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INSTITUTE OF HIGHER EDUCATION AND RESEARCH
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BHARATH INSTITUTE OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF AERONAUTICAL ENGINEERING
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TECHNICAL MAGAZINE

Mach Book

2022-2023

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EDITORIAL COMMITTEE

STUDENT MEMBERS

Chaduvu Sri Anutej Reddy (Final Year)

S Kareena Chandini (Final Year)

Kasa Dheeraj (Third Year)

Ramana (Third Year)

Priyadharshini (Second year)

Satheesh (Second year)

FACULTY MEMBERS

Mr.E.Maha Vishnu

Mr.N.Kalaimani

B.Tech- Aeronautical &Aerospace Engineering

Vision of the Department

Department of Aeronautical Engineering will endeavor to accomplish worldwide recognition with a focal point of Excellence in the field of Aeronautics by providing quality Education through world class facilities, enabling graduates turning out to be Professional Experts with specific knowledge in Aeronautical & Aerospace engineering.

Mission of the Department

- To be the state of art Teaching and Learning center with excellent infrastructure and empowered Faculties in Aeronautical & Aerospace Engineering.
- To foster a culture of innovation among students in the field of Aeronautics and Aerospace with updated professional skills to enhance research potential for sponsored research and innovative projects.
- To Nurture young individuals to be knowledgeable, skilful, and ethical professionals in their pursuit of Aeronautical & Aerospace Engineering.

B.Tech- Aeronautical & Aerospace Engineering

Program Educational Objectives Statements (PEO)

PEO 1: Demonstrate a solid grasp of fundamental concepts in Mathematics, Science, and Engineering, essential for effectively addressing engineering challenges within the Aerospace industry.

PEO 2: Involve in process of designing, simulating, fabricating, testing, and evaluating in the field of Aerospace.

PEO 3: Obtain advanced skills to actively engage in research and development endeavors within emerging domains, while also pursuing further education opportunities.

PEO 4: Demonstrate efficient performance both as independent contributors and as valuable team members in diverse multidisciplinary projects.

PEO 5: Embrace lifelong learning and career advancement while adapting to the evolving social demands and needs.

Programme Outcomes (PO's)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and Engg. Specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of

engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Dean Message

Winged Words is particularly important as it encourages the students to share the knowledge they have acquired. Writing articles for the magazine also improves the communication skills of the budding engineers of the Aeronautical department. It is common knowledge that representation of an idea is as important as, if not more important, than the idea itself. Winged Words represents a cloud with a silver lining for the world of technology. It aims to inspire and nurture upcoming engineers to bring a revolution in this ever-evolving world of technology. The magazine captures the current technological advancements. To conclude I would like to congratulate the faculty and the students of the editorial team on bringing out the Second issue of Winged Words

HOD Message

Congratulations to the students and faculty associated to magazine committee for successfully publishing this issue of departmental technical magazine Winged Words is creating platform which provides an opportunity to the students and staff to express their original thoughts on technical topics.

The magazine plays an instrumental role in providing exposure to the students to develop written communication skills and command over the language. It is a step towards building professional and ethical attitude in them. The entire journey of creating Winged Words is an outcome of rigorous effort made by students and faculty. Students not only gain the knowledge about the latest technological developments and advancements through reading and writing articles but they also develop verbal and written communication skills.

This issue has expanded its scope by introducing articles by major stakeholders. Apart from students and faculty, inputs have been collected from alumni, parents and industry experts. On concluding note, I would like to thank all the stakeholders for their involvement and encouragement and wish all the best for their bright future

Occupational outlook

Summery

Quick Facts: Aerospace Engineers	
2022 Median Pay	$126,880 per year $61.00 per hour
Typical Entry-Level Education	Bachelor's degree
Work Experience in a Related Occupation	None
On-the-job Training	None
Number of Jobs, 2022	63,800
Job Outlook, 2022-32	6% (Faster than average)
Employment Change, 2022-32	3,900

What Aerospace Engineers Do

Aerospace engineers design, develop, and test aircraft, spacecraft, satellites, and missiles.

Work Environment

Aerospace engineers typically work in an office setting, often using a computer. Most work full time, and some work more than 40 hours per week.

How to Become an Aerospace Engineer

Aerospace engineers must have a bachelor’s degree in aerospace engineering or a related field to enter the occupation. Aerospace engineers who work on projects that are related to national defense may need a security clearance.

Pay

The median annual wage for aerospace engineers was $126,880 in May 2022.

Job Outlook

Employment of aerospace engineers is projected to grow 6 percent from 2022 to 2032, faster than the average for all occupations.

About 3,800 openings for aerospace engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

State & Area Data

Explore resources for employment and wages by state and area for aerospace engineers.

What Aerospace Engineers Do

Aerospace engineers evaluate designs to see that the products meet engineering principles.

Aerospace engineers design, develop, and test aircraft, spacecraft, satellites, and missiles.

In addition, they create and test prototypes to make sure that they function according to design

Duties

Aerospace engineers typically do the following:

Coordinate and direct the design, manufacture, and testing of aircraft and aerospace products

Assess project proposals to determine whether they are technically and financially feasible

Determine whether proposed projects will be safe and meet defined goals

Evaluate designs to ensure that products meet engineering principles, customer requirements, and environmental regulations

Develop criteria for design, quality, completion, and sustainment after delivery

Ensure that projects meet required standards

Inspect malfunctioning or damaged products to identify sources of problems and possible solutions

Aerospace engineers develop technologies for use in aviation, defense systems, and spacecraft. They may focus on areas such as aerodynamic fluid flow; structural design; guidance, navigation, and control; instrumentation and communication; robotics; or propulsion and combustion.

Aerospace engineers may design specific aerospace products, such as commercial and military airplanes and helicopters; remotely piloted aircraft and rotorcraft; spacecraft, including launch vehicles and satellites; and military missiles and rockets.

The following are the two common types of aerospace engineers:

Aeronautical engineers work with aircraft. They are involved primarily in designing aircraft and propulsion systems and in studying the aerodynamic performance of aircraft and construction materials. They work with the theory, technology, and practice of flight within the Earth’s atmosphere.

Astronautically engineers work with the science and technology of spacecraft and how they perform inside and outside the Earth's atmosphere. This includes work on small satellites such as CubeSat's, and traditional large satellites.

Work Environment

Aerospace engineers held about 63,800 jobs in 2022. The largest employers of aerospace engineers were as follows:

Aerospace product and parts manufacturing 34%

Engineering services 16

Federal government, excluding postal service 16

Research and development in the physical, engineering, and life sciences 10

Navigational, measuring, electromedical, and control instruments manufacturing 6

Aerospace engineers typically work in an office setting, often using a computer. They also may travel to meet with clients.

Work Schedules

Most aerospace engineers work full time, and some work more than 40 hours per week. Engineers may need to work extra hours to monitor progress and troubleshoot when problems arise

How to Become an Aerospace Engineer

Aerospace engineers typically need a bachelor's degree in aerospace engineering or a related field to enter the occupation. Aerospace engineers who work on projects that are related to national defense may need a security clearance.

Education

Aerospace engineers typically need a bachelor's degree in engineering or a related field. High school students interested in studying aerospace engineering should take classes in chemistry, physics, and math.

Bachelor's degree programs in engineering usually include classroom, laboratory, and field courses in subjects such as stability and control, structures, and mechanics.

College students may have an opportunity to participate in cooperative education programs or internships. Through partnership with local businesses, these programs allow students to gain practical experience while they complete their education.

Some colleges and universities offer a 5-year program that leads to both a bachelor's degree and a master's degree. A graduate degree may allow an engineer to work as an instructor at a university or to do research and development.

Employers may prefer to hire graduates of aerospace engineering programs accredited by a professional association such as ABET. A degree from an accredited program is usually required to become licensed.

Licenses, Certifications, and Registrations

Licensure is not required for entry-level aerospace engineer positions. Experienced engineers may obtain a Professional Engineering (PE) license, which allows them to oversee the work of other engineers, sign off on projects, and provide services directly to the public.

State licensure generally requires a bachelor's or higher degree from an ABET-accredited engineering program, a passing score on the Fundamentals of Engineering (FE) exam, several years of relevant work experience, and a passing score on the PE exam.

Each state issues its own license. Most states recognize licensure from other states, as long as the licensing state's requirements meet or exceed their own licensure requirements. Several states require continuing education for engineers to keep their licenses.

Advancement

Aerospace engineers who gain experience or who have additional education or credentials may advance into technical or supervisory positions. Those with leadership skills also may become engineering managers or project management specialists.

Important Qualities

Analytical skills. Aerospace engineers must be able to evaluate project design elements and propose improvements, if necessary.

Business skills. Meeting federal standards in aerospace engineering requires business knowledge, including commercial law. Project management or systems engineering skills also may be useful.

Communication skills. Aerospace engineers must be able to explain, both orally and in writing, the details of their designs. They may need to convey information to a variety of audiences, including nontechnical ones.

Interpersonal skills. Aerospace engineers often work on teams and must be able to interact with other types of engineers and with nontechnical team members.

Math skills. Aerospace engineers use calculus, trigonometry, and other math in their analysis, design, and troubleshooting work.

Problem-solving skills. Aerospace engineers upgrade designs and troubleshoot problems to improve aircraft, such as for increased fuel efficiency or safety.

Pay

The median annual wage for aerospace engineers was $126,880 in May 2022. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. The lowest 10 percent earned less than $78,170, and the highest 10 percent earned more than $176,280.

In May 2022, the median annual wages for aerospace engineers in the top industries in which they worked were as follows:

Research and development in the physical, engineering, and life sciences $141,730

Navigational, measuring, electromedical, and control instruments manufacturing 129,890

Aerospace product and parts manufacturing 128,550

Federal government, excluding postal service 127,150

Engineering services 122,480

Most aerospace engineers work full time, and some work more than 40 hours per week. Engineers may need to work extra hours to monitor progress and to troubleshoot when problems arise.

Job outlook

Employment of aerospace engineers is projected to grow 6 percent from 2022 to 2032, faster than the average for all occupations.

About 3,800 openings for aerospace engineers are projected each year, on average, over the decade. Many of those openings are expected to result from the need to replace workers who transfer to different occupations or exit the labor force, such as to retire.

Employment

Aircraft are being redesigned for less noise pollution and better fuel efficiency, which should help drive demand for aerospace engineers.

Technological advancements have reduced the cost of launching satellites. Demand for aerospace engineers is expected to increase as space becomes more accessible, especially with developments in small satellites that have greater commercial viability. In addition, continued interest in drones for certain uses, such as forest fire detection, may help to drive employment growth for these engineers

Employment projections data for aerospace engineers, 2022-32

Occupational Title	SOC Code	Employment, 2022	Projected Employment, 2032	Change, 2022-32		Employment by Industry
				Percent	Numeric	
SOURCE: U.S. Bureau of Labor Statistics, Employment Projections program						
Aerospace engineers	17-2011	63,800	67,700	6	3,900	

The Top Trends in the Aerospace and Defense Sector in 2023

Like many engineering sectors, the aerospace industry has experienced much disruption in recent years. The result: changing demands, skills sets, and expectations on engineers and other professionals.

Some of these disruptions are caused by changes in federal government policies. Others are due to new innovations and technologies that have opened up new possibilities for the industry.

Let's walk through six key engineering trends among aerospace and defense companies emerging from these disruptions.

What is causing the disruption in the aerospace industry?

There isn't a single factor responsible for the current disruption in the defense / aerospace industry. Rather, it looks like a number of different events and trends are converging:

Aftershocks from the COVID-19 pandemic and the resulting supply chain disruptions

Labor shortages and other disruptions in the engineering workforce

Technological advancements that have made major strides in the last couple of years

Evolving consumer and client expectations, particularly around sustainability and clean energy

Let's take a closer look at each of these disruptions in more detail.

Supply chain disruptions

A major source of aerospace industry disruption has been increasingly complex supply chains. As aerospace & defense (A&D) companies rely on multiple tiers of suppliers - often numbering in the tens of thousands - the noise can lead to limited visibility.

What's more, recent policy decisions from the U.S. federal government have had downstream consequences. Some of these policies are proactive, while others are reactive. Proactively, the U.S. Department of Defense (DoD) has prioritized the development of domestic supply chains to prevent the shortages that were common during the COVID-19 pandemic. Reactively, the

conflict in Ukraine has resulted in a number of defense production software requirements that engineers didn't anticipate prior to the invasion.

Additionally, the Ukrainian conflict has also cut off U.S. manufacturers from Russian supplies of titanium, which comprised 50% of supply to the aerospace & defense sector.

In response, aerospace companies are prioritizing the following initiatives:

Supply chain diversification to avoid concentration risk

Developing deep visibility into supply chains to improve supply control and coordination—which requires a transformation of the use of data in A&D

Implementing digital supply chains to better monitor supplier risk, as most disruption occur beyond tier 1

Prioritizing cybersecurity, cloud privacy, and resilience of systems and automations

Labor and workforce dynamics

Despite improvements in the U.S. labor market, workforce turnover rates are still high, leading to reduced production and delays in contracts. This is due to a number of factors:

Aging workforce composition resulting in shortages that increase the competition for talent in the industry

Automation and use of advanced digital technologies bringing a change in education requirements, driving the need for more advanced aerospace engineering, math, data science, and digital skills

Technical skills gaps as defense companies transition from legacy tools and technologies to more modern operations

Downstream effects of labor dynamics of supply chain issues to lower revenue outlooks

One example from Deloitte shows that a leading aerospace and defense company hired 2.5 times planned engineer hires due to high attrition. Additionally, a leading global aerospace OEM estimates that the commercial aerospace segment could require an additional 610,000 technicians for the maintenance division alone in the next two decades, with the North American region accounting for about 22% of the overall requirement.

Because of these changes, many aerospace & defense companies are facing challenges in organizational change management. These issues have downstream implications for culture and organizational efficiency.

Technological advancements and innovations

It almost seems unnecessary to discuss the many technological advancements and nnovations within aerospace & defense. Some of the more prominent and impactful include:

Energy transformation from fossil fuels to renewables

Explosion of Big Data in tandem with the evolution of AI and machine learning Virtual reality (VR) and augmented reality (AR) becoming more responsive and useful

Manufacturing transformation, including smart factory and 3D printing

Chemical engineering advancements resulting in more flexible materials for building Many of these advancements enable greater agility and versatility to specific demands, as well as streamlining engineering processes to improve efficiency.

At the same time, these advancements come with their own challenges. Among the most prominent are the different skill sets new engineers are expected to know, as well as general change management challenges in adopting new processes and technologies.

Consumer and client expectations

In every field, but especially in the aerospace sector, there are growing consumer xpectations, particularly around climate change and renewable energy.

Some of these expectations are a result of market conditions, while others are due to federal mandates. Consumers are becoming more environmentally conscious and prefer to do business with companies that prioritize clean energy.

There is also a proposed rule from the federal government that, if approved, would require all defense contractors to disclose their greenhouse gas emissions and set emissions reduction goals.

Regardless of where the expectations are coming from, there's a growing push toward renewable and sustainable energy. This is undoubtedly driving a number of environmental and technological innovations we're seeing in the field right now.

What are the top aerospace engineering trends for 2023?

In response to a number of these trends in the aerospace and defense sector, many major companies are investing in new processes and technologies to become more adaptable and agile.

Note that while we list these six trends separately, they're all interconnected. A great example is the overlap between digital transformation and artificial intelligence, additive manufacturing and space infrastructure, and so forth. It's wrong to think of these as distinct trends, but as pieces in a much more complex puzzle.

As these aerospace engineering trends continue to bear out, many companies will need to change their tools, systems, processes and technologies to keep up. Those who don't may, in a decade or less, find themselves unable to compete.

Digital Transformation in Aerospace Tooling

Aerospace engineers are increasingly expected to be more agile with limited production capabilities, not to mention future disruptions. In response, many companies are embracing digital transformation to:

Remain agile and avoid bottlenecks by enabling efficient operations Adopt data-intensive solutions like digital threads, digital twins, and advanced analytics Provide a competitive advantage over companies remaining on legacy platforms Meet requirements to compete for certain government programs Digital transformation touches all areas within an organization, including engineering processes, supply chain management and visibility, digital factory, data de-sioling, and more. Specific features and functionalities include cloud, big data, artificial intelligence and machine learning (more on that below), digital twins, the Internet of Things (IoT) and more.

One approach some aerospace engineers are taking is adopting model-based design. This approach enables them to build functional digital models and test them in virtual environments. By reducing the need to manufacture and test physical prototypes, model-based design provides a more effective and agile approach to testing.

In addition, virtual environments and immersive technologies are also applied to train aerospace employees. Virtual reality (VR) and augmented reality (AR) are used to allow engineers and pilots to work in complex environments, view composite structures, and even provide additional information via helmets or glasses.

For example, Aries is a startup providing VR-based training solutions. Fyr, another startup, has developed a head-mounted AR-based visualization system. Here's an article where we go into more depth about why digital transformation is critical for forward looking aerospace systems engineering companies.

Artificial Intelligence and Machine Learning

In an effort to automate monotonous processes and eliminate human errors, aerospace companies are turning to AI and machine learning technology to aid certain human operations. AI provides a benefit by handling complex problems in a shorter amount of time, and with fewer errors, than a human counterpart.

These can include:

Route optimization

Asset utilization

Fuel efficiency

Decision-making during autonomous flight operations

Right now, the goal is for AI to serve as an assistant to the human pilot, rather than replace them.

Among recent aerospace AI startups are Skydweller Aero, which has developed a solar-powered autonomous flight system; and Beacon AI, which has pioneered an AI-enabled co-pilot device.

Sustainable Energy

With growing concerns around climate change, many aerospace companies are prioritizing carbon footprint reduction. This has recently become a possibility due to innovations and advancements in energy technology:

Biofuels can reduce dependence on fossil fuels, cutting down carbon emissions

Electric flight technology can further curb emissions

Energy-efficient integrations & designs can aid in improving fuel efficiency, thereby reducing emissions and costs even for those designs that continue to use fossil fuels

A couple of interesting examples of these trends include Metafuels, a Swiss startup that's developing alternative fuels for aerospace operations. Metafuels's proprietary technology converts green methanol into sustainable aviation fuel, potentially reducing the carbon footprint by up to 80%.

Additionally, Airbus has launched a new line of electric aircraft in an effort to bring zero emission aircraft to market by 2035.

Here's an article where we go into more depth about the key drivers and challenges of sustainable energy in aerospace, aviation and defense companies.

Additive Manufacturing and Smart Factories

With advances in metal 3D printing, additive manufacturing plays a significant role in aerospace manufacturing, enabling companies to leverage low-volume production runs in a more cost effective way.

Additionally, smart materials allow manufacturers to produce stronger, lighter alternatives to conventional materials. These can include:

Piezoelectric materials. Materials that can produce electric energy upon application of mechanical stress

Shape memory materials. Materials that can recover their original shape from a significant and seemingly plastic deformation when a particular stimulus is applied Chromoactive materials. Materials that change color when exposed to certain stimuli Magnetorheological materials. Materials whose rheological properties may be rapidly varied by application of a magnetic field Photoactive materials. Materials that actively interact with light are tuned and optimized to achieve effects such as light emission or detection

Additive manufacturing enables aerospace companies to rapidly develop prototypes, shortening lead times, improving cycle times, and increasing factory efficiency. It can also be

a key component in enabling the adoption of “smart factory” initiatives, another aerospace engineering trend for 2023.

Smart factory specifically connects individual processes within and beyond production sites. This can provide critical material and component supply visibility to ensure efficient production, faster design to delivery, and increased scalability.

Satellites and Space Infrastructure

A moonshot goal of the aerospace industry has been the development of a flourishing space industry, enabling us to take advantage of the environment outside our own planet. In 2023, it seems we’re closer to that dream than ever.

Falling costs of launching satellites into orbit and the growing demand for geospatial intelligence and satellite imagery has led to a boom in the satellite and space infrastructure sector. In fact, satellite launches make up the majority of commercial space activities.

Some of the more notable developments in this area include:

Satellite miniaturization, which enables pico- and nanosatellites to become easily launchable and scalable

Global connectivity demands driving the needs for satellite-based communications systems

Additive manufacturing optimizing satellite production and maintenance of in-orbit systems

Examples of transformation in space infrastructure include Dragonfly Aerospace, a South African startup building Satellite Buses. Additionally, UK startup Citadel Space Systems is manufacturing nano- and picosatellite platforms for applications in research, discovery, and education.

Additionally, there is a growing trend for space activity management, which seeks to better understand and control movements in space. These can include tourism, industrial missions, servicing, food production, waste disposal, and more. This development is key to a safe, productive space industry to emerge.

Other Emerging Technologies

Finally, there are a number of emerging technologies in the aerospace sector that promise to transform the industry. These innovations include:

Hypersonic aircraft & weaponry

Advanced Air Mobility (AAM), which is fully electric commercial air travel

Unmanned aerial vehicles, often electric, providing safer, more efficient commercial deliveries

As these markets continue to develop, engineering requirements and expectations will have to evolve to keep up.

How do regulations such as ITAR, DO-178, DO 330 affect the trends in aerospace and defense?

Aerospace tools are heavily regulated due to the sensitive nature of the technologies involved. Aerospace certifications and regulations such as the International Traffic in Arms Regulations (ITAR certification), DO-178C, and DO-330 are just a few examples of the many standards that have been put in place to ensure that products and technologies developed in this industry meet the highest standards of safety, reliability, and security.

While these regulations can be seen as a hindrance to innovation by adding extra layers of bureaucracy and cost, at Collimator, we believe that they actually do the opposite. They ensure that the end products meet the safety needs of the customer while providing a solid foundation upon which innovation can be sustained. More information on this is included in the appendix.

Final thoughts on major aerospace engineering trends

The aerospace engineering trends we've listed here only scratch the surface. Supersonic flights, satellite communication, and further advancements in Big Data are just a few.

This is an exciting time to be in aerospace engineering, but it also can be a confusing time. With so much change in the air, it can be challenging to adapt your engineering processes to keep up. In some cases, companies don't adapt - and they put their business at risk while doing so.

There are several key aspects to an effective aerospace engineering process in the face of all this change:

Quick pivoting to incorporate and test new technologies in response to client demand

Process changes that can easily conform to the design, testing, validation, and production requirements of various complex and interconnected systems

Data intelligence that resists silos and enables open sharing of information among all your teams

Cross-functional communication to ensure efficiency and peak productivity across your whole organization

As the aerospace industry becomes more complex, your organization has to keep up. Fortunately, with the right amount of planning and intentionally, you can soar in this opportunity-rich market.

Aerospace Advances: 6 Cutting-Edge Technologies Showcased at Paris Air Show 2023

1/ VoltAero Unveils the Cassio 330 Electric-Hybrid Aircraft

VoltAero, a leading innovator in electric-hybrid aircraft technology unveiled their Cassio 330 electric-hybrid aircraft which could represent a significant milestone in the journey towards sustainable aviation.

With its patented electric-hybrid propulsion system, this aircraft offers a unique combination of safety, quietness, efficiency, and eco-friendliness.

Designed to accommodate 5-12 passengers, the Cassio aircraft family caters to various applications including air taxi/charter, commercial flights, utility-category tasks such as cargo transportation, postal delivery, and Medevac services, as well as private ownership. The shared modular design strategy adopted by VoltAero ensures significant commonality among the different models, allowing for enhanced versatility and cost-effectiveness.

SolarStratos' Solar Plane

SolarStratos, the pioneering mission led by eco-adventurer Raphaël Domjan, is making its debut appearance at the Paris Air Show. The HB-SXA solar-electric aircraft aims to reach the boundaries of the stratosphere (25,000 meters). If conditions permit, a flight over the French capital will also be attempted during the event.

Designed by Calin Gologan and the German company Elektra Solar GmbH, the aircraft boasts a wingspan of 24.8 meters and a length of 7.9 meters. Propelled by dual 19 kW electric motors with a maximum speed of 2,200 rpm, the aircraft's three-blade propeller spans 1.75 meters. It is powered by 22 square meters of solar panels and weighs only 450 kg.

The primary objective of SolarStratos is to prove that electric-solar aviation is not only feasible but also surpasses the potential of fossil fuel-based systems. To achieve this extraordinary feat while minimizing the aircraft's weight, the cabin will not be pressurized. As a result, the pilot, Raphaël Domjan, will wear a pressurized astronaut-like suit, a world-first, powered solely by solar energy. This endeavor represents both a technical and human challenge.

The SolarStratos plane is designed to fly at high altitudes to collect scientific data on the Earth's atmosphere and climate. It will also be used for tourism and adventure flights. The plane can carry two passengers and a pilot and has a maximum speed of 130 km/h.

The mission is expected to last approximately six hours, involving three hours of ascent to approach space, fifteen minutes of stargazing, and three hours of descent back to Earth. The aircraft and its pilot will endure extreme temperatures as low as -70°C, making this a truly scientific endeavor. Solar Stratos plans to conduct test flights of the plane in the coming months and hopes to begin commercial flights by 2022.

Aerospace industry outlook: Sustainability on the agenda at Paris Air Show and beyond

Covid-19 kept planes grounded

Recent years have been unkind, and the aerospace industry has been forced to navigate a series of turbulent events, with the Covid-19 pandemic delivering a particularly devastating blow.

As international travel ground to a halt for long but undefined periods of time, airlines faced unprecedented financial strain and the demand for commercial aircraft declined sharply, with cancellations for existing orders coming fast. The resulting production cuts, delayed deliveries, and workforce reductions sent shockwaves throughout the entire supply chain, leaving some manufacturers, suppliers, and service providers scrambling to survive.

This combined with economic downturns and geopolitical tensions fostered uncertainty and volatility in the sector, with each complex hurdle testing its resilience and adaptability.

But they're now flying off the tarmac

Of course, outcomes for manufacturers in the civil aerospace sector largely follow predicted travel trends. And today, with Covid-19 restrictions [illegible] countries, and the market having regained confidence, travel is firmly back on the agenda for many.

With airlines using the pandemic to clear out fleets of older or less efficient planes, and the industry changing its focus to more efficient and greener options, new planes are taking to the skies. ADS Commercial Aircraft & Engine Data for 2023 shows that deliveries of aircraft year to date by April 2023 totalled 337 – a considerable leap from 2020 and 2021, and only a fraction behind 2022's bumper year.

Though the data shows orders are much lower this April than last, wider announcements and sector comments since then point to a further post-pandemic acceleration in orders around this years' show.

What's incredibly positive for the industry is the backlog of orders, which at the end of April stood at 13,401 aircraft – worth around £200bn to the UK over many years. That only looks set to grow further over the next week.

There are so few sectors that can boast such a pipeline this far in advance. This is a very healthy amount of work for businesses in the supply chain to get through and, notwithstanding potential order cancellations, a strong position for the industry to be in. However, companies will need to gear up swiftly to deliver or risk order cancellations if other players are able to scale more quickly, or the current demand eases before orders can be delivered.

While the companies that survived the pandemic were those able to flex and downscale quickly, thriving in the next few years will rely on the ability to flex and upscale rapidly.

Smaller aircraft in demand as travellers opt for short-haul travel

Though holidays and (to a lesser extent) business travel are back in vogue, travel habits have not simply reverted to their pre-pandemic norm. Most long-haul travel was paused during the pandemic. And in the years following, more passengers have opted for short-haul travel – possibly to minimise financial loss in the event of cancellation, or simply due to flight costs being up during the current cost-of-living challenges. Passenger numbers are also only recently coming close to pre-pandemic levels, though IATA predicts they will meet them in 2024.

Airlines initially followed the trend of refreshing short-haul fleets while keeping remaining wide-body fleets partially mothballed. This is evidenced in the 2023 ADS Commercial Aircraft & Engine Data, which showed that, of the 337 deliveries year to date by April 2023, 88% were single-aisle aircrafts, while just 12% were wide body.

Of course, with the exceptionally long lead times on aircraft, these delivery figures reflect decisions made two years ago or more, coinciding with the beginning of the end of national lockdowns.

What's interesting, however, is that gross orders of wide-body planes are up by 200%, indicating that airlines have confidence in passenger appetite for long-haul trips in the next few years. On this trend, British Airways also recently announced that four Airbus A380s will re-join its fleet, as it launches its biggest schedule since March 2020.

Despite positivity up and down the aerospace supply chain, businesses will be keeping a close eye on the economic outlook and consumer spending, in the hope that recessionary pressures do not result in a marked decrease in international travel over the next 12 months.

While a recession would of course not be positive, data gathered from our recent consumer markets outlook showed that, following long lockdowns, travel is one of the last categories of discretionary spend that respondents would look to cut back on. While 40% planned to spend less on eating or drinking out, only 10% intended to reduce spend on long stay holidays, and 14% on weekends away. This is indicative of the appetite for international travel and the willingness to prioritise it ahead of other discretionary spend, which is encouraging for the sector.

Zero-emission commercial flights coming soon

Meanwhile, spurred on by the announcement of a £113m investment through the Aerospace Technology Institute (ATI) Programme, announced by the Business and Transport Secretaries in February, aircraft developers are firmly focused on innovation, taking leaps towards zero-emission goals. In January of this year, ZeroAvia flew the largest aircraft in the world (19 seats) to be powered by a hydrogen-electric engine.

Zero-emission commercial flying would be a game-changer for the aerospace industry, and advancements like ZeroAvia's, as well as Rolls-Royce's recent steps forward with its UltraFan cutting-edge jet engine technology, show that the industry is moving in the right direction. But is it going fast enough?

Environmental pressures are not going away, and consumers more and more expect and consider greener options. Primes in the sector are also increasingly expecting their suppliers to communicate action plans and progress through transparent reporting on emissions, resource consumption, environmental impact, waste and recycling (driven by increasing analysis and disclosure requirements in part by financial regulators and investors). All of this was discussed at a recent industry event run in partnership between ADS Group, Rolls Royce and RSM.

It will be interesting to see the split of aircraft orders announced at the air show. Presumably, this will continue to follow the focus on the most fuel-efficient long-haul aircraft options. But perhaps more intriguing will be how much more we see of the emerging clean technology options.

Call for renewed industrial strategy

Sadly, it's not all rosy, with one key risk for the aerospace industry being regulatory alignment following the Brexit agreements made in December 2020, and the UK's consequential leaving of the European Aviation Safety Agency (ESAE).

As a result, UK aviation licenses are no longer recognised in the EU. European maintenance firms also require a separate approval to work for UK-registered airlines. ADS Group has raised concerns around these new rules – saying that failure to secure membership to the ESAE as part of Brexit negotiations has hampered aviation's recovery following the pandemic. In addition, the UK is also yet to reach an agreement allowing its scientists to re-join Horizon Europe, the €95bn research and innovation programme. Given the pace of change currently taking place within the industry, it is even more important that the UK works closely with the EU. Meanwhile, Make UK, has called for the development of a long-term modern industrial strategy that takes into consideration not only the need to accelerate the transition to net zero and other technological changes, but also a plan that considers the skills, infrastructure, finance and innovative business environment the UK requires. Without this strategy, British businesses risk losing out to other companies around the world.

Soaring to New Heights: Emerging Trends in Aeronautical Engineering in India

Aeronautical engineering, a field synonymous with flight and innovation, is experiencing rapid advancements in India. With the aviation and aerospace industries witnessing significant growth aeronautical engineering is at the forefront of this transformation. According to a report by Boeing, India is expected to require around 2,380 new aircrafts by 2039. This demand is driven by factors such as increasing domestic and international air travel, the introduction of regional connectivity schemes, and the rise of low-cost carriers.

Unmanned Aerial Vehicles (UAVs) and Drones

The utilization of unmanned aerial vehicles (UAVs) and drones has skyrocketed in recent years. From commercial applications like aerial photography and delivery services to defense and surveillance purposes, UAVs are transforming various sectors. Aeronautical engineers are at the forefront of developing and optimizing these technologies, focusing on areas such as autonomy, navigation systems, and payload capabilities.

Electric and Hybrid Aircraft

The pursuit of sustainable aviation has led to the emergence of electric and hybrid aircraft. With an increased focus on reducing carbon emissions, aeronautical engineers are developing innovative propulsion systems and energy storage solutions for aircraft. These advancements aim to enhance efficiency, minimize environmental impact, and pave the way for greener aviation technologies.

Supersonic and Hypersonic Flight

Advancements in supersonic and hypersonic flight technology have gained significant attention in recent years. Aeronautical engineers are exploring concepts such as supersonic passenger planes and hypersonic space travel. These endeavors require expertise in aerodynamics, materials science, propulsion systems, and thermal management. The development of advanced materials and propulsion technologies is crucial to achieving safe and efficient high-speed flight.

Composite Materials and Lightweight Structures

The use of composite materials and lightweight structures is revolutionizing aircraft design. Aeronautical engineers are continually researching and developing innovative materials that offer improved strength-to-weight ratios, enhanced durability, and resistance to fatigue. These materials play a vital role in reducing aircraft weight, increasing fuel efficiency, and improving overall performance.

Artificial Intelligence (AI) and Machine Learning

The integration of artificial intelligence (AI) and machine learning (ML) in aeronautical engineering is unlocking new possibilities. These technologies assist in various areas, including aircraft design optimization, predictive maintenance, flight control systems, and

autonomous decision-making. Aeronautical engineers are harnessing AI and ML to enhance safety, operational efficiency, and overall aircraft performance.

Space Exploration and Satellite Technology

India's space program has made significant strides, and aeronautical engineers are actively contributing to space exploration and satellite technology. From designing launch vehicles and satellite systems to spacecraft propulsion and orbital dynamics, engineers are involved in the entire lifecycle of space missions. India's growing presence in space research opens up exciting opportunities for aeronautical engineers in the field of space exploration.

The field of aeronautical engineering in India is witnessing a wave of emerging trends that are revolutionizing the aerospace industry. This tremendous growth will mean that aeronautical engineers will have a plethora of career opportunities in aircraft design, aerospace manufacturing, flight testing, maintenance and repair, aerodynamics, propulsion systems, avionics, space exploration, research and development, and consulting, providing diverse roles in the aviation and aerospace sectors. As India continues to invest in its aviation and aerospace sectors, aeronautical engineering will play a crucial role in shaping the future of flight, pushing boundaries, and propelling the nation's aviation ambitions to new heights**.**

Aerospace manufacturing in 2023 – the big issues

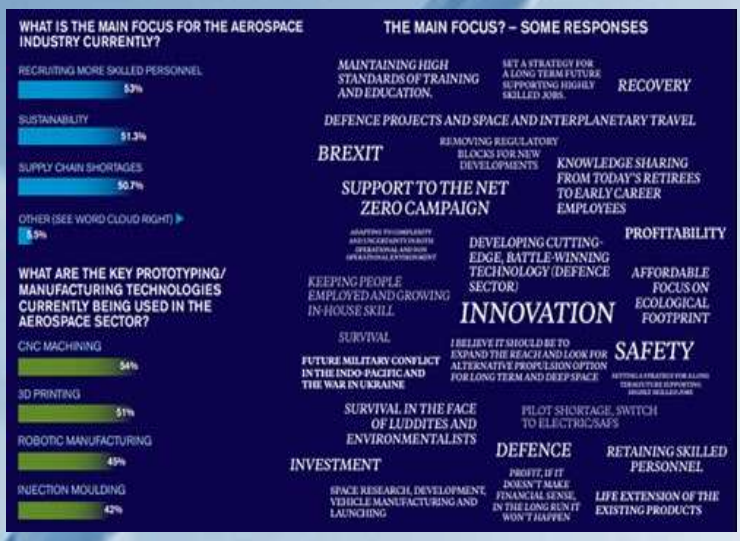
In early 2023, a joint survey from the Royal Aeronautical Society and digital manufacturing specialists, Protolabs, was conducted to learn more about the aerospace sector's most important concerns and top priorities. TIM ROBINSON FRAeS examines the results.

Airbus is now ramping up airliner production - but what are the obstacles. (Airbus)

It may be a cliché, but it is a time of unprecedented change in the global aviation, aerospace and space industry. No sooner had the Covid pandemic ended, temporarily grounding air travel, than a high-intensity peer-on-peer war erupted in Eastern Europe with Russia's invasion of Ukraine. Climate action, meanwhile, is now top of the agenda in many places, and the aerospace industry is racing to decarbonise itself – even as it struggles with supply chain shortages and a skills crisis. Meanwhile, sci-fi dreams of flying taxis, rockets that land vertically, hotels in space and now AI that can hold lengthy conversations with humans are almost here. All of these external factors make for a challenging landscape for today's firms to navigate when deciding on technology and investment priorities.

This landmark survey, with an impressive take-up, saw over 1,800 responses from RAeS members, with respondents ticking job roles, such as Engineer (29.48%), Procurement (15.15%), Product Designer/Development (13.66%), R&D (12.61%), Retired (8.46%), Other (8.08%), IT/Digital (7.47%) and Student (5.09%).

In addition, as might be expected for the 'Other' category, this also included a significant number of respondents with 'pilot' in their job title. In terms of seniority, some 27.32% of respondents were in the 'Middle Management' category, while 23.41% described themselves as 'Experienced' and 21.73% as 'Team Lead' level. Let us take a look at some of the key takeaways from this survey.

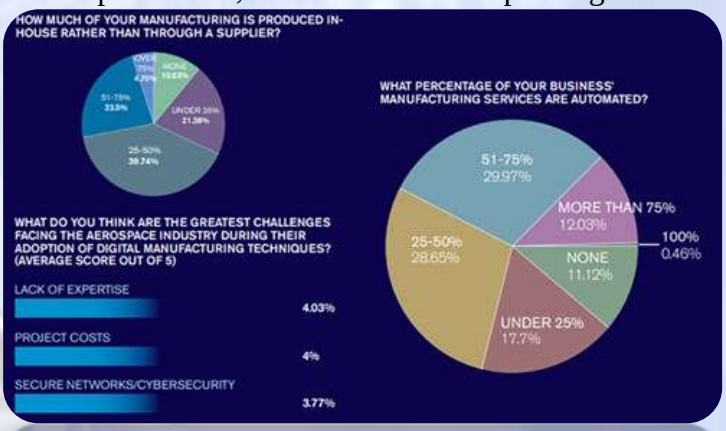


What is the main focus for the aerospace industry?

Reflecting on the key priorities of the global aerospace industry, recruiting more skilled personnel was chosen as the number one focus by respondents at 52.9%, closely followed by Sustainability (51.6%) and Supply Chain Shortages (50.7%). This tracks closely with the sector-wide skills' crisis the aerospace industry now finds itself in, with a combination of demographics and workers not returning after being furloughed or downsized during the pandemic. Meanwhile, the sustainability agenda is also accelerating as the industry races to decarbonise itself. Yet, aerospace is still reeling and attempting to play catch-up with disrupted supply chains that have played havoc with tightly integrated 'just-in-time' global networks. In November 2022 Airbus CEO Guillaume Faury said he expected 'supply chain constraints' to last another year.

The 'Other' (5.59%) category, which allowed respondents to specify additional issues threw up some further challenges and issues, such as 'inflation and its negative effects on sustainability and growth', 'regulation changes post-leaving EASA', 'fuel price increases' and a call from one respondent to embrace digitalisation fully: 'the industry is operating in the past. Most of the leaders in the industry are missing the key lessons regarding AI and automated systems. Nobody is looking at information technology as a key component in aerospace… Why?"

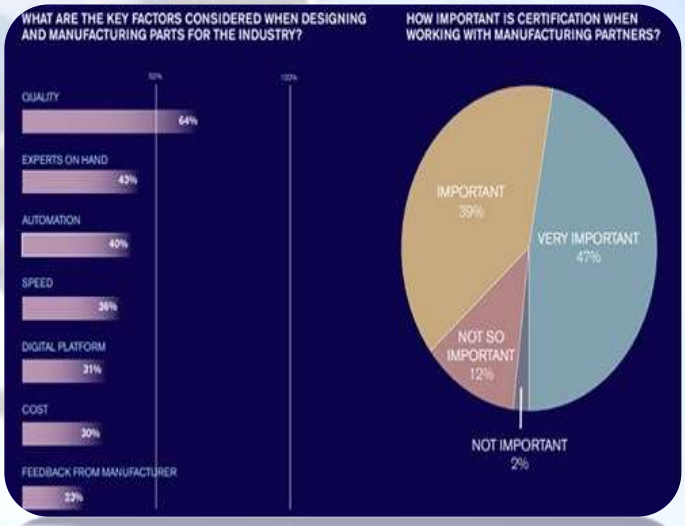
Meanwhile, the survey found that CNC machining (53.85%) was the key prototyping/manufacturing technology in the aerospace sector, followed by 3D printing (51.41%) and then Robotic Manufacturing (44.88%) and Injection Moulding (41.51%). While the option of CNC machining in grinding, cutting and milling metallic structures as the number one choice is perhaps no surprise for aircraft production, the selection of 3D printing/additive manufacturing by nearly 50% of respondents is more noteworthy. This indicates that 3D printing has now gone mainstream in the aerospace and space industry, passing from a niche 'rapid prototyping tool' to more widespread use. Indeed, earlier this year saw the first-ever fully 3D-printed rocket, Terran 1, attempt to reach orbit.



In the 'Other' category at 4.10%, additional suggestions included 'casting', 'digital twinning' and 'MBSE (model based system engineering)', as well as several entries suggesting 'composites and composites moulding'.

What percentage of business manufacturing services are automated?

Roughly 25-50% of components are manufactured in-house, found the survey, with 39.68% of respondents picking this option, followed by 23.35% indicating a greater vertically integrated in-house capability at 51-75% and 21.35% for more outsourced enterprises – under 25%. This backs up consolidation trends in the aerospace industry that have seen mergers and acquisitions in recent years concentrate manufacturing in a smaller number of large 'Tier 1' or 'Super Tier 1' suppliers.



What are the key factors in manufacturing components?

However, in embracing the possibilities of this new digital manufacturing landscape, the survey highlighted that the aerospace sector could well be falling behind with respondents selecting 'Lack of expertise' as the biggest obstacle – highlighting a growing need for 'digital natives' and IT specialists in the aerospace industry. Despite its history of being on the cutting-

edge of technology, the aerospace industry is now competing with the financial sector, app developers, AI specialists, motorsports and more. Indeed, consultants McKinsey found that, for every traditional engineer the global aerospace and defence (A&D) industry is trying to recruit, it is also trying to recruit two software engineers. Other challenges identified were 'Project costs' – an admission perhaps that investing in 'Factory 4.0' technology may be initially expensive. Meanwhile, 'Secure networks/cybersecurity' was also highlighted as a concern. This is particularly relevant with the current geostrategic environment and the 'decoupling' of some industries with China and Russia.

The industry as a whole is significantly automated with 29.84% of respondents replying their manufacturing was 51-75% automated, followed closely by the 25-50% segment (28.47%). Interestingly, some 11.29% of respondents chose 'none' as an answer. This could very well indicate sub-sectors in small batch production, artisan-style manufacturing, such as rebuilding WW2 'warbirds' or assembling custom UAV prototypes.

In automated manufacturing, it would also be interesting to revisit this question in a few years time to see the effect of the nascent eVTOL sector on the answers. Here 'air taxi' manufacturers are aiming for automotive-levels of production with Archer and Vertical both planning 2,000 air vehicles a year. This is over double the 661 airliners that Airbus delivered in 2022 and strongly suggests that the level of automation will increase.

As might be expected from a highly-regulated industry designing safety-critical equipment and components, 'quality' was the overriding (64%) factor chosen by respondents in designing and manufacturing parts for the aerospace sector. Yet 'quality' is not purely just about safety – but also flows into overall costs with tightly integrated and complex supply chains, where the discovery of substandard parts or components can cascade further down the production process and disrupt deliveries. Recent examples include the pause in some Boeing 737 MAX deliveries, due to sub-standard fittings from Spirit AeroSystems.

The focus on quality, standards and experts on hand was echoed in the largest (47.47%) 'very important' answer to the question: 'How important is certification when working with manufacturing partners?''

Certification priorities

A free-form poll of the most valuable aerospace certifications to hold produced a wide range of answers – not all of them manufacturing related. However, despite the UK respondents slightly outnumbering US ones in this survey, the number of people who put 'FAA' as a single answer outnumbered 'EASA' two to one – potentially a sign of how dominant the US still is in the global aviation regulatory framework and the importance of designing products for this key market.

Finally, the top priority for the next three years was again recruiting skills and talent (55.77%), followed by sustainability (52.33%) and ramping up civil production post-Covid (47.56%).

This then is a clear message about the immediate skills and recruitment crisis that the industry is facing – and one that if not solved, then the other two (sustainability/ramping up production) cannot happen. Among the comments in the 'Other' category (4.83%) were 'Competition with China, Security of Proprietary Data And Technology', 'Space Exploration and Commercialisation' and, interestingly, one suggestion that: 'a strong PR campaign should be launched to counteract present trends that (falsely) consider aviation a highly polluting industry.'

The top priorities

In conclusion then, this was a landmark survey into the state of the aerospace industry in 2023, providing a significant snapshot of the global aerospace sector as it emerges from the pandemic and attempts to ramp up production, recruit skilled workers and meet sustainability targets. it will be interesting to see what lies ahead for the industry in the future, and good to keep a close eye on how widely digital manufacturing expand through the industry.\

7 Emerging Aerospace Technology Trends to Know About in 2023

The aerospace industry is constantly evolving. New technology posed to disrupt the world is continuously in development. Many of these are very early in their development. We may not see their results for decades to come.

However, there are a few that are worthy of our attention today as they're likely to change the industry within the next decade. Should we ignore these trends, it is likely we will be left behind by our competitors and forced to catch up on the new industry standards.

That's why today we're going to take a brief look at how aerospace technology has changed, the major industry major players of today, and discuss the trends of today that will likely affect the industry in the coming years.

What is Aerospace Technology?

When we talk about aerospace technology, we are referring to the methods, systems, and devices used in the practical application of the aerospace industry. More broadly, it refers to the technology that makes spacecraft and aircraft construction possible. This encompasses everything from the invention of the pressurized cabin that allowed aircraft to reach even higher altitudes to developments in jet engine fuel efficiency.

What is Aerospace Manufacturing Technology?

We can consider aerospace manufacturing technology as a niche subsection of aerospace technology. This field specifically refers to the methods and systems that make the fabrication and manufacturing of aerospace components possible. Whereas aerospace technology refers to the development of air- and spacecraft, aerospace manufacturing technology encompasses mechanical assembly and composite fabrication of aerospace materials.

It is the developments in manufacturing that truly make the modern aerospace industry possible.

Is the Aerospace Industry Growing?

The aerospace industry is constantly growing. Today's global aerospace market currently stands as a staggering $328 billion industry with an expected compound annual growth rate of 7% by 2025, bringing the market value to $430.9 billion.

Despite a brief decline in aerospace demand during the Covid-19 pandemic, this is a marked increase from $276 billion in 2012 with a $52 billion net increase over the last 10 years.

As for the next 10 years, we can expect this trend to continue exponentially, with some researchers projecting revenue to grow upwards to $1,233 billion in the 2030s. Although there is a deviation between market forecasts, they all share the same sentiment that we can expect an explosion of growth in aerospace in the coming decade.

Who Leads the World in Aerospace Technology?

As the aerospace industry grows, so too does the number of companies that participate in it. Some of these companies stand out more than others regarding their contribution to aerospace technology. These companies are at the forefront of aerospace technology.

Here are a few companies leading in the world in aerospace technology.

Lockheed Martin – In collaboration with Amazon and Cisco, Lockheed Martin recently developed an AI-based telecommunication software called Callisto – a system designed to improve efficiency and situational awareness onboard spacecraft with real-time mission information and connection to ground control.

Raytheon Technologies – Raytheon Technologies are among the top companies taking on the many aerospace challenges we see today. In September, they announced progress on developing and defending against hypersonic missiles from their Raytheon Missile & Defense company.

Boeing – Developers of the famous Boeing 747, Boeing develops and manufactures commercial airplanes as well as defense products and space systems. On December 5th, they announced the delivery of the first two 03b mPOWER satellites to SES, a Luxembourgish-French satellite telecommunications network provider. These satellites combine Boeing's 702 platform, their subsidiary Spectrolab's custom-designed solar array, and Boeing's 702X software-defined payload.

Airbus – Another company known for its airplane designs, Airbus is one of the largest aerospace companies in Europe. In November, Airbus announced its preparations to launch its first megawatt-class hydrogen fuel-cell aircraft test flight in just under four years from now.

Northrop Grumman – Northrop Grumman markets itself as a pioneering company in the world of aerospace. They develop and build advanced aerospace products such as next-generation spacecraft and aircraft.

And here are the leading space companies.

SpaceX – SpaceX is famous. This is in part due to the fame of its co-founder, Elon Musk. More importantly, however, they developed the Falcon 9 reusable rocket: the first orbital class rocket capable of reflight. Consequently, many aerospace projects have been able to recover and refly the most expensive rocket components.

Boeing – In addition to its advances in aircraft, Boeing is constantly pushing the boundaries of space technology.

Virgin Galactic – A pioneer in space tourism, Virgin Galactic has developed a craft and flight method to achieve a low space apogee of 50,000 feet. Although these flights are expensive to charter, the company is constantly innovating to make the trip more cost-effective.

Sierra Nevada Corporation – SNC is one of the top companies leading the world in advanced aerospace and national security development, SNC recently began to transition its space systems operations to an independent space company – Sierra Space.

Airbus Defense and Space – A division of Airbus, Airbus Defense and Space focuses on the development and manufacturing of, as the name implies, defense and space products on behalf of Airbus and is the world's second-largest space company after Boeing.

All of these companies rely on industrious aerospace manufacturers like Advanced Structural Technologies, Inc that consistently step up to the challenge of space flight by providing high-performance components that were impossible a decade ago. This includes the construction of custom components to aid the space race.

Aerospace Technology Examples

Aerospace Technology has been rapidly evolving ever since the first aircraft left the ground. Since then, numerous innovations have shaped the aerospace industry throughout history.

As we mentioned before, one such example is the Falcon 9 reusable rocket. For much of aerospace history, rockets were a costly one-use component of space travel. As such, the cost – the biggest hindrance to aerospace missions – was drastically reduced for projects deploying this rocket. This cost is expected to be further reduced as this technology is further developed.

Further back in history, we have the solid-propellant rocket. Although these rockets existed throughout history in primitive form, in the mid-20th century, government initiatives and the cold war drove rocketry to a new level. These would eventually become the iconic boosters

associated with space flight, offering a cheaper alternative to liquid propellant boosters to help escape the atmosphere.

However, enough with the past. Innovations in aerospace continue today as governments and independent companies continue the mission to advance the industry.

7 Emerging Aerospace Technology Trends

For new aerospace technology in 2023, you only need to look around. Numerous companies are hard at work developing new technology every day as the 21st-century space race continues.

From 3D to printing to artificial intelligence to even blockchain, several new trends in aerospace are taking off today.

1. Autonomous Flight Systems

Autonomous ground vehicles are already a popular and growing trend in the automotive industry, and it is already prevalent for drones. It was only natural that this would eventually reach the aerospace industry. Although this trend has a long way to go before it becomes prevalent, many groups are investing in these autonomous flight systems.

In the short term, we may well see single-pilot commercial aircraft as more and more tasks become automated. However, it will be some time before this technology is scaled enough for us to see fully automated aircraft. Though, we may well see pilotless passenger aircraft in our lifetimes.

2. Additive Manufacturing

Also known as 3D printing, additive manufacturing is growing by the day as a manufacturing solution in aerospace.

This is because this method of manufacturing has allowed companies to produce components with significantly less material than traditional methods. As 3D printing technology progresses, complex geometries are becoming more feasible in this approach. What's more, the resulting components produced by this method have consistently shown to be durable and lighter.

It is no secret that reliable and lightweight components are becoming increasingly important to the aerospace industry. Lighter components mean improved performance for speed, fuel consumption, and more.

3. Supersonic Flight

The very first aircraft to break the sound barrier did so in 1947. Ever since, companies have invested billions in the development and production of supersonic aircraft.

In August of 2022, American Airlines announced its intent to buy new supersonic airliners from Boom Supersonic. These planes are slated to roll out in 2025 and be put to commercial use by 2029. This will be the first time the sky will see such passenger flights since 2003.

However, for now, these new aircraft are yet to be flight-tested, and the deal is conditional until they meet safety standards. Should this become the new norm for the future of commercial airlines, they will need manufacturers to meet the demand for lightweight and durable materials. AST stands ready with the skills to develop and deliver the necessary components to meet this demand.

4. Artificial Intelligence

AI is a word that's been on everyone's lips for a few years now. Almost every industry has found a way to implement this sci-fi-sounding technology from predictive analytics for marketing companies to department stores using machine learning to track merchandise. Aerospace is no different.

AI is capable of superhuman levels of computation, processing massive amounts of data in short periods of time. As such, machine learning offers numerous benefits to the aerospace industry such as the ability to process mass swaths of data for faster material analysis and supply chain management.

By automating these mundane tasks, AI increases the speed at which aerospace researchers are now able to develop all forms of technology. And as technology develops at a faster pace, aerospace companies will need to turn to companies that provide flexible and streamlined manufacturing processes to meet demand.

5. The Internet of Things

A recent trend, specifically for aerospace maintenance and repair, is the implementation of IoT technology. This technology is being utilized to create a predictive maintenance approach to air- and spacecraft by monitoring components. Analyzing this data allows companies to identify breaks and part failures before they happen.

From this data, it is possible to address repairs before part failure. What's more, this data allows for more and more data gathering to create better components.

This will eventually lead to innovations in aerospace components that will require new manufacturing techniques to address. AST's in-house engineering is prepared for this circumstance with rapid development and delivery.

6. New Materials

Everyone in the aerospace industry is constantly looking for lighter and stronger materials to use in air and spacecraft. So, it is no surprise that new and advanced materials are being tested and adopted year after year. One such example is the carbon-based material known as graphene, an atom-thick material used in high-capacity, lightweight batteries.

As advanced materials appear, manufacturing adapts to incorporate them.

7. Electric Propulsion

The world is slowly shifting towards electric propulsion. This trend is already well-known in the automotive industry, but it is also true for the aerospace industry. Not only does this shift in propulsion offer a quiet craft with reduced emissions, but it also comes with reduced costs. As such, electric propulsion stands to open new segments of the aerospace industry. That's why today there are approximately 215 electrically-propelled aircraft currently in development.

Of the trends we've discussed today, electric propulsion holds the greatest potential to disrupt the industry as it opens unknown possibilities for the future of space and aircraft design.

Should this method of propulsion become prevalent, we will see manufacturers faced with demands to produce components capable of accommodating it as well as handle the shift in design to aircraft.

Conclusion

From these trends, we can expect serious changes to come to the aerospace industry throughout the next decade. Technology will continue to develop at an exponential rate, bringing with it new challenges to manufacturing to keep pace. That's why aerospace manufacturers need to remain on top of these trends and be flexible enough to respond to them.

Acknowledgement

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