuration, the rocket will have six strap-on motors hugging the rocket's first stage. However, the launch rocket tomorrow will have just two strap-on motors for the first time, called the DL mode. Moreover, the final fuel stage of the PSLV rocket will also play an additional role. IIST is co-building a satellite with California, Surrey institutes After launching several satellites built by students of different universities, ISRO will launch one built by the Indian Institute of Space Science and Technology (IIST) in collaboration with California Institute of Technology, an Indian space agency official said. "The IIST is designing a satellite along with California Institute of Technology," ISRO Chairman Dr K Sivan, told IANS. The IIST is an autonomous body under the Department of Space and is a deemed university inaugurated in 2007. According to the California Institute of Technology, the student-made satellite would be a test bed for a new type of space telescope and is called AAReST (Autonomous Assembly of a Reconfigurable Space Telescope). The AAReST is designed and built in large part by students of California Institute of Technology in collaboration with IIST and Surrey Space Centre in England. "The satellite is in Kourou. It will be put into orbit by Ariane rocket. Weighing about three ton, the satellite is a replacement for INSAT-4CR. It will be followed by GSAT 30 which will be a replacement for INSAT 4A," Sivan said.

Source: <https://www.indiatoday.in>

For ISRO's First Manned Mission, Bengaluru Gets Human Space Flight Centre

Gearing up for its maiden manned space mission "Gaganyaan", ISRO unveiled its Human Space Flight Centre in Bengaluru. The space agency is gearing up for the human spaceflight programme by 2021-end that is likely to include a woman astronaut. Gaganyaan is the "highest priority" for ISRO in 2019, according to the space agency, and the plan is to have the first unmanned mission in December 2020 and second for July 2021. Once this is completed, the manned mission will happen in December 2021. Dr K Kasturirangan, former ISRO Chairman, in the presence of Dr K Sivan, ISRO Chairman and Secretary, Department of Space, inaugurated the Human Space Flight Centre (HSFC) at ISRO Headquarter campus in Bengaluru, the space agency said on its website. Directors of other ISRO Centres, former Chairman and other dignitaries were also present, it said, adding that a full scale model of Gaganyans crew module was also unveiled during the event. HSFC shall be responsible for implementation of Gaganyaan project which involves end-to-end mission planning, development of engineering systems for crew survival in space, crew selection and training and also pursue activities for sustained human space flight missions, ISRO said. It will take the support of existing ISRO centres to implement the first development flight of Gaganyaan under the human spaceflight

programme. Mr S Unnikrishnan Nair is the founder director of HSFC, while Mr R Hutton is the project director of Gaganyaan. The Union Cabinet gave its nod for the Rs. 9,023 crore programme recently.

Source:<http://www.defencenews.in/>

Drone Olympics to debut at Aero-India

Unmanned Aerial Vehicles (UAVs) are all set to make a big splash at the Aero-India 2019 with a unique 'Drone Olympics' on February 21. The initial build-up rounds will be at the Jakkur Flying Club while the finals will be at the Yelahanka Air Force Station. Reuters file photo Unmanned Aerial Vehicles (UAVs) are all set to make a big splash at the Aero-India 2019 with a unique 'Drone Olympics' on February 21. On the Olympics, agenda is a 'Surveillance Competition' that judges participants under two broad categories: Fixed VTOL (Multirotor) and hybrid designs. The weight classes are 4-7 kilograms for Multirotor and 4-20 kgs for hybrid designs. The candidates will be evaluated on Flight Time (40% Weightage), Live Transmission Range in Full HD/1080p resolution in "Free band" S & C (40% Weightage) and Detection of Human sized targets (20% Weightage). We use cookies to understand how you use our site and to improve user experience. This includes personalising content and advertising. By continuing to use our site, you accept our use of cookies, revised Privacy Policy. Learn more I agree X Sign in UAV Formation Flying Challenge is another competition lined up for the Olympics. The competitors, with 12 UAVs, will have to demonstrate Minus, Formation, Three Spokes, Division Sign, Plus and Multiplication signs. The contest will only get tougher as they would be asked to do shapes of a triangle, square, letter 'I', 'O' shape with 12 UAVs. The rules demand that they demonstrate the shape for at least 30 seconds in static mode. Here's the 'official' rationale behind the Drone Olympics: "UAV market is one of the fastest growing market today. Starting from expensive military UAVs or small consumer toys, UAVs are now venturing into commercial space, be it basic surveillance, photography, site inspections, monitoring crops, collecting geographical data, delivery services. Avenues are limitless."

Source:Deccan herald

All-women flights to take o at Aero-India 2019

An earthmover clears a path during preparations ahead of 'Aero India Show 2019', at Yelahanka Air Base station in Bengaluru, Jan. 30, 2019. (PTI Photo) Women aviators will fly high, giving the 12th edition of Aero-India at the Yelahanka Air Force Station here a distinct gender twist. On the airshow agenda is a Women's Day on February 23, complete with an all-women flight and a visit by American astronaut and US Navy officer Sunita Williams. The imprint of women pilots will be felt this time like never before, assures the Yelahanka IAF Station's top brass. The airshow will also be about students, 10,000 of whom have been invited to competitions designed to inspire the aviators in them. Aerobatic teams We use cookies to understand how you use our site and to improve user experience. This includes personalising content and advertising. By continuing to use our site, you accept our use of cookies, revised Privacy Policy. Learn more I agree X Sign in Beckoning their attention from the skies will be the Sarang aerobatic team with the Advanced Light Helicopters (ALH) and another led by the Hawks. At least two foreign aerobatic teams are expected to fly in, although the hugely popular SKYCATS, the Scandinavian team will give this airshow a miss. Parking space An additional vehicle parking space with trained manpower has been created this time. Twenty shuttle buses will take visitors from this area to the exhibition space. The airshow organisers have also increased the number of security frisking gates to reduce the congestion. The State police, the Central Reserve Police Force, Disaster Management Rescue Force and Central Industrial Security Force (CISF) personnel will fan out across the airshow space to ensure foolproof security, Air Commodore Ravuri Sheetal told media persons. Tickets Sales have already begun for tickets to the Air Display Visitor Area (ADVA), priced at Rs. 600. The tickets are valid for one day for single entry only. Children below five years are allowed free entry. General visitors to the exhibition areas are charged Rs 1,800. Access to ADVA will be through gates 8, 9 and 10. Gate 2 will be for VIPs and gate 5 for the public to access the public parking area.

Source:Deccan herald

TECHNOLOGY

Indigenous Sensors Will Change Defence Applications: DRDO

Indigenous development of sensors would play a great role and revolutionise applications like Unmanned Aerial Vehicles (UAVs) for commercial and defence applications, scientist and chairman of Defence Research Development Organisation (DRDO) Dr G Satheesh Reddy said. Dr Reddy, also the chairman of Aeronautical Society of India, said there was a huge transformation in the areas of unmanned systems and associated technologies. "UAVs are going to play a major role in both defence and civilian sectors. So, there is an urgent need for industries to gear up and work in these areas," a press release from the Aeronautical Society of India quoted him as saying. Reddy highlighted the contributions of DRDO to design and development of modern UAVs and said a contest 'Drone Olympics' would be organised by Ministry of Defence during the forthcoming Aero India event. He was speaking at a national conference on 'Unmanned Aircraft Systems: Opportunities and Challenges' organised by the Society which also held its AGM (annual general meeting) here. NITI Aayog member Dr V K Saraswat, delivering a talk on the topic 'Artificial Intelligence(AI) in Aerospace 4.0,' said, "AI is one of the disruptive technologies, which is going to impact efficiency, productivity, speed and innovation in the emerging industries." He said Aerospace 4.0 would include all features of AI in the next 15 years to cut cost and cycle-time of design, optimisation, simulation, prototyping, manufacturing, supply chain, maintenance and product updates. Programme director, Agni-3, Mr VV Rao said aerospace sensor technology would play a vital role in the futuristic unmanned systems. He said the scenario was changing fast with the emergence of nano technologies and miniature embedded systems. He added that unmanned systems would revolutionise agriculture, medical, space, defence and environment management. Former chairman of ISRO Mr AS Kiran Kumar and nearly 500 scientists, engineers, industrialists and professionals from the aerospace sector participated in the conference.

Source:<https://www.india.com/>

BUSINESS

Tamil Nadu Defence Corridor May Have Projects On Aerospace, Missile Parts

Defence manufacturing will get a shot in the arm with a series of projects set to be announced for the Tamil Nadu Defence Corridor, the second such hub in the country. The projects may include aerospace, hand-held weapons, parts of missiles and manufacture of composites. Secretary of Defence Production Mr Ajay Kumar said that the corridor will be developed on the existing defence ecosystem in the state and create synergy with its manufacturing base in terms of automobiles and components, information technology, textiles besides a large pool of engineering talent. He said the Tamil Nadu Defence corridor is expected to attract more initial investment than Rs. 3,700 crore announced when the Uttar Pradesh Defence Industrial Corridor was unveiled last year. "Tamil Nadu will be very good for aero components," adding it has a proximity with Bengaluru with a reliable aero-industry base. The function to be held at Tiruchirappalli will be attended by Defence Minister Mrd Nirmala Sitharaman and will have Chennai, Hosur, Salem, Madurai, Coimbatore and Tiruchirappalli as major nodes. Two defence corridors were announced in Tamil Nadu and Uttar Pradesh in the Union Budget last year. The Uttar Pradesh Defence Industrial Corridor at Aligarh last year saw announcement of investment of over Rs. 3,700 crore. The defence innovation hub will be based at Coimbatore, which has a large number of micro, medium and small enterprises. Mr Kumar said efforts are being made to attract these units to the defence sector and boost indigenisation. The innovation hub will have a common facility centre to be created through a special purpose vehicle. The government has already approved Defence Innovation Fund (DIF) to foster innovation and technology development in defence sector by engaging research institutions, academia, industry including MSMEs, start-ups and also individual innovators. An expert familiar with the project said that more than a dozen projects are expected to be announced for the Tamil Nadu Defence Corridor along with investment both by the private industry and public sector undertakings.

Source:<https://www.ndtv.com>

India to buy 2 more AWACS worth Rs 5.7k crore from Israel

Highlights

- India is finally close to approving the over \$800 million (around Rs 5,700 crore) deal for two more “Phalcon” airborne warning and control system (AWACS) aircraft from Israel
- Armed forces are also looking to induct additional “Heron” surveillance and armed drones as well as “Harop” killer unmanned aerial vehicles

India is finally close to approving the over \$800 million (around Rs 5,700 crore) deal for two more “Phalcon” Airborne Warning and Control System (AWACS) aircraft from Israel, which comes soon after it inked a Rs 4,577 crore contract for air defence radars with the Jewish state. Reinforcing Israel’s status as one of the top arms suppliers to India, the armed forces are also looking to induct additional “Heron” surveillance and armed drones as well as “Harop” killer Unmanned Aerial Vehicles, which act as cruise missiles by exploding into enemy radars and other targets, from the country. With Israeli Prime Minister Mr Benjamin Netanyahu keen to visit India in mid-February, Tel Aviv is also pushing for a renewed deal for the “Spike” Anti-Tank Guided Missiles (ATGMs). This comes after India in late-2017 cancelled a proposed Rs 3,200 crore deal for 8,356 medium-range Spike missiles, 321 launchers and 15 simulators after DRDO said it could deliver a more technologically advanced man-portable ATGM within a couple of years, as was reported earlier by TOI. In another mega contract worth an estimated Rs 12,640 crore, Israeli firm Elbit Systems is also competing with Nexter Systems of France for supplying India with 400 towed 155mm artillery gun systems, which is to be followed by another 1,180 such guns to be made in India. But that is in the future. For now, India recently inked the Rs 4,577 crore deal with Israeli Aerospace Industries for 66 fire control radars, with maintenance transfer of technology. These 3-D surveillance and tracking radars will replace the aging Flycatcher radar systems present with the Army’s Air Defence Corps. Then, IAF’s long-pending quest to induct two more AWACS, with Israeli Phalcon early-warning radar systems mounted on Russian Ilyushin-76 heavy-lift aircraft, is now being examined afresh by the finance ministry after being cleared by the defence ministry. “The Cabinet Committee on Security, of course, will have to give the final nod,” said a source. IAF had inducted the first three Phalcon AWACS in 2009-2011 under a \$1.1 billion deal inked by India, Israel and Russia in 2004. But the finance ministry had objected to “the high costs” involved in the new deal for two more AWACS, which have now been “brought down” through extensive negotiations, said sources. Considered potent “eyes in the sky”, AWACS can detect and track incoming fighters, cruise missiles and drones much before ground-based radars as well as direct friendly fighters during air combat with enemy jets. But India has lagged in this crucial sector. Compared to its three Phalcon AWACS and two indigenous “Netra” mini-AWACS, China has around 30 such systems, including Kong Jing-2000 “Mainring”, KJ-200 “Moth” and KJ-500 aircraft. Pakistan, in turn, has eight Chinese Karakoram Eagle ZDK-03 AWACS and Swedish Saab-2000 AEW&C, and is on course to get more from China.

Source: <http://www.defencenews.in/>

MoD to discuss proposal on acquiring torpedoes for nuclear submarine

Already delayed by many years, the Defence Ministry is expected to discuss a proposal for acquiring heavyweight torpedoes for the nuclear submarine INS Arihant and the six Scorpene-class submarines being built for the Indian Navy. “A high-level meeting of the Defence Ministry is expected to discuss the proposal to acquire heavy-weight torpedoes for the INS Arihant nuclear submarine and the submarines of the Kalvari-class of the Indian Navy. The Kalvari class are originally the Scorpene submarines of France built in India at the Mazagon Dockyards Limited (MDL),” sources in the Navy told ANI. The Defence Ministry is also likely to take a call on the tender to be issued by the Navy for the heavyweight torpedoes and also on the number to be acquired. The Navy had issued a Request for Information more than a year ago and has been in discussion on the formalities with the vendors and the Defence Ministry acquisition wing. The DRDO is also developing a heavyweight torpedo as the next version of its light torpedoes for submarines and surface ships. The proposal for acquisition of the torpedoes has been going on for more than 10 years now as an earlier proposal to acquire it from an Italian firm WASS was scrapped due to its alleged links with the scam-tainted AgustaWestland and Finmeccanica group of companies allegedly involved in the chopper scam. The heavyweight torpedoes are the main weapons of any submarine operating under water against both enemy submarines and surface warships. At the moment, the Kalvari class and the INS Arihant are relying on the old torpedoes in the naval inventory for operations. INS Arihant is the first indigenously-built and developed nuclear submarine of the Indian Navy, and the vessel completed its maiden operational deployment in the Indian Ocean Region a few months ago. The strategic submarines are operated by the Strategic Forces Command (SFC) and as per plans, the Navy will have a

fleet of at least five nuclear submarines which can carry long-range ballistic missiles. The Navy has already inducted one of the Kalvari class boats and is expected to induct the remaining five in the next four years.

Source:<http://www.defencenews.in>

Why doesn't India replace the fleets of the MiG-29 as it is decades old?

The MiG-29 is one of the IAF's premier Air Defense fighters. Whilst always appreciated for its raw performance, the MiG-29 was not acquired in bulk or series produced in India. Among the primary reasons were the inability of MiG-MAPO to properly support the IAF during its initial service and their continued reluctance to share design data later (design data since the IAF intended to use for optimizing its operation in Indian conditions). Plus there were the spares parts issues caused by the fall of the Soviet Union. The IAF ultimately, both on its own and with HALs help, started making a lot of the spares locally, and also took over a lot of the maintenance actions. IAF BRDs and their MiG capabilities. These helped raise the serviceability of the aircraft. The aircraft is effectively 33 years old and still remain an effective weapons platform to this day. Indian review of the MiG-29 does show that the jet structures is still sound and worthwhile the upgrades it needs to performance for another 10–15 years. While the upgrades continues, India will be searching for a new jet to replace the legacy jets including the Fulcrum in 10–15 years time. The Fulcrum has shown great service in the IAF and that image in which it was successfully used extensively during the 1999 Kargil War in Kashmir by the Indian Air Force to provide fighter escort for Mirage 2000s attacking targets with laser-guided bombs. According to Indian sources, two MiG-29s from the IAF's Black Archer squadron gained missile lock on two of the Pakistani F-16s, which were patrolling close to the border to prevent any incursions by Indian aircraft, but did not engage them because no official declaration of war had been issued. The Indian MiG-29s were armed with Beyond-Visual-Range (BVR) air-to-air missiles whereas the Pakistani F-16s were not equipped at the time with AIM-120 Amraam. The MiG-29's good operational record prompted India to sign a deal with Russia between 2005—2006 to upgrade all 62 jets for over \$900 million. Under the specific arrangement, Russia supplies upgrade kits to Indian technological professionals, and MiG Corporation specialists provide the necessary advice and technical assistance and know-how required for installation. Now fully operational, this MiG-29UPG sports the much larger centreline fuel tank of 1800 litres, extending the range to nearly 3,000km. With the introduction of the R-77 Adder missiles on the MiG-29UPG, it is now one of the most capable interceptor in the region. The upgraded MiG-29UPG has helped reduce maintenance cost by as much as 40%. The improvements can be seen from the unpainted parts on this flying MiG-29 as it under goes flight testing. Believe it or not, MiG-29UPGs are THE best BVR combat aircraft in IAF service. D-29 EW system which has been integrated with newly upgraded MiG-29UPGs is probably the best EW system in this part of the world. D-29 is an integrated EW warfare system carried internally by MiG-29s. It's an derivative of UEWS EW developed for LCA. Difference between UEWS and D-29 is that the later uses active phased array TRX- In simple terms AESA antenna. Coupled with DRFM, AESA antenna drastically improves EW system's effectiveness against BVR missiles (like AIM-120s deployed by PAF F-16s). After receiving the upgrades, the combat readiness of the MiG-29UPG will attain a performance level similar to that of the naval MiG-29K fighter aircraft. Under this deal, the MiGs incorporated the following:

- Capable of deploying the R-77RVV-AE (AA-12 'Adder') air-to-air missile which was successfully tested in 1998.
- Gain the ability to attack ground and sea targets at any time of day and in any weather conditions as well as carrying the interception and air defence role with autonomous capabilities.
- Integration of the Zhuk-ME airborne radar system.
- Ability to use the advance subsonic anti-ship missile Kh-35E (AS-20 Kayak).
- Introduced the OLS-UEM IRST sensor with the laser, thermal-imaging and television capabilities.
- increased the range by 40% to 2,100 km on internal fuel.
- The upgrade improve maintenance which helped reduced maintenance cost by as much as 40%.
- Using the Indian licence manufacture of the new RD-33 series 3 turbofan engines.
- Introduction of new weapon control system.
- Improved cockpit ergonomics with enhanced HOTAS design, two large and two smaller monochrome LCD.
- Introduction of a retractable inflight refuelling probe, similar to Malaysian MiG-29N and Russian MiG-29SMT.
- Weapons load was increased to 4,500 kg on six underwing and one ventral hard points similar to the MiG-35.
- Secure datalink system.
- Life increased to another 15 years of use.
- Introduction of a bigger centreline tank from 1500 litres to 1800 litres tank extending range toward 3,000km.

- The MiG-29 is still a modern fighter and has a lot more of capabilities in them. It is still a sound and robust machine that the IAF has come to respect and appreciate. As of 2012, the Indian UPG version was considered the most advanced MiG-29 version in the world.
- The major improvements apart from the avionics and weapons suite is the internal fuel capacity which was increased by introducing a modified bulge at the rear of the canopy as seen here. This has effectively eliminated its achilles heel with its short range that was named as the fighter that could only defend its air base. With the increased range, the MiG-29UPG is a fine and very capable fighter.
- Conclusion- IAF MiG-29 hasn't lost its edge yet. MiG-29s are still a force to be reckoned with. They might remain in service until late 2030s.

Source:- Quora

31 aircraft register for flying display at aero

The controversial Rafale and indigenous Tejas aircraft are likely to be the eye-catchers at the biannual Aero India 2019, to be held in the city between February 20 and 24. Speaking to reporters ahead of the 12th edition of the carnival, Air Commodore Ravuri Sheetal, air officer (commanding) at Yelahanka Air Force Station (AFS), said preparations are on in full swing at the air base in Yelahanka. While Hindustan Aeronautics Limited (HAL) will be this year's event manager, Dassault's Rafale war jets will be the main attraction at the show. Apart from HAL's Light Combat Aircraft (LCA) Tejas and French aerospace major Dassault Aviation's Rafale, Light Utility Helicopter (LUH), multi-role fighter jet Sukhoi Su-30MKI, National Aeronautics Laboratories' (NAL) Saras PT1N are among the aircraft that will be flying. Air Cmd Sheetal said aerial display will be held at Yelahanka AFS from 10am to noon and 2pm to 5pm. "So far, 31 aircraft have registered for flying display and another 22 for static display. We expect more to join in the coming days," he said. Some 360 exhibitors — 196 from India and 164 from abroad — have registered so far to showcase their products in the aerospace and defence sectors. The event is likely to be flagged off by Prime Minister Mr Narendra Modi, but there is no confirmation as yet. This year's show will see theme-based events like drone olympics (drone competitions), women's day, startup day, photography contest and students' pavilion. The fourth day — February 23 — will be observed as women's day with flying display by women crew, including pilots and paratroopers. Indian-born American astronaut Sunita Williams is expected to arrive on that day to share her experience and felicitate women achievers in the aerospace sector. Technology day will be observed on February 22 where students who are involved in the aerospace sector — both civil and defence — will showcase their projects. Startup day, on February 21, aims to tap the country's entrepreneurial talent pool. Global aerospace majors, including Boeing (US), Lockheed Martin Corp (US), Russian Aircraft Corp MiG (Russia), Saab (Sweden), Dassault Aviation (France) and European aerospace firm Airbus, will be among the exhibitors. In 2017, the aero show saw 5.4 lakh visitors and some 7 lakh are expected this time. "We have decided to provide more facilities, including additional food stalls/toilets, enhanced security arrangements, parking managements and garbage clearance, compared to previous years," said Air Cmd Sheetal. There will be more food courts at the air display viewing area and exhibition centre. Ticket for business visitors to the exhibition area on February 20, 21 and 22 is Rs 2,750 each; for general visitors on February 23-24 is Rs 1,800 and Rs 600 for air display

Source:TOI

Better amenities at Aero India this time

Scores of war planes and helicopters from India and around the world will regale enthusiasts during the 5-day event from February 20. Guess where two Indira Canteens, albeit temporary, will come up next month. At Air Force Station Yelahanka. Aero India 2019 is less than a month away and its venue for the 12th time, the Indian Air Force base, some 30 km north of the city, is abuzz with preparations for the biennial event. For five days starting February 20, over a lakh visitors are expected daily at what the organisers say is Asia's biggest civil and military aeronautical spectacle. The show will be smoother and more people-friendly than before, according to Air Commodore Ravuri Sheetal, Air Officer Commanding, Air Force Station Yelahanka. Three times more toilets, more pocket-friendly eateries, much bigger parking spaces with assistance; bigger viewing shelters, but pricier tickets at ₹ 2,750 for the exhibition area and ₹ 600 for just the public aerial display viewing area, Air Commodore Sheetal said at a pre-event news conference. Aircraft, aerobatics and stall exhibitors were still sending in their bookings and the final names and numbers would be clear in the coming weeks. As for security, "it would be adequate" from the Air Force, CISF, State police, and other personnel, he said. Exhibition for the exhibition crawlers, there will be two more hangars F and G in addition to A, B, C, D, E, and

AB. Preparations, which began six months ago, gathered pace after the Ministry of Defence announced the date and the venue a couple of months back. The IAF has pressed around 2,500 officers on air show duty, some 500 of them from other stations. Some 900 contract workers were said to be working day and night to put up access-controlling barricades, hangars, and other facilities. An estimated 60% of works has been completed. The spectacle will have scores of hardened war planes and helicopters from India and around the world lined up fin to fin on the tarmac. There would be a 60-tonne giant passenger plane, the Airbus A330-900, tonne-class nanolight planes, and also tinier drones flying for the first time at the air show for prizes. The real treat will be two French Rafale fighters, the HAL-built Light Utility Helicopter, and CSIR National Aerospace Labs' small civil plane Saras. Aero India 2019 will have a few special sub-events along with the customary technical conference, such as a drones competition and a start-up challenge on defence-related innovations. The fourth day will be dedicated to women in uniform, as pilots, air traffic controllers, and other IAF experts. All-woman crews are slated to rule the skies on the day. U.S. astronaut and space shuttle commander Sunita Williams is likely to be there, too. The HAL, which used to be in the thick of handling air show activities in the early years, is back again as the event manager. The show is organised in odd years by the MoD's Defence Exhibition Organisation, which now has a new head. Highlights Around 5.5 lakh visitors are expected over five days Buy tickets online, in advance. There will be a latecomer's counter at the venue Show time is 10 a.m. to 12 noon; 2 p.m. to 5 p.m. on all days Air display area-only visitors have to take the road via Yelahanka and reach Gates 8-10. Do not take National Highway 7. Easy and assisted parking at the air base; 20 buses will ferry visitors from the parking spaces to main venues Many more food courts this time; an Indira canteen each at the ADVA and public parking space 1,000 toilets are being set up, five times more than in 2017 Commuters to Kempe Gowda International Airport should avoid NH7 stretch before the air base and instead take the new alternative road. This will decongest traffic on the road 10,000 students from select institutions and Army schools in Karnataka and other States are being brought in each day to view the show and interact with the IAF at the public viewing area

Source: The Hindu

Aero-India: 5.5 lakh visitors; Rafale to fly

A Rafale on flight display as crowds watch at the 2017 airshow in Yelahanka. DH file photo The controversial Rafale jets will catch everyone's attention as they take off yet again at the 12th Aero India 2019, the biggest aerospace exposition this side of the world. The five-day show will come alive on February 20 at the Yelahanka Air Base here, beckoning an estimated 5.5 lakh visitors. Despite initial fears of a poor turnout, 365 Indian and global aerospace companies have registered for the show so far. At least 53 aircra will be on display, 31 of them taking to the skies for daily aerial displays. But this number will go up significantly, says a top Indian Air Force (IAF) official. We use cookies to understand how you use our site and to improve user experience. This includes personalising content and advertising. By continuing to use our site, you accept our use of cookies, revised Privacy Policy. Learn more I agree X Sign in Three Rafale jets will be on display, two of them showing off their prowess in the air. The hugely popular flight displays are lined up daily from 10 am to 12 noon, and from 2 pm to 5 pm, February 20 to 24. Eight Tejas, the indigenously designed Light Combat Aircra (LCA), Sukhoi-30Mki, the Advanced Jet Trainer Hawk, Advanced Light Helicopter (ALH), Light Utility Helicopter (LUH), Light Combat Helicopter (LCH), trainer HTT 40, Dorniers, the Mi-17 choppers and a vintage Dakota will also be part of the flight displays. An estimated 5.4 lakh visitors, both local and foreign, had turned up for the 11th edition of the airshow in 2017. "We expect a similar footfall, if not more this time," the Yelahanka Air Force Station's Air Officer Commanding, Air Commodore Ravuri Sheetal told media. The civil aviation side of the airshow will be highlighted by the Airbus A330-900, both in static and flying displays. Falcons will be part of the business jet section, a regular at the airshow. Speculations that the airshow might be shifted out of Bengaluru this time to Uttar Pradesh had sparked fears that the preparations could be affected. However, Air Commodore Sheetal maintained it was 'a matter of procedure' for the IAF. Regardless of the airshow schedule, the Air Force Base always planned for the event. "The delay in fixing the venue has not affected us at all," he said. State-owned aviation major, Hindustan Aeronautics Limited (HAL) is the event manager for this edition of the show. Three weeks ahead of the show, the airshow venue resembled a work in progress. Exhibitors had begun to unload their displayware, the hangars were emptied for the design fabricators to take over, and the skeletal structure for two additional hangars were coming up

Source: Deccan Herald

MoD may invite private companies to bid for Rs 21,000 crore Naval Chopper deal

The defence ministry is set to invite private sector companies to participate in the Rs 21,000 crore deal for new naval utility helicopters, which will be the first project to kick off under the strategic partnership (SP) policy under the 'Make in India' initiative. Sources said that the first 'expression of interest' (Eoi) to the private sector under the policy will be issued for the helicopter deal in the coming days while others like a mega plan to manufacture submarines, main battle tanks and fighter jets will be tackled later, based on how the pilot project goes through. It is learnt that the defence ministry has finalised several financial and technical parameters to shortlist Indian companies that will be considered for the bidding process. Among the criteria is a net worth of at least Rs 800 crore, a minimum revenue of Rs 1,800 crore and a proven capability of delivering mega projects in the past. Companies that would be considered would also need to have some experience of handling defence production contracts in the past three years, with a minimum combined value of Rs 300 crore. Adequate land to set up the helicopter manufacturing plant would also be a criteria. "This will be a test case for the strategic partnership policy, which is a completely new process to select the private sector for major defence projects. A lot on other projects carries on how smoothly this goes and how issues that are bound to come up are tackled," an official working on the process told ET. As per the process, the defence ministry will shortlist both Indian companies and foreign collaborators in a parallel process. The shortlisted entities will then be asked to submit a joint commercial proposal and the lowest bidder would be declared the winner. In August last year, the Defence Acquisition Council (DAC) approved the procurement of 111 utility helicopters for the Indian Navy at a cost of over Rs 21,000 crore as the first under the SP model. "SP model envisages indigenous manufacturing of major defence platforms by an Indian strategic partner, who will collaborate with foreign OEM, acquire niche technologies and set up production facilities in the country," the ministry had announced. Among the Indian companies that are likely to put in their bids for the project to manufacture 111 choppers are Mahindra Defence, Tata Aerospace and Defence, Adani Defence and Reliance Defence. As a parallel process, foreign companies will also be issued an Eoi to be the technical partner for the contract. The companies in the fray are Airbus Helicopters, Sikorsky and Russian Helicopters. The naval utility helicopter contract has seen twists and turns in the past few months as another potential foreign bidder, Bell Helicopters, has made it clear that it is not interested.

Source:defencenews.in/

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Inattetional blindness and bias during visual scan

Capt. Amit Singh FRAeS

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Abstract

Visual illusion is a perception of something existing in such a way as to cause misinterpretation of its true nature. It convinces us that the real life version of the object is untrue or false. The cognitive power of our brain can also create an effect of blindness wherein we do not see obvious and discernible objects in our visual field. In day-to-day life, the term used is “looking without seeing”. Aviation, marine, and automobile occurrences have been recorded that have an element of not sighting the obvious. Investigations in the past have not considered this aspect at all thereby, in a way linking the flight crew to the error. Cognitive ease prefers the mental image of a layout to be seen as it is when it comes in the field of vision. Intuitive thinking prefers to match the two images somehow and introduces biases which affect the decision making. This paper highlights the aspects, which can jeopardize safety during critical maneuvers. Simplistic solutions are suggested, which can enhance awareness and consciousness so that even in high workload situations, error is virtually eliminated.

Keywords: inattentional blindness, expectation, confirmation, fatigue, disorientation

Inattentional blindness and bias during visual scans

The proverb, seeing is believing means that you need to see something to believe it; visible facts cannot be denied. This a general statement valid for most scenarios but human psychology warns us that this statement may not be true under certain set or combination of circumstances. Two aviation and one marine occurrence has brought up the question, “Why didn’t the crew see the obvious”? In any accident/incident there is no single root cause, there are a number of contributory causes. A detailed investigation will reveal the probable cause along with the contributory causes. All the accident/incident investigations that will be analyzed will have one thing in common, certain aspects of cognitive side of crew were not investigated from a human factor and psychological view.

1. Taxiway over flight Air Canada 759 at KSFO (called AC759) 07 July 2017,
2. Risk of collision Canadian North B737 flight no. MPE9131 and Jazz aviation DHC08 (called MPE9131) 04 Aug 2014,
3. Marine accident Greenville nuclear submarine and Ehime Maru fishing & Training trawler, 09 Feb 2001.

According to a 2007 Federal Aviation Administration report, there were 267 instances of pilots mistakenly landing on a taxiway parallel to a runway in the United States between 1962 and August 2007. These events, identified through U.S. National Transportation Safety Board and Aviation Safety Reporting System databases, occurred at 110 different airports and involved aircraft from the spectrum of operator types. There were multiple occurrences at 44 of the airports, with single occurrences at the remaining 66. It should be noted that these data included only aircraft that had landed on the taxiway; the number of instances of runway/taxiway confusion that were detected prior to landing was likely much higher (Transportation Safety Board of Canada, "Aviation Investigation Report A14W0127", 2015).

Investigation reports of the two incidents had a few commonalities. The captain was

the pilot flying and the first officer was the pilot monitoring (PM) and visual approach was being carried. Where there was a parallel runway, it was closed and notified as a notice to airmen (NOTAM). There were parallel taxiways too. The crew had flown to the airport frequently and were not new to the topography and procedures.

Expectation Bias

The Purdue University carried out a study of accidents incidents of landing on wrong runways and wrong airports. One of the reasons for landing at the wrong surface is that flight crew have a mental picture of the airport and orientation of the runways, this is compared with what the pilot see outside. The pilots misjudge the time, speed, distance and; finally, misidentify the landing surface through distortion of facts of the facts of reality (Antuano & Mohler, 1989). The pilots are thus, disoriented and are inadequately informed by the external visual environment. This is more so when transiting from instrument conditions to visual conditions.

Visual cognition is limited by the number of computations it can perform, because the brain can process only a fraction of the visual faculties in detail, and by the inherent ambiguity of the information entering the visual system (Christopher, 2011). The brain prioritizes the information to reduce the burden. Attention prioritizes stimulus processing on the basis of motivational relevance, and expectations constrain visual interpretation on the basis of prior likelihood.

Expectation is the state of the brain that reflects prior information about what is possible or probable in the forthcoming sensory environment. Expectation leads to faster acquisition and interpretation of the visual input.

Confirmation bias

Once the human has adopted an opinion either received or self-agreed, he draws all things else to support and agree with it. He then neglects or sets aside and rejects any input

even though it may outweigh the current opinion. And though there be a greater number and weight of instances to be found on the other side, yet these it both neglects and despises, or else by some distinction sets aside and rejects; in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate Francis Bacon (1620/1939).

People tend to seek information that they consider supportive of favored hypotheses or existing beliefs and to interpret information in ways that are partial to those hypotheses or beliefs; conversely, they tend not to seek and perhaps even to avoid information that would be considered counter indicative with respect to those hypotheses or beliefs and supportive of alternative possibilities (Koriat, Lichtenstein, & Fischhoff, 1980).

Sleep deprivation/fatigue

Evidence suggests that certain conditions such as fatigue, sleep deprivation and cognitive overload, predispose decision makers to using intuitive processes (Corskerry, 2012). More biased decision making resulting in more errors take place as an outcome of fatigue and sleep deprivation. At the end of a 16 hours of being awake, the cognitive power is reduced to 75% and the impact is in the cognitive function located in the pre-frontal cortex leading to degraded analytical reasoning and impaired monitoring. There is also an increased tolerance of risk and loss of situational awareness.

Inattentive blindness

Everyone has some awareness of the limited capacity of attention, and our social behavior makes allowances for these limitations. Intense focusing on a task can make people effectively blind, even to stimuli that normally attract attention (Kahneman, 2011). When engaged in a demanding task, attention can act like a set of blinders, making it possible for salient unexpected stimuli to pass unnoticed right in front of our eyes (Neisser & Becklen, 1975). This phenomenon of “sustained inattentive blindness” is best known from Simons

and Chabris' (1999) study in which observers attend to a ball-passing game while a human in a gorilla suit wanders through the game. Despite having walked through the center of the scene, the gorilla is not reported by a substantial portion of the observers. Does inattention blindness (IB) still occur when the observers are experts, highly trained on the primary task? (Drew, Vö, & Wolfe, 2013) In computed tomography (CT) lung cancer screening, radiologists search a reconstructed 'stack' of axial slices of the lung for lung nodules that appear as small light circles. A series of experiment conducted with 24 radiologists (mean age: 48; range 28–70), they had up to three minutes to freely scroll through each of 5 lung CTs, searching for nodules as their eyes were tracked. Each case contained an average of 10 nodules and the observers were instructed to click nodule locations with the mouse. On the final trial, a gorilla with a white outline was inserted into the lung.

In the experiment, 20 of 24 expert radiologists failed to note a gorilla, the size of a matchbook, embedded in a stack of CT images of the lungs. This is a clear illustration that radiologists, though they are expert searchers, are not immune to the effects of IB, even when searching medical images within their domain of expertise. Potchen (2006) showed that radiologist could miss the absence of an entire bone. Why do radiologists sometimes fail to detect such large anomalies? Of course, as is critical in all IB demonstrations, the radiologists were not looking for this unexpected stimulus. Though detection of aberrant structures in the lung would be a standard component of the radiologist's task, our observers were not looking for gorillas. Presumably, they would have done much better had they been told to be prepared for such a target. Moreover, the observers were searching for small, light nodules.

Selection of landing surface

Air Canada AC759

AC759 executed a visual approach to land on a taxiway followed by a go around. AC759 was cleared for the quiet bridge visual approach runway 28R on completion of the

standard terminal arrival route (STAR) (NTSB, "Accident Investigations", 2018). Runway 28L was closed as per NOTAM. The Captain had been awake for almost 16 hrs when he was flying the approach. The Captain had flown to this airport a number of times; thus, had a good mental picture of the airport with two closely spaced parallel runways. The flight crewmembers had recent experience flying into SFO at night: the captain reported that he had flown into SFO one or two times during the previous 4 months. The captain flew the STAR and at the final descent point transitioned from instrument to visual reference at the same time switched off automation. There was a lighted flashing "X" placed on the closed runway 28L but as per NTSB, the flashing rate was too slow to have been noticed by the crew. The crew would have first sighted the landing runway 28R in front since the approach lights were illuminated and then they would have seen the parallel taxiway dimly lit but with similar dimensions to that of the runway. The captain in his interview said that he knew that runway 28L was closed as per the NOTAM. Expectation bias would have set in when only one runway and associated approach, PAPI lights were sighted. The parallel taxiway was visible, and the lights of the parallel taxiway close to the runway, the pilot's mental picture of the two runways was incomplete, as he had expected. Humans use their intuitive decision-making 90% of the time and more so when they are tired. They resist the analytical part of decision making. The mental and real pictures didn't match; therefore, the pilot assumed that the now closed runway 28L was still open and the runway in front of him was runway 28L. Expectation bias lead to confirmation bias. As per this assumption he now believed that the lights right of the runway lights were those of runway 28R, which were in fact of the parallel taxiway 'C'. Despite all visual evidence pointing out that the taxiway did not have approach lights nor did it have a PAPI for vertical descent guidance, the pilot aligned the aircraft trajectory with the taxiway parallel to the runway.

The captain had aligned the aircraft with the parallel taxiway "C"; instead, of the

runway 28R despite all visual illuminations associated with an active runway visible. The taxiway dimensions were similar to the runway and there was a centerline light like what a runway has but green in color as against white runway centerline lights. With this assumption and decision, the mental picture matched what they saw in their field of vision ahead of them. Three aircraft were taxiing on the taxiway. These were large passenger jets, and they had their navigation lights steady, flashing beacon on top illuminated. The crew did not sight any of the three aircraft. The preceding aircraft that landed on runway 28R had sighted the runway number written when his aircraft was 300' above the runway. AC759 could not see any of the three large jet aircrafts at 300'. They did see some lights and queried the air traffic controller (ATC) to which the ATC checked runway 28R visually and on the radar scope for any aircraft and replied that the runway was clear.

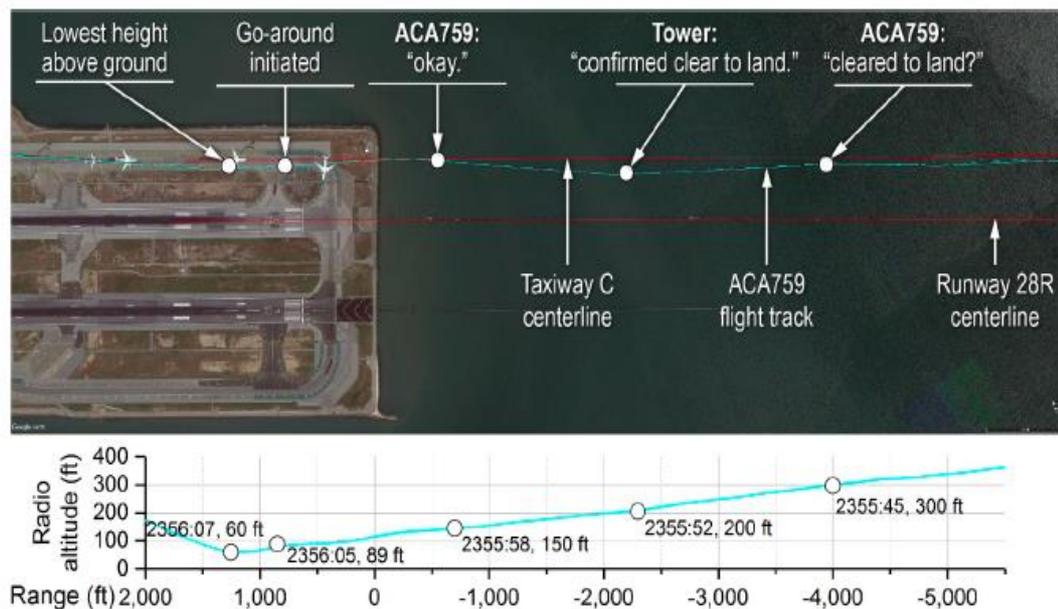


Figure 1 Flight profile of AC759 at KSFO

The reason crew did not sight the three large passenger jets can be attributed to inattentive blindness. A fatigued crew had aligned the aircraft with a taxiway due to expectation and confirmation bias. With limited cognitive capacity and analytical skills due to fatigue and biases, the crew further got a confirmation from the ATC that the runway was

clear. During approach to land, the pilot's attention was focused to keep the aircraft on the lateral and vertical profile i.e., maintain the centerline and aim for the touchdown point. They do not normally expect or look out for aircrafts on the runway since they assume that the ATC is controlling the access to the runway. Inattentional bias sets in when maximum attention is focused on a particular activity, here the crew were focused on the dimly lit taxiway and trying to fly a vertical profile with limited guidance that they were blinded to unexpected objects in their field of vision. It relates to the gorilla in the CT scan experiment, which could not be detected since the radiologists did not expect them to be there and were focused on looking for smaller sized images.

Canadian North B-737 MPE9131

Canadian North B-737 flight number MPE9131 executed a visual approach to land on a taxiway followed by a go around. MPE9131 was preparing for the approach at Fort McMurray, Alberta, CYMM and obtained the weather through the ATIS (Transportation Safety Board of Canada, "Aviation Investigation Report A14W0127", 2015). Visibility was 4 statute mile (sm) and cloud ceiling 4100' for runway 25. The company SOP required an instrument approach when visibility is less than 5sm. The crew decided to carry out a visual approach but set the approach aids for an ILS approach for runway 25 and carried out an approach briefing accordingly. A regional jet, which landed before them asked the ATC for the reason for using runway 25 because they were landing into the sun and the smoke, was making it difficult to see the runway environment. MPE1931 was given step descent, instructed to reduce speed and to fly to a waypoint 12.8nm from the runway before turning back and cleared for ILS approach. When cleared for approach, the aircraft was established on the extended centerline for runway 25, but was higher than the required vertical profile and at the final approach fix by 2.5 dot. The aircraft had leveled out at the platform height.

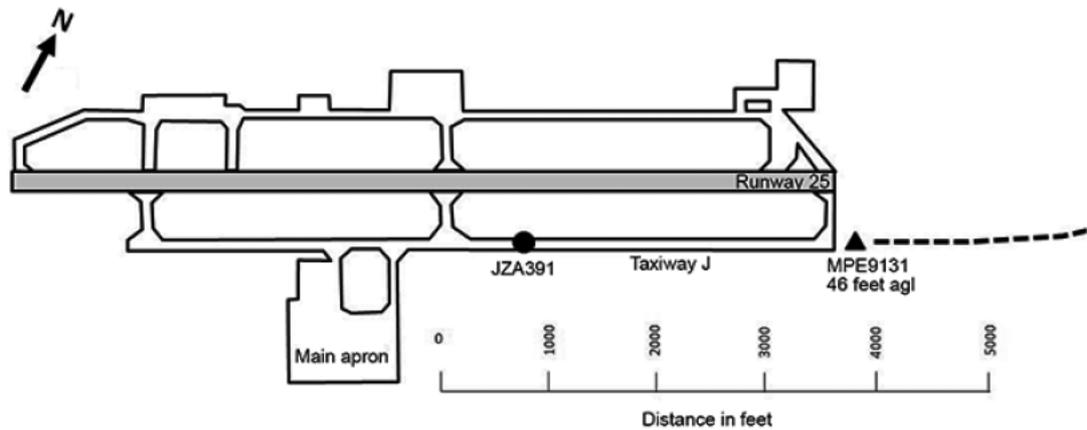


Figure 2 Flight profile of MPE9131 at CYMM

At this time a B737 was cleared to taxi via the parallel taxiway and to hold short of the landing runway 25. MPE9131 leveled out at 3000' (1800 AAL) and at 3.5nm to touchdown the captain disconnected the autopilot and auto thrust followed by a left turn and initiated descent. The pilot aligned the aircraft with the taxiway on the left and descended at a high rate. The glideslope alert was triggered since the aircraft was now below the vertical profile. The glide slope warning stopped when the aircraft was abeam the threshold but over the taxiway. The crew asked the ATC if the runway was clear and the ATC replied that it was. The aircraft descended below 50' aligned with the taxiway before the taxiing aircraft announced over the tower frequency that there was an aircraft lined up with the taxiway.

The airport has two parallel taxiways either side of the runway. While approaching runway 25, taxiway "J" is on the left of the runway and runs parallel from the start of the runway but half the width of the runway. Taxiway "G" is on the right side and is connected with the threshold via a taxiway at 45 degrees angle. The visibility had dropped from 4 sm to 2.5 sm when the approach was commenced but the pilots were unaware of it. The approach lights for runway 25 had not been switched ON. The pilots had completed almost 11hrs of duty and would have been awake for almost 14-16 hrs. They were unaware of the visibility drop and the sun was in their eyes, making it even more difficult to locate the runway. With

approach lights OFF, both the surfaces would have looked similar. The taxiway 'J' had been commissioned 4 months before, and the crew had flown with the new taxiway open but had significantly more experience flying into the airport before opening of the taxiway.

The mental picture that the crew probably had was from the time they operated frequently, before the new taxiway opened. They would have expected a taxiway 'G' and the runway to the left of the taxiway 'G'. The taxiway 'J' is more prominent than 'G' since its positioning is squared to the runway whereas 'G' starts after the threshold linked by a taxiway at an angle of 45 degrees. The crew were carrying out visual approach in poor visibility for a visual approach, coupled by the setting sun and no approach lights. They were aligned with runway 25 but were high on approach and leveled out at 3000'. Since they were expecting the runway to be on the left of the taxiway, and the taxiway 'J' was more prominent than 'G', they would have decided that runway 25 was to the left and turned left at 4nm to touchdown and initiated descent at a high rate. These actions can be attributed to expectation and confirmation bias as explained in the beginning of the paper and seen in the Air Canada incident as well. The aircraft was high on profile at 4 nm to the runway and since the taxiway 'J' to which the crew had turned towards was half the width of the runway, the crew got the perception that they were even higher. They increased rate of descent and at 1000' AAL they were descending at 1200'pm. They disregarded the glide slope alerts when they crossed the glideslope signal and went below profile due to confirmation bias and reached 50' AAL before the beginning of the taxiway or abeam the runway. There was a Boeing 737 taxiing on the taxiway 'J' but the crew did not detect the medium sized commercial jet since their attention was towards getting back on profile for landing. This presence was unexpected, and they did notice something, asked ATC if the runway was clear and the ATC replied clear since there was no aircraft on the runway. Due to expectation and confirmation bias the crew were preoccupied in getting back on profile and aligning with the

landing surface, this was the probable cause of suffering from inattentive blindness.

An experiment was conducted using flight simulator and approaches flown under low visibility with the head up display. There was no need to scan the instruments since all the relevant information was available through the head up display. The result concluded that a few pilots did not see a large commercial jet on the runway and those who saw the aircraft were almost 2.5 times slower in executing a go around maneuver.

Greeneville and Eham Maru

The commander of the nuclear submarine USS Greeneville near Hawaii, ordered a surprise maneuver known as “emergency deep” in which the submarine suddenly dives (NTSB, "Accident Report Detail", 2001). He followed this with an “emergency main ballast tank blow,” in which high pressure air forces water from the main ballasts, causing the submarine to surface as fast as it can. In this maneuver the bow of the submarine leaves the water surface and comes out of the water ("Marine accident brief", 2001). As the Greeneville performed this maneuver, and the bow surfaced, the crew heard a loud noise, and the entire submarine shook. The submarine’s bow had surfaced and torn through the fishing trawler. Within minutes, the trawler sank. Prior to initiating these maneuvers, the crew and the commanding officer had carried out a visual scan of the surroundings through the periscope. They did not see the huge fishing trawler. The crew and the commanding officer never expected the fishing trawler in the area where they were performing the maneuver; therefore, they probably did not see the ship.

Conclusion

The incidents involved crew who were transitioning from instrument to visual approach. They had long flight duty periods and had enough experience flying to the airport. The probable cause for lateral alignment with the taxi way can be attributed to the mismatch between the mental picture based on past experiences, and the visual indications acquired.

Expecting the landing runway to be adjacent to a runway/ taxi way caused the expectation bias to take a decision for alignment to the incorrect landing surface. Due to limited cognitive capability at that stage, and probably due to intuitive decisions, the pilots aligned with the taxiway and ignored all obvious and coherent indications of sighting the runway. This indicates confirmation bias, and the crew continued to fly the approach with vertical assistance from internal or external guidance. The reason for not sighting the aircrafts on the taxiway was probably due to inattention blindness. This has been proven in the gorilla experiment where in one case the life size gorilla was unnoticed by many observers amongst the basketball players and in the other case expert radiologists could not detect a matchbox size gorilla figure in the CT scan film. This was due to increased focus on the primary task and not noticing the unexpected. The pilots would not have expected three aircrafts on the runway; therefore, they were not looking for them, instead they were focused on the landing surface and maintain the vertical profile at night/poor visibility in a black hole approach.

These are human cognitive limitations, which have been highlighted in other means of transport accidents. The crew needs to be aware of their limitations, especially when a task demands too much attention and/or when they are fatigued. Awareness of one's limitation, trusting the instruments and having adequate cross check with the crew and ATC can help to prevent the bias as described in the paper.

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