The Gl@bal Trade Driver

(An International Forum on Industry and Education)

Explore The Space

(Promoting STEM Education & Space Exploration awareness in Schools across geographies)

Bulletin - May 2022

Indian Space Exploration, Commercial Aviation & Defence Industry

- Growing Opportunities for Collaborations

"The Global Trade Driver" & "Explore The Space" are authorised support partners of Space Tech Expo, USA, May 2022, where more than 200 International Companies in Aerospace & Defence Industry exhibit their products and services.





- Indian Space Exploration, Commercial Aviation & Defence Industry
- Special Feature on Tamil Nadu
- Indo US Business
- Profiles of Aerospace & Defence Companies in India
- STEM Education & Skill Development Workforce for tomorrow

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India became an independent nation on 15th August 1947. Today, it is a country with a population of 121 crores, and a democratic republic.

India has emerged as the fastest-growing major economy in the world and is expected to be one of the top three economic powers in the world over the next 10-15 years, backed by its robust democracy and strong partnerships.



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Indian Space Exploration, Commercial Aviation & Defence Industry

Growing Opportunities for Collaborations

<u>CONTENTS</u>

S1.	Topic	Page No.
1.	Introduction - India Opportunity	4
2.	Tamil Nadu - A Special feature	8
3.	"Why India, Today?"	18
4.	"India is Exciting"	19
5.	PRL	20 - 21
6.	Global Space Leaders	22 - 23
7.	India - Emerging Electronics Hub	24
8.	Industrial Ceramics	25
9.	Privatization of Indian A & D	26 - 27
10.	Space Tech Expo	28 - 29
11.	Indian Heavy Engineering	30 - 31
12.	Indian Commercial Aviation 33	
13.	Supply Chain Management for Space	34
14.	Israel Aerospace 35	
15.	Future of Space Technology &	
	Exploration	36 - 37
16.	STEM Experiment & Space	
	Exploration - Workshops	38 - 39
17.	Trained & Talented Engineers	40 - 41
18.	Investing in USA	43
19.	US Visas	44
20.	"From the Seas to the Stars"	47
21.	Indian Business Cities	48 & 49
22.	Profiles of A & D Companies	50 - 51
23.	Indian MSMEs & Global OEMs	53
24.	Acknowledgment	55

The Gl@bal Trade Driver

(An International Forum on Industry and Education)

Established in 2010, **The Global Trade Driver** (**TGTD**), is a niche facilitator of Businesses connecting Indian Companies within the domestic market and International Markets, particularly USA through Business Delegations, B2B meetings, Strategic Consultancy, Advocacy and other programmes.



Promoting STEM Education & Space Exploration awareness in Schools across geographies

"Explore The Space" is an educational venture and an NGO working to promote awareness on Space Sciences and Technology among Schools and Colleges through seminars, quiz programmes, study tours and research. ETS connects Institutions and Industry through its programmes.

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Disclaimer

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The Global Trade Driver & Explore The Space

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Opportunities Unleashed.... Indian Space Exploration, Commercial Aviation & Defence Industry Growing Opportunities for Collaborations



Honourable Prime Minister of India Mr. Narendra Modi

Prime Minister Narendra Modi, a great supporter for free enterprises and public private partnerships has called upon the private sector to use the technology and resources available with the Indian Space Research Organisation (ISRO) to help make India a vital part of the end-to-end supply chain in space technology.

India is one of the handful countries across the globe with end-to-end capabilities in the space sector and efficiency and affordability are the hallmarks of Indian space technology, something which can set it apart as the world moves from the "Information Age to the Space Age". This efficiency's brand value needs to be strengthened.

The Indian Space Research Organization is the national space agency of India, headquartered in Bengaluru. It operates under the Department of Space (DOS) which is directly overseen by the Prime Minister of India, while Chairman of ISRO acts as executive of DOS as well. ISRO is the primary agency in India to perform tasks related to space based applications, space exploration and development of related technologies.

ISRO built India's first satellite, Aryabhata, which was launched by the Soviet Union on 19 April 1975.In 1980, ISRO launched satellite RS-1 onboard its own SLV-3 making India the sixth country to be capable of undertaking orbital launches. SLV-3 was followed by ASLV which was subsequently succeeded by development of many medium-lift launch vehicles, rocket engines, satellite systems and networks enabling to launch hundreds of domestic and foreign satellites and various deep space missions for space exploration.

ISRO

Goals in near future include expanding satellites fleet, landing a rover on Moon, sending humans into space, development of a semi-cryogenic engine, sending more unscrewed missions to the Moon, Mars, Venus and Sun. Deployment of more space telescopes in orbit to observe cosmic phenomena and outer space beyond the Solar System.



Opportunities Unleashed....

ndia's space-age had its humble beginnings in the 1960s when we first launched a borrowed – surrounding rocket from the Thumba Equatorial Rocket Launching Station in Thiruvananthapuram. Since that day, we have come a long way, wherein the Indian space Sector now contributes significantly to the global space landscape. For much of its history, the Indian space industry was largely a government affair, with the ISRO leading the way for research, development, and production of equipment and supplies. In the 70s we launched our first satellite called Aryabhatta with the help of the Soviets, and by the late 80s and early 90s, India had its own reliable launch capabilities developed with SLV,PSLV, and GSLV launch vehicles.

Given the complex and sensitive nature of the industry with overarching implications in national security, economy, and wellbeing of its citizens, space has always been a heavily regulated sector. Significant progress has been made in the regulatory and policy aspect to promote the private space industry over the past few years. A few of the key policy milestones in the recent past include:

NewSpace India Initiative – Commercial arm of ISRO aimed at production and marketing of spacebased services, including launch services and space-based applications like transponder leasing, remote sensing, and mission support services. NewSpace India will enable better collaboration with start-ups and private sector players without the hassle of government intervention

Spacecom Policy 2020 allows for space companies to leverage the FDI norms to encourage foreign investments in India's private space sector.

IN SPACE— is a nodal agency that acts as a promoter and regulator of all space-related activities. IN-SPACE will work closely with private players to ensure greater collaboration with the private sector, sharing of resources and facilities, fast-track approvals etc.

India's space program stands out as one of the most cost-effective in the world. India has earned worldwide recognition for launching lunar probes, building satellites, ferrying foreign satellites up and has even succeeded in reaching Mars.



India has two operational launch vehicles: Geosynchronous Satellite Launch Vehicle (GSLV) and Polar Satellite Launch Vehicle (PSLV). The number of launches undertaken by Indian Space Research Organisation (ISRO) during the last five years.

Recent Launches

January 17, 2020	: GSAT 30
November 7, 2020	: PSLV-C49/EOS-01
December 17, 2020	: PSLV-C50/CMS-01
February 28, 2021	: PSLV-C51/AMAZONIA1
August 12, 2021	: GSLV-F10/EOS-03
February 14,2022	: PSLV-C52/EOS-04

From 1999 till December 2021, a total of 342 foreign satellites from 34 countries have been successfully launched on board, PSLV on a commercial basis.



Indian Commercial Aviation

The civil aviation industry in India has emerged as one of the fastest growing industries in the country during the last three years. India has become the third largest domestic aviation market in the world and is expected to overtake UK to become the third largest air passenger* market by 2024.

India's passenger* traffic stood at 131.62 million in FY22 (from April to December 2021). Domestic passenger and international passenger traffic declined at a CAGR of -9.02% and -28.64%, respectively, from FY16 to FY21, owing to C9.0OVID-19-related restrictions on flights in FY21 however they are recovering. In FY21, airports in India pegged the domestic passenger traffic to be ~105.2 million, a 61.7% YoY decline, and international passenger traffic to be ~10.1 million, an 84.8% YoY decline, over the fiscal year ended March 31, 2020. In October 2021, the average daily domestic passenger flight departures stood at >5,857, with average daily domestic traffic being >7,00,000 air passengers. Between FY16 and FY21, freight traffic declined at a CAGR of -1.77% from 2.70 million tonnes (MT) to 2.47 MT. Freight traffic on airports in India has the potential to reach 17 MT by Fy40.

Aircraft movement declined at a CAGR of -7.79% from 1.60 million in FY16 to 1.20 million in FY21. From FY16 to FY21, domestic aircraft movement decreased at a CAGR of -6.44% and international aircraft movement declined at a CAGR of -18.52%. India's domestic and international aircraft movements reached 1,062 thousand and 135 thousand, respectively, in FY21.

India has envisaged increasing the number of operational airports to 190-200 by FY40. Further, the rising demand in the sector has pushed the number of airplanes operating in the sector. The number of airplanes is expected to reach 1,100 planes by 2027.



Key investments and developments in India's aviation industry include:

• In February 2022, the Airports Authority of India (AAI) and other airport developers have set a capital outlay target of Rs. 91,000 crore (US\$ 12.08 billion) for the development of the airport industry.

• In October 2021, Tata Sons won the bid to acquire state-run Air India by offering Rs. 18,000 crore (US\$ 2.4 billion) to acquire 100% shares.

• In October 2021, Akasa Air, a start-up airline, received a 'No Objection' certificate from the Ministry of Civil Aviation to launch operations. The start-up plans to commence its operations from mid-2022.

• In September 2021, JetSetGo, a private aviation company, plans to make its flight operations carbon neutral by 2024 through a carbon management programme.

• In August 2021, Indira Gandhi International Airport was declared the best airport in India and Central Asia at Skytrax World Airport Awards.

Indian Defence Industry

The defence industry of India is a strategically important sector in India. India has one of the world's largest military forces with a strength of over 14.4 lakh (1.44 million) active personnel. It has the world's largest volunteer military of over 51 lakh (5.1 million) personnel. The total budget sanctioned for the Indian military for the financial year 2021 is 4.78 lakh crore (US\$63 billion). It has the fourth largest annual defence budget behind USA (US\$732 b) and China (US\$261 b). It is the second largest defence importer behind Saudi Arabia making up 9.2% of global arms import. India has a domestic defence industry of which 80% is government owned. The public sector includes DRDO and its 50 labs, 4 defence shipyards, 12 defence PSUs. India has a new defence procurement, acquisition and manufacturing policy to reduce imports and enhance domestic manufacturing.

India's defence manufacturing sector has been witnessing a CAGR of 3.9% between 2016 and 2020. The Indian government has set the defence production target at US\$ 25.00 billion by 2025 (including US\$ 5 billion from exports by 2025). Defence exports in India were estimated to be at US\$ 1.29 billion in 2019-20. India's defence import value stood at US\$ 463 million for FY20 and is expected to be at US\$ 469.5 million in FY21. Defence exports in the country witnessed strong growth in the last two years. India targets to export military hardware worth US\$5 billion (Rs. 35,000 crore) in the next 5 years. As of 2019, India ranked 19th in the list of top defence exporters in the world by exporting defence products to 42 countries.

Investments: Foreign Direct Investment (FDI) equity inflow in the defence sector for April 2000 -June 2021 stood at US\$

10.15 million (Rs. 61.52 crore) as per data released by the Department for Promotion of Industry and Internal Trade (DPIIT).



In November 2021, Mr. Rajnath Singh, Minister for Defence, inaugurated the first private operationalised defence manufacturing facility in the Uttar Pradesh Defence Industrial Corridor (UPDIC), in Lucknow. The facility operated by Aerolloy Technologies — a wholly owned subsidiary of PTC industries — will manufacture parts for aircraft and helicopter engines, structural parts for aircrafts, drones and UAVs, submarines, ultra-light artillery guns, space launch vehicles and strategy systems.



Defence Research & Development Organisation (DRDO) : DRDO is the R&D wing of Ministry of Defence, Govt of India, with a vision to empower India with cutting-

7

edge defence technologies and a mission to achieve self-reliance in critical defence technologies and systems, while equipping our armed forces with state-of-the-art weapon systems and equipment in accordance with requirements laid down by the three Services. DRDO's pursuit of self-reliance and successful indigenous development and production of strategic systems and platforms such as Agni and Prithvi series of missiles; light combat aircraft, Tejas; multi-barrel rocket launcher, Pinaka; air defence system, Akash; a wide range of radars and electronic warfare systems; etc., have given quantum jump to India's military might, generating effective deterrence and providing crucial leverage. - TGTD/ETS Resource Team





Honourable Minister for Department of Industries, Government of Tamil Nadu **Mr. Thangam Thennarasu**

Welcome to Tamil Nadu, The Land of Opportunities....

Tamil Nadu is the southernmost Indian state, surrounded by Andhra Pradesh on the north, Karnataka and Kerala on the west, Indian Ocean on the south, and Bay of Bengal on the east.

Tamil Nadu is among the most industrialized states in the country. Tamil is the state language ; English is also commonly used for communication and as a medium of education.

Chennai, Coimbatore, Madurai, Thiruchirappalli, Salem, Tirunelveli and Erode are some of the key cities in the state.

The climate ranges from dry sub-humid to semiarid. Major rivers flowing through the state include Palar, Cheyyar, Ponnaiyar, Kaveri, Bhavani, Vaigai and Tamaraparani.

The state has a highly qualified, skilled, disciplined, productivity- oriented and English-speaking human resource pool.

Tamil Nadu produces nearly 4lakh engineering and polytechnic students every year, the highest in the country.

Tamil Nadu ranks first among all states interms of the number of factories and industrial workers. The GSDP at current price of Tamil Nadu grew at a CAGR of 12.20% between 2015-16 and 2020-21.



Total merchandise exports from the state stood at US\$20.49 billion in 2020-21*.

According to the Good Governance Index 2019, Tamil Nadu ranked first interms of governance.

In the last 12 months, 131 MoUs for investment worth ₹69,375 crore were signed. These investments have the potential to create 2,25,802 jobs.

To make TN an ideal destination for investments, the State government has announced plans to create a land bank of 45,000 acres in the next five years. Tamil Nadu has well-developed social, physical and industrial infrastructure and virtual connectivity.

ndia is one of the key Aerospace and Defence (A&D) markets of the world driven by increasing growth of aviation industry, defence spend, military modernization plans, increased exploitation of space for supporting all industrial domains and strong engineering base. However the country, in its past has been dependent on external agencies for its aviation, space and military needs. While agencies like ISRO, DRDO and Indian Academia has been contributing greatly for the current state of growth of these industry, for the country of India's stature to achieve its deserving greatness, there is an immediate need to accelerate its ascent in the Aerospace and Defence Sector. This sector also serves as a seed for development of new technologies which has utility in various other sectors.

India has been the second largest importer of defence equipment in the world contributing to about 9.5 % of the global trade. However it has been a poor performer in the export front contributing to just about 0.2 % of the global trade. A similar situation exists in aviation, where India, despite projected to be the third largest market for aviation in the near future depends on foreign countries for sourcing planes, fuel, after-market products for maintenance, pilots etc. However, a certain degree of self-reliance has been achieved in the subdomain of space as compared to aviation and military. This has resulted in a national vision of enhancing self-reliance in aerospace and Defence domain. Multiple measures have been initiated by the Govt of India towards achieving self-reliance.

Tamil Nadu Defence Industrial Corridor

One of the measures is the creation of two "Aerospace and Defence Industrial Corridors" in the states of Tamil Nadu & Uttar Pradesh. Tamil Nadu Industrial Development Corporation (TIDCO) has been designated as a nodal agency for implementing the Tamil Nadu Defence Industrial Corridor which stretches between five nodes in the state viz. Chennai, Coimbatore, Hosur, Salem, and Tiruchirappalli. The state has a strong industrial base nurtured by public and private industries which will be enhanced as part of the development of the Corridor. The development of the Aerospace and Defence sector is one of the focus areas for the Tamil Nadu government which has promoted the industry assiduously. The Strategy developed by the Government of Tamil Nadu for the development of the industries of this domain encompasses the following.

• Establish Common manufacturing and Testing facilities in collaboration with the private industry for the benefit of MSMEs to undertake jobs and services related to the A & D sector.

• Provide Additional Incentives to Industries investing into the Corridor.

• Support the R&D initiatives of the private industry by way of funding the developmental costs and other costs specific to such activities

• Skill development through introduction of courses specifically catering to the specialized needs of the Aerospace and Defence Industry

• Invite and incentivise anchor A & D units to set up their facilities in Tamil Nadu

Govt of Tamil Nadu has both fiscal and physical interventions to ensure the growth of the Aerospace and defence industries in Tamil Nadu. Fiscal interventions have been in the form of additional incentives to the A & D industries which establish themselves in the State of Tamil Nadu.

> தமிழ்நாடு தொழில் வளர்ச்சி நிறுவனம் TamilNadu Industrial Development Corporation Ltd (A Government of Tamil Nadu Enterprise)



Mr. S. Krishnan, IAS Additional Chief Secretary & Secretary Industries, Government of Tamil Nadu

Physical interventions are in multiple forms, one of them being creation of aerospace and defence parks across the State. The

first one spread over 250 acres is operational at VallamVadagal near Chennai. To assist the industries in their growth, additional physical intervention in form of establishment of Centres of Excellence is being done jointly along with GE Aviation, DassaultSystemes and Siemens. These CoEswould be located in the Advanced Computing and Design Engineering Centre (named as AeroHub) which would be first of its kind facility in the country to would host the engineering and design centres which support the A&D industries.

Taking cognizance of the vitality of the testing infrastructure need to support the high quality need of the A & D domain, Govt of Tamil Nadu is in the process of establishing various testing centres in a public-private partnership mode across the State. Test Centres are being established for Unmanned Aerial Systems, Communication Systems, EMI/EMC. Environmental testing, mechanical and material testing. Govt of Tamil Nadu has also initiated the process of establishing common facilities centres, jointly with the private sector at all the nodes of the Corridor. These would help the industries which operate in the A & D domain to have robust support ecosystem to fuel their growth. The Government of Tamil Nadu was one of the first states in India to issue a dedicated Policy for Aerospace & Defence Industries. To catalyse the A & D industrial base in the state further, it is in the process of tweaking its Aerospace and Defence Industrial Policy to offer higher incentives to investors and focus on R&D to build an end-to-end

ecosystem, encompassing design, engineering and manufacturing in the Aerospace & Defence Sector.

The space research activities were initiated in India during the early 1960's. As a first step, the Department of Atomic Energy, in the year 1962 created INCOSPAR (Indian National Committee for Space Research). The Indian Space Research Organisation (ISRO) was later formed on August 15, 1969 with an objective of developing space technology and its application to cater to the national needs.



Since inception, the Indian space programme has been orchestrated well and with distinct elements such as, satellites for communication and remote sensing, the space transportation system and application programmes. Two major operational systems have been established – the Indian National Satellite (INSAT) for telecommunication, television broadcasting, and meteorological services and the Indian Remote Sensing Satellite (IRS) for monitoring and management of natural resources and Disaster Management Support. ISRO's lunar and interplanetary missions and other projects continue to generate crucial scientific data which are extremely valuable to the scientific community.

The demand for space-based applications has been growing at a scorching pace in India cutting across multiple sectors such as agriculture, transport, urban development and weather department, to name a few. These domains are now keen to exploit the space technology and data to grow their business and develop future strategy.



Mr. Pankaj Kumar Bansal, IAS Principal Secretary / Chairman and Managing Director TIDCO

In 2020, Govt of India permitted private companies to venture into the space industry which was the completely under

the control of ISRO. This was done to allow ISRO to concentrate on scientific space missions instead of being engaged in routine activities like launching weather and communication satellites. The government introduced these policy reforms intending to leverage the private sector to make it one of the most self-reliant, space faring nations.

Business Potential for Space Industry

Space is a booming industry around the world—current estimates predict that the revenue generated by the global space industry could increase to over \$1 trillion annually by 2040. The potential of this has already been leveraged by the ISRO, which has launched over 300 foreign satellites till date aboard its Polar Satellite Launch Vehicle (PSLV) earning valuable foreign exchange for the country. With the entry of many players, the space industry has become a highly competitive venture. The cost of launching satellites has gone down. There is intense competition in developing new technologies.

New ventures are also springing up for space tourism, space travel, nano-satellites and so on. One of the key sub-segment and probably the fastest growing one is the Small Satellite market. The global small satellite market size was valued at USD 3215.9 Million in 2020 and is projected to reach USD 13711.7 Million by 2030 growing at a Compound Annual Growth Rate (CAGR) of 16.4%.

The primary driving factor supporting the growth of the small satellite market during the forecasted

period is an increase in satellite manufacturers' attention on the creation of compact satellites due to the decreased cost and development time.Further, launch programs which provide ride sharing have also resulted in increase in demand for small satellites.



These programs provide more access to space exploration, have the ability to send multiple satellites into higher orbits and reduce launch costs. The time taken to deploy is also decreased as small satellites can easily fit into ride sharing payloads along with other objects.

Small satellites also permit allow a wide range of scientific investigations and technology demonstrations to be carried out in orbit with relative ease. This in turn is expected to further drive the growth of the small satellite market.

Small satellites manufacturing is an inexpensive one and hence this removes barriers to reaching and exploring space, resulting in a spike in these satellites' popularity. Depending on the requirements, a small satellite could be manufactured and launched into orbit at a lesser cost than the traditional MEO/HEO satellite. In addition to the weight and size advantages possessed by small satellites, a significant aspect is the short time to build one, which enables use of latest technologies aboard the satellites.

A growing demand for high-resolution imaging services is also a key driver for the small satellite market. The video and images find applications in forestry, agriculture, urban management, disaster management, meteorology etc.

Small satellites have been used to provide cuttingedge services such as broadband internet, satellite TV, and other services in commercial organizations thanks to satellite manufacturers' intense focus on lowering the cost of small satellites. Small satellites do not require a specialized launch vehicle like regular satellites because they are compact and lightweight, lowering launch costs by up to 40%. Because of the miniaturization of components and software, established private companies and SMEs have begun to invest in small satellites.

Government of India Initiative

Govt of India has taken cognizance of this small satellite market potential and has embarked on establishing its new spaceport specifically for supporting this segment of the space sector. This space port is coming up near the southern tip of the country at a place called Kulasekarapatinam (8.35N, 78.00E).

The proposed launch pad will help to increase the performance of the launch vehicle as the location allows the rockets to go directly southwards, unlike in the current spaceport of Sriharikota where the launch vehicles have to go southeast first, avoid Sri Lanka and take a turn after crossing Sri Lanka.

Kulasekarapattinam's proximity to the seashore, presence on the east coast of the country and near the equator makes it ideal for "straight southward" launches. The rockets launched from herealso be able to carry heavier payloads due to the straight launch allow them to carry heavier payloads. The space journey of India has been powered largely by ISRO which has a huge precense in the vicinity of Tamil Nadu. The spaceport of Shriharikota, Thumba Equatorial Launch Station, the HQ of ISRO are within 50 kms from the borders of Tamil Nadu. The ISRO Propulsion Centre exists at Mahendragiri which is at a distance of about 70 kms from the new space port.

Govt of Tamil Nadu has taken into cognizance the huge demand for the LEO satellite launch market. For example, Starlink, One Web and Amazon have plans to put in place about 2000, 650, 3000 satellites respectively. With more than 5000 satellites in Low earth orbits, there would be a steady demand for launch of replacement satellites.

These needs a number of rocket launches on a regular basis at low cost and high reliability through the year from places which have large number of launch windows. This also needs an efficient supply chain for both upstream and downstream industries to complete the space industry ecosystem.

தமிழ்நாடு தொழில் வளர்ச்சி நிறுவனம் TamilNadu Industrial Development Corporation Ltd (A Government of Tamil Nadu Enterprise)



As part of the development of the Aerospace and Defence Industrial Corridor in Tamil Nadu, it is envisaged to create the required ecosystem for the upstream industries which include research, space manufacturing and ground systems (fundamental and applied research activities, scientific and engineering support activities, material and components supply, manufacturing of space systems, subsystems and equipment, telemetry, tracking and command stations).

The Govt of Tamil Nadu plans to create space industrial park in the vicinity of the proposed spaceport to shorten the supply chain for the upstream activities. It also plans to link this industrial park with the existing ecosystem in the state for manufacture of electronics, mechanical structures, propulsion chemicals etc to support the efficiencies. The Common Test Centres, Common Facilities Centres and the centres of excellence which are being established would provide a supporting base for the linked industries.

The upstream industries would also be provided all required assistance, interventions and incentives to establish themselves in the vicinity of the proposed spaceport. The Govt of Tamil Nadu would also be willing to consider being a coinvestor in the organisaitons which would establish their facilities here. The Govt also takes into cognizance the emergence of Space startup in this domain as development of new technologies in this new domain is likely to come from the space sector starups. A special fund termed as Tamil Nadu Emerging Sector Seed Fund has been created to provide the seed capital for industries in multiple domains which include the Space sector. The Govt of Tamil Nadu would also partner with educational institutions/organisations of repute to offer special skilling which are need for this sector. Space of the Govt of Tamil Nadu to walk in tandem

Space, needless to mention, is the new frontier for the scientific world and for mankind. The country and the state has the technology that is better than what we had in the past, and the national will to explore this new frontier is forever pressing. This technological growth and vision have resulted in the country getting better at guiding or launch vehicles, positioning the payloads. With these new and advanced tools, we can explore the New Frontier like never before. The vision of the Govt of Tamil Nadu to walk in tandem with the organisations which have the required escape velocity to reach the space has put Tamil Nadu on its launch pad to reach for this new frontier.



With the organisations which have the required escape velocity to reach the space has put Tamil Nadu on its launch pad to reach for this new frontier. This journey to places where no man has gone before through interventions and incentives provided by the State of Tamil Nadu is a vital step towards achieving a significant market share of the global space industry in the TN Defence Industrial Corridor.,





TIIC'S PIVOTAL ROLE IN THE DEFENCE SECTOR

TIIC's Unique Selling Proposition (USP) of being a Lending Plus Service Provider is fully cemented and the Brand TIIC is now an established name in the Financial World. TIIC's value proposition is not a mere lender, it is beyond that. It is a Growth Catalyst. It is invested in the long-term success of its valuable customers. TIIC's Vision is "To be the Growth Catalyst for Tamil Nadu's Economy" and Mission is "To position the Brand TIIC's 'Lending Plus Value Proposition' under which TIIC proactively engages with various Stakeholders in the MSME Eco System and offers its clients a boutique of Services comprising Lending, Financial Services, Technical Guidance, Marketing Assistance, Competency Building, Raw Material Sourcing..."



Mr. Hans Raj Verma, IAS., CMD, TIIC

With this Vision and Mission, TIIC's endeavour is to promote the 5 nodes of the Tamil Nadu's Brown field Defence Corridor. TIIC has an MoUs with different organisations to promote defence industry in Tamil Nadu.



LOWER COST OF FUNDS - INTEREST RATE REDUCTION

TIIC has availed Low Cost Funds from Banks by changing the strategy of negotiation with the Banks. All the negotiations from a position of strength by operating with a "Buyers' Market Mindset". With these low-cost borrowings TIIC has reduced its average cost of funds and enhanced its Competitiveness andLiquidity.

TIIC is in the journey of establishing itself as an "Institution of Significance" in the financial landscape of Tamil Nadu and for handsomely contributing to the Hon'ble Chief Minister's Vision of making Tamil Nadu a USD 1 Trillion Economy by 2030 by leveraging on Defence Manufacturing.

TIIC'S PIVOTAL ROLE IN THE DEFENCE SECTOR

TIIC has signed 6 MoUs with the following stake-holders for promoting Defence Sector in Tamil Nadu

Sl No.	Stake-Holder	Date of Signing MOU	Purpose
1.	Confederation of Indian Industries (CII) & Society of Indian Defence Manufacturers (SIDM)	1.11.2021	Through this partnership, in the first phase "Champion MSME Industries" in each of the five Nodes of the Tamil Nadu Defence Corridor at Chennai, Trichy, Coimbatore, Salem and Hosur will be identified. They will be enabled with guidance and support for enhancing their managerial and technical capabilities to meet the demands of the Defence Sector. Note: Based on this, efforts are being taken to reconfigure the Trichy BHEL ancillary units to manufacture Defence Products.
2.	Project Management Associates (PMA) promoted by Dr.Sivathanu Pillai, Distinguished Scientist and Founder CEO & MD of BrahMos Aerospace.	14.03.2022	For imparting the capacity building in Project Management to the officers of TIIC by PMA from April 2022. Note: 1 st training session was conducted from 18 th to 22 nd April 2022 to 40 Officials of TIIC.
3.	National Small Industries Corporation (NSIC)	31.03.2022	For providing financial assistance to MSMEs referred by NSIC on a case-to- case base and on merits of the individual cases. In turn NSIC to provide Raw material assistance to the MSMEs referred by TIIC.
4.	CODISSIA Defence Innovation and Atal Incubation Centre (CDIIC).	31.03.2022	For extending financial support to Startups/Incubatees nurtured by CDIIC.
5.	Defence Acquisition Business Group (DABG) of Bharat Heavy Electricals Limited (BHEL).	31.03.2022	For promoting Defence Manufacturing in Tamil Nadu with BHEL Trichy and ancillary Units as the hub for Armed Explosive Vehicles.

MSMEs in Tamil Nadu

Partners in making the Global Aero space & Defence Industry more Competitive



Mr. G. Santhanam, I.A.S. (Retd,.) Independent Director, Tamil Nadu Industrial Investment Corporation (TIIC)

The *Aatmanirbhar* initiative of the Government of India has paved way for many opportunities for the Indian

MSMEs in the Aerospace and Defence Industry (A&D) in indigenous design, development and manufacturing.

India is fast emerging as a major defence and aerospace market fuelled by the increasing defence spending and a booming commercial aviation market. Aerospace and Defence industries include units involved in designing, testing, developing, manufacturing and servicing of commercial and military aircrafts, missiles, space crafts, defence systems, space exploration systems etc. Global Original Equipment Manufacturers (OEMs) are shifting their bases to Asia, especially India.

The two Defence Industrial Corridors (DICs) established by Government of India, one in Uttar Pradesh and another in Tamil Nadu aim to attract investment of about Rs 10,000 crore in each corridor. Five nodes, namely **Chennai**, **Coimbatore, Hosur, Salem and Tiruchirappalli** have been identified for Tamil Nadu Defence Industrial Corridor. The nodes have been selected based on high potential for creation of end-to-end ecosystem for Aerospace and Defence sector development covering design, engineering and manufacturing.

Micro, Small & Medium Enterprises are an integral part for the successful implementation of both the corridors attracting investments in Aerospace and Defence sector. About 80% of the parts and subassemblies for the domestic defence sector are being manufactured by MSMEs and start-ups. In the Tamil Nadu Defence Corridor, investments have been attracted from Anchor industries, MSMEs, including Foreign Original Equipment Manufacturers (FOEMs) and Start-ups. Mechanical Parts, Precision Engineering, Metal Sheets, MRO, Fabrication Engineering Design Services are some of the areas where MSMES in Tamil Nadu are doing a commendable work. TIIC (Tamil Nadu Industrial Investment Corporation) is a growth catalyst for Tamil Nadu's economy and it has proactively engaged with various stakeholders in the MSME Eco system by signing MOUs and offers its clients a boutique of services comprising of lending, financial services, technical guidance, marketing assistance, competency building, raw material sourcing etc.



Another important opportunity is Research& Development that will find new methods to bridge the gap between design and manufacturing capability. There is also a need to invest in manufacturing strategic materials and electronics items for the A&D sector. Unmanned aircraft as systems are becoming more sophisticated and find application in both civil and defence purposes. India's growing need for UAVs presents tremendous business opportunities to the MSMEs

Considering this, Global majors can collaborate and partner with MSMES in Tamil Nadu to ensure their business goals in the vast and fast-growing Indian Market.



Why India, Today?



Dr. GSK Velu is the Chairman of Tamil Nadu State Council of FICCI, a premier Industry Organisation in India. A successful entrepreneur in the healthcare industry, Dr. Velu is a Champion of Industry and Entrepreneurship.



A ccording to the Global Consulting organisation, Deloitte, India remains an attractive destination for foreign direct investments (FDI) on account of healthy prospects of economic growth and its skilled workforce. India is known for its information technology and business process outsourcing. It also ranks second worldwide in farm output and 12th in the world in terms of nominal factory output. These industries have

pushed the country to be ranked third in the world based on purchasing power parity (PPP)

The country also houses a workforce that is growing faster than any other in the world. The population of India is young. More than 85% of the people are below the age of 55. Of that number, more than 41% are between 25 and 54 years old. The country has a longstanding parliamentary democracy and liberal

economic policies that make it a safer place than many other rising markets.

Aerospace & Defence, Food Processing, Infrastructure, Information Technology, Healthcare and Education are some of the sectors that can be very attractive for any Foreign Company. It is now, "advantage" India and "opportunity " for global organisations!



Key Advantages for your Business in India

• The population of India is expected to rise from 121.1 cr to 152.2 cr during 2011-36 an increase of 25.7% in twenty five years. *(Source: National Commission on Population, Ministry of Health & Family Welfare.)*

- India has the third-largest group of scientists and technicians in the world. (*Source: All India Management Association, The Boston Consulting Group*)
- By 2030, it is estimated that around 42% of India's population would be urbanised from 31% in 2011 (*Source: World Bank*)

India is exciting, Communication is the key for bigger success



Preisdent Elcon Precision Inc., San Jose, USA



Tim Dyer, is the President of the Material Science firm, Elcon Precision in San Jose, USA. Elcon specializes in photochemical machining, metallization of ceramics

and brazed assembly services. With a Bachelors and Masters in Materials Science and Engineering, from University of California, Davis, creating and making products at nexus of energy, fabrication technologies, and materials science is the special feature of the distinguished career of Tim.

1) What are the major technology breakthroughs / advancements that you have seen in your Company/Business in the last 5-10 years.

a) Ion engines in space craft and micro satellites have created opportunities. b) New and advanced non-contact inspection equipment is less costly and has enabled us to improve quality. Systems like optical CMMs and digital X-Ray systems. c) SPC Software has improved and is easier to use, also enabling us to determine risks and process stability. d) Direct imaging systems for photolithography enable us to make small high purity refractory metal (Tungsten, Molybdenum) components for joining and brazing hermetic assemblies.

2) Metals comprise the largest part of Rockets / Launch Vehicles. Is there enough and quick innovation taking place to discover lighter (lesser in weight) and stronger metals.

a) 3-D printing of both high entropy alloys (HEA) and difficult to manufacture composite aluminum alloys will help reduce weight. b) Metal-ceramic composites also offer promise as lightweight materials with better properties >500C. c) Laminar material designs made via layer based additive manufacturing processes also offer higher temperature and light weight performance. 3) If you are to be asked the three most important things / developments that have happened in the Space / Aerospace Industry, in the recent past, what will they be?

Semiconductor industry innovations - High speed, large memory, Lithium ion batteries, and compact computers augment human capabilities to control and manage a space flight vehicle; Development of advanced digital imaging sensor technology for data capture and ion engines for micro satellites and long range space flight.

4) What is your opinion on Indian Market?

The Indian Market is very exciting. It offers lot of opportunities for a company like us and we look forward to working with Indian Customers & Suppliers.

Elcon Precision Seeking Suppliers: Precision Ceramic Components, Metal Forming and Electronic Components with Laser Machining Capabilities

Elcon Precision Seeking Customers: Metalization of Alumina, Aerospace Electronic Components Aerospace Components assemblies Photo Chemically etched parts

"PRL - The Cradle of Indian Space Industry"



Anil Bhardwaj is an eminent Indian astrophysicist and the Director of the Physical Research Laboratory, in Ahmedabad, India. Bhardwaj is a recipient of the prestigious Shanti Swarup Bhatnagar Award and was awarded NRC Senior Research Associateship by the US National Academy of Sciences. He is also the Chairman, INSA - International - Science Council Committee for COSPAR, URSI, SCOSTEP.

he Physical Research Laboratory (PRL) was established in 1947, in Ahmedabad by Dr. Vikram Sarabai, the father of the Indian space program as a center for excellence in the space sector. The importance of space research and a separate space technology center to be established within the Indian territory was realized during the time of independence itself.

PRL is considered the cradle of Indian space research and innovation. The very first rocket launch at Thumba, Kerala on November 21st, 1963 was developed in PRL. The Rocketman Dr. APJ Abdul kalam is one of the pioneers of PRL. U.R Rao who started the satellite program in Banglore was once a faculty professor at PRL. The three different



Director, PRL

In the early 80s, study on plasma physics picked up pace resulting in the establishment of an independent Plasma physics program under the Institute for Plasma Research at Ahmedabad.

The Indian space program began growing as massive entity and so the need to have separate specialized centers grew simultaneously.

> Rocketry program at Thiruvananthapuram, Kerala, UR satellite center at Banglore, Space application center at Ahmedabad which is the base location for sensor development and the like. Bangalore also holds a laboratory for electrooptic systems and free developing optical systems for satellites. The tracking and commanding station is basically taking control of the satellites when it reaches the orbit. The

spectra of the Indian space sector – communication program, satellite program, or the rocketry program, all trace back itself to the mother organization PRL. It has always been the umbrella under which many more concepts got evolved. It evolved not only as a research center but also as a learning center for space science.

Allied physics is one such field where research and learning started off at the same time. Later the whole organization grew into various other fields like radio science, solar physics, nuclear physics, astronomy physics, and atomic molecular physics. planetary missions like Chandrayaan, Mangalyaan, and Chandrayaan 2 were handled through this system.

The centers are distributed in Lucknow, Delhi, Ahmedabad, and Jaipur. The observatory laboratory and an infrared telescope at Mount Abu are present in Rajasthan, Aravalli range. This infrastructure has been installed and running efficiently. Multiple launchpads are being built across the space centers since the announcement of the Human Space Program by the Prime Minister.

"PRL - The Cradle of Indian Space Industry"



The southward extension of the program, near to equator will increase the payload capacity and will make the space satellites fuel-efficient. The strategic placement of the launch pads is an added advantage to the Indian space sector.

Former director of PRL, Jitendra Goswami was the principal scientist for Chandrayan, the first lunar mission (2008), and the first planetary mission in India. The satellite found water on the moon and the presence of magnetosphere, minerals, and rock elements were noted. The tectonic and volcanic activities were also noted by the satellite sensors, which was a huge discovery by the Indian-made satellite.

The world started noticing the efficacy of ISRO. These data made the world realize that the Indian space sector is a pioneer in sustainable, affordable satellite making. The immediate success of Mission Mangalyan (2014) made our country to be the first country in the world to have a successful insertion of an orbiter around the planet Mars in a maiden attempt.

The In-situ resource utilization ISRU is another major program that picked pace after the Mangalyan mission. The ISRU will help us realize the ultimate goal of creating a human habitat on the moon, which is now emphasized by countries across the globe. They are conducting surveillance of the surface morphology, topology, and mineralogy to create a habitat.

The Indo-US space cooperation is a very valuable relationship for both the countries. This bilateral cooperation that started in 1963 is at its zenith. NASA and ISRO work hand in hand in many space projects including Chandrayan1 and 2. The upcoming space exploration projects from discovering parts of Venus and Mars is under discussion between the two countries.

The exploration of planetary bodies is a costly affair and the necessity for bilateral cooperation leads to an expanded resource pool. A multilateral approach with aligned ideologies is the way forward. Due to liberalization in the Indian space sector, the entry of private players into all levels of the industry is now a game-changer.

We need a very large pool of people who will specialise in areas like rockets and subsystems, satellites, instrumentations, payloads, robotics, artificial intelligence, machine learning, material technology & material development, optical sensors and other evolving areas.

The emphasis on R and D by the government of India has started giving out results. The discovery of an exoplanet in 2018, using the Mount Abu telescope, an instrument that was indigenously developed in PRL, is a fine example of PRL's success path.





Global **Space Industry-Leaders** Opinion



Daniel L. Dumbacher **Executive Director** *American Institute of Aeronautics* and Astronautics (AIAA), USA

Building the space economy in low earth orbit is a unifying priority and this is reliant on constancy of purpose, as we move shaping the future of AEROSPACE towards Moon, Mars and beyond.



Technologies like Advanced Manufacturing, Artificial Intelligence, Robotics, Nanotechnology, Cyber security, Data Analytics - will have a lasting and positive impact on the Space Industry.

Future workforce is very important in the (A&D) industry. We need highly skilled workers. This is a significant concern, exacerbated by the global pandemic. Workforce Diversity and fostering inclusion by encouraging women and underrepresented minorities are important. AIAA is encouraged by how many countries are engaging in the space

economy... it's not just a few countries exploring and commercializing space - the democratization of space has begun. Educational Institutions need to focus on Systems engineering, or inter disciplinary engineering, which has become more and more important.

From my experience with school and college students in Florida, engaging in hands-on collaborative project is essential for the overall development of a student. Hands-on collaborative projects are those where the students build something, using their knowledge of science, mathematics, engineering and technology. The students should be from a mixture of various backgrounds. Some of the students should be focused on sciences and some on engineering. In the real world, especially for projects in outer space, science leads the mission but most of the work is done by engineers. Sitting in a class room and getting 90% or 95% does not mean anything if the students cannot apply their knowledge to the real world.

An example of a hands-on collaborative project for college students would be a project where the group is divided into two parts. The project could be say, building a payload to measure the characteristics of the earth's atmosphere. The launch vehicle could be a weather balloon or a small rocket. The engineering students design the rocket etc, whilethe science students come up with the payload idea.





Global Space Industry-Leaders Opinion



Arup Dasgupta Scientist, ISRO (Retd.,)

I think, we have reached an inflexion point and we are going to see a burst of activity both in the upstream and downstream activities. Upstream are satellites and launchers, downstream is satellite applications. In satellite communications applications private industry has been very active in the DTH and Satellite News Gathering



activities. Now with 5G we will see a lot of satellite backhaul usage.

This is because 5G is essentially urban based and to connect different geographically separate urban areas, satellites will be used by the service providers.

In remote sensing and position location private industry is coming up very fast. One area is the design of hardware and computer systems and software, the other is in the applications for management of natural resources as well as the human-built environment.

Harness the potential of space activities to solving global social issues. Space science and technology have great significance in solving global social challenges, such as resources, energy, food crisis, natural disasters and as we have seen over the past months, it can alleviate global medical crisis. We need to rely on continuous technological and scientific advances, and global nations need to work hand in hand so as to bring greater benefits and hope for human kind.

Build a more inclusive space sector, focusing on diversity and equity. Inclusion is not an illusion, but it needs work and commitment. We need to build a space community that feels accessible to everyone, make them



INTERNATIONAL ASTRONAUTICAL FEDERATION feel that they belong, are seen, heard, respected and valued, and that everyone can contribute to the space legacy.



Dr. Christian Feichtinger Executive Director International Astronautical Federation, (IAF), Paris, France

INDIA - EMERGING ELECTRONICS MANUFACTURING HUB





PC: The focus on 'Make in India' in the Indian electronics industry is increasing the opportunities for electronics manufacturing services (EMS) in the country.

Domestic demand for electronic products is galloping every year, predicting that the sector will reach a turnover of US\$ 400 billion by 2020. Indian market backed by the "Make in India" initiative can witness a huge leap of growth in this sector. Governmental policies and modern technological adoptions are yet to bear fruits to establish India as a semiconductor manufacturing hub.

Global companies are trying to shift their Headquarters from China to other SE nations including India, Vietnam, and the likes due to

affordable labor and demographical dynamics of the Indian market.

Samsung has shifted its manufacturing unit from China to Indiawith an investment of US \$650 million. At present, 70% of all display products used in TVs, mobile phones, tablets, and watches are manufactured by Samsung in South Korea, Vietnam, and china. Shifting the unit will change this data. Pegatron to invest US\$140 million to set up its first manufacturing unit in India.Foxconn plans to invest US\$1 billion in India, amid apple's gradual production shift from China.

Amazon announced a partnership to set up the first device manufacturing line in India.Nokia starts production of 5G equipment in India. Nokia was the first to manufacture 5G new radio (NR) in India and is now producing the Nokia Airscale Massive Multiple Input Multiple Output (Mmimo)



S. Narendra Kumar Executive Director, Apex Solutions Ltd, Guntur, Convenor, Electronics & IT Panel CII, Andhra Pradesh

solution, which is already being exported to several countries that are at an advanced stage of 5G deployment.This will lead to hyper-development in the Indian Electronics industry.

Increased dependency on OEMs by the Aerospace and Defense (A&D) sector helps the EMS companies to exploit this surge in demand. The Asia Pacific region is the central focus of such development. India is now a lucrative destination for such EMS providers.

"Tirupati and Visakhapatnam are emerging as Electronics and IT Hubs in Andhra Pradesh"

The Indian government is continuously making efforts to move up in the global supply chain with its attractive incentives and modern policies. But the imminent challenges around the electronics sector with demand and supply issues on components, and availability of raw materials along with the Covid pandemic are pushing down the government efforts. The government report mentions a "five-part strategy" to reach the \$300 billion goals that it has set.

With the relocation of MNCs and governmental incentives, a modern policy from the concerned ministries must be adopted and pushed into implementation to realize this geo-economical shift. The covid pandemic has exacerbated the growth of Indian electronic industry to the zenith.

Advancement in Industrial Ceramics in the World & Importance of Ceramics to Space Missions ..



Dr .L.K. Sharma

CEO-Mahamana Ceramic Development Organization, New Delhi, President, Indian Ceramic Society & Chairman, American Ceramic Society -India Chapter high temperature capability, hardness and electrical properties. Parts are being manufactured by modern shaping methods like injection molding, pressure casting, hot pressing, high pressure extrusion, 3D designing, mirror finishing, machining and robot use

Latest developments and advancements in industrial ceramics are taking place throughout world. Wear resistance and self lubrication Alumina/ Silicon nitride components are being used by automobile industry. Alumina substrates are being used by electronic industries for circuit printings.

Ceramic pistons, ceramic metal composite seals, ceramic bullet proofs, optical fiber for communication, ceramic implants for body parts replacements, reduction of super refractories utilization/ ton of metal cast for ferrous and non ferrous industry, reduction in thermal energy consumption per kgs of white wares production through energy efficient refractory kiln furniture, Wear resistance rollers for wall & floor tiles industry by contributing to reduction in thermal energy consumption.

Ceramic Materials like wear resistance coatings & products are finding use in aerospace like Reentry, radoms, turbine components and in emission control because they are lighter than metals

enabling faster speeds, reduced fuel consumption, larger payloads, and longer times in space for exploration vehicles.

Advanced technical ceramics are frequently being used to replace metals, polymers, and refractory materials in a wide variety of applications due to their notable



in process. Now researchers have used a 3D printer to make customized ceramic parts that have also overcome the Achilles' heel of ceramic objects: their tendency to crack. Scheduler and colleagues at HRL invented a resin formulation that can be 3-D printed into parts of virtually any shape and size.

The printed resin can then be fired, converting it into a high strength with fully dense ceramic. The resulting material can withstand ultrahigh temperatures in excess of 1,700 degrees Celsius (3,092 Fahrenheit) and is 10 times stronger than similar materials. Natural ceramic raw materials are being replaced by synthetic raw materials so that better products are in place. India provides huge scope in the fields of research & production of automobile ceramic components, products for aerospace field, components for electronic & computer industry, Nano ceramic powders, processing machineries and methods.

If super heroes were real, their uniforms would be made of Nextel. Stronger than aluminum, fireproof and able to withstand meteoroids, Nextel is the wonder ceramic fabric that protects Space Shuttles and keeps satellites from getting smashed to pieces. Ceramics are known for their incredible

> strength and superior heat resistance. Ceramic fibers are made by super-heating raw materials like silica until they are molten, and then spinning them into hair-like strands. These strands can then be chopped up and mixed in with other chemicals to make new compounds or woven into useful fibers.

Privatisation of Indian A & D sector is in the right direction



Ajay Sarin

Sector?

A jay Sarin is the CEO, USA of Axiscades, a leading Engineering Services Company offering solutions for Aerospace and Defence (A & D) Industry. He is a spokes person in various forums on Engineering Services and Technology.

What specific value does AXISCADES provide to its clients in the Aerospace and Defence

In the Aerospace sector, AXISCADES offers concept to manufacturing support and certification, making us the preferred choice of engineering partner for OEMs and Tier 1 Suppliers. Over the years we have succeeded in rationalizing their engineering spend, address their capacity constraints, apply tailor made processes and methodologies to minimize risk and enhance quality through a combination of local front offices, offshore engineering centres and strategic partnerships.

In the Defense sector, AXISCADES is recognized as a preferred partner to the global Aerospace, Defence and Homeland Security industry, addressing the strategic needs across air, land and water. we seamlessly integrate into customer's supply chain, provide holistic solutions and add value to their product development process to gain strategic advantage in the competitive business ecosystem.

In a nutshell AXISCADES specific value to our clients are a) deep domain experience from our skilled and scalable talent pool b) our proactive initiatives and a culture of creating cost effective innovation towards Continuous Product Development, c) Seamless high quality delivery owing a matured project and quality management system d) unique and proven hybrid delivery models ensure smooth operations at optimized costs e) as a recognised and experienced offset partner, end to end offset management with minimal risk to the OEMs Thus AXISCADES is the preferred partner to add value to global OEMs by aiding them to strike a balance amongst innovation, time to market, margin pressure and government regulations.

The two Indian Defence Industrial Corridors created in U.P. and Tamil Nadu are attracting lot of attention. How can sizable investments be drawn to them?

India is among the top military spenders and is a major Aerospace and Defence market. Over the last few years, Govt of India identified Defence manufacturing as an area of focus, not only to be self-reliant but also move towards exports of Defence products. Government of India initiated Aatmanirbhar Bharath where "Make in India" came to the fore-front and it saw rapid adoption in the Defence sector with many Indian firms plunging into defence related R&D and production of arms.



These corridors are of important significance because they will have single window approvals and clearances to Defence and Aerospace (D&A) manufacturing, simple procedures, incentives and subsidies and also with a huge skilled talent pool in the country, these corridors will help in attracting big ticket investments.

It will also help in enhancing defence related manufacturing system through development of technologies, further advancing the growth and encourage many private domestic manufacturers and start-ups.

How can more Indo-U.S. collaborations take place in the Aerospace and Defence segment?

India-US ties have grown stronger over the past decade or so especially after inking the Indo-US nuclear deal, it has seen an upward trajectory related to growth in bilateral trade and defence cooperation. India USA defence co-operation in the last decade has witnessed US bagging major defence deals amounting to billions of dollars.

US-India Aviation Cooperation Programme which began in 2007 has successfully completed 15 years. It was established to provide a forum for unified communication between the Government of India and U.S. public and private sector entities in India.

This partnership has enabled various multi-phase Air Traffic Management Training Program, technical workshops on certification of India's satellite navigation system, GAGAN and Air Traffic Flow Management practices.

In the aerospace sector India has been successful in bringing major US aerospace companies such as Boeing, Honeywell, Raytheon, GE etc to establish their engineering centres in India and also given that the Government of India has enhanced FDI limit in Defence Sector up to 74% through Automatic Route for companies seeking new defence industrial license and up to 100% through Government Route which in my opinion presents a huge opportunity for both the countries to enhance further co-operation in aerospace and defence.

This has benefited enormously for some major US companies such as Boeing, Lockheed Martin etc to enter into strategic partnerships and Joint Ventures with Indian companies and manufacturers thereby boosting India US co-operation across Aerospace and defence industries.



Government has introduced the 'Strategic Partnership (SP)' Model, which envisages establishment of long-term strategic partnerships with Indian entities, wherein they would tie up with global Original Equipment Manufacturers (OEMs) in order to seek technology transfers and to set up domestic manufacturing infrastructure and become a part of global supply chain.

The huge modernisation programme that the Indian defence forces are about to undergo in the coming decade which amounts to more than 150Billion USD, provides huge opportunity for major American OEM's to take a piece on the offering, given the huge technical superiority that the American companies bring to the table.

With the government already relaxing FDI limitations, further attention must be given to simplify the defence offset policy, approvals for defence specific tax exemptions, well defined and streamlined processes for seeking and obtaining industrial licenses & approvals that should be time bound.

"Space Tech Expo is all set to grow further into new geographies, with extremely positive projections"



Douglas Emslie, CEO, Tarsus Group

Douglas has been with Tarsus since its launch in 1998; having previously held senior positions at Blenheim Group plc and after its takeover, United Business Media plc. He is a past Chairman and Director of the Association of Event Organisers (AEO), as well as past Chairman of the Events Industry Alliance. He was also the first international board member of the US industry trade body, SISO, where he went on to serve as Chair. Douglas speaks about Space Tech Expo and related matters in this interview with D.V. Venkatagiri, CEO, The Global Trade

Driver.

1) Can you please give us a brief background of the SpaceTech Expo - its beginning.... growth and future plans.

Space Tech Expo USA was launched in 2011, coinciding with the retirement of NASA's space shuttle and the dawn of the new commercial spaceage era. It was designed to enable the supply-chain to meet and engage with both the heritage space and new space OEMs and subsystem manufacturers. In 2015 the European sister edition was launched in Germany, again in line with more activity in commercial space in the region, as well as an appetite for international collaborations, and has quickly grown to become the largest supply-chain trade fair with more exhibiting companies than any other event in the industry globally.

2) How important is Space Tech Expo to Tarsus and how does this Compare with your order Shows in Terms of Business Visitors, Popularity etc.



The Space Tech Expo events became part of the Tarsus Group in late 2019 when we acquired the organising company Smarter Shows. The strength of the Smarter

Shows portfolio made it a very attractive



GLOBAL AEROSPACE SUMMIT

acquisition for us – we could see a clear synergy between Tarsus and Smarter Shows both n terms

of the quality of their events and also the industries they work with as we already had events such as the Dubai Airshow and Global Aero space Summit in our portfolio. In line with other Tarsus events, Space Tech Expo USA and Europe editions are amongst the premier events in their industry calendar, hosting hundreds of exhibiting companies and thousands of professional industry visitors each year, enabling many thousands of worthwhile B2Bmeetings. Space Tech Expo Europe in particular is the fastest

growing exhibition in the space industry.



3. Space Industry Shows

are a kind of relatively new compared to shows of other industries - Automobile or Pharma or Chemical.... how is Space Tech Expo helpful to boost the business of the exhibitors. What about confidently of data, given the sensitivity of the Aerospace and Defence Industry.

Space Tech Expo simply enables companies from start-ups through to small and medium enterprises (SMEs) and also primes to engage and network on a level otherwise not possible in a normal day-to-day business environment. Small companies would otherwise have improbable access to design architects, technical leads and buyers of major companies to demonstrate firsthand and in-persontheir specific capabilities. Large companies have access to a vast array of new as well as proven technologies, products and services and an efficient platform for discussing business opportunities for upcoming space programs and projects .In addition, it goes without saying that data management and security is a top priority for our business and all the events werun.

4) The Covid-19 pandemic had opened a new window of opportunity - Online Tradeshows. With normalcy coming back, and physical shows returning, what will be the future of virtual trade shows...

We heard and saw first-hand throughout the pandemic and as we reopened larger-scale events over the past year how nothing can replace the value of a live event. When the industry was brought to a stand still at the height of the pandemic, online events became a useful alternative for some but as soon as it was safe and practical to do so our customers have wanted to meet in-person again. The opportunity to see products first hand, meet new contacts and write orders on the show floor simply cannot be matched online. Needless to say virtual events will continue to exist, but we see their role as being a complementary element.

5) Given its growing importance and strategic nature, the Aerospace and Defence Industry have lot of sensitive information. As a trade show company how do you handle this to protect the

interests of the exhibitors and visitors.

The most important factor for us are the strong relationships which we have built with our customers and stakeholders, we listen to their views and deliver events that meet their needs; including any specific requirements on their part. In addition, it goes without saying that data management and security is a top priority for our business and all the events we run.

6) We run projects to promote STEM Education and to popularise Space Science Technology among Students across the World. As a leader and trendsetter of the trade show industry, what is your opinion on creating more awareness of Science, Technology, Innovation among Students.

Exhibitions can be a wonderful channel to engage and educate young people, they will shape the future of all the industries that we work with and it's essential to give them opportunities to participate early on. Many of our events have dedicated days or educational sessions especially for students.

7) What kind of plans does Tarsus group have for the India Market in the near future?

India is a hugely important market for the group – both in terms of customers and attendees – as well as our own presence there. We have fantastic participation levels from India at a number of our shows, particularly our Middle Eastern events. We also have an office and small team on the ground in India – they are predominantly focussed on our presence in the labels industry and organise the Labelexpo India as well as providing regional content for our Labels & Labeling magazine.



Indian Heavy Engineering Capabilities -Advantage Global Defence Industry Supply Chain



Smt. V.L.Indira Dutt President - Andhra Chamber of Commerce CMD - The KCP Ltd.,

The KCP Limited is one of the oldest and reputed Heavy engineering unit in India supplies equipment for Indian core engineering sector and for Indian Defence and Space establishments. KCP – Heavy engineering produces equipment from 5 kilograms to 650 Tons in weight.

Supplied 650T Mobile Launch Pad, Launch Pad Platforms, 7.5m Vacuum chamber, Aluminium structures, Rocket motor cases, Satellite propellant tank components to Indian Space research organisation and Supplied Missile canisters, Propellant tanks etc. to Indian Defence establishments for the last four decades.

Indian Heavy engineering industry is self-reliant and Catering to the needs of Indian core industries, Indian Defence and Space establishments through supplying the critical components and equipment. The key drivers of this industry are professional education , world class infrastructure and capability & capacity creation by capital investments and government policy support.



Indian educational system produces large pool of young talent engineers every year in various fields, a core strength of India. Indian heavy industries moulds them into talented, skilled, experienced, innovative source. Indian dominance on IT sector helps to achieve greater heights on Artificial Intelligence, Produces more numbers of start ups. These Start ups evolves the breakthrough technologies and developing new ideas.

Indian Heavy Engineering Industries viz. L&T, Godrej, Mahendra, TATA, WIL, KCP and BEML & PSUs etc. supplies equipment Like Missile Launchers, Canisters, Battle Tanks, Self-propelled Howitzers, Air-defence Systems, Infantry Combat Vehicles, Future-ready Combat Vehicles, Battle Tanks, underwater platforms & Bridges etc..to Indian Defence towards Self - Reliance. This created required infrastructure andraise Indian companies to Global level.

A cited example is - Indian Space Research Organisation developed launch vehicles from core to concept and to launch with vehicle parts through Indian Heavy and Precision industries shows that the aero space quality level



Indian Heavy Engineering Capabilities -Advantage Global Defence Industry Supply Chain



infrastructure creation. The industry not only manufactured the products but also the created strategic equipment to produce parts and created the sustainable supply chain.

With this strength, presently ISRO is planning for Private partnerships for their Launch vehicle programme, Shows that well established Methods/Process and Systems existence throughout the supply chain.

India also carried out more Research and Development activities on Aerospace strategic materials (Viz. alloys of Aluminum, Titanium, super alloys and steels including ultra high strength materials & composites) and developed well established procedures to process these materials to meet the smooth and uninterrupted supply chain. with out any hindrance.

Indian Aerospace and Defence (A&D) manufacturing sector is at an inflection point as the Government of India is expected to spend approximately USD250 billion over the next 10 years on upgradation and modernisation of defence equipment/systems.

This robust growth potential of the industry is attracting global Original Equipment Manufacturers (OEMs) into the A&D sector to setup facilities in India thereby providing



opportunity for participation of Indian companies as suppliers.

India has the third largest armed forces in the world and one among five largest military spenders. India plans to spend billions of dollars on defence acquisitions over the next several years. Make in India and Atma Nirbar Bharat (Self – Reliant India) initiatives of Govt. of India encourages capital investments in Indian Heavy engineering which is moving towards A&D and to tie up with OEM's, leads to Global supply.

In addition the New Defence Procurement policy also allows FDI up to 74% which also encourages Indian companies to tie up with Foreign OEM's. A fivefold increase noticed in Indian aviation industry by 2035 and about 2500 aircraft additions expected. Indian Heavy engineering companies will play a vital role to meet this challenge. Some industries have already entered into Joint ventures with Foreign OEMs.

India's attractiveness in wider supplier base, lowcost manufacturing, persistent focus on infrastructure development, huge pool of skilled workforce, geo political strength, tax policies on exports and increased penchant for enhancing competitiveness suits well for the Global supply chain, defence industry in particular.

SHRI VENKATESWARA HI-TECH MACHINERIES PVT LIMITED (PIONEER IN HEAVY ENGINEERING AROUND 50 YEARS)

- Seeking a tie-up / Joint venture to manufacture updated engineering products.
- Any new engineering product which attracts a good market.
- Support for manufacturing and marketing a product.



Shri Venkateswara Entered the space science Equipments fabrication by 1971 and from there on it is continuously engaged and our unit had successfully executed and commissioned many challenging products for Indian Space Research Organization (ISRO) in their SLV, ASLV, PSLV, GSLV projects. Collapsible mandrels for motor case winding, PSLV-propellant casting mandrels, INSAT-II integration fixtures, INSAT-II Horizontal Transportation & Vertical Transportation containers, GSLV technological transportation container are some of the sophisticated items manufactured by the unit.

Shri Venkateswara is an ISO 9001-2015 Company equipped with Heavy Fabrication, Machining and Handling facilities. The main motto is to deliver quality products on assured delivery schedule with team work. The firm met all expectations of Indian Space Programme.

The industry received many appreciation awards & certificates of merits from Indian Space Research Organization (ISRO) for its continued service with quality moto. And also manufacturing of other machineries and spares for Paper, Sugar, Cement and Process Plants, etc.

RH 560 mandrels and collapsible type fiber glass winding mandrels and moulds to \$3 & \$	S4 for SLV project.
Propellant Casting Mandrels And Transport Container Systems For ASLV and	PSLV
Technological Transport Systems, Throat entry mandrels, Pressure chami	ber
Payload Adopter And Assembly Fixtures, Ignitor Casting Mandrel, Vibration Test Fixture, Ho Fixture, Test Rings, Ignitor Castings Fixtures Etc. For GSLV Project.	rizontal Integration
Various Types Of Satellite Integration Fixtures And Satellite Transport Container Sys Oxidizer Tank, Welding Fixture Of Various Type To Satellite Projects.	tems To Insat
Special Purpose Fixture , Spacecraft Transportation System, Large Manipulator A Transportation Container	nd Vertical
Email : venkateswarahitech@gmail.com	

Indian Commercial Aviation – Exploding with Opportunities



K. Suresh President Hindustan Chamber of Commerce & President& CEO India Cements Capital Ltd Chennai.

he civil aviation industry in India has emerged as one of the fastest growing industries in the country during the last three years. India has become the third largest domestic aviation market in the world and is expected to overtake UK to become the third largest air passenger market by 2024.

Currently, major airlines connect 103 operational airports within the country and many more across the globe. Despite the RCS-Udan scheme, India's aviation industry is largely untapped with huge growth opportunities- Maintenance Repair and Overhaul (MRO). Safety and Security, Navigation and Air Traffic Management Systems Human Resource Development and Helicopters.

The aviation sector is growing fast and will continue to grow. The most recent estimates suggest that demand for air transport will increase

by an average of 4.3% per annum over the next 20 years. The Indian civil aviation industry had witnessed annual growth rates of up to 30 in the years prior to the onslaught of the COVID-19 pandemic. A slew of low-cost airlines compete with the more established operators.



India is expected to overtake China and the United States as the world's third-largest air passenger market in the next ten years, by 2030, according to the International Air Transport Association (IATA).

India's passenger traffic stood at 131.62 million in FY22 (from April to December 2021). Domestic



passenger and international passenger traffic declined at a CAGR of -9.02% and -28.64%, respectively, from FY16

to FY21, owing to COVID-19-related restrictions on flights in FY21 however they are recovering now.



According to the data released by the Department for Promotion of Industry and Internal Trade (DPIIT), FDI inflow in India's air transport sector (including air freight) reached US\$ 3.06 billion between April 2000 and June 2021. The government has allowed 100% FDI under the automatic route in scheduled air transport service,

> regional air transport service and domestic scheduled passenger airline. However, FDI over 49% would require government approval. In January 2022 the renowned Tata group announced the completion of the transaction for the purchase of Air India, from the Government of India. That was a historic

occasion for Indian Business and is expected to generate a lot of renewed activities driven by private enterprise in the Commercial Aviation Sector.

Suppy Chain Management - A Key to Space Programme

Supply Chain Management is key to the uccess of the Space Programme. Effective and efficient supply chains enable Space Industry and Missions tomeet their strategic and financial goals. They're also complex and very different for original equipment manufacturers (OEMs); maintenance, repair and overhaul (MRO) providers; and



Dr. B. Ramesh Chairman, IIMM, Chennai Chapter

customers, including airliners and armed forces.

organizations in space research in the country. My experience with them through the supply of special purpose trailers and vehicles for payloads movements and streamlining of transportation is most seamless", says Dr. B. Ramesh, Chairman of IIMM, Chennai Chapter

Most of the assemblies are of Over Dimensional Cargo. Emphasis is given to the design and development of the

vehicle for the critical movements.



Indian Institute of Materials Management IN PURSUIT OF EXCELLENCE IN SUPPLY MANAGEMENT

Effective supply chain strategies, like using the digital technology effectively through connected devices and sensors not only help companies improve efficiency, control costs and mitigate risks, but also enable them to deliver value to the customers.

Indian Institute of Materials Management (IIMM) is a national apex body that has a wide spectrumof professionals in the Supply Chain Industry with over 10000 members representing various manufacturing and services organisations.

Certain other industries from General engineering, Automobile, Auto ancillary, forging industries, electronics and electrical, Food manufacturing, Distribution, warehousing, logistics, pharma and Healthcare, Hospitals, Hotel, Import and Export (C&F Agents), Currently aerospace industry, and AI and big data, etcare also in the catalog. All pieces of equipment are tested thoroughly to avoid any last-minute glitches. Quality equipment is necessary for smooth performance, the experts who are specialists in the given field handle such important nitty-gritty in the process.



"ISRO is one of the best professional and dedicated

ISRAEL AEROSPACE INDUSTRY CALLING

The Aerospace industry is a multi-discipline sector that includes manufacturing of the primary components of the industry and other production activities such as R&D as well as propulsion, navigation and communications and software development in addition to maintenance.



Consul –Trade & Economic Affairs Consulate General of Israel In Bengaluru, India

Israel is known as a world leader in the satellite industry, with the first minisatellites to be developed, and is one of a few countries in the world with independent launching capabilities. The Israeli space industry has also developed installed equipment capabilities as well as developing satellites and launching systems.

The capabilities that Israel has developed make it a leader in nano-

Israel's aerospace industry

sector is well known with capabilities in UAV production and advanced space-launching. In addition, Israel has classic advantages in fields such as relatively low-cost but high-quality manufacturing for Western countries, innovation and entrepreneurship that produce advanced technologies and with operational experience of products.

Many Israeli companies are sub-suppliers that specialize in fields such as machining, electronic systems and components, and composite materials. Israeli companies collaborate with leading international enterprises. Although the majority of satellite, defense and electronics technology development is conducted by the large Israeli corporations, the UAV segment is promoted by smaller Israeli manufacturers that develop exclusive technology. The metal, composite and electronics segments are promoted by multiple companies that apply manufacturing technologies and develop additional products used by the aerospace industry.

Israel is a significant UAV exporter in the world, with many advantages, such as manufacturing high-quality products at low cost; the innovation and entrepreneurship that produce highly sophisticated technologies. satellite technology, just as it was a leader in minisatellite technology. There are a number of Israeli start-ups developing new, groundbreaking civilcommercial applications. Simulators are another area of expertise due to the increase in commercial air traffic and the higher demand for training tools and simulators with advanced technological capabilities.



The Israel Space Agency cooperates with many space organizations around the world, including cooperation agreements. Among the reasons the Israeli space and satellite industry is a global pioneer in small satellite technologies are the fact that it features high-quality human resources and highly effective work processes, the fact it is supported by Israeli cutting-edge academic activities, and that it constantly interacts with the renowned world-leading Israeli hi-tech sector.

International Webinar Series on Future of Space Technology & Exploration



Dignitaries who have inaugurated the webinar series so far...



Dr. T. V. Nagendra Prasad Consul General Consulate General of India San Francisco, USA



Her Excellency **Ms. Grace Akello** High Commissioner of the Republic of Uganda to New Delhi



His Excellency **Mr. Nitirooge Phoneprasert** Consul General, Royal Thai Consulate General Chennai, <u>India</u>



Mr. Joseph Avraham Consul - Trade & Economic Affairs Consulate General of Israel in Bengaluru, India



Networking

Explore The Space (Promoting STEM Education & Space Exploration awareness in Schools across Geographics)

Key Takeaways

- Certificate for each Participant
- Exposure to latest developments in Space Technologies

Webinar Series Topics

Edition 1 - June 25, 2021 -	Advanced Materials for Space Exploration Vehicles

- Edition 2 September 14, 2021 NASA's Artemis Mission -Humanity's return to the Moon
- Edition 3 November 24, 2021 Micro Satellites Manufacturing and Operational Technologies & Challenges
- Edition 4 February 24, 2022 Human Exploration of Outer Space Past, Present & Future
- Edition 5 June 23, 2022 Materials for Planetary Exploration



Tim Dyer, President, Elcon Precision LLC.



Scott J. McCormack, Asst. Prof. Dept. of Materials Science & Engg. Peter A. Rock Thermochemistry Lab. University of California, Davis



Dr. Jaydeep Mukherjee, Director NASA - FSGC, Florida, USA



Nikki Do, Data Analyst Elcon Precision LLC San Jose, USA



Ed Tomasek, Director, Business Development Elcon Precision LLC San Jose, California, USA



Rebacca Salcedo, Process Engineer, Elcon Precision LLC, San Jose, USA



Dr. Ram Prasad Gandhiraman Founder & CEO Space Foundry Inc., San Jose, USA



D.V. Venkatagiri Chief Executive Officer Explore The Space, Chennai

Key Points discussed at the Webinar Series:

- Advanced materials that can withstand high temperatures and that will be lighter in weight very essential for the advancement of space exploration.
- The Artemis program is a human spaceflight program that is being led by NASA with multiple international and US domestic partners with a primary to return humans to the Moon, specifically the lunar south pole, by 2025
- The miniaturisation of electronics chips and development of Nanotechnology has brought in the great concept of Microsatellites. Satellites that were the size of a room are today as small as a loaf of bread! And they do more work with greater efficiency and speed.
- Space Tourism and In Space Manufacturing are great ideas which can make travel to space a regular phenomenon in the near future.

Objectives of the Webinar Series:

- To encourage the global youth to pursue Space Education
- Facilitate Industry Institution Linkages in Space and Allied Industries
- To emphasize on Global Space Cooperation

Who Can Register - Research Scholars, Entrepreneurs, Senior / High School, College and University Students from all over the World and with background in Engineering, Mathematics, Physics, Chemistry, Management, Life Sciences, Astronomy, Metallurgy and Material Science, Aerospace and Aeronautics.

Do you want to participate in this webinar

Please contact : +91 9790186633 or email: explorespace360@gmail.com

Workshop series across the Globe STEM Experiment & Space Exploration



Students have to be curious and ask questions about various scientific phenomena / facts happening around them. This will kindle their scientific temper...

ISRO invites young minds to pursue space as a career. -N. Sudheer Kumar, Director, CBPO, ISRO Headquarters, Bengaluru



V. Ramamoorthy, Scientist, ISRO (Retd.)



V. Sumitrra Devi Chief Administrative Officer, Explore The Space



Students with certificates at the Bengaluru workshop (March 5, 2022) on STEM Experiments & Space Exploration at St. John's English School, Amruthahalli



Motivating School Students aspiring for a great career in Space Sciences & Technology Online Quiz on Space Sciences & Technology for School Students in UAE - July & August 2020



Prof. Hari Om Vats Scientist (Retd)., Physical ResearchLaboratory & Directory SERF, Ahmedabad, India Education, specially science education should be made learning oriented instead of marks

oriented. There is a need for better trained teachers, we need to ensure training and upgradation of knowledge for teachers from time to time. Practical and activities in schools need to be created. There is a need to evolve a

system of education (specially science education) which is more interactive learning, concept oriented and based on practical applications. Maths, Physics and several branches of Engineering (Electronics, Mechanical, Photonics, Electrical, Fuel engineering etc.) are backbones of space exploration. However, as space exploration marches ahead, we need application of knowledge from Zoology, Botany, Geology, Material Science and more. Thus STEM education is very important for Space Exploration.

Team Explore The Space in action at workshops in Schools



S. Balagurunathan Science writer & STEM Instructor

Workshop components:

Technology that will be sent to the students

2) Interesting videos on ISRO's history,

6) List of questions from previous

programme to increase curiosity of students

1) Questionnaire on Space Sciences &

two weeks before the workshop.

NASA videos & Space Technology

3) Quiz on Space Technology

5) Certificate for Participants

7) Pledge on Space Cooperation

4) STEM Experiments



K. Balachander Sr. Consultant, Explore The Space



Popular Questions from Participants

- 1. Apart from Science & Technology Graduates, can students from other branches join the Space Industry?
 - 2. What is the center of gravity of earth?
 - 3. How far we should go to escape from gravity?
 - 4. If oxygen increases in earth, what will happen?
 - 5. Why should humans show interest in space research?
 - 6. Which is the deepest place in earth?
 - 7. What is meant by solo star and group of stars?

If you want STEM Experiment & Space Exploration workshop to be conducted in your School / Region...

Please contact: Explore The Space - Mobile No.+91 9790186633; 7401644840 or Email: explorespace360@gmail.com

The Global Trade Driver - Indian Space Exploration, Commercial Aviation & Defence Industry - Explore The Space

39

Multi Disciplinary Trained & Talented Engineers – Growing Need of the Space Industry



The SRM University, an accomplished & multi disciplinary institution in India, is known for innovation and a flair for out of the box thinking. After graduation several of our alumni have made a remarkable contribution as

inventors, entrepreneurs and scientific investigators in national laboratories and their work has made a significant impact on India's technological progress and hence on the nation's economy and also shine in other parts of the World. A few such cases are described below.



Prof. T.V. Gopal Dean, College of Engg. & Technology, SRM IST, Potheri



Veelog Nano Ceramics Private Limited was formed in June

2016 by three alumni of the department of Aerospace Engineering, SRM IST named Velraj Murugan, Logeswaran dhasraj and Venkat Ramanan Venkatesan. Initially formed to offer Automotive protective coating services in Chennai, this organisation is now a global leader in Nano Ceramic Coating Technology and provides a standard which is never compromised in any perspective. Now the Veelog team has diversified into allied fields specializing in surface refinishing, restoration, and protection in

Automotive, home, and Industrial applications and aims at bringing the best of technologies to be easily accessible for each and every consumer. As an authorized distributor for Ceramic Pro series in Tamil Nadu, Veelog currently has eight showrooms located across the state of Tamil Nadu.

Mr. Aman Johri, an alumnus of the 2016 batch has founded a new venture named "Jatayu Unmanned Technologies" headquartered in Goregaon Mumbai. This organization specializes in AI based civil and defence solutions. Licensed by the Government of India JUSTECH carries out research, development and manufacturing of unmanned systems and technology. The team at JUSTECH has developed multiple UAS platforms for a myriad of drone-based solutions. Their all-weather, all-terrain systems have proven



themselves in the field time and again. Their specialities are in the field of Civil & Defence and they continuously operate in the private & commercial space. The ideology of this organisation aligns with the **Make- In-India initiative** as up to 98% of their product platforms are designed, developed & manufactured inhouse in their facility in Mumbai, India.

Mr. Rasheed C. Mohammed has come up with "An innovative process for enhancing the pressure ratio using



base integrated double cone". On 17 December, 2020 the International Bureau of World Intellectual Property Organization, WIPO has acknowledged the receipt of a PCT international application filed by Mr. Rasheed for the purpose of protection of his invention.

Mr. Ajay Arulmozhi who graduated in the year 2014 is the Founder CEO of Ajaba Aerobotics. His organization designs custom built drones to meet

the individual needs of specific customers, provides end to end solutions using drones and offers advice and services in diverse areas such as aerial inspection of wind turbines, agricultural pesticide spraying, aerial gas detection and small cargo transportation.





There are a few other alumni who by virtue of their illustrious career in the industry are often quoted as ideal role models for the present generation of students pursuing Aerospace Engineering. We have Mr. G. Sathappan, a graduate of the batch of 2011-15, is currently employed as Project Lead - Manufacturing Engineer - New Product Introduction - Turbine Blade Facility at Rolls-Royce, UK. An Advanced Manufacturing Engineer Mr. Sathappan is working as part of the New Product Introduction division of Turbines Supply Chain Unit within the Civil Aerospace Domain of

Rolls-Royce.





Mr. Mohamed Sohail an alumnus of the (2012-2016) batch scored AIR 2 in the GATE examination. Soon after completing MTech from IIT Madras, he joined DRDO and he is currently working in DRDO Bangalore.

Accomplishments of Ms. Kalpana Chawla, Sunita Williams and other female astronauts have always been a source of inspiration for the girl students of Aerospace Engineering at SRMIST. A few cases of our former girl students who are presently pursuing an illustrious career as a professional Aerospace Engineer are mentioned below. Ms. Poonam Josam (2009 – 2013) is currently pursuing PhD in Aerospace

Mr. Samay Sigamani a batchmate of Mr. Sathappan is an Avionics Systems Engineer (ATA 34 - Navigation, Surveillance Systems), specialized in Airline Operations. He has

been working in Airbus System Engineering since June 2017.

Engineering (with a focus on Bioastronautics and human performance) at Texas A&M University and graduate Pathways engineering trainee at NASA Johnson Space Center.



Ms. Neelam Shivhare (2010 – 2014) wears several caps. She is a TEDx Speaker | Aerospace Engineer | Aircraft Propulsion Architect | Founder @ Munchies with Neelam & @Route 2 Happiness | Certified Meditation trainer.

Mr. Lokesh Panthri an alumnus of the 2007-2011 batch pursued a course in Airline Management at the LUISS Business School, Rome,



Italy and has varied experience as an executive working with leading airlines. At present he works for the Qatar Airways as the Cargo Country Manager.

Some of the recent noteworthy accomplishments of Aerospace Engineering students presently pursuing B. Tech are listed below: Under the guidance of Dr. Malaikannan, Research track Asst. Professor a batch of final year students (Mayukh Sarkar, Ritvik Pareek, Keven Dankhara, Nandini Jain)



presented a technical paper titled "*Identifying future technologies for space station*" at the **IAA-ISRO-ASI** Symposium on Human Spaceflight & Exploration held from Jan 22-24, 2020, in Bengaluru, India. Notably, this work is included in the top 10 papers across the country. Students pursuing their major project under the guidance of Dr Malaikannan published a journal article titled, "Development of a Novel Autonomous Space Debris Collision Avoidance System for Uncrewed Spacecraft" in *The Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering*, p.09544100211072321. In addition, a patent has also been applied by this group "An automated Collision

Avoidance System for a Spacecraft", IN Patent App. 202141011133 (Indian Patent - Published). Dr. G. Malaikannan was allowed by NASA the use of **FIAT v3** (Fully Implicit Ablation & Thermal Analysis Program) for carrying out his computations.



" U.S. Investments by Foreign Companies can be very profitable "

What are the essential elements that a Foreign Company will have to consider when setting up base in USA ?

The first step for any foreign company in setting up in the United States should be doing its "homework", i.e. study the market, perhaps adjust or redesign products or packaging accordingly, observe competitors, pricing, sales channels, as required, ascertain availability of raw materials, or production costs, and, finally, select



Michael Kraus Partner, Smith Gambrell & Russell LLP Atlanta, USA

the best location for its US venture considering availability of good transportation (airports/seaport) and cost parameters. The foreign investor from Asia should keep in mind that, while the United States West Coast may be physically closer to its homeland, more than 80% of the US consumers and thus the company's customers live east of the Mississippi river.

How safe and profitable is the U.S. for foreign investments?

Given proper planning, time, persistence, management attendance as well as initial seed money, US investments by foreign companies can be very profitable. Numerous foreign ventures in the USA, after a decade or more, may even evolve to be larger and more profitable than the parent company abroad.

What kind of Investment / Business activities are happening in the U.S in high technology areas involving International Companies.

While "high technology" is always a magnet for investors, given that individual companies have produced staggering profits and growth, the foreign investor should not forget that many high tech ventures can equally be very risky and ultimately prone to failure. Often, more prudent growth opportunities in what is called brick and mortar investments in the US consumer or B to B market may turn out to be better sustainable in the long run.

Which kind of company structure is suited for a new foreign firm that is being established in USA?

Most foreign corporate investors either form a corporation, i.e. a company held by one or more share holders and are managed by a Board of Directors and officers or do business in the form of the limited liability company (LLC). This may provide a

more flexible basis for management as well as tax benefits. Thus, particularly smaller companies tend to opt to form a LLC rather than a corporation.

What are the Common Pitfalls to watch out for?

Often companies underestimate the time, management effort and also sustained investment necessary to truly conquer the US market. Typically, this does not happen in a year or two but rather takes 3 to 5 years of focused commitment. Also, from a legal perspective, HR and employment matters are often overlooked. The US has very strict anti-discrimination laws for the benefit of employees regarding race, religion, sex, age and other criteria.



There is, except for a few e x e m p t i o n s , a mandatory requirement to pay overtime of 50% for hours worked in excess of 40 hours per

calendar week. Further, companies are dealing with the United States as the laws of individual states govern matters such as contracts, corporate law, real property, and, to some degree, also employment or environmental law, not to mention vastly different methods and rates of taxation in each state and local communities.

U.S law makers realize the importance of high tech workers to ensure the global leadership position of the U.S.



Sheela Murthy

Sheela Murthy is a lawyer, entrepreneur, and philanthropist, founder and president of the Maryland based Murthy Law Firm, which has been ranked as one of the world's leading U.S. immigration law firms. Excerpts from an interview with The Global Trade Driver :

1) What is the current policy / trend in Non-Immigrant U.S. Visa – for technology employees to visit the U.S. for training or for work on H or L visa?

The U.S. Department of State (DHS) and the U.S. Citizenship and Immigration Service (USCIS) has a different approach compared with the prior administration. Overall, both Democrats and Republicans realize the importance of high tech workers to the U.S. to maintain and grow the global

leadership position of the U.S. in the field of technology. H1Bs for specialty knowledge workers is critical for U.S. companies as there is an acute shortage in today's climate for employees and particularly for tech workers. The current Biden administration has been amenable to

interpret the law and regulations in a manner consistent with the statutory intent.

The type of work permissible for the B1 business visitor is to attend conferences, speak at such conferences, present papers and attend board meetings or company meetings with the goal of performing the work abroad.

The H1B category for specialty knowledge workers allows employees to apply for the H1B petition approval with the USCIS and then after its approval, the worker is allowed to work for the particular H1B employer on a full time or part time basis and based on the terms and conditions as outlined in the H1B petition. On the other hand, the L1 category is meant for employees of entities that are related like a parent, subsidiary, branch, affiliate or joint venture where the person complies



with certain terms and conditions as permissible under the law.

2) As a leading US Immigration attorney, has the recent developments in the sectors -Aerospace, Defence and Space Exploration, attracted your attention.

The whole world is watching in awe the rapid changes occurring in the field of Space Exploration with so much in the international news particularly with the U.S. taking a lead with billionaires jumping on that bandwagon. This

has resulted in younger people feeling
fascinated with the idea of looking
beyond Earth. Though in its infancy,
the idea of expanding U.S. immigration
law to include other planets and
possibly other solar systems, is both
intriguing and challenging. Since our
firm's headquarters are based in

Maryland, just outside of Washington, D.C. the fields of Aerospace and Defense are relevant for some of the largest companies that hope to attract a global workforce.

3) Your advice for the top Indian Companies (in USA)

Indian companies and businesses need to become more astute in embracing the culture and norms of countries where they choose to work. One cannot simply put on blinders and do one's work and expect that it will be business as usual. Every business wants to compete and be a step ahead. One way to attract the attention of lawmakers is by having lobbyists present facts and information to help lawmakers understand issues pertaining to this industry of Aerospace, Defense and Space Exploration.





INNOVATING IS NOT AN OPTION. IT'S THE ONLY WAY.

At Great Lakes, we believe that innovating constantly is the only way to stay ahead of the curve in a world that is rapidly changing. We have consistently focused on preparing our students to be future ready, agile, and adaptable to change. It is one of the reasons why we have emerged as one of India's top ranked and most respected business schools in a very short span of time.

THE SCHOOL OF FIRSTS



From Eden Fishing Village to... University of Wollongong, Australia to... UC Davis, USA.... All the way towards Mars... !





A Profile of Scott J. McCormack

Science and Engineering at the University of California Davis. His research focuses on the interplay of crystal symmetry and energetics of materials in extreme environments, focusing on ultra-high temperatures, for

applications in space exploration.

McCormack is interested in the crystallography and thermodynamics of complex oxides, carbides, nitrides and di-borides in extreme environments. <u>The McCormack group</u> focuses on understanding how material symmetry and atomic structure affects the materials thermochemical and thermophysical properties when pushed to high temperatures. These efforts aim to lead to the discovery and understanding of properties (stability, melting point, thermal expansion, heat capacity etc.) of new material systems that can be utilized for humankind's next grand frontier: space exploration.

Materials in extreme environments: enabling future space travel: Scott asks very interesting questions as he remarks, "How fast, is fast? How hot, is hot? How strong, is strong? These are some of the questions that materials scientists need to answer every day to develop materials that can handle the journey from Earth to Mars. On Earth, vehicles are required that travel faster than the speed of sound, and when doing so, heat their surfaces up to ~3000 °C! In space, vehicles are required to



provide thrust for months on end to reach destinations millions of miles away. On Mars, vehicles are required to descend into the Martian atmosphere and arrive safely on the surface. What materials do we have available today in our toolbox to achieve these missions? More importantly, how does one implement the philosophy of "imagineering", the idea of playing in the realm of science fiction using physics, to push the boundaries of science fact, to develop materials of the future."



Webinar Series on "Future of Space Technology & Exploration", organised by Explore The Space and Elcon Precision LLC: Scott J. McCormack will be delivering the Keynote Address at the fifth edition of the International Webinar Series on "Future of Space Technology & Exploration" on June 23, 2022. The Specific topic of the webinar is "Materials for Planetary Exploration".

For participation in the webinar, please contact +91 9790186633 or email to

INDIAN BUSINESS CITIES



Chennai: Chennai, nicknamed Detroit of Asia, is an automobile hub and the center for economic, cultural, and educational excellence. It has the fourth most populous urban settlements in the country. Chennai is the healthcare capital of India, attracting 45% of health tourists in the country, due to its excellence in the health and hospitality sector.

Pune: Pune is the secondlargest city in Maharashtra after Mumbai and is an important business center. It is considered as the Oxford of the east due to the educational centers present. Home to many colleges and universities, the city is a great education hub. Biotechnology and microbiological industries are at zenith here. Pune has a largenumber of information technology (IT), engineering, and automotive companies. Bloom Engineering, Delfingen, and Cassiopae are among the growing number of foreign Companies in Pune.



Coimbatore: Dubbed the textile capital of South India, and the Manchester of Tamil Nadu, the black soil supports flourishing agricultural growth and cotton production. The city is famed for its foundry, automobile, and manufacturing equipment from spares, motor pumps, and other engineering pieces of equipment. The GI tag on Wet grinders is known to the world.

Kolkota: Called the jewel of the east, Kolkata is one of the financial hubs of east India. It is home to many natural riverine and seaports. It is the third most productive metro in the country with many big-time manufacturing companies like Alstom, Videocon, Larsen and turbo. It holds some of the oldest public sector companies in the nation like the national insurance company, Coal India Ltd, the National tea board, and the geological survey of India. It is also home to some of the country's largest, oldest publication houses.





Bengaluru: Bengaluru city is the IT capital of the country; considered the Silicon Valley of India, hosting the major HQ of global MNCs, the city leads inservice industries due to its cosmopolitan culture. It is nicknamed the melting pot for entrepreneurs, a dreamland for innovators, and tech developers.Many state-owned Aerospace and defence organizations are located here. It is the most liveable city according to the Ease of Living Index 2020.

INDIAN BUSINESS CITIES



Hyderabad: Hyderabad, the center for trade and commerce constitutes a gigantic share of the city's economy. Pharmaceuticals, IT, and a well-connected road facilitate smooth goods movement pan India. Service activities have expanded dramatically, especially those associated with IT. Additional sobriquet is Cyberbad and also the very famed name of Pearl city due to its high-quality Ornamentals and jewelery production.

Indore: The commercial capital of Madhya Pradesh with a diverse economic portfolio from the food processing sector, IT, and a huge number of pharmaceutical companies. It is considered the mini-Mumbai due to massive investment flow from countries across the globe. It is considered to be one of the cleanest cities in the country.



Mumbai: City of dreams, Financial capital of the country and market leader in media and associated activities, Textile hub, fashion apparel capital with some of the biggest road markets. Wealthiest city due to high inflow of FDI, FII. Innovator and developer at every gully is the unique identity of Mumbai. A city filled with many natural ports, most exportimport happens via this city to all other countries.

Gurgaon: Called the millennium city of India, due to its development during the 2000's. Gurgaon is an entrepreneur's dream hub, in many service industries, and automobile manufacturing is done by Maruthi, Hyundai, etc. It is a hub of MNCs which employs millions of people.





Profiles of Foreign A& D Companies in India



GE Aviation is a world-GE Aviation leading provider of jet engines, components and integrated systems for

commercial and military aircraft. GE Aviation has a global service network to support these offerings. www.geaviation.com.



Headquartered in Bethesda, Maryland, Lockheed Martin is a

global security and aerospace company that employs approximately 114,000 people worldwide and is principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services. www.lockheedmartin.com

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At BAE Systems, we help our customers to stay a step ahead when protecting people and national security, critical infrastructure and vital information. This is a long-term commitment involving significant investments in skills. www.baesystems.com



As a leading global aerospace company, Boeing develops,

manufactures and services commercial airplanes, defense products and space systems for customers in more than 150 countries. www.boeing.com



Pratt&Whitney is an GO BEYOND American Aerospace Manufacture with Global service operations. Its

aircraft engines are widely used both in civil aviation and military aviation. www.prattwhitney.com

GENERAL DYNAMICS A leading producer of business jets and the

standard hearer in aircraft repair, support and completion services, General Dynamics has earned its reputation through superior aircraft design, quality, performance and customer support. www.gd.com



L3Harris is an American Technology Company and

information technology services provider that produce C6ISR systems and products, avionics, antennas etc., www.l3harris.com

Raytheon Technologies

Raytheon Technologies serves customers in the commercial aerospace and defense industries by combining complementary technology offerings and world-class engineering teams to deliver innovative solutions. www.rtx.com

NORTHROP GRUMMAN

Northrop Grumman solves the toughest problems in space,

aeronautics, defense and cyberspace to meet the ever evolving needs of its customers worldwide. www.northropgrumman.com



designing, manufacturing and

delivering aerospace products, services and solutions to customers on a worldwide scale. With over 130,000 employees and as the largest aeronautics and space company in Europe and a worldwide leader, Airbus is at the forefront of the aviation industry. www.airbus.com

Profiles of Indian A & D Companies



HINDUSTAN AERONAUTICS LIMITED, one of Asia's largest space companies,

generates over \$2 billion a year in revenue. More than 40% of HAL's revenue comes from international contracts for the manufacture of aircraft engines, spare parts and other aircraft products. www.hal-india.co.in



Larsen & Toubro LARSEN & TOUBRO is an Indian multinational

engaged in EPC Projects, Hi-Tech Manufacturing and Services. It operates in over 50 countries worldwide. A strong, customer-focused approach and the constant quest for top-class quality have enabled L&T to attain and sustain leadership in its major lines of business for over eight decades. www.larsentoubro.com



Godrej develops high precision spacecraft components made of exotic alloys for the Indian Space Research Organisation (ISRO). Godrej Aerospace is a part of Indian rockets and spacecrafts, including those of the Mangalyaan and Chandrayaan missions. www.godrej.com



National Aerospace Laboratories (NAL) is India's first and largest space research organization. It was established in 1959 by the Council

for Scientific and Industrial Research (CSIR) in Delhi. The company works closely with HAL, DRDO and ISRO is primarily responsible for the development of civilian aircraft in india. www.nal.res.in



Alpha Design Technologies Private Limited operates as a manufacturer of electronic equipment. The Company specializes in research and development, assembly, testing, qualification, integration and installation of defence electronics, avionics and space satellites systems.www.adtl.co.in

Mahindra AEROSPACE

Mahindra Aerospace is

an Indian aerospace company, part of the Mahindra group. It was the first Indian private company to manufacture small civil aircraft for the Indian public aviation market. www.mahindraaerospace.com



(Walchandnagar Industries Limited) is an ISO 9001: 2015 certified Indian company with global presence and

diversified business portfolio in Projects, Products and High-tech Manufacturing. Carrying a legacy of more than 100 years of Engineering Excellence. www.walchand.com



BHARAT ELECTRONICS LIMITED (BEL) is a state owned aerospace and defense electronics company in India. BEL is one of the nine public sector undertaking under the Ministry of Defense of India. www.bel-india.in





GIVING WINGS TO MSME DREAMS





Indian MSMEs & Global OEMs -Great Partnerships in Cards

MSMEs are the backbone of defence and aerospace industry in India. The Government aims to double the number of MSMEs from 8000 in defence and aerospace sector to 16000 in the next five years. The Government has reserved that any procurement up to Rs. 100 crores will be reserved from Indian MSMEs.



K. Mariappan President, TANSTIA

A multi-billion dollar sector, the Indian aerospace and defence (A&D) sector is a focus market for many global A&D companies. The Indian market is also attractive for domestic industrial product conglomerates aspiring to achieve non-linear growth via positions across the A&D value chain across platforms. This is a result of tightening of defence budgets in Western countries, while countries like India and Saudi Arabia continue to spend ever increasing amounts on defence.



Indian start-ups and MSMEs have a very important role to play in aerospace and defence manufacturing. Considering this, industry majors can collaborate with start-ups to experiment with new concepts, try for disruption and once developed for domestic end-users, they can be exported.

Besides manufacturing and innovation, Indian startups are also helping other MSMEs by providing them with financing

opportunities. Some of the notable names are Credable, KredX, Cashflo, PYMNTS, Priority Vendor, Vayana Network, among others. These startups are operating in the space of supply chain financing which aims to ease the working capital requirements of MSMEs.

In the commercial aviation sector, since travelling patterns were disrupted due to the pandemic, there was a disruption in the aircraft production due to low demand. The demand for spare parts was also low since aircraft maintenance was minimal. This affected the complete supply chain and sourcing schedules of the OEMs by over 40% last year.

In 2022, sustainability will remain a key focus area for commercial aviation while technological leapfrogging led overmatch shall become the core focus for defence in India. Technological advancements and evolution on the supply side will stimulate demand growth in the A&D sector. The Aatmanirbhar initiative in A&D presents many opportunities for the private sector and encourages participation in indigenous design, development and manufacturing.



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- Building meta data sets
- Analysis & Inferences from the data using standard statistical techniques

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- Education
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Acknowledgement Space Exploration – Increased Global Cooperation, called for

Our Team from the twin firms, "The Global Trade Driver", and "Explore The Space" are very happy to have the opportunity in presenting this information bulletin to you on, "Indian Space Exploration, Commercial Aviation & Defence Industry".

The objective of this bulletin is to connect Companies and Institutions across the world, in the Space and

related fields, with the growing opportunities in the Indian Market.

We would like to express our sincere thanks to Space Tech Expo of the Tarsus Group for providing us an opportunity to be part of this great event at Long Beach, California, (May 23-25,2022)

The launch vehicles (Rockets) and the Satellite programmes all over the world have made huge progress, ever since the first artificial satellite (Sputnik 1) was launched by the USSR in 1957. Thousands of satellites have been positioned into orbit around the Earth by many Countries. Earth observation, communication, navigation, Biomedical research, weather monitoring, broadcast are some of the applications of Satellites, which is only growing by the day.

Indian Space Research Organisation (ISRO) has been playing a pivotal role in space exploration and bringing glory to the Country and helping its defence forces, government, society, and industry at large. Indian Government's budget this year for the Space Programme is almost Rs. 14000 crore – a number that is steadily increasing to support the increasing demands and ambitions of the sector.



D.V. Venkatagiri

Government of India (GoI) under its *Atmanirbhar Bharat* programme released the draft of 'Defence production and Export promotion policy (DPEPP) 2020 aimed to achieve self-reliance in defence manufacturing and emerge as a defence manufacturing hub. The p o l i c y w h i c h a i m s a t indigenization of the imported components including alloys and special materials for defence

equipment, has many opportunities for Foreign Companies that want to invest and produce in India.

This effort is the result of many years of hard work and sustained International business networking in India and USA done by our team. We thank with utmost gratitude the support of Government of Tamil Nadu and the gracious support of our friends from different agencies and companies.

A key learning for us is the need to emphasise further the importance of i) STEM education for Space Exploration, ii) global cooperation among countries in Space Programmes and iii) harnessing new technologies with continued research and development.

We welcome your valuable feedback in our mission of connecting capabilities with requirement across geographies in the Space and related sectors.

Thank you!

D.V. Venkatagiri, CEO The Global Trade Driver & Explore The Space

Notes





Now approaching its 5th edition, Space Tech Expo Europe returns to Bremen – City of Space - in November

SPEAKERS





As the sister event to Space Tech Expo, USA the Europe edition has quickly established itself as the prominent supply-chain meeting place for the space industry and will welcome more exhibiting companies than any other space event globally in 2022. As the sector continues to grow at a fantastic pace, join us in the industry hub of Bremen this year for our largest ever event to connect with technical and executive representatives of the European (and wider) space community.

Experience the latest innovations in technology at the leading showcase for space manufacturing & testing services, components and systems engineering for spacecraft, launcher and satellite programs this coming November at Space Tech ExpoEurope.

- Space Technology
- Test & Measurement
- Space Situational Awareness
 - Electronics

• Materials

• Mechanical

Reason to Attend: Hear about top industry developments from diverse, high-level speakers from agency, prime integrator and supplier perspectives

Find out how European space will continue to develop its launch capabilities to establish its position as a global industry leader

Learn about the latest technological developments of subsystems and software-defined applications

Meet with peers and gain a competitive advantage with unlimited networking opportunities, allowing you to make business connections with new customers and suppliers, all under one roof in the delightful city of Bremen.



Bremen - The Aerospace City

Flight history in Bremen began over a hundred years ago with the aviation pioneer Henrich Focke. And since the Northern Development Ring (ERNO) was founded more than half a century ago, Bremen has established itself as a global standard-bearer both in aerospace research and the aerospace industry. The city and the region are on the same page when it comes to the significance of this ever-growing branch of industry, and are promoting the innovation cluster. Future-focused technologies and flagship projects such as the Galileo satellites and Ariane rockets bear the 'Made in Bremen' seal of quality.

Bremen's aerospace industry comprises more than 140 companies and 20 institutes, employs over 12,000 people and generates revenue in excess of €4 billion a year. The city has more space aeronautics and aerospace experts as a percentage of its population than anywhere else in Germany. Bremen is the largest aerospace centre in Germany.





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(An International Forum on Industry and Education)

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The Global Trade Driver (TGTD), is a niche facilitator, connecting Indian, U.S. and other International Companies through its programmes. We welcome your company to join The Global Trade Driver.

The Global Trade Driver

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