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IMPACT OF COVID-19 ON AERONAUTICAL ENGINEERING

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Keywords

AERONAUTICS
COVID-19
ENGINEERING

ABSTRACT

The world today is experiencing what no one had anticipated as one of the worst pandemics of all time. Industries are struggling to stay afloat, given the uncertainty of when all this will be over. One such sector to be impacted is the aeronautical or aerospace industry. In the course of this report, we will be understanding what aerospace engineering is all about, its employment opportunities in the industry, and what impact COVID-19 will have in the short-term and mid-term. Many companies have diversified the use of their aircraft, drones, helicopters, etc. to stay afloat. What is noteworthy is that most of these companies cater to the military belonging to the Governments. The defence is a crucial element and key to a nation's survival.

I. Introduction

Aeronautical engineering, which is now popularly known as aerospace engineering is the field of engineering concerned with the development of aircraft and spacecraft. Branches of Aerospace Engineering. Aerospace engineering can be broadly categorized into two branches:

- **Aeronautical Engineering**

This type of engineering focuses on how certain objects fly within the earth's atmosphere and then apply that knowledge to plan and build aeroplanes, helicopters, fighter jets, missiles, unmanned aircraft, etc. The subfields in this engineering branch array from research and development, testing, assembly, and aircraft maintenance. The noteworthy is the fact that how interdisciplinary this branch is. It has elements of math, electronics, apart from other elements. It may comprise the maintenance of aircraft also. It also encompasses studying how the environment might be affected by the usage of aircraft, its potential risks, how efficiently does the aircraft use the fuel i.e. fuel efficiency and last but not the least systems efficiency. All of the above involves a deep-dive study of aerodynamics and propulsion (these subjects are also extensively used in the automotive industry; hence aeronautics engineers have a lot of scope in this industry too). Aerodynamics is the study of how air intermingles with solid objects. Propulsion is the study of how to generate enough energy to achieve and remain in flight.

- **Astronautical Engineering**

This branch of aerospace engineering focuses on the exploration of space flight and the delineation of spacecraft and satellites. This branch is quite technical and encompasses various disciplines and elements. The engineer studies how to best launch a space flight, developing systems to control the spacecraft apart from studying the environmental effect the spacecraft launch will have. Astronautical engineering is a relatively new field. The first spacecraft took off in the early 20th century. Did you know that mid-century rivalry between the United States and the Soviet Union to get to space first led to propelling scientific discovery and engineering design to the forefront? Similar to aeronautical engineering, this branch of engineering is based on concepts of propulsion and in this case astrodynamics. Propulsion involves the engine systems of spacecraft, which includes launch capabilities. Astrodynamics centres on studying trajectory and orbital patterns. Designing a spacecraft involves studying, manufacturing, and application of a spacecraft's body and systems. To successfully build a spacecraft, specialists from the department must work collectively and closely to give shape to an all-inclusive vehicle that can endure the

gruelling environment of space. You can build rockets that are used to launch space shuttles and satellites into space.

2. Satellites have multiple purposes:

- Directing television signals to your homes
- To take high-quality images of the earth
- Forecasting weather
- GPS satellites
- Military purposes (conducting recce or communicating securely)

3. Industry Application

The aerospace engineer's role is not restricted to the aerospace industry alone. Since this discipline is based on aerodynamics, they play a prominent role in the automobile industry too. The vehicles- like cars, motorcycles, ships, etc. are designed keeping in mind the optimum utilization of speed and efficiency. What's noteworthy is the fact that an aerospace engineer's role isn't restricted to only the two branches mentioned above. The mechanisms applied in the aerospace industry amalgamated with the automobile industry during the 20th century when the aviation industry was going through a lull. A few roles that an aerospace engineer can be employed in the aviation sector is that of either a crash investigator or performance analysts amongst others.

Here are a few representational areas in which the aeronautical engineer can be employed:

- Fuel efficiency testing
- Airframe design
- Flight testing
- Investigating aeroplane crashes
- Collecting information via test flights
- Overseeing the assembly of aircraft and missiles

The influence of aerospace technology has filtered down to many companies engaged in the research and development of flight simulation, robotics, drones, medicine

and other high-technology fields. There are two career options that you can explore as part of aerospace technology:

Design: A good illustration of designing involves developing aircraft wings on the computer and then using the computation of fluid dynamics, you can simulate to see how it will respond to interactions with air.

Testing: Once the design team is done with designing the testing team needs to test how well the design will work given the physical conditions like air, pressure, etc. in the real scenario. For example, they can test it using a wind tunnel. They put the physical structure in a large tunnel and run fast winds through it to see whether it behaves as the computer simulation predicted. An important area of research in current times is - flexible wings (wings that can morph and change shape during flight). This is being investigated by NASA to increase the efficiency and performance of flights.

4. Future of Aviation

Unmanned Aerial Vehicle or UAV or more commonly known as a drone is the future of aviation. This type of aircraft minus a physical pilot's presence onboard is fast gaining popularity. They are quite resourceful in military operations that are considered rather dangerous or murky or not worth the human effort. An unmanned aircraft system or UAS includes- UAV, controller which is ground-based and a communication system to communicate between the two. UAVs can be operated either by a remote control which is handled by a human or independently by onboard computers. As technology advancements take place, the human's roles have to evolve too. While handling UAVs or drones you need to be able to collect and process data and then present it. You need to be able to manage projects exuberating dynamic leadership through and through. Drones were originally used for military purposes, but over the years their use has widened into other industries and niches like- agricultural, commercial, recreational, surveillance (widely used during the coronavirus pandemic), aerial photography, smuggling and drone racing. Ironically, the usage of UAVs in commercial space has outnumbered its usage in military activities. Drones can fly beyond the visual line of sight (BVLOS). Commercial industries have maximized on this capability and increased production. This has also lead to reduced

costs, risks, ensured site safety and regulatory compliance. Dependability enhancements target all aspects of UAV systems, using resilience engineering and fault tolerance methods.

5. Impact of COVID-19 on Aerospace Industry

As 2019 came to an end and the new year started, the global economy was in for a rude shock. Coronavirus or COVID-19 as it is famously known as now forced the global economy to come to a complete shutdown. Governments across the world enforced a lockdown so severe, that many companies had to shut shop. Only essential services were allowed to function. Travel across cities, states and countries were banned. The aerospace industry took a massive hit. Companies across industries have adopted new remote work technologies and procedures to limit the impact of the virus on the economy and their employees. Most recently, in the wake of the coronavirus pandemic, usage of drones has ensured the safety of the human workforce. Companies manufacturing drones even discovered new ways that they can be deployed to combat viruses. The police force used drones to survey humans from a distance and this led to controlling the pandemic to a certain extent. Since drones can be remotely piloted, human interactions become minimum, which is critical when the very officers meant to guard the communities can potentially become transmitters for the virus to spread.

6. Inspection and Broadcast

Drones have become effective tools to sieve through complicated dense urban areas and communicate with the public. These machines have ensured efficient scanning and if required broadcasting important messages such as- wear your mask, timings of the curfew, where the essential goods and services will be available, etc. All along keeping the police away from coming in contact with infected people.

7. Delivering Essential and Critical Supplies

Governments are trying to deliver care packages and food via drones. This helps in encouraging citizens to stay at home. Although, delivering via drones aren't full scale yet, since the global tests (using drones) have only been conducted in the USA and the Dominican Republic, they have proved to be an effective and efficient way of delivering

lifesaving medical supplies. Drones can be modified with a payload drop mechanism. The maximum load that they can carry is 6 Kgs, without risk to both parties. This is most helpful in containment zones where no outsiders are allowed.

8. Sanitizing Common Zones

As information is being shared across the world amongst health officials, evidence states that virus can survive on doors, chairs, etc. Public spaces, as well as doors and corridors where residents reside, are being sanitized every two weeks using drones. The drones used in farming for spraying pesticides over the farmland are now being used to spray disinfectants over public spaces, house doors and common areas. These drones can cover 100,000 m² in an hour with a tank capacity of 16L.

9. Measuring Temperatures

Supermarket to apartment complexes to hospitals, you name it and they have implemented temperature checks for the visitors. To limit the exposure of security guards to the virus, some of them are using drones armed with infrared cameras to take temperatures. With proper calibration, these drones can do the job. In commercial aviation, a lot of the companies are experiencing a disturbance in production and demand slowdown as workers are heading home given the uncertain future. Passengers have stopped travelling, leading to a slowdown in air travel which has had a cascading effect on demand for maintenance and spare parts. Manufacturers of aircraft, helicopters, automobiles are capital intensive by nature, hence triggering short-term anxieties about cash flow and liquidity. Defense contractors aren't majorly affected when it comes to short-term and long-term as they are better positioned. Despite production slowdown, demand will most likely not be affected over the next two years since budgets for projects were allocated much before the pandemic. Another major reason for the projects to be not affected is the fact that they are quite important and play a major role in the defense sector.

Conclusion

While these are unprecedented times, industries and sectors around the globe are trying to innovate how their products, services and machinery can be used. Boeing, for

example, is using its Dream lifter to transport urgent supplies to healthcare professionals across the globe; shipping masks and other equipment to the impacted areas. They are working with various stakeholders like- industry experts, passengers, global regulators, etc. to establish industry-recognized safety rules and regulations. They are also advising operators on the approved disinfectants to be used aboard the flight decks and cabin. Enhanced cleaning, rigorous temperature checks are helping maintain cabin cleanliness. High-Efficiency Particulate Air (HEPA) filters are 99.9+% effective at eliminating viruses, bacteria and any other contamination before the air is re circulated back to the cabin.

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