

3D GRAPHY ENGINEERING WORKSHOP 2021

3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE

3D GRAPHY is a platform for 3D Technology Training, Skill development, Education, Research, Technology consultancy and Service for Students and Professional across different Sectors like Aerospace, Defence, Space Technology, Drones, Robots, Automotive, Marine, Oil & Gas, Dental, Medical and others. **3DTechnology** which includes 3D Printing, 3D Imaging, 3D Scanning, 3D Software, 3D Simulation and 3D Visualisation i.e. AR & VR is revolutionising all the Major Sectors. **3D GRAPHY WORKSHOP** is a series of events conducted on various industries and sectors. The current event held on 11th December 2021 is on the topic, **3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021** which will address the Aerospace, Defence, MRO Companies about 3D Printing and 3D Visualisation technologies. It is the 38th event and a Virtual event organised by **TRINITY MEDIA & MARKETING SOLUTIONS**. The company is promoting 3D Technology from India conducting Events for last 7 years. And due to pandemic till we have a formal note from the govt. all our events will be conducted through Virtual Conference & Exhibition to ensure knowledge, network and business continues with a real time experience close to an actual physical exhibition through our platform. The event is supported by **AEROSPACE & DEFENCE CONSULTANTS ASSOCIATION OF INDIA** and various other industry Associations from India & Globally.

ORGANISER



ASSOCIATION PARTNERS



OFFICIAL PLATFORM





Message from Dr. Surendra Pal - Advisory Council Member 3D Graphy Engineering

Dear Respondents,

Greetings from 3D GRAPHY!!

Firstly let me congratulate Dr Shibu John, Founder, Trinity Media & Managing Director, 3D GRAPHY LLP for organizing the 38th event in 3-D Printing Technology a Workshop for Aerospace and Defence applications. Am happy to join the Advisory Council of the 3D GRAPHY ENGINEERING – a consortium sharing Knowledge about 3D Technology which consist of 3D Printing, 3D Imaging, 3D Design, 3D Simulation, 3D Visualisation .i.e AR & VR and also Material Science with dedicated efforts made on research in Material Science.

3D GRAPHY is the parent platform which is instituted for 3D Technology Training, Education, Research, Events and Innovative Services. 3D GRAPHY has 3 division 3D GRAPHY DENTAL & MEDICAL, 3D GRAPHY ENGINEERING & 3D GRAPHY KIDS & SCHOOL.

3D GRAPHY ENGINEERING is a sub-platform addressing various specialisation in engineering that includes Mechanical Engineering, Aerospace Engineering, Electronics, Marine Engineering and the others.

3-D Printing is a boon to the present-day manufacturing of complex aerospace and defence systems. In the last couple of years, the progress in the domain of 3-D printing and manufacturing has been exponential. 3-D printing technology comes under different nomenclatures namely: FDM, SLA, SLS, SLM, EBM, DMLS, DED and with the advent of combined use of different materials in manufacturing, depending on applications coupled with environmental conditions (like; vacuum, vibrations, temperature and radiation conditions) The technology uses manufacturing processes like sintering, fusing, curing, radiation hardening etc.. 3-D printing technology is extensively used in Three -Dimensional VLSI and MMCs in the semiconductor domain. In aerospace and defence manufacturing the technology helps in designing and manufacturing subsystems as per applications for prototyping and avoiding wastage of materials. In the present era wherein space suborbital flights, manned flights like GAGANYAN, International Space stations, inter-planetary manned missions where in-flight repairs may need manufacturing of some critical components during the flight can be accomplished using 3-D manufacturing Technology.

On the other hand 3D Visualisation is also highly important not just for aerospace and defence industry but also for all the engineers as it will definitely help them to access and design a component by Virtually being able to see it being created. Using the 3D CAD machine and technology will help to get highest quality products and services for manufacturers. So both 3D Printing & 3D visualisation is complementing each other for better product formulation.

Am happy to be a part of the event - 3D GRAPHY ENGINEERING WORKSHOP – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021 to be held on 11th December 2021.

On behalf of **3D GRAPHY ENGINEERING**, I would take the opportunity to invite all the Engineering Colleges, Material Research Institutes, Defence Technology Institutes, Aerospace & Defence Component Manufacturers, MRO's, OEM's and all the 3D technology companies to join for a great session for Knowledge, Networking and business.

We welcome you all for the event.

Thanking You,

**Dr. Surendra Pal,
Ex- Vice Chancellor,
Defence Institute of Advanced Technology,
Ministry of Defence, Govt of India.
Distinguished Scientist, Associate Director, ISRO Satellite Centre, Govt. of India
Advisor, 3D GRAPHY ENGINEERING**



Message from Wg. Cdr. Raman Sopory - Advisory Council Member 3D Graphy Engineering

Dear Industry Respondents,

Greetings from Aerospace & Defence Consultants Association of India (ADCAI)- India's largest think tank on disruptive technologies , critical projects and Strategic Advisory services including Project financial needs.

Under the Prime Minister's clarion call for AatmaNirbhar Bharat or Make in India , it is a very timely event . It is estimated that the market in India is **growing at a rate of 20%**. Automotive and electronics holds the highest share in Indian 3D printing market, while healthcare, aerospace and defence sectors are witnessing higher growth too. This technology allows designing without constraints, thus, enabling further creativity and innovation.

The utility of 3D printers have made them popular today in countries like U.S., Europe and India. 3D printers are being used in a wide range of fields including **dentistry**, fashion and of course high-end engineering industries like aerospace, automotive, specialty components, etc.

The global 3D printing market size was valued at USD 13.78 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 21.0% from 2021 to 2028. Globally, 2.1 million units of 3D printers were shipped in 2020 and the shipments are expected to reach 15.3 million units by 2028. The aggressive R&D in three-dimensional printing (3DP) and the growing demand for prototyping applications from various industry verticals, particularly healthcare, automotive, and aerospace and Defense, are expected to drive market growth. The industrial application of 3DP is referred to as Additive Manufacturing (AM) as it involves a layer-by-layer addition of material to form an object referring to a three-dimensional file with the help of software and a 3-dimensional printer. A relevant 3D printing technology is selected from the available set of technologies to implement the process. The last step involves the deployment of this process across different industry verticals based on necessity.

In the Aerospace sector of India , the turning point came when Hindustan Aeronautics Limited (HAL) and Wipro 3D signed an MOU for Metal 3D Printing Adoption in Aerospace. We are living in exciting times . Hence any amount of time and money spent today in 3D sector will surely create few Unicorns from India in next five years .

We are pleased to partner Dr Shibu John and his esteemed team of Trinity Media & Marketing Division and 3D Graphy LLP to host the important event on 3D Printing technology and related business opportunities . This event 3D GRAPHY ENGINEERING WORKSHOP – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021 will unfold multiple business opportunities and create jobs in India and rest of the world.

We welcome you all to join the event.

Thanking you,

Wg. Cdr. Raman Sopory
Founder & President
Aerospace & Defence Consultants Association of India (ADCAI)
Advisor, 3D GRAPHY ENGINEERING



Message from Col. K. V Kuber - Advisory Council Member 3D Graphy Engineering

Dear Respondents,

Additive manufacturing is being adopted widely as it offers flexibility in type of material and is cost-effective. It allows new ideas in design and prototyping. Additive manufacturing uses metals, polymer, ceramics and composite materials in the building process to fulfil user specifications. Polymers and composite materials are gaining popularity in aerospace manufacturing, owing to their light weight and high strength.

Application of technology is expanding globally in Aerospace and Defence. For instance, General Atomics Aeronautical Systems Inc (GA-ASI) is taken on using additive manufacturing processes to expand the application of metal and non-metal components across its unmanned aerial vehicle (UAV) product lines to achieve production efficiencies.

In India, HAL uses direct metal laser sintering (DMLS) technique to build components for the indigenously developed Hindustan Turbofan Engine-25 (HTFE25). Additive manufacturing has helped HAL to reduce the time to produce a high pressure turbine blade, which generally takes two years to build using of computer numerical control (CNC) machines. Gas Turbine Research Establishment (GTRE), a laboratory of DRDO has employed fused deposition modelling (FDM) to build components for engines. This has allowed GTRE to reduce the time to produce these components which would have otherwise taken approximately a year to build.

IIT Madras and General Electric India Technology Centre (GEITC) are also jointly developing a 3D-printed combustor. The said product is aimed at reducing weight and improving fuel efficiency in small aircrafts and helicopter engines. The project is named Uchhatar Avishkar Yojana (UAY) is worth INR 7.24 crore. The Government of India and GETIC are funding 75% and 25% of the project, respectively. The design uses additive manufacturing technology and non-intrusive laser diagnostics. This is the first time that a 3D-printed full annular combustor was tested at actual turbine conditions in India.

This event **3D GRAPHY ENGINEERING WORKSHOP – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021** shall be a platform to highlight more initiatives and upcoming opportunities in this segment in India.

Look forward to meet you all in the event.

Thanking you,

Col. K. V Kuber
Director Aerospace and Defence, E&Y India.
Ex -Director, Capital Acquisitions Programs, in Ministry of Defence,
Advisor NSIC, Ministry of MSME : From June 2012 till June 2014.
Advisor, 3D GRAPHY ENGINEERING



Message from Dr. Shibu John, Founder, Trinity Media / Founder & MD, 3D GRAPHY LLP

Dear Respondents,

It gives me immense pleasure to share the potential of a Game Changing technology called 3D Printing. This is indeed a unique technology, which is benefiting almost all sectors. And since we are operating in a digital world a technology like this can only help change the dynamics of manufacturing to benefit all the end users. Aerospace & Defence Sectors will benefit a lot from this technology. 3D Printing is also called Additive manufacturing, Rapid Prototyping and **DIGITAL MANUFACTURING**.

How does this operate? In 3D printing, the first step is to make a virtual design of the desired object, and subsequently the virtual design is made in a CAD file by using a 3D scanner or by using a 3D modelling program with software. The next step is to get the 3D file to print it; the 3D modelling software in the 3D printer will "slice" the design into numerous layers, and uses the material to create the object layer by layer. It is a process of making 3D objects using plastic, metal, ceramic, wood, gold powder and composite materials, usually layer upon layer, to build physical models, prototypes, patterns, tooling components, and production parts. There is a great deal of R & D going into the various materials to ensure it can be used for various requirements. It is estimated that the global 3D printer market will grow at a **CAGR of 29.5%** during the period 2021-2026. This is inspite of pandemic.

3D GRAPHY is a platform for 3D Technology Training, Education, Research & Service for Students, Professionals and Technology experts. It has 3 divisions focussing on each specialisation and sectors – **3D GRAPHY DENTAL & MEDICAL**, **3D GRAPHY ENGINEERING** & **3D GRAPHY KIDS & SCHOOL**. More details you can please find in our website WWW.3DGRAPHY.IN

And the current event is conducted under **3D GRAPHY ENGINEERING**. Here is website link with details <https://engineering.3dgraphy.in/>

We have conducted 37 events in the last 7 years and this would be our 38th event the **3D GRAPHY ENGINEERING WORKSHOP – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021** to be held on **11th December 2021**. It is a day workshop with *speakers and delegates participating from 3D Printing, 3D Visualisation expertise and end users from Aerospace, Defence, MRO companies joining to learn the potential of 3D Printing and its benefits*. We will also have different 3D Printer machines, 3D Imaging Cos, 3D Software, 3D Design and material companies share knowledge with the latest updates and projects.

The event is supported by our **Industry Association Partner – Aerospace & Defence Consultants Association of India**.

We are happy to invite all the end users from different specialisation from Aerospace and Defence industry for a good knowledge, networking and business opportunity. Here is the conference page with details of the event the virtual event for an experience <https://engineering.3dgraphy.in/workshop.html>

Due to pandemic even this event we are conducting virtually. But am sure it would have the same opportunities as the virtual event platform is very close to a physical event as we have dedicated meeting rooms, VIP Lounge, Lobby, experience centre and virtual exhibition booths for good interaction.

We welcome you all for the event.

Thanking You,

Dr. Shibu John
Founder, Trinity Media & Marketing Solutions
Founder & Managing Director, 3D GRAPHY LLP.
Secretary General & Founder,
3D Printing Education & Research Association

Inauguration of 3D GRAPHY & 3DPERA Shri. Subhash Desai, Honorable Minister for Industries, Govt. of Maharashtra, India



AGENDA

Trinity Media & Marketing Solutions (TMMS) jointly with 3DPERA and ADCAI is conducting **3D GRAPHY ENGINEERING WORKSHOP 2021 – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE** event to be held on **11th December 2021**. We will have lectures, panel discussion & Q & A to be conducted by professionals, scientists and researchers from 3D Printing, Aerospace and defence who are experts in each specialization. We will also have 3D printing hardware, 3D Software, 3D Design, 3D Simulation, 3D Visualisation and Material companies also share the insights about the technology. So, there will be use cases shared by speakers with all the participants attending the event.

Due to the pandemic all our events for the past 1 year were conducted through Virtual Conferences and Exhibition for students and professionals to get the same opportunity for learning through our platform sitting at home or offices to have a live experience through their laptops. This will be a real time experience like an actual physical event since it is a license event software which is interactive. The intent is to have an active participation of students and professionals for Knowledge, Networking and Business. We have meeting rooms for students and professionals to interact directly with the speakers and others with meeting rooms and exhibition booths. The main title of the event is **“3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021”**

PRELUDE OF THE EVENT

3D printing in the aerospace and defence market is estimated to register a CAGR of over 20% during the forecast period (2020-2025). One of the major sectors which will benefit from this customised manufacturing 3D technology is the airline industry with aerospace and defence. 3D Printing can alleviate supply chain constraints, limit warehouse space, and reduce waste materials from traditional manufacturing processes to help the Airline Industry grow. And with more innovative materials the market is definitely on the growth path. With the introduction of materials Ultem and Ceramics with its properties of heat resistance. It is well used in the Airline, Aerospace to make use of ULTEM materials to manufacture the inner shell for freezer units, which contain all the necessary mounting structures. So with this advancement in ULTEM materials is expected to provide growth opportunities for the market in the near future. 3D Printing in Drones, Robots is also a great prospect for the industry to make the best use of these technologies even further for lighter parts with a good choice of materials. There are different 3d printing technologies – FDM, SLA, SLS, SLM, EBM, DMLS, DED and more with a combination of materials which can be used for Aerospace and Defence sector. Depending on the application, manufacturers use common processes, like sintering, debinding, fusing, curing, heat treatment and more, to achieve results for finished parts. A high-temperature industrial furnace is then used to apply these treatments to 3D-printed parts or prototypes. In addition to a controlled heat environment, a versatile vacuum furnace supports a variety of atmospheres, including hydrogen, argon, or other inert gases, to facilitate metal processing.

As aerospace engineers the dream is always to make new hypersonic weapons and space launch vehicles, and for this they will always need ceramic parts that can withstand temperatures as high as 2,700 degrees Celsius and drag forces of hundreds of kilograms that are encountered at speeds of Mach 5 and higher, such as on nose cones, wing leading edges and engine inlets. But at the same time these ceramics are harder than titanium and brittle, making them tricky to work with. To make a ceramic part, a technician typically presses a soft clay-like material into a die to create an approximation of the desired shape, hardens it in a furnace and then grinds it down to the precise shape. This milling process can take months and result in chipped or cracked parts. But this can be achieved with 3D-printing method that could produce the precise ceramic part shape with no milling required. Components could be made by any aerospace manufacturer with a particular kind of off-the-shelf commercial 3D printer, a paste of metal and polymer devised by the scientists, and a furnace to cure the parts. 3D Visualisation is also a key aspect since it helps to virtually plan and execute the project well. 3D Printing & 3D Visualisation will thus complement each other for efficiency and product formulation.

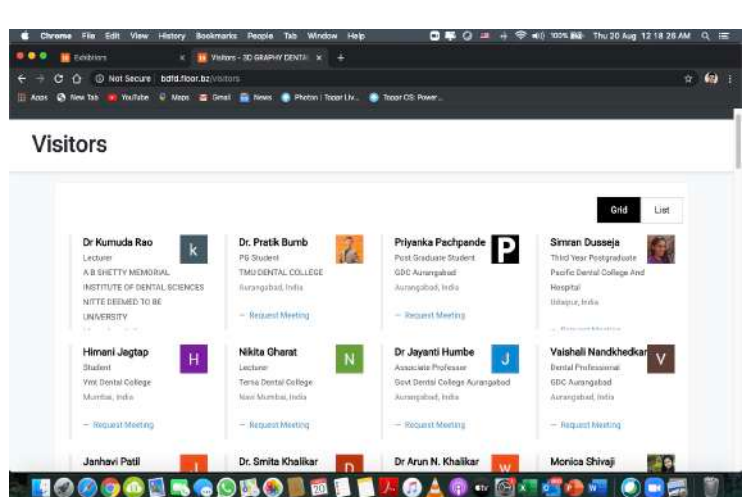
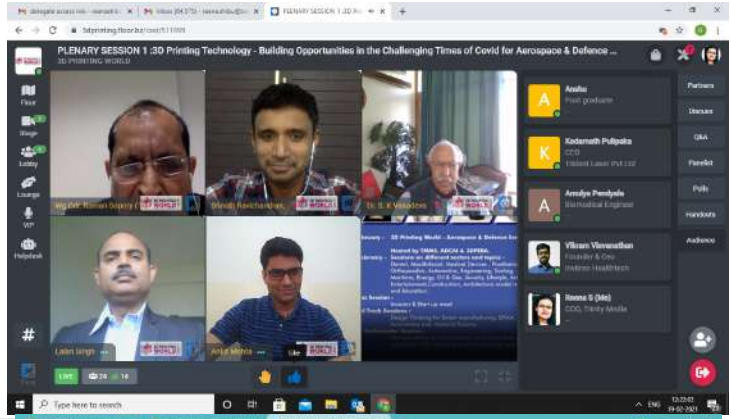
3D GRAPHY ENGINEERING WORKSHOP 2021 – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE will address all the 3D Printing innovative solutions with a combination of materials used in the offering for each specialisation in Aerospace and Defence to meet the requirements.

PAST ONLINE EVENTS

RECEPTION DESK | LOBBY | CONFERENCE HALL | PARALLEL TRACK HALL | MEETING ROOMS | EXHIBITION BOOTH | SPONSORS BACKDROP | SPONSORS LOGO SCROLL | VIP LOUNGE | HANDOUT AREA | POLLING CENTRE | Q & A SESSION

PAST ONLINE EVENTS

RECEPTION DESK | LOBBY | CONFERENCE HALL | PARALLEL TRACK HALL | MEETING ROOMS | EXHIBITION BOOTH | SPONSORS BACKDROP | SPONSORS LOGO SCROLL | VIP LOUNGE | HANDOUT AREA | POLLING CENTRE | Q & A SESSION



VIRTUAL EVENT STAGE

3D GRAPHY ENGINEERING WORKSHOP - 3D...
3D GRAPHY ENGINEERING WORKSHOP - 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021

Floor
Stage
Lobby
Lounge
VIP
Booths
Helpdesk

#

Scheduled
11 December 10:00 AM

BACKSTAGE

Join

Break End Session Go Live

PLATFORM

3D GRAPHY
3D PRINTING & 3D VISUALISATION SYSTEM
ENGINEERING & TECHNOLOGY FOR AEROSPACE & DEFENCE

3D PRINTING IN AEROSPACE & DEFENCE

3D GRAPHY ENGINEERING WORKSHOP
3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE 2021

DATE : 11th December 2021
TIME : 10:00 AM to 06:00 PM (IST)

INDUSTRY ASSOCIATION PARTNER

AEROSPACE & DEFENCE CONSULTANTS ASSOCIATION OF INDIA

3DPER

Partners

Discuss

Q&A

Panelist

Polls

Handouts

Audience

Wg Cdr. Raman Sopory
Founder President, Aerosp...

Dr. Surendra Pal
Ex- Vice Chancellor, Defenc...

Col K. V Kuber
Director Aerospace & Defe...

Dr. V. Anil Kumar
Scientist S F, VSSC/ ISRO, T...

Ashok Varma
Executive Vice President & ...

Saroop Chand
Director, Adrotec Informati...

Vaman kulkarni
Ex-Director, Honeywell Tec...

Shreyans Khot
AGM, Additive Manufacturi...

SPEAKER PRESENTATION & PANEL DISCUSSION

2nd Day - OPENING CEREMONY - 3DPW 2021 - Theme : 3D Printing Technology - Building Opportunities in the Challenging times of ...

PLENARY SESSION 1 3D Printing Technology - Building Opportunities in the Challenging Times of Covid for Aerospace & Defence ...

3D Printing World

3D Printing World

Partners

Discuss

Q&A

Panelist

Polls

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Director Aerospace & Defe...

Dr. V. Anil Kumar
Scientist S F, VSSC/ ISRO, T...

Ashok Varma
Executive Vice President & ...

Saroop Chand
Director, Adrotec Informati...

Vaman kulkarni
Ex-Director, Honeywell Tec...

Shreyans Khot
AGM, Additive Manufacturi...

Session 6: 3D Printing in Education & Research

SESSION 3: AEROSPACE, DEFENCE & SPACE - BENEFITING FROM 3D TECHNOLOGIES - (3D Printing, 3D Imaging, 3D Software, 3D S...

3D Printing World

3D Printing World

Partners

Discuss

Q&A

Panelist

Polls

Handouts

Audience

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Scientist S F, VSSC/ ISRO, T...

Ashok Varma
Executive Vice President & ...

Saroop Chand
Director, Adrotec Informati...

Vaman kulkarni
Ex-Director, Honeywell Tec...

Shreyans Khot
AGM, Additive Manufacturi...

**ORGANISER****PATRON****CHIEF GUEST****GUEST OF HONOUR**

Dr. Shibu John,
 Founder, Trinity Media
 & Marketing Solutions
 Founder & Managing
 Director, 3D GRAPHY
 LLP
 Secretary General &
 Founder, 3DPERA
 Mumbai,
INDIA

**Wg Cdr. Raman
 Sopory**
 Founder President,
 Aerospace & Defence
 Consultants Association
 of India,
 Delhi,
INDIA

Dr. S K Vasudeva,
 Scientific Consultant
 (Defence Technologies)
 Office of the Principal
 Scientific Advisor to Govt of
 India

Dr Anil Kumar Vesangi,
 Scientist SF, VSSC/
 ISRO, Trivandrum,
 Kerala
INDIA

**3D GRAPHY ADVISORY MEMBERS**

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 Sopory**
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 Ex Vice Chancellor,
 Defence Institute of
 Advanced
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 Ministry of Defence,
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 Director, Aerospace
 & Defence
 Advisory,
 Ernest & Young
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INDIA

Mr. D K Sharma,
 Past President,
 TAGMA,
 Mumbai,
INDIA

Dr. B. B Ahuja,
 Director,
 College of Engineering
 Pune
INDIA



3D GRAPHY ASSOCIATE CORPORATE MEMBERS



Saroop Chand
Director,
Adroitec Information
System(P) Ltd.
Delhi,
India



**Dr. Vishwas
Puttige,**
Business Head,
Amace Solutions
Pvt,
Bengaluru
India



Chandan Mishra,
Director & Co-
Founder, Lodestar
Innovation Pvt Ltd,
Mumbai
India



Manish Jasani,
Founder & CEO,
A.M. Designs Pvt Ltd.
(AMD)- Advance
Manufacturing
Solutions, Gujarat
India



**Gp. Capt. E R
Rajappan,**
Chairman & MD,
Shivayu Aerospace,
Bengaluru,
India



SPEAKERS



**Dr. V. Anil
Kumar,**
Scientist
SF, VSSC/
ISRO,
Trivandrum,
Kerala
India



**Gp. Capt. E
R
Rajappan,**
Chairman &
MD,
Shivayu
Aerospace,
Bengaluru,
India



**A
Manjunath**
Scientist F,
Group
Director,
Metal
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Joining
Division,
GTRE,
DRDO
Bengaluru,
India



**Anthony
Paul,**
DGM,
Product
Development
Technology,
L & T
India



**Saroop
Chand,**
Director,
Adroitec
Information
System(P)
Ltd.
Delhi,
India



**Shreyans
Khot,**
AGM, Additive
Manufacturing,
Amace
Solutions Pvt
Ltd.
Bengaluru
India



**Chandan
Mishra**
Director &
Co-
Founder,
Lodestar
Innovation
Pvt Ltd,
Bengaluru,
India



**Vaman
Kulkarni,**
Consultant,
Ex- Director,
Honeywell
Technology
solutions
Bengaluru,
India



**Dr. Christ
Paul,**
Additive
Expert,
Raja
Ramanna
Centre for
Advanced
Technology
(RRCAT)
India



PROGRAM SCHEDULE - 11th December 2021

10.00 am (IST)	Registration, Networking & Virtual Exhibition Booth Visit
10:00 am - 10:05 am (IST)	Welcome Address by Dr. Shibu John , Founder, TRINITY MEDIA, Managing Director, 3D GRAPHY LLP, Secretary General & Founder, 3DPERA – Announcing the event - 3D GRAPHY ENGINEERING WORKSHOP 2021 – 3D PRINTING & 3D VISUALISATION FOR AEROSPACE & DEFENCE
10:05 am - 10:10 am (IST)	Welcoming the PATRON & 3D GRAPHY ADVISORY MEMBER - Wg Cdr. Raman Sopory , Founder President, ADCAI & 3D GRAPHY ADVISORY MEMBER.
10:10 am – 10:15 am(IST)	Introducing the CHIEF GUEST - Dr. S K Vasudeva , Scientific Consultant (Defence Technologies) Office of the Principal Scientific Advisor to Govt of India.
10:15 am - 10:20 am(IST)	Introducing the GUEST OF HONOUR – Shri. Hari Mohan , IOFS, Former DGOF & Chairman Ordnance Factory Board, Ministry of Defence, Govt of India.
10:20 am -10:25 am (IST)	Welcoming the 3D GRAPHY ADVISORY MEMBERS – Dr. Surendra Pal , Ex- Vice Chancellor, Defence Institute of Advanced Technologies, Ministry of Defence, Govt. of India, Pune, India
10:25 am - 10:30 am(IST)	Col K. V Kuber , Director Aerospace & Defence Advisor, E & Y, India
10.30 am – 10:35 am(IST)	Welcoming the GUEST OF HONOUR - Dr. V. Anil Kumar , Scientist SF, VSSC/ ISRO
10.35 am - 10.40 am(IST)	Introducing the 3D GRAPHY CORPORATE ASSOCIATE MEMBERS
10.40 am - 10.45 am(IST)	Announcing the launch of 3D GRAPHY NEWS platform and also the 3D GRAPHY REPORTS another new initiative jointly by Trinity / 3D Graphy & QnQ Markets - Introducing our first report – 3D PRINTING FOR AEROSPACE & DEFENCE MARKETS IN INDIA
Session 1	“3D TECHNOLOGY A GAME CHANGER FOR AEROSPACE & DEFENCE ”.
10:45 am – 11:20 am (IST)	KEYNOTE SPEAKER - Dr. V. Anil Kumar , Scientist SF, VSSC/ ISRO, Trivandrum, Kerala – “ AM initiatives in ISRO”
11:25 am – 11:45 am (IST)	A Manjunath , Scientist F, Group Director, Metal Forming & Joining Division, GTRE , DRDO “ Additive Manufacturing in Defence Applications”.
11:50 am – 12:15 pm (IST)	Antony Paul , Head Additive Manufacturing Centre of Excellence, L & T Defence “Metal AM – Necessity for Technology Diversity”
12:20 pm - 12:45 pm (IST)	Vaman Kulkarni , Consultant, Ex- Director, Honeywell Technology solutions, Bengaluru, India “ Additive Manufacturing in Aerospace and Defence Applications
12.45 pm - 01.15 pm (IST)	Lunch & Networking
Session 2	3D PRINTING & 3D VISUALISATION TECHNOLOGY INNOVATIONS - 3D printer Hardware Machine, 3D Scanners, 3D Software, 3D Imaging Visualisation & 3D Design & Materials.
01:15 pm - 01:40 pm (IST)	Saroop Chand , Director, Adroitec Information Systems, Delhi, India
01:45 pm - 02:10 pm (IST)	Shreyans Khot , AGM, Additive Manufacturing, Amace Solutions Pvt, Bengaluru, India
02:15 pm - 02:40 pm (IST)	Chandan Mishra , Director & Co- Founder, Lodestar Innovation Pvt Ltd, Bengaluru, India
02:45 pm – 03:10 pm (IST)	Dr. Christ Paul , Additive Expert, Raja Ramanna Centre for Advanced Technology,(RRCAT),India
03:15 pm – 03:40 pm (IST)	Gp. Capt. E R Rajappan , Chairman & MD, Shivayu Aerospace, Bengaluru, India
03:45 pm – 04:10 pm(IST)	Karthik Chittepu , Technology Specialist, CADFEM India.
04:15 pm – 04:40 pm(IST)	Rajesh Mrithyunjayan - Vice president, 3D Product & Solutions, Monotech Systems Pvt Ltd
05:00 pm – 06:00 pm (IST)	PANEL DISCUSSION : “3D TECHNOLOGY A GAME CHANGER FOR AEROSPACE & DEFENCE ”. SESSION CHAIR : Wg. Cdr. Raman Sopory , Founder President, Aerospace & Defence Consultants Association of India, Delhi, India MODERATOR : Col. K. V Kuber , Director, Aerospace & Defence Advisory, E & Y, Delhi, India Dr. Surendra Pal , Ex- Vice Chancellor, Defence Institute of Advanced Technology, Ministry of Defence, Pune, India Air Vice Marshal S Saxena VSM , Consultant Munitions India Ltd Pune, Ministry of Defence, GOI Saroop Chand , Director, Adroitec Information Systems, Delhi, India.
05:55pm - 06.45 pm	Media Briefing & Interaction - Virtual Media Room
06:45 pm – 6.50 pm (IST)	Closing of the event



SPEAKERS PRESENTATION - TOPIC & ABSTRACT



Dr. V. Anil Kumar, Scientist SF, VSSC/ ISRO

“ Additive Manufacturing Initiatives in ISRO”

The talk covers introduction to additive manufacturing, potential of metal additive manufacturing for space applications, AM product development cycle, quality control aspects in AM and a few case studies on the metal additive manufacturing activities carried out in VSSC/ISRO. The role of Design for Additive manufacturing (DfAM) and topology optimization in weight reduction of systems and/or part count reduction is explained in brief. The various metal additive manufacturing methods such as laser powder bed fusion, electron beam powder bed fusion, directed energy deposition, electron beam additive manufacturing and their applications are also explained. The quality control for AM components for space applications, the various AM standards available such as the AWS D20.1, ASTM and AMS standards and datasheets for different alloys are discussed. The detailed qualification plans employed for qualification of various AM components for space applications are covered. The qualification includes powder qualification, equipment qualification, qualification of process parameters in the form of first article/ development stage hardware qualification, production hardware qualification and NDT of AM components, need for functional testing and qualification before induction the components into space programme. The need for reliable in-process monitoring of the AM processes and also reliable NDT inspection techniques is emphasized for confidently inducing the components into space programme.



A Manjunath, Scientist F, Group Director, Metal Forming & Joining Division, GTRE , DRDO

“Additive Manufacturing in Defence applications”



Saroop Chand, Director, Adroit Information Systems, Delhi, India

“Opportunities with 3D Printing for Aerospace & Defence”

Defence and Aerospace is struggling with the problem of non-availability of the parts for maintenance . They come at prohibitive cost with long delivery period . Some of these parts are critical to the operation. And defence and aerospace industry is quite closed to material , test reports etc and are not able to take advantage of 3D printing as the new technology. However, there are non-operational ground facility needs like jigs & fixture, Interiors of the equipment which can easily be moved to 3D printing. 3D printing is critical to development of new equipment's like Drone , Movable bunkers , parts for the logistic vehicles , camera casings , Exoskeleton, etc which are necessary and can easily be done using 3D printing .Quality measurement jigs, rubber seals, drilling jigs , opening and closing of the equipment are other key applications. We intend to cover large number of applications and the technologies available for 3D printing and how they can be effectively used by defence and aerospace



Dr. Christ Paul, Additive Expert, Raja Ramanna Centre for Advanced Technology,(RRCAT),India

“Design Rules for Laser Additive Manufacturing”

One of the most important aspects of additive manufacturing is design freedom. The design freedom offered by the technology allows the user to redesign components with the same or superior performance removing the limitations of the conventional manufacturing route for additive manufacturing, which is called *design for additive manufacturing*. The talk will start with Design for Additive Manufacturing. Different methodologies in *design for laser additive manufacturing*, *design guidelines for laser based metal additive manufacturing*, and *topology optimization* will be discussed citing real-life case studies.



SPEAKERS PRESENTATION - TOPIC & ABSTRACT



Shreyans Khot, AGM, Additive Manufacturing, Amace Solutions Pvt, Bengaluru, India

Recent applications in metal additive manufacturing in Aerospace and indigenously developed technology

Additive manufacturing (AM), is revolutionising the global manufacturing landscape. The design and production capability of the manufacturing industry has been impacted by additive manufacturing. Currently, the technology is mature enough to get closer to building a 3-D printed parts for the aerospace, space & defence applications. According to the latest edition of Wohler's report, the AM industry grew by 7.5% to nearly \$12.8 billion in 2020. Many leading aerospace organisations have leveraged on the advantages offered by AM to print parts such as fuel nozzles & heat exchangers for applications in the aerospace industry. Currently, India is warming up to AM. Space, aerospace & defence research institutions such as ISRO, DRDO & HAL are using AM for their specific applications. The AM landscape is changing in India as it is seeing an emergence of organisations that are involved in offering indigenously developed AM systems. The defence R&D establishment can play a decisive role in nurturing these indigenously developed AM capabilities as well as focus on the standardisation of AM for an increased adoption of the technology in the aerospace domain.



Chandan Mishra, Director & Co- Founder, Lodestar Innovation Pvt Ltd, Bengaluru, India

Polymer based AM adaptation in Aerospace and Aviation. An overview of materials and applications area of polymers in Aerospace and Aviation with a brief snapshots on Airbus Industries adaptations of polymers in their work processes. The presentation will also highlight roles of Lodestar3d and its partner company in bringing such systems and materials to Indian companies.



Vaman Kulkarni, Consultant, Ex- Director, ,Honeywell Technology solutions

“Additive Manufacturing in Aerospace Application”

Aerospace contributes for almost 20% of AM revenue and has been growing annually at about 1.6%. This is mainly because AM Produces parts that are lighter in weight, higher performing (No DFM constraint), reduced part count (Part Consolidation) and reduced inventory. Market for AM parts in Aerospace can be divided into metallic and nonmetallic (mostly Polymer) components which are generally related to critical and non-critical aircraft parts respectively. Airbus is also using AM metal brackets and bleed pipes on Airbus A320neo and A350 XWB. GE, Honeywell, Pratt & Whitney, Lockheed Martin are also important users of AM. This Abstract is about the Advances of Metal AM for applications in Aerospace.



Gp. Capt. E R Rajappan, Chairman & MD, Shivayu Aerospace

"How 3D printing can revolutionise indigenous development and manufacturing of Aerospace and Defence Equipment"

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