MMA – KAS – THE PENINSULA FOUNDATION DISCUSSION

The Future of Drones in India: Threats, Operations & National Capabilities

Tuesday, 10 August 2021

Event on Zoom

MMA Facebook

https://www.mmachennai.org/pages/livestream/

YouTube

KONRAD ADENAUER STIFTUNG

THE PENINSULA FOUNDATION

MADRAS MANAGEMENT ASSOCIATION ESTD. 1956

Discussion on the theme

The Future of Drones in India: Threats, Operations & National Capabilities

Speakers

Mr Peter Rimmele

Air Marshal M. Matheswaran AVSM VM PhD (V)

Air Marshal S. Varthaman PVSM AVSM VM VSM (V)

Air Marshal B. Suresh PVSM AVSM VM (V)

Group Capt. M. J. Augustine Vinod (V)

Prof P. M. Soundar Rajan

Mr Abhishek Jain

Mr Sai Pattabiraman

Wg. Cdr. David Devasahayam (V)

Held on **Tuesday, 10 August 2021**

6.00 pm – 8.30 pm

KONRAD ADENAUER STIFTUNG

THE PENINSULA FOUNDATION

MADRAS MANAGEMENT ASSOCIATION ESTD. 1956

Discussion on the theme

The Future of Drones in India: Threats, Operations & National Capabilities

TABLE OF CONTENTS

THE CONTEXT

The concept of drones also called unmanned aerial vehicles (UAV) has been transformational in all senses of innovation and warfare. Presently, drones are undergoing a paradigm shift in their ability to carry out various roles. They can be lethal and act as a decisive factor in the battlefields. The recent Jammu drone attack has opened the Pandora's Box in India's approach towards drones and the future of warfare.

Developing concepts such as swarming and manned-unmanned teaming (MUM-T) will completely alter the traditional means of operations. This demands organisations to capitalise on this technology to have the upper hand on the battlefield.

While India has its own programs for developing advanced drones, there is a lot to catch up on. A combination of evolutionary and revolutionary approaches is required to meet our future threats. Thus, the future of drones in India will play a crucial role in national security.

PROGRAMME OVERVIEW

Madras Management Association (MMA) in partnership with the India Office of the **Konrad-Adenauer-Stiftung** (KAS) and **The Peninsula Foundation** (TPF) organised a Panel Discussion on the theme "**The Future of Drones in India - Threats, Operations & National Capabilities" from 6.00 to 8.30 pm on Tuesday, 10 August 2021** for the benefit of MMA members, management professionals and national level policy makers.

Group Captain R Vijayakumar, VSM (V), Executive Director of MMA initiated the proceedings. **Mr Peter Rimmele**, Resident Representative to India, Konrad-Adenauer-Stiftung delivered the Welcome address and the Introductory remarks.

Air Marshal M Matheswaran, AVSM VM Ph.D (V), Chairman & President, The Peninsula Foundation (TPF), Chennai delivered the Opening Remarks and introduced the panellists.

Air Marshal S Varthaman, PVSM AVSM VM VSM (V), Distinguished Fellow of TPF and former AOC-in-C of Eastern Air Command led the conversation with the below panellists:

- **Air Marshal B Suresh,** PVSM AVSM VM (V), Former AOC-in-C of Western Air Command
- **Group Captain M J Augustine Vinod (V),** Director, AutoMicroUAS
- **Wing Commander David Devasahayam (V),** CYIENT, Hyderabad
- **Prof P M Soundar Rajan**, NIAS, Bangalore and Former Director, DARE, DRDO
- **Mr Sai Pattabiraman**, MD, Zuppa Geo Navigation, Chennai
- **Mr Abhishek Jain**, Vice President - Strategic Partnerships, Zeusnumerix, Pune

This was followed by a Q&A session. **Group Captain R Vijayakumar,** VSM (V) proposed a vote of thanks. A total of 964 participants joined the event live and watched the proceedings.

Mr Peter Rimmele

Mr Peter Rimmele is currently the Resident Representative to India of Konrad-Adenauer-Stiftung.

He has a First Law Degree from Freiburg University, as well as a Second Law Degree from the Ministry of Justice Baden-Württemberg, Germany and a M.A. in Geography.

After working as, a jurist, judge and lecturer, he took public office as Ministerialrat, Head of Division at the State Ministry of the Interior in Saxony, Germany, from November 1991 on until 2000. There he first served in the Police and Security and later in the Local Government Department. On behalf of the German Foreign Ministry he served in East Timor as Registrar General, Head of Civil Registry and Notary Services (UNTAET), and became later the principal Advisor for Governance Reform for GIZ (German International Cooperation) to the Ministry of Administrative Reform and the Anti-Corruption-Commission of the Republic of Indonesia, where he served for 7 years. He then moved to Rwanda, also as Principal Advisor Good Governance/Justice Program. Earlier he was Resident Representative Lebanon, Director of Rule of Law Program Middle East North Africa, Konrad-Adenauer-Stiftung.

Air Marshal M. Matheswaran AVSM VM PhD (V)

Air Marshal M Matheswaran is an Indian Air Force veteran with 39 years of active service. He is the Founder-President of The Peninsula Foundation, a policy research think-tank based in Chennai. He is a fighter pilot, an Experimental Test Pilot, and a Fighter Combat Leader, and has flown over 40 types of aircraft. He is an alumnus of IAF's prestigious institutions, ASTE and TACDE where he was Commandant and Deputy Commandant respectively. The Air Marshal is also a graduate of the Defence Services College, Wellington and the National Defence College, New Delhi. He has held various operational and command appointments that include Senior Air Staff Officer of Eastern Air Command, Assistant Chief of Air Staff (Space), Air Officer Commanding (Maritime Air Operations), Principal Director (Air Staff Acquisition) and Director of Ops at the Strategic Forces Command.

The Air Marshal has a master's in military science, M Phil, and PhD in Defence and Strategic Studies from the University of Madras. He also has a post graduate diploma if financial management. He has done a Senior Fellowship in National and International Security from the Harvard Kennedy School of Governance, Harvard university. He has been advisor to HAL, Cyient and also as President, Aerospace Business in Reliance Defence. He continues to be involved in strategic consultancy in Defence and Aerospace.

The Air Marshal is a recipient of Presidential awards – AVSM (Ati Vishisht Seva medal) and VM (Vayu Sena Medal) – and Commendation by the Chief of Air Staff.

Air Marshal S. Varthaman PVSM AVSM VM VSM (V)

The officer joined the Indian Air Force as a fighter pilot in 1973. He is an alumnus of Sainik School Amaravathinagar, Coimbatore Dist, and the National Defence Academy, Khadakvasla. In his remarkable flying career spread over 39 years, he flew 4000 hours in over 40 different types of aircraft. As the Chief Test Pilot of ASTE Bangalore, he has the distinction of having flown most of the Fighter, Transport and Helicopters currently in Service.

He commanded a MiG 21 Squadron in the Northeast. During the Kargil Conflict in 1999, he coordinated aircraft upgradation that proved instrumental in the success of the air campaign. In 2001 he was in command of an operational airbase on the western border when the country was close to a war with Pakistan after the attack on the Indian Parliament.

His diplomatic assignment includes a 3-year deputation to Paris responsible for defence cooperation with France, Belgium, Netherlands and Luxemburg. Here he made an indelible mark on International Defence Co-operation with European Air Forces. On return to India as Air Vice Marshal, he continued to strengthen ties with Air Forces of the world as the head of Air Force Intelligence. Soon after, he was assigned to take over responsibilities of the Air Force Modernisation Programme and Long-Term Plans at Air Headquarters New Delhi.

On promotion to Air Marshal, he was appointed as the Senior Air Staff Officer responsible for air operations of the strategic Central Air Command. Thereafter he was promoted and appointed Air Officer Commanding in Chief of Eastern Air Command during a crucial period of the Nation's "Look East Policy". This Command spread over 12 States of the Indian Union is critical to National security.

The President of India awarded him the highest military peacetime award of Param Vishist Seva Medal for distinguished service of an exceptional order. In addition, he has also been awarded the Athi Vishist Seva Medal, Vayu Sena Medal and Vishist Seva Medal for distinguished service.

He is a Postgraduate from the Defence Services Staff College, Wellington. Married to Dr Shobha, a specialist in Anaesthesia, the couple has a son and a daughter.

The Air Marshal retired from the IAF in December 2012 and lives in Chennai.

Air Marshal B. Suresh PVSM AVSM VM (V)

Air Marshal Balakrishnan Suresh is an alumnus of Rashtriya Indian Military College and National Defence Academy. He has flown varied fighter aircraft – Mig-21 (all types), MiG-23BN, MiG-27ML and Rafale, SU-30MKI, M-2000, MiG 29 UPG, Jaguar etc. as well as Helicopters in his career spanning nearly 40 years.

He is a Fighter Combat Leader with extensive experience in formulation of tactics and war fighting strategies. He spent a total of eight years in the elite 'Tactics and Air Combat Development Establishment" (TACDE) including as Commandant of the establishment. During his tenure as Commandant, air combat tactics in a BVR environment were formulated. As Director International Exercises, he was responsible for conduct of two international air exercises – 'Cope India 2004' (with USAF after a gap of 40 years) and 'SINDEX 2004' (first bilateral with Republic of Singapore Air Force). IAF did exceptionally well in both exercises.

Important operational, staff and command assignments held by the Air Marshal include command of a MiG-27 squadron during the Kargil conflict, Director, Air Staff Inspection Directorate (DASI), Directing Staff and Commandant TACDE, Air Assistant to Chief of Air Staff, command of one of the largest IAF bases (western front), and Assistant Chief of Air Staff, overseeing entire Air Defence Operations of the country (for nearly 04 years). In this capacity, he headed the Joint Services Study Group (JSSG) for formation of Space Command and was also deeply involved with important indigenous AD programmes.

On promotion to Air Marshal, he was appointed as 'Senior Air Staff Officer' (SASO), WAC, responsible for air operations of the entire Western Air Command. He then became Air Officer Personnel (head of HR of IAF). This was followed by two stints as Air Officer Commanding in Chief of Southern Air Command followed by Western Air Command. As AOC-in-C, SAC, he oversaw the HADR operations during the Kerala floods of 2018. During his tenure as AOC-in-C, WAC, he handled the onslaught of the COVID pandemic while simultaneously dealing with the situation in Ladakh in 2020.

The Air Marshal has a Master's in Defence Studies (Madras University) and another in Global Security from Cranfield University, UK. Commended twice by AOsC-in-C, he is a recipient of Presidential awards - Vayu Sena Medal (VM), Ati Vishisht Seva Medal (AVSM) and Param Vishisht Seva Medal (PVSM).

The Air Marshal superannuated as AOC-in-C WAC on 31 Jul 2020.

Group Capt M. J. Augustine Vinod (V)

Group Captain MJ Augustine Vinod (Retd) was commissioned in the IAF as a fighter pilot. He was posted at HQ EAC as Ops 1B in charge of the Centre for Air Tasking and Strike Planning for Aerial Warfare (CATSPAW). He is a Qualified Flying Instructor and a graduate of DSSC, Wellington.

He has flown over 3000 hours on Mirage 2000, MiG 21 and Kiran aircraft. He has commanded the MiG-21 (T-77) Operational Conversion Unit from 2009 - 2011. He is a recipient of the Vishisht Seva Medal (VSM). He is a drone expert and manages his own Drone Company, AutoMicroUAS.

Prof P. M. Soundar Rajan

Prof PM Soundar Rajan is a Senior Visiting Fellow at The Peninsula Foundation. He obtained his Masters from IISc, Bangalore. He has developed numerous sub-systems for IAF aircraft during his stint in DRDO and DARE.

Currently, he is a Visiting Professor at the NIAS, Bangalore and works on the International Strategic and Security Studies Programme, progressing studies on Cyber Security of Aerospace and Weapon Systems, AI, Next-Generation Aircraft Technologies and Directed Energy Weapons. He is a recipient of the AGNI Award for Excellence in Self Reliance for the year 2003 and the DRDO Performance Excellence Award for the year 2008.

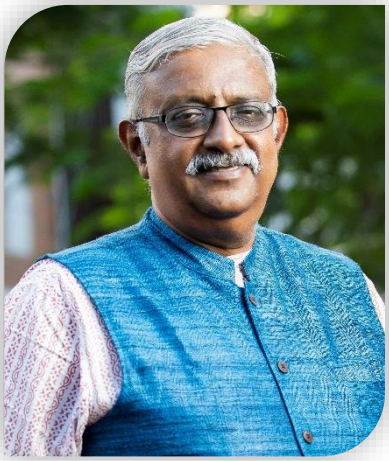
Mr Abhishek Jain

Abhishek holds a master's degree in technology from Indian Institute of Technology (IIT) Bombay with Aerodynamics (CFD) as specialization. Abhishek has been associated with Zeus Numerix Pvt Ltd since the inception of the company. He has been associated in many technical and managerial roles. He is a Centre for Military Airworthiness and Certification (CEMILAC, Govt of India) certified engineer for design of propellers/fans, technical documentation, and aerodynamics. He is product manager for FanZ™ software for the aerodynamics and structural design of large axial fans usually used in power plants, data centres and furnaces for cooling tower applications. He has made more than 15 technical and managerial contributions to reputed conferences and magazines. He has organized more than 25 workshops in CFD and other simulations and delivered lectures in technical and business conferences.

He is VP Strategic Partnerships and has been responsible for acquiring new customers and formalizing partnerships with potential collaborators and customers. He is instrumental in proposing design solutions to customers instead of only analysis and has partnered with fabrication companies for providing these.

He was one of the 10 innovators to meet Defence Secretary USA, Winner of Lockheed Martin Innovation Medal, and various other awards and achievements. He is a member of Aerospace and Defence committees of FICCI and SIDM, governing council member of Capital Goods and Skill Council (CGSC), mentor to start-ups at SINE IIT Bombay. Abhishek is a strong votary of saving time instead of money in business.

Mr Sai Pattabiraman



Right after finishing MBA in 1981, the 'Road Less Travelled' has always had a special appeal to Sai.

Starting out in early 1982, a career of 4 decades in India and abroad has been a career of experiences spanning new products across a range of Industries covering Composites, Manufacturing, Defence, Steel, Consumer Durables and Electronics.

The entrepreneurial path led to a Globally Proprietary Artificial Intelligence centric Embedded Electronic control & communication Systems starting with UAVs ,Driverless Vehicles , Agribotics Vehicle Telematics , Industrial IoT (IIoT) and an ever expanding range of applications for the Technology from Both Indian & MNC Company's.

Sai has nurtured & grown ZUPPA Geo Navigation Technologies Pvt Ltd (ZGNT), Chennai recognized by the Department Of Science & Technology as one among India's most Innovative MSME's (https://tifac.org.in//images/pdf/sidbi_pro.pdf : Beneficiary No. 15) to cater to a range of civilian applications for their Proprietary AI & Geo IoT devices.

Sai has a deep understanding of India's Drone Ecosystem being one of pioneers in the sector. He has been single handedly involved sensitising the country's National Security , Defence and Civil Aviation officials involved in Drone Regulations to Threats posed by the huge number of illegally imported Chinese Drones operating in India, leading to import restrictions and action against the smugglers.

Wg Cdr David Devasahayam (V)

17 years progression in the IAF and three years in the Industry exclusively on Remotely Piloted Aircraft Systems (RPA/S).

- Presently, Operations Director at Cyient Solutions & Systems, Hyderabad.
- Flight Safety Officer & investigator
- Was Command HQs Remotely Piloted Aircraft Officer
- Commanding Officer
- Joint Director Remotely Piloted Aircraft Air HQs Two Flight Commander tenures
- Pioneer in the raising of four out of five Remotely Piloted Aircraft squadrons in the IAF
- Flown 1250h of Searcher Mk-II and Heron (650h on Searcher Mk-II, 600h on the Heron) 120h on SpyLite sUAS and 1500h of manned aircraft flying.

Career Highlights

- Project Lead in carrying out High Altitude sUAS trials in Ladakh, leading to a successful PO in Mar 2018.
- Planned and executed the highest flying achieved by RPAs in a Pan-IAF exercise at Command HQs, integrating RPAs with all types of manned aircraft types.
- Achieved the highest Heron & Searcher Mk-II RPAs Sensor flying done by any RPA unit in the IAF for the financial year 2011-12, Led development of a sensor gathering, IMINT and SIGINT intelligence interpretation and analysis laboratory, Conducted acceptance tests for equipment received including the first ATOL flying for the IAF, whilst carrying out Command tenure at a frontline RPA unit.
- Integrated RPAs to heighten and augment ISR capability along-with Delhi Police and other Intelligence agencies towards Common-Wealth Games Delhi - 2010.
- Conceptualised and started up two major Remotely Piloted Aircraft acquisitions worth $1300m, cleared for procurement for the IAF with the MoD, Govt of India.
- Team lead for Anti-Naxal Ops in Chattisgarh, Central India.
- Pioneer, starting up four out of the five IAF Remotely Piloted Aircraft Squadrons

"The Future of Drones in India: Threats, Operations & National Capabilities"

KEY STATEMENTS

•As Albert Einstein said, "The world will not be destroyed by those who do evil, but by those who watch them without doing anything." - **Mr Peter Rimmele,** KAS

• Balancing the need for development of drone technology against the need for security in the context of threats is going to be a challenge. - **Air Marshal M Matheswaran AVSM VM PhD (V)**

• Aviation changed the concept of war ever since Wright Brothers took to the sky in 1903. - **Air Marshal S Varthaman PVSM AVSM VM VSM (V)**

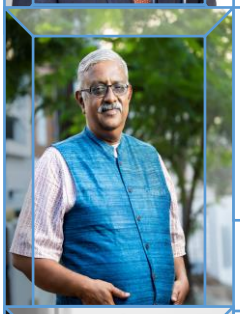
• Non-state actors attacked Russian bases in Syria. What is important to note is that the Russians were able to neutralise all the attacks. - **Air Marshal B Suresh PVSM AVSM VM (V)**

• Defensive system against drones is a very costly affair. We need to retaliate any drone attack with a much powerful drone attack. - **Gp Capt M J Augustine Vinod (V)**

KEY STATEMENTS

- The avionics that we have in our civil and fighter aircraft is very robust while there are many limitations in the current generation of drones. - **Prof P M Soundar Rajan**

- We have to now concentrate on the base technologies rather than being carried away with the glamour of swarm or misssile carrying drones- **Mr Abhishek Jain**



- The 2014 notification banning the use of drones set our national capabilities back by 5 years, if not more.- **Mr Sai Pattabiraman**

- Unless we make things friendly for people to fly drones, we will not be able to make much progress. The regulations now announced by the Government are very good.- **Wing Commander David Devasahayam (V)**

KEY TAKEAWAYS

From Mr Peter Rimmele's Introductory Remarks:

- Drones are the present and the future of warfare. Any nation that shuts its eyes to the drone technology, would be unable to compete militarily with nations that are heavily invested in this new technology.
- The recent war between Armenia and Azerbaijan marked the first in modern warfare to be won almost entirely by the strength of drones.
- Armenia, which fought with tanks, artillery and air defence systems, was resoundingly defeated by Azerbaijan, which relied to a great extent on drones, such as the heavy and expensive Turkish-made Bayraktar TB2 and the Israeli-made Kamikaze drones.
- Drone technology is evolving rapidly, carrying wide-ranging consequences – both economic and strategic; benign and not so innocuous.
- Drones exist in small sizes, are easy to conceal, can be deployed quickly and in large numbers and are difficult to track. They are also comparatively cheaper and unlike other advanced weaponry, are not exclusively limited to military superpowers with huge defence budgets.
- Any country, even non-state actors could afford them in large numbers. For instance 20 to 30 quadcopters cost as much as the equipment of a single US soldier, which stands at around 17,000 US Dollars.
- This low cost and easy accessibility poses a danger. Non-state actors such as terrorist groups could use them to carry out terrorist attacks on civilians.

- The development of such defence technologies will be of utmost importance in the future for the safety, security and protection of the civil population and the defence of the territorial sovereignty of nations.
- International, multilateral agreements on the availability of drone parts and regulations concerning their sale are of utmost importance to mitigate such dangers.
- Given that both India's eastern and western neighbours have access to drones and China has even reached US- standards with its CH4 and CH5 drones, as well as the fact that Turkey and Pakistan are moving towards closer alliance, India's investment in such technologies appears mandatory.
- It seems inevitable to equip India's military with the latest drone and anti-drone technologies.
- As the resident representative of the KAS-India office, a foundation that works tirelessly for peace, prosperity and security throughout the world, it is essential to remain realistic about the dangers that both countries could pose to the entire Indo-Pacific region at large and avoid underestimating them.

From Air Marshal M Matheswaran AVSM VM PhD (V)'s Opening Remarks:

- US Air Force carried out a study in 1995 and released the findings in 1996 titled, 'Air Force 2025.'
- This study predicted that other nations could catch up with the military might of the US by using air power.
- The study also covered in detail the future threats from air and about drones. Their predictions have come true.
- It also highlighted the need for Global Information System and integration and networking of all drones from a bumblebee drone to the largest drone and generation of 24 x 7 information flow.
- The Azerbaijan-Armenia war has indicated what the smaller drones can do.
- Smaller drones and the ability to bring in highly evolved explosives are changing the landscape of war. They help in levelling the playing field for non-state actors against governments and established military.
- Balancing the need for development of drone technology against the need for security in the context of threats is going to be a challenge.

From Air Marshal S Varthaman PVSM AVSM VM VSM (V)'s Initial Remarks:

- Aviation changed the concept of war ever since Wright Brothers took to the skies in 1903.
- Air power played a major role in The World War I and II, the Battle of Britain, the Thousand Bomber Raid on Cologne, the Pearl Harbour attack, Hiroshima-Nagasaki bombing, Vietnam War and Gulf War.
- Mathias Rust, a German aviator, took off from Finland in 1987 and penetrated the Russian air space and landed in Red Square near the Kremlin, sending shock waves across the world.
- Terrorists have also used air power intelligently. The Liberation Tigers of Tamil Eelam (LTTE) used it against Sri Lankan army. They took off from Vanni jungles and bombed Colombo. They created huge panic forcing the Sri Lankan forces to fire 40,000 rounds.
- Al Qaeda used air power to crash planes into the twin towers of World Trade Centre and other targets in the 9/11 attack.
- Offence is the best form of defence. When terrorists strike us, we have the entire national resources to strike back and we showed that in Balakot surgical air strikes.
- When the recent Jammu drone attack happened, the arm-chair strategists commented that Indian army was caught napping. Unfortunately, this is not true. India has drone technology for over twenty five years and we have high capabilities. We are as prepared as an evil thinker.

From Air Marshal B Suresh PVSM AVSM VM (V)'s Speech:

- Non-state actors have been the biggest beneficiaries of drone technology, be it war or peace.
- Different kinds of payloads can be delivered even in micro UAVs; Impact fuse had been used in the Jammu drone attack.
- Drones are used by three categories of people, namely:
    - State actors
    - Non state actors with the implicit backing of states
    - Non state actors acting independently.
- The second group is the most dangerous as they get access to technology.
- Non-state actors attacked Russian bases in Syria. What is important to note is that the Russians were able to neutralise all the attacks. All the drones were made of wood and they carried rockets.
- The Houthi rebels attacked Saudi with 25 drones in two waves and caused heavy damage. This was more of a coordinated attack.
- The targets in most of the global drone attacks were static. Mobile, underground and camouflaged targets are different and difficult to attack.
- Weather, altitude and terrain are the main challenges in deployment of drones.
- Different technologies are now used in drones. Swarm Technology, though not widely used, is seriously considered by our defence team.
- For developing Swarms, absolute and relative position accuracy, advanced data link algorithm, autonomous swarm technology comprising AI and Robotics, targeting sensors, etc. are required.

- For offensive use, drones must have penetration, range and survival capabilities.
- We now have capability to jam and spoof drones, though we do not have this in the required numbers. Of course, there are attendant problems in jamming and spoofing. There can be collateral damages in using it.
- There have been cases across the world of drones used for recreation causing havoc.
- The regulatory frame work for commercial and recreational drones during peace time is not adequate. It needs to be updated and put in place.
- All drones must be registered and geo-fencing made mandatory.

From Group Captain M J Augustine Vinod (V)'s Speech:

- AutoMicrOUS successfully demonstrated to the Indian Air Force a project by launching a swarm of 11 drones with autonomous mode using AI and Machine Learning, at Pokhran range, at 50 degree C, as part of Meher Baba Swarm Drone competition. Each drone picked up and dropped one litre water bottle and a biscuit packet at the target destination.
- Data link forms the backbone of swarm drones.
- There is a wide scope of playing with the images and interpreting the data generated by a drone.
- Detection of drones is essential to counter security threats.
- For air defence, we need to detect, identify, destroy and divert the drones.
- There are three ways in which drones can be detected – using drone radar, intercepting data link between drones (electronic triangulation) and using acoustics. Acoustics show greater promise than the other two.
- There is a distinct advantage in the development of technology in drones - it can be immediately put to use and tested. This is not possible in aircraft.
- India has some of the best drone technologies.
- Defensive system against drones is a very costly affair. We need to retaliate any drone attack with a much powerful drone attack.
- It is high time that India has a drone command. It has to fit in with the overall gambit of theatre command.
- Man-Unmanned Teaming (MUM-T) has been there for more than two decades. Aerial MUM-T will be a reality in a couple of years. A mother aircraft can carry

the drones. These drones can cross the border, fire across and come back. MUM-T will change the fighter pilot environment tremendously.

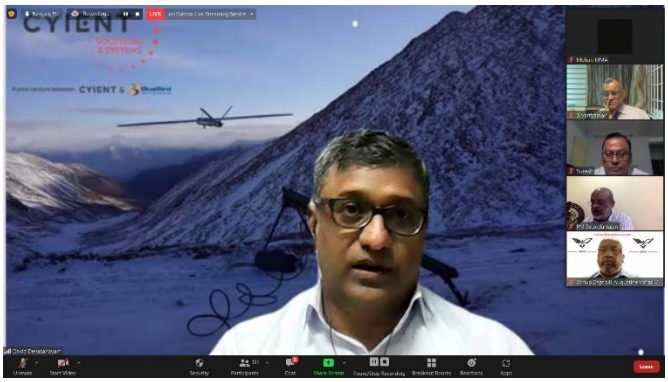
- If we do not get on board with MUM-T, we will be left behind.
- There are lots of opportunities for deployment of drones in civilian use and especially construction industry, according to a Goldman Sachs report.

From Prof P M Soundar Rajan's Speech:

- The avionics that we have in our civil and fighter aircraft is very robust while there are many limitations in drones.
- The current generation of drones grew from Radio controlled (RC) toys and there is a need for robust design.
- During our work in DRDO using Chakor drones, we realised the importance of electromagnetic shielding for drones. The communication, navigation and surveillance aspects of drones need greater focus.
- The communication in drones is data linked and very easily jammable. 'Mesmer' is an example of a product that was first introduced to bring down drones by cracking the communication link and radio protocol.
- Having a robust communication system is expensive and civil drones may not be able to afford that cost.
- For the current drones, internet will be the core of operation. Even FAA (Federal Aviation Administration) guidelines prescribe operation over internet.
- Drones can easily drift and are updated with GPS. But GPS is highly vulnerable. IRNSS (Indian Regional Navigation Satellite System) recommended by Indian regulations is also equally vulnerable, because the satellite that is used is 26,000 kilometres away and do not have much power.
- **Vision based navigation** with a simple camera is one of the promising developments. For this, the weather should be good. If not, we can use radars mounted on cars, similar to the ones used for self-driving cars.
- **The flight control algorithm** / software for drones is very complicated. However, the knowledge in the public domain from use of civil drones has provided useful inputs in the form of drone codes to develop the software.

- Certification of dual use drones is recommended.
- Use of AI requires powerful processors that will consume a lot of power. Therefore, in extremely small drones which are part of swarm drones, we should think twice before using AI.

From Wing Commander David Devasahayam (V)'s Speech:



- There is a need for having the **right kind of manpower** to design, operate and maintain drones. They must be familiar with the technology, knowledge of operating systems, and understanding of the air situation both from a military and civil perspective. This is an area that merits consideration.
- The manpower must be trained well. We must invest in our human capital.
- The small cameras available today are able to generate high resolution picture quality. So miniaturisation and improvement in the payload quality need to be looked at.
- Meteorology is another focus area especially when we operate in high terrain areas. In places like Leh, Ladakh and upper regions of Arunachal Pradesh and Sikkim, this plays a crucial role.
- The atmosphere in the mountains is totally different. When we operate the UAVs in mountainous regions, the challenges are very different. The knowledge base in terms of meteorology should be of a very high order.
- In cold conditions, battery is an issue.
- Unless we make things friendly for people to fly drones, we will not be able to make much progress. Drone regulations must be made by the operators and with the help of air force personnel, drawing on their experience. The drone regulation which the present civil aviation minister has announced is a welcome step.

From Mr Sai Pattabiraman's Speech:

- On 7 October 2014, notification was issued banning the use of civilian drones. This was a dampener in developing national capabilities in drones and set us back by at least five years.
- This led to proliferation of illegal smuggling of Chinese drones and it is estimated that there were six lakh illegal drones. It helped the Chinese to build their capabilities.
- Though the regulation was removed in August 2018, there are still grey areas.
- Many developments in drone can be mapped to the automobile sector.
- The cost of a motor bike and a civilian drone is fairly similar – about 1350 to 2000 USD. There are also similarities between the two in ownership and distribution.
- The DGCA regulation on drones and the Make-in-India campaign are happening at the same time. This is a very positive development for the evolution of drones in India.
- GPS tracker for drones based on GSM technology is in progress. This can be connected to any digital or localised dashboard application.
- Miniature cameras and sensors are also being developed, based on the technology used in mobile phones and computing.
- The coming together of the application of drones for both defence and civilian areas is a good opportunity.
- India can become a global dominator in drones as we have a huge captive market for drones.
- Certification of drones is recommended for military use but it is not advisable for civilian drones as the customers will not be ready to pay for its cost and will lead to a clandestine market.
- The future of drone industry in the country is bright.

From Abhishek Jain's Speech:

- India's biggest threats are ad-hoc developments rather than solid research, laziness, obsolescence and lack of vision.
- That drones can transport weapons, drugs, IEDs and be used for surveilance are other threats.
- Drones are an excellent option for India's enemies because they are difficult to detect and shoot down, cost-effective, provide faster logistics, can cause higher terror and grab media attention. The cost of humans getting caught is far higher than drones getting caught.
- India needs to focus on indigenous autopilots and firmware, minitiaturised motors, battery development and optimisation and propeller manufacturing with carbon composites.
- Swarming drones are latest technology and should not be made mandatory everywhere.
- Kamikaze loitering munitions should be developed ahead of armed drones.
- India's capabilities are scattered and there is no long term vision to connect those capabilities.
- On the positive side, India has lot of enthusiastic manpower and there are schemes available to fund this manpower.

EXTRACT OF THE DISCUSSIONS

Introductory Remarks

Mr Peter Rimmele, Resident Representative to India of Konrad-Adenauer-Stiftung (KAS)

Mr Peter Rimmele delivered the Welcome address and the Introductory remarks. He said that any nation that shuts its eyes like the proverbial ostrich to this new technology, would undoubtedly find itself unable to compete militarily with nations that are heavily invested in this technology. He related it to the recently concluded war between Armenia and Azerbaijan, marking the first in modern warfare, to be won almost entirely by the strength of drones. Armenia which fought with conventional systems was resoundingly defeated by Azerbaijan, which relied to a great extent on drones.

"The low cost and easy accessibility of drones pose a disquieting danger, as they could fall into the wrong hands of non-state actors such as terrorist groups," Mr Peter Rimmele cautioned and stressed the need for development of defence technologies for the safety, security and protection of the civil population and the nations. He also advocated international, multilateral agreements on the availability of drone parts, and regulations concerning their sale to mitigate such dangers.

He pointed out that given that both India's eastern and western neighbours have access to drones and China has even reached US- standards with its CH4 and CH5 drones, as well as the fact that Turkey and Pakistan are moving

towards closer alliance, India's investment in such technologies appears mandatory.

He added that as the Resident Representative of the KAS-India office, a foundation that works tirelessly for peace, prosperity and security throughout the world, it is essential to remain realistic about the dangers that these countries could pose to the entire Indo-Pacific region at large and avoid underestimating them.

Opening Remarks

Air Marshal M Matheswaran AVSM VM PhD (V), Chairman & President, The Peninsula Foundation (TPF), Chennai

Air Marshal M Matheswaran (V) delivered the Opening Remarks and introduced the panellists. He spoke about a study done by US Air Force in 1995 and released in 1996 titled, 'Air Force 2025.'

This study predicted that other nations could catch up with the military strength of the US using air power. The study also covered in detail the future threats from air and about drones. It highlighted the need for Global Information System and integration of all drones through a dedicated network and generation of 24 x 7 information flow.

Panel Discussion by the Distinguished Panellists

Air Marshal S Varthaman PVSM AVSM VM VSM (V), Distinguished Fellow of TPF and former AOC-in-C of Eastern Air Command

Air Marshal S Varthaman (V) traced the history of the usage of air power ever since Wright Brothers took to the sky in 1903 and spoke of its deployment from the World War I to the Gulf War, its use by terrorists like the Liberation Tigers of Tamil Eelam (LTTE) against Sri Lankan army and Al Qaeda's crashing of planes into the twin towers of World Trade Centre and other targets in the 9/11 attack.

He did not agree with the contention that when the drone attack happened in Jammu, India was caught napping. He said that India is as prepared as any civil thinker can think of and that we have offensive capabilities. He opined that offence is the best form of defence.

He led the conversation with the panellists and moderated the discussions, chipping in with his expert views and comments.

Air Marshal B Suresh PVSM AVSM VM (V), Former AOC-in-C of Western Air Command

Air Marshal B Suresh spoke about India's operational preparedness and the global aspects. He pointed out that non-state actors have been the biggest beneficiaries of drone technology. Different kinds of payloads can be delivered even in micro UAVs, he said and added that impact fuse had been used in the Jammu drone attack. He pointed that drones are used by three categories of people:

a) State actors
b) Non state actors with the implicit backing of states
c) Non state actors acting independently.

According to him, the second group is the most dangerous as they get access to technology. Listing out various global drone attacks, he pointed out that in most of the attacks, the targets were static. Mobile, underground and camouflaged targets are different and difficult to attack, he said.

He listed out weather, altitude and terrain as the challenges in deployment of drones. He discussed the different technologies now used in drones. Swarm Technology, though not widely used, is seriously considered our defence team, he said and added that for offensive use, drones must have penetration, range and survival capabilities.

There have been cases across the world of drones used for recreation causing havoc. The regulatory frame work for commercial and recreational drones during peace time is not adequate. It needs to be updated and put in place, he remarked and said that all drones must be registered and geo-fencing made mandatory.

Group Captain M J Augustine Vinod (V), Director, AutoMicroUAS

Group Captain M J Augustine Vinod (V), Director, AutoMicrOUS described a successful demo project carried out by his firm for the Indian Air Force, by launching a swarm of 11 drones with autonomous mode using AI and Machine Learning, at Pokhran range, at 50 degree C, as part of Meher Baba Swarm Drone competition. Data link forms the backbone of swarm drones, he explained and said that there is a wide scope of playing with the images and interpreting the data generated by a drone.

He dealt with the challenges of detection of drones which is essential to counter security threats and listed three ways in which drones can be detected – using drone radar, intercepting data link between drones (electronic triangulation) and using acoustics. He reckoned that acoustics show greater promise than the other two.

He said that defensive system against drones is a very costly affair. He batted for retaliating any drone attack with a much more powerful drone attack. He also suggested that India must have a drone command and it must fit with the overall theatre command.

He also said that Manned –Unmanned Teaming (MUM-T) will play a big role in fighter pilot environment in the future and that India must get on board MUM-T so that it is not left behind. There are lots of opportunities for deployment of drones in civilian use and especially construction industry, he said and referred to a Goldman Sachs report on the same subject.

Prof P M Soundar Rajan, NIAS, Bangalore. Former Director, DARE, DRDO

Prof P M Soundar Rajan talked about his work on drones during his stint at the DRDO and the importance of electromagnetic shielding. He brought out the limitations in the current generation of drones and stressed the need for a robust design. He covered the communication, navigation and surveillance aspects of drones.

He stated that communication in drones is data linked and very easily jammable. Having a robust communication system is expensive and civil drones may not be able to afford that cost, he said. He added that for the current drones, internet will be the core of operation.

He pointed out that GPS system used to control navigation of drones is highly vulnerable. According to him, vision based navigation is a promising development. He recommended certification of dual use drones.

Wing Commander David Devasahayam (V), Operations Director, Cyient Solutions & Systems, Hyderabad

Wing Commander David Devasahayam (V) highlighted the issue of manpower required to operate drones and their knowledge and skillsets. "They must be familiar with the technology, knowledge of operating systems, and understanding of the air situation both from a military and civil perspective. This is an area that merits consideration," he said.

According to him, miniaturisation and improvement in the payload quality need to be looked into. Meteorology is another focus area especially when we operate in high terrain areas. He pointed out that the knowledge base in terms of meteorology for an operator should be of a very high order.

Commenting on the drone regulation, he remarked that unless we make things friendly for people to fly drones, we will not be able to make much progress. "Drone regulations must be made by the operators and with the help of air force personnel, drawing on their experience," he said and added that the drone regulation which the present civil aviation minister has announced is a welcome step.

Mr Sai Pattabiraman, MD, Zuppa Geo Navigation, Chennai

Mr Sai Pattabiraman talked about the national capability in drone technology and the steps to be taken to achieve dominance in this domain.

According to him, the 2014 notification banning civilian drones was a dampener in developing national capabilities in drones and set us back by at least five years. This led to the proliferation of illegal smuggling of Chinese drones, he lamented. Though the regulation was removed in August 2018, there are still grey areas, he said.

He explained how automobile sector can be used to benchmark drone industry and brought out the similarities between the two in cost, ownership and distribution. He also noted that miniature cameras and sensors for drone are developed based on their application in mobile phones.

Regarding certification of drones, he opined that military application drones need certification but it is not advisable to make it mandatory for civilian drones. It will increase the cost of drones and customers will not be ready to pay for it, which in turn, will lead to development of a clandestine market.

Mr Abhishek Jain, Vice President - Strategic Partnerships, Zeusnumerix, Pune

Mr Abhishek Jain said that the fuselage of the drone is not that important. It can be easily made even from 3D printing but it is the electronics and the source code of the auto pilot that are critical to a drone.

He also explained why drones are an excellent option for enemies of India. He listed out design flaws, ad-hoc and temporary arrangements and lack of solid research, enemy capabilities, laziness, obsolescence and lack of vision as India's key threats. He recommended that sufficient time frame must be given for designing and making drones.

Abhishek stressed that India needs to focus on indigenous autopilots, miniaturised motors, battery development and its optimisation and propeller manufacturing. According to him, swarming drones should not be made mandatory everywhere as they are from latest technology; and Kamikaze loitering munitions should be developed before armed drones.

He listed out India's enthusiastic manpower and availability of schemes to fund the manpower as positive aspects. "We need a national UAV road map and we need to fund it. We cannot miss this bus," he appealed.

Q&A

After the panellists completed their individual presentations, Air Marshal S Varthaman (V) posed a series of questions to the panellists.

Insights from the Q&A Session:

Q: ***We discussed about small and miniature drones. What about the need for making of large drones like the Searcher and Heron which can loiter over an area for 3 to 4 days with an eye that does not blink?***

Prof P M Soundar Rajan: There are two approaches to making drones: the aircraft angle and the other one, the RC (Radio Controlled) toy approach. For large drones, DRDO has been going with the aircraft approach. DRDO may not have been highly successful here, but they have vast expertise. We can even convert unreliable aircrafts into drones using auto pilot, for one way missions.

India can also make large drones like the Searcher with the support of the private enterprises. We have data link and flight control technologies. DRDO lost out to Searchers only because of the sensors. The users found the sensors in Searcher drones more useful than that in the DRDO-developed drones. So we are now focussing on developing in India smart sensors.

Certification of drones has been a main issue as it involves cost. We are now familiar with our requirements and this too can be addressed.

Abhishek Jain: We need to invest in IC engines to power large drones. These engines can also be used in many areas, other than drones.

Air Marshal B Suresh: Even during earlier times, we had large benign drones. But Air Force lost such drones in hostile environments. So for large drones, I advocate one way drones. We have offensive capabilities but we need to develop capability to pinpoint the author of an attack on us.

Q: ***Abhishek Jain talked about the national UAV roadmap and funding. Can you elaborate?***

Abhishek Jain: Motor development has been a problem area. Most of the smaller drones need sophisticated and reliable motors. For defence systems, we require high performance motors. I believe that the brain of a drone has to be indigenously developed.

Sai Pattabiraman: We have very good indigenously developed auto-pilots with our own patented technology. We have used them for UGVs, boats and tractors. I agree that we need to develop motors and batteries for drones in India. There are incentives for making in India, electronics and related products.

Electronics supply chain has today shifted from system level to component level. In future, it will shift from component to raw material level. This is a reason why we are able to get sensors, processors and chips at a fairly low cost today. This will evolve as the industry evolves. But what is important is that there has to be sufficient industry demand to absorb the supply chain. If we build the national capability and the industry, then the rest of the things will fall in place.

Air Marshal Matheswaran: China has 120 satellites dedicated to ISR alone (Intelligence, Surveillance and Reconnaissance). Going into the brain of the drone, the chip is the most important. The battle between US and China is on technology front. China heavily depends on other nations for its semiconductor chips. They have plans to make at least 50% of these in China between 2030 and 2035. India is completely dependent on imported chips and we need to focus on the chips.

Air Marshal Varthaman: Manufacturing chips requires huge investment and rare earth minerals.

Sai Pattabiraman: We need investors. Unfortunately, most Private Equity investors are ready to fund APP based developments that will give quick

returns, in say less than six months. They shy away from investments in manufacturing sector. We developed autopilot in 2015 and got our funding from TIFAC from the Department of Science and Technology. Getting funds for expansion became impossible. We also need large volumes to attract funding.

Air Marshal B Suresh: As a user of drone components, I have an observation. The product support ecosystem in India has been a big issue. It needs to be greatly improved.

VOTE OF THANKS

Group Captain R Vijayakumar VSM (V), Executive Director, MMA

Group Captain R Vijayakumar (V) proposed the vote of thanks. He thanked **Mr Peter Rimmele**, Resident Representative to India of the Konrad-Adenauer-Stiftung for delivering the welcome address and for being a pillar of support to MMA.

He thanked **Air Marshal M Matheswaran** (V) of The Peninsula Foundation for his opening remarks and introducing the panellists. He thanked **Air Marshal S Varthaman** (V) for moderating the panel discussion and the Q&A session with his rich experience in the armed forces and contributing with his expert views.

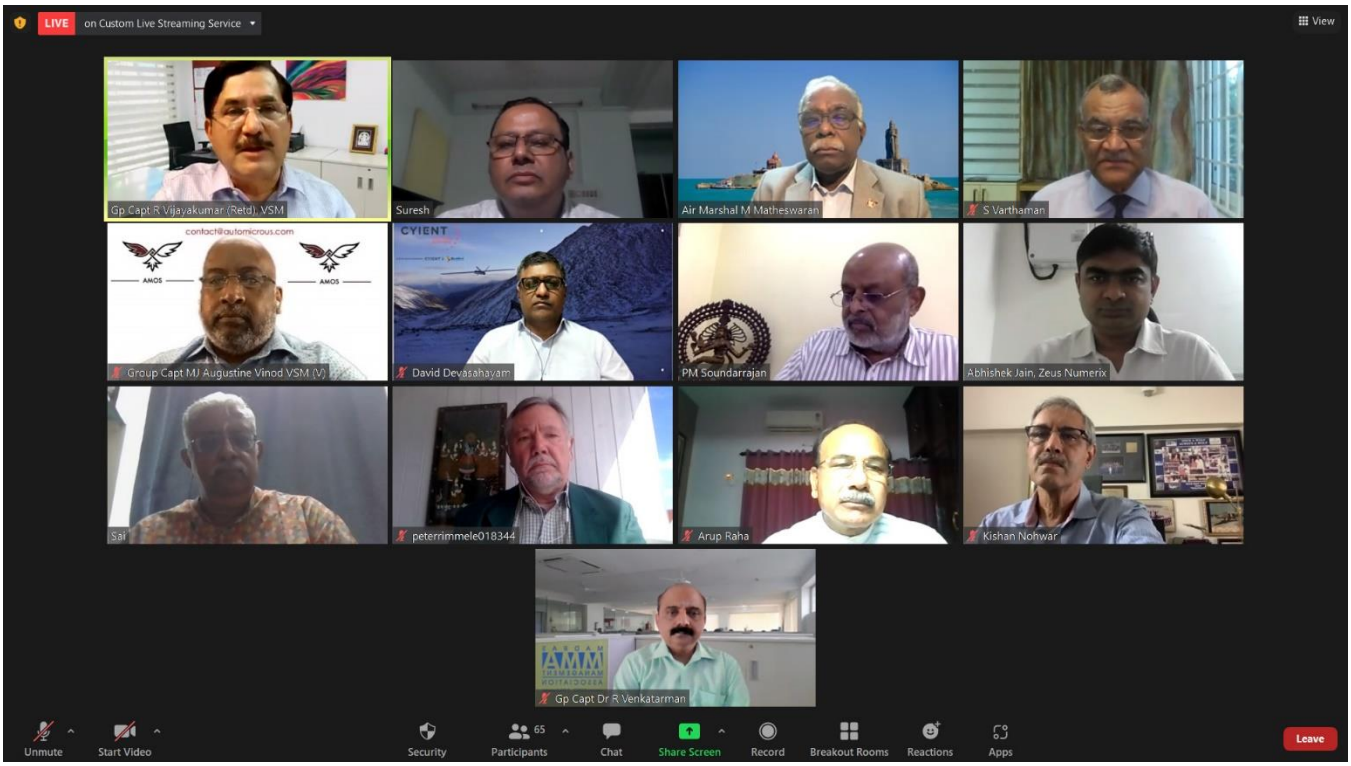
He also thanked all the panellists **Air Marshal B Suresh (V), Captain M J Augustine Vinod (V), Wing Commander David Devasahayam (V), Prof P M Soundar Rajan, Mr Sai Pattabiraman and M**r Abhishek Jain for sharing their experience in the field of drones.

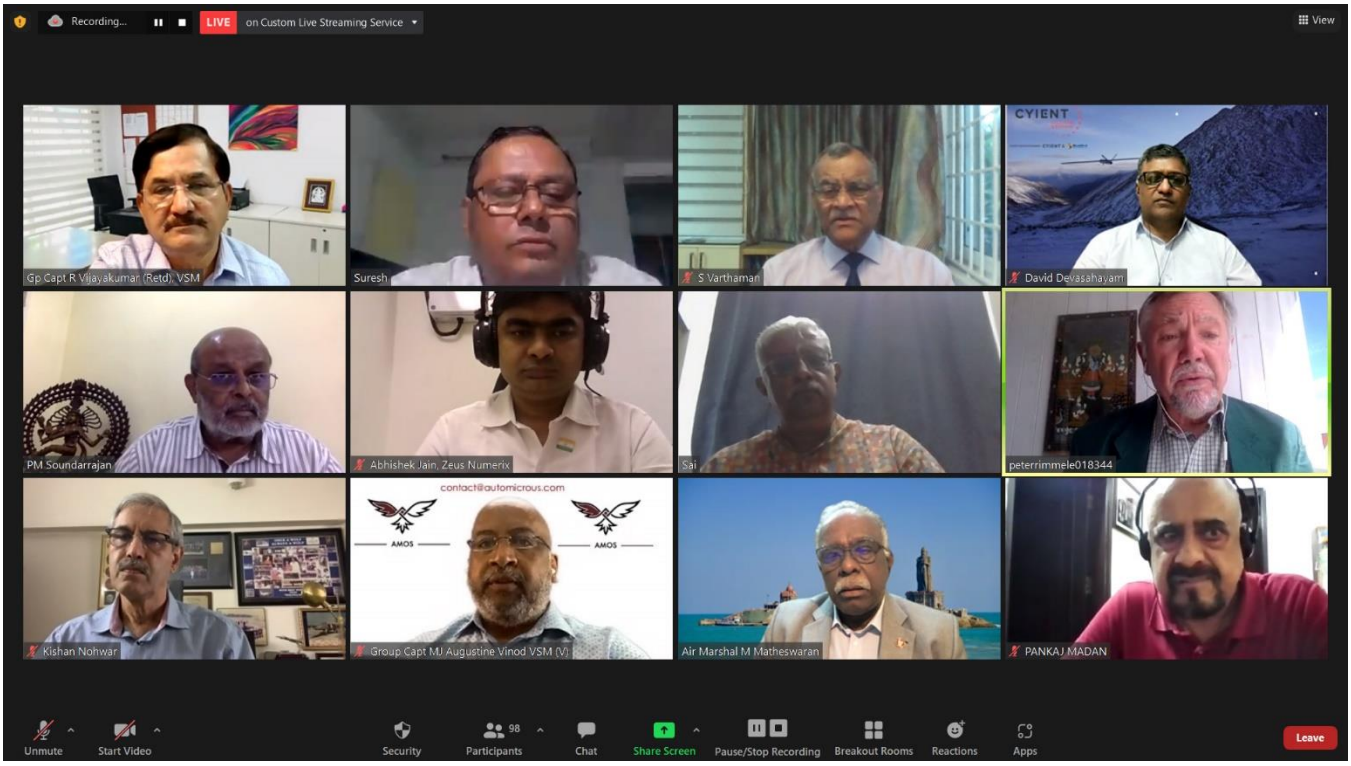
He thanked **Mr Pankaj Madan** of KAS, India office for his support in organising the webinar. He thanked the special invitees and all the online participants.

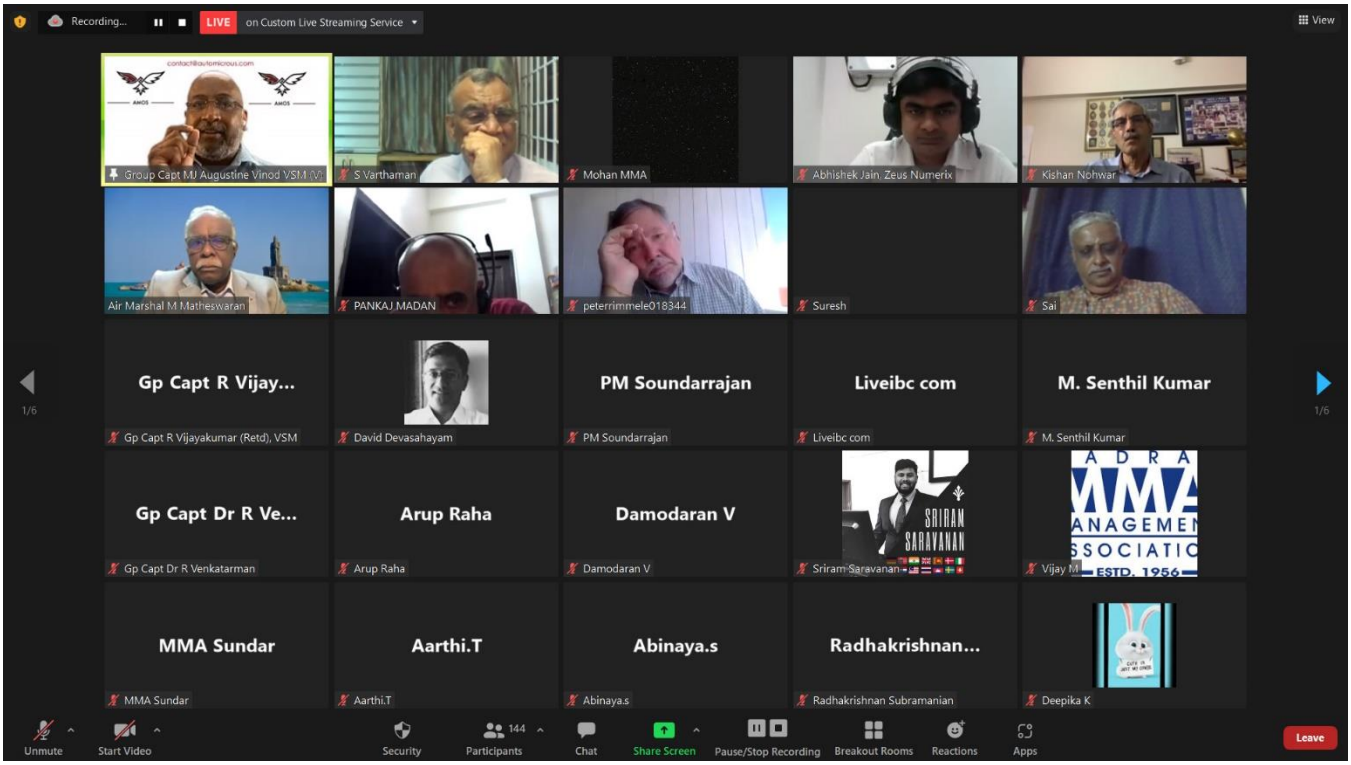
Group Captain R Vijayakumar (V) presented an e-memento to the panellists. On behalf of the panellists, MMA would distribute 1000 N95 face masks free of cost to the local community and educate them on Covid appropriate behaviour.

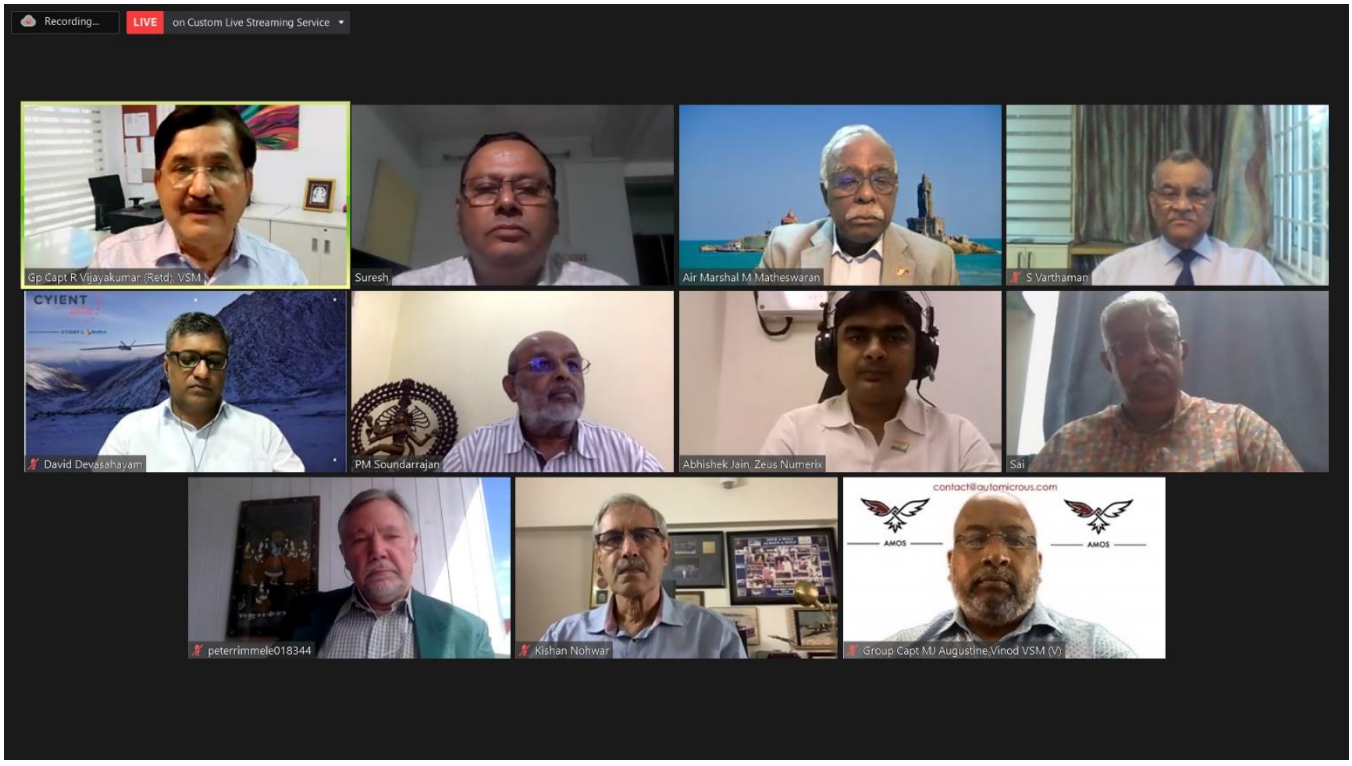
PHOTOS

Photographs taken during the Discussion on the theme "The Future of Drones in India: Threats, Operations & National Capabilities"






Recording...
LIVE
on Custom Live Streaming Service
View
Group Capt MJ Augustine Vinod VSM (V)
S Varthaman
Mohan MMA
Abhishek Jain, Zeus Numerix
Kishan Nohwar
Air Marshal M Matheswaran
PANKAJ MADAN
peterrimmele018344
Suresh
Sai
Gp Capt R Vijay...
Gp Capt R Vijayakumar (Retd), VSM
David Devasahayam
PM Soundarrajan
Liveibc com
M. Senthil Kumar
Gp Capt Dr R Ve...
Gp Capt Dr R Venkatarman
Arup Raha
Damodaran V
Sriram Saravanan
Vijay M
MMA Sundar
Aarthi.T
Abinaya.s
Radhakrishnan...
Radhakrishnan Subramanian
Deepika K
1/6
Unmute
Start Video
Security
Participants
144
Chat
Share Screen
Pause/Stop Recording
Breakout Rooms
Reactions
Apps
Leave


Recording...
LIVE
on Custom Live Streaming Service
Gp Capt R Vijayakumar (Retd), VSM
Suresh
Air Marshal M Matheswaran
S Varthaman
David Devasahayam
PM Soundarrajan
Abhishek Jain, Zeus Numerix
Sai
peterrimmele018344
Kishan Nohwar
contact@automicrous.com
Group Capt MJ Augustine Vinod VSM (V)

LINKS FOR THE RECORDING

The Future of Drones in India: Threats, Operations & National Capabilities

We are pleased to share that the recording of the event is available for viewing through the links indicated below:

Website:

www.liveibc.com/mma/

YouTube:

https://youtu.be/RFKv8xDiRt8

Facebook:

https://www.facebook.com/mmachennai/videos/417003501977660 8/

The response to the event was excellent and a larger number of viewers logged in live through Zoom, MMA Live webinar, YouTube and Facebook.

Total Number of Participants:

Zoom: 145

YouTube: 5409

Facebook: 45

MMA Webinar: 612

Total number of participants at the event – 6211

THE PARTNERS

About Madras Management Association (MMA)

Madras Management Association (MMA) was established in 1956 with the prime objective of promoting management education, training and development activities in this part of the country. The vision of MMA is "To be the Fountainhead of World class Management Excellence in India".

Over the past six decades, MMA has striven for development and nurturing management expertise, combining Indian ethos with International Management thoughts and practices. MMA has contributed immensely to the enhancement of management capability in this part of the country, and in particular Tamil Nadu and Puducherry. MMA has over 7000 corporate houses, industries, professionals, academics and executives on its rolls as members. MMA annually organizes about 725 executive development activities, including seminars for top management with a total participation of fifty nine thousand executives and entrepreneurs.

MMA is the largest affiliate association of All India Management Association (AIMA) in the country and has been adjudged as the Best Management Association in India by AIMA for ten times in a row including the "National Excellence Award" for the year 2017-18.

The activities of MMA are planned to achieve managerial excellence in the functioning of industries and professional managers in Tamil Nadu and Puducherry. In this direction, MMA chapters have been established at various towns in Tamil Nadu mainly to cater to the needs of SMEs. Nine such MMA Local Chapters at Ambur, Attur, Erode, Hosur, Namakkal, Salem, Sri City, Trichy and Puducherry are functioning effectively.

Apart from corporate leaders, MMA has, in its Managing Committee, the Vice Chancellors of Madras University & Anna University, the Directors of IIT Madras and IFMR and the Chief Secretary, Government of Tamil Nadu, as members.

OUR VISION

To be the Fountainhead of World Class Management Excellence in India

OUR MISSION

- Synthesise Indian Ethos with international management thought
- Be a reservoir of expertise in management
- Inspire individuals to actualise their potential
- Nurture creativity and originality

About Konrad-Adenauer-Stiftung (KAS)

The Konrad-Adenauer-Stiftung (KAS) is a political foundation. Established in 1955 as “Society for Christian-Democratic Civic Education”, in 1964 the Foundation proudly took on the name of Konrad Adenauer, the first Chancellor of the Federal Republic of Germany.

With 16 regional offices in Germany and over 120 offices abroad, the Konrad Adenauer Foundation is committed to achieving and maintaining peace, freedom and justice through political education. We promote and preserve free democracy, social market economy, and the development and consolidation of the value consensus. We focus on consolidating democracy, the unification of Europe and the strengthening of transatlantic relations, as well as on development cooperation.

The leitmotif of the Konrad Adenauer Foundation "Germany. The next chapter" is supported by a thematic focus. With the three main topics Innovation, Security and Representation and Participation, it is quite clear which topics the Konrad Adenauer Foundation will focus on in the coming years.

We cooperate with governmental institutions, political parties and civil society organizations, building strong partnerships along the way. In particular, we seek to intensify political cooperation in the area of development cooperation on the foundations of our objectives and values. Together with our partners, we make a significant contribution to the creation of a global order that empowers every country to determine its own developmental priorities and destiny in an internationally responsible manner.

The Konrad-Adenauer-Stiftung has organized its program priorities in India into five working areas:

1. Foreign and Security Policy
2. Economic, Climate and Energy Policy
3. Rule of Law
4. Political and Societal Dialogues focussed on multilateralism and Indo-German relations
5. Media and Youth

The India Office of the Konrad Adenauer Foundation takes great pride in its cooperation with Indian partner institutions who implement jointly curated projects and programmes.

About Peninsula Foundation

TPF (The Peninsula Foundation) is an important policy research think-tank based in Chennai, Tamilnadu, India. Think tanks have an important role to play in the social and intellectual development of the country. They are valuable resources for the governments for policy research, analysis, and advice. Think tanks complement the country's educational and research system by contributing through focused academic research and in the development of young scholars. Most think-tanks gravitate around the national capital for obvious reasons of being close to the seat of power. The situation in India is no different, with nearly 98% of the think tanks located in and around Delhi. The idea of a peninsula based think-tank evolved from the need to have a different perspective; regional, maritime, aerospace and Indo-Pacific approach; to complement Delhi's largely continental view, and contribute to development of young scholars in the region.

The idea has been translated into reality as "The Peninsula Foundation" by the founding trustees with a broad-based objective of policy advocacy in governance, international and security affairs. The Peninsula Foundation (TPF) is an independent, non-profit, non-partisan, public policy research think tank, established to promote innovative thinking and stimulate critical debate on issues of governance, international affairs, and economic and technological sovereignty.

Mission of 'The Peninsula Foundation' is to formulate and advocate innovative and robust public policies, and serve as a trusted resource for decision makers in government, business, academia, and civil society on issues of India's sovereignty, security, and prosperity.