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## Manufacturing Methodology of an Aviation-Grade Part: Part 21 Certification

Although there have been economic recessions, growth in the aviation industry steadily continuous. Even during Covid days. On April 17th 2020 The International Air Transport Association (IATA) released a report regarding air travel expectation which is shown in Figure 1. Hopefully air traffic will increase through Q3 and Q4 2020.

As we look at the manufacturing side of the aviation industry, it is worth emphasizing that yearly based aircraft manufacturing also increases. The main players such as Boeing, Airbus, Embraer, Bombardier, Comac, ATR, etc. share the commercial aircraft manufacturing market. Amongst those manufacturers, as it is shown in Figure 2, Boeing and Airbus have 81% of all commercial aircraft which have been manufactured from 2008-2018 according to IATA reports (IATA, 2019). The remain, 19% is shared by the others.

The aviation industry will execute on strategies to recover as quickly as possible. During the

recovery phase, there will be many applications based on manufacturing technologies. More likely, new sterilization mechanisms will be implemented inside the cabin, cockpit and cargo bay and disinfection systems will be added to the environmental control system (ECS). In order to ensure successful implementation of new systems, design assurance flow should be followed. In the aviation industry, it is known that the manufacturing of aviation-grade parts is clearly defined. The components of the system and the relation between steps are provided in Figure 3 as a flow chart.

The companies which

have manufacturing capability of airworthy parts/components should have Design Organization Approval (DOA – Part J) and Product Organization Approval (POA – Part 21 G) from the relevant airworthiness authorities. To ensure customer satisfaction, the aircraft design organization should establish its own quality management system to demonstrate that their capabilities to manufacture, and to continually progress, with safe, reliable products that meet customer requirements. It is typically referred to as a design assurance system.

Needless to say, the process in obtaining those privileges from

the authorities is a long and winding road. POA which is referred to as Part 21 process is divided into two, depending on its functionality. Mainly these privileges are due to being located in a niche league as well as having manufacturing capability of the parts which have a value that are 60 times higher compared with the automotive industry. According to the National Academies Press (NAP) report, the finished value of a vehicle per pound is only about \$5, however, the finished value per pound for a commercial transport aircraft is \$300. This equates to the price of aviation-grade parts as 60 times higher than those in the automotive

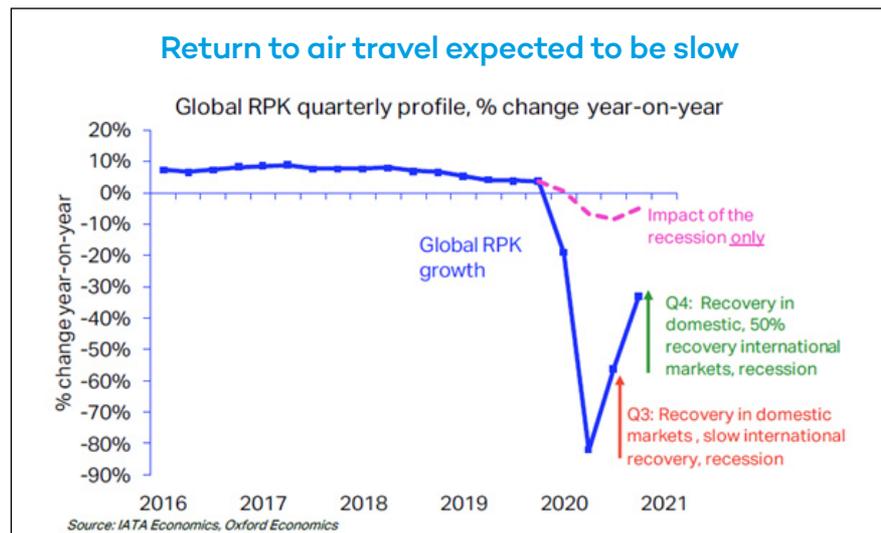


Figure 1. Air Travel Expectation in 2020 and 2021 (IATA, 2020)

industry. On the other hand with the implementation of novel technologies in mass-production lines in the aviation industry, companies are producing more aircraft comparatively than previous capacities would allow, in the same facility. For example, Boeing has declared that in their Renton facility the manufacturing capacity has been increased from 52 to 57 through 2019 (Zang, 2019).

It is obvious that aviation-grade materials are highly engineered and comparatively expensive, and saving aviation-grade material is of vital importance. With this in mind, what should be done in the manufacturing of these high-tech parts, what are the dos and don'ts during the certification process that is executed by the airworthiness authority. The FAA and the EASA's Part 21 certification processes are similar to

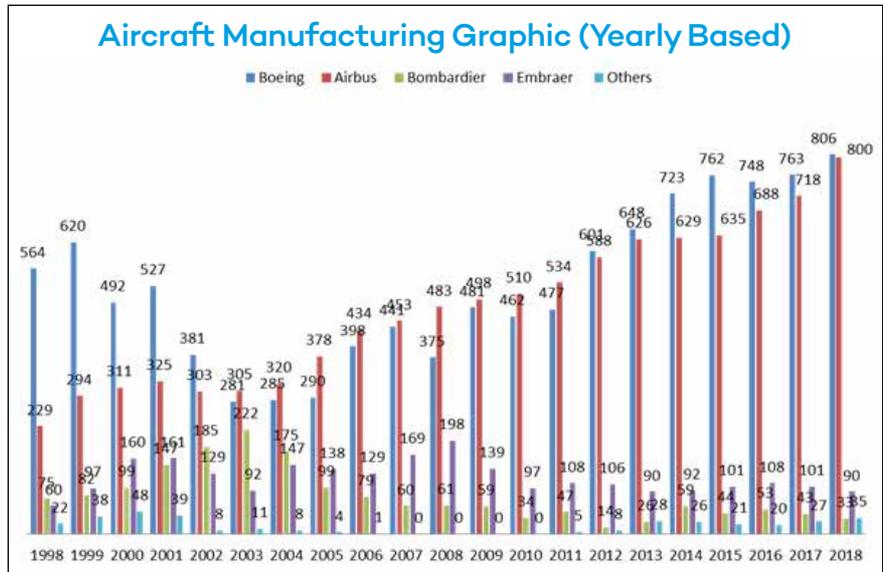


Figure 2. Aircraft Manufacturing Graphic (Yearly Based) (IATA, 2019)

each other but, based on their specifications there is also a gap between them. In the table given below the comparison is provided between the two authorities.

In conclusion, if a company wants to manufacture an airworthy part, the proper method is to secure Part 21 certification. The Part 21 G-J certificate brings its own privileges along with it

Subparts 21	EASA	FAA
A	General Provisions	General
B	Type-certificates	Type-certificates
C	-	Provisional Type-certificates
D	Changes to Type-certificates	Changes to Type-certificates
E	Supplemental Type-certificate	Supplemental Type-certificates
F	Production Under Type certificate Only	Production Under Type Certificate Only
G	Production Certificates	Production Certificates
H	Airworthiness Certificates	Airworthiness Certificates
I	Noise Protection Certificates	Provisional Airworthiness Certificates
J	Design Organization Approval	Delegation Option Authorization Procedures
K	Materials, Parts, Processes, Appliances	Approval of Materials, Parts, Processes, and Appliances
L	-	Export Airworthiness Approvals
M	Repairs	Designated Alteration Station Authorization Procedures
N	-	Approval of Engines, Propellers, Materials, Parts, and Appliances: Import
O	ETSO Approval	Technical Standard Order Authorizations
Q	Labelling products, materials and parts	-

Table 1. Comparing EASA and FAA Subparts of Part 21

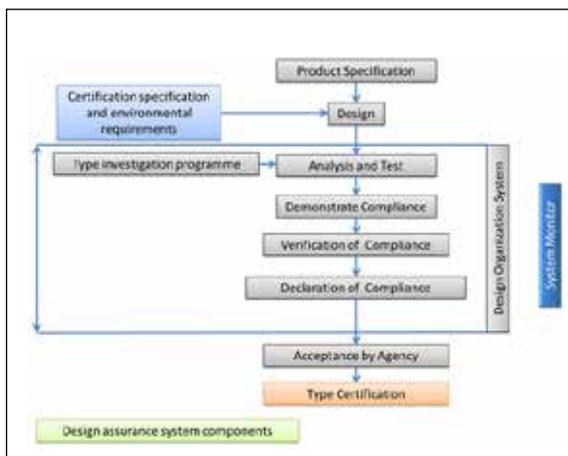


Figure 3. Relationship between design, design Assurance, and Type Investigation (Florio, 2016)