

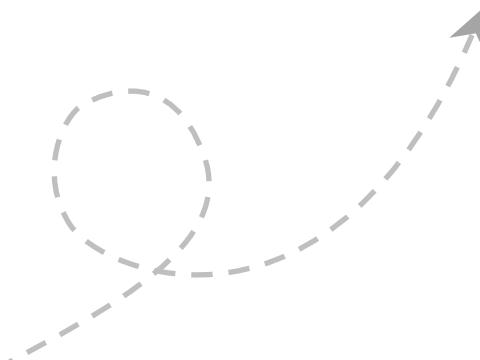


(Aircraft Production Technology)

APT introduction lecture 2

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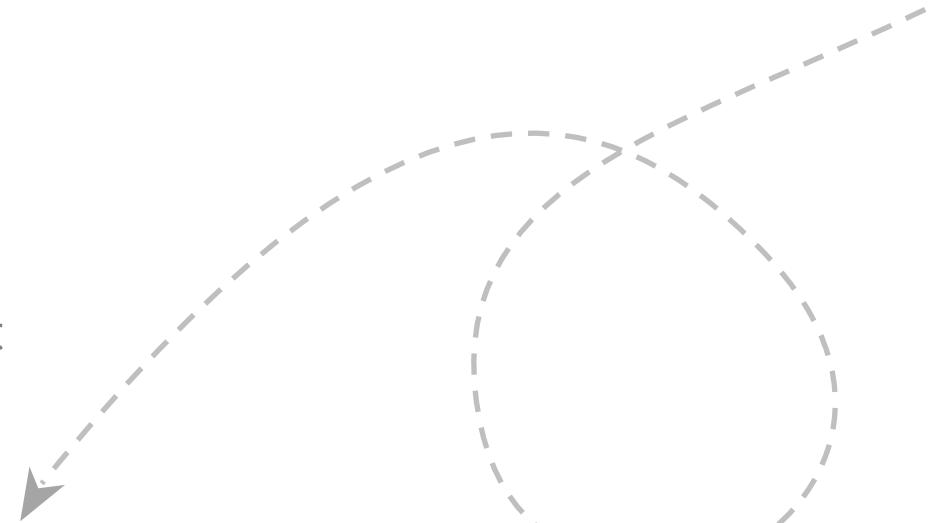


WELCOME

Lecture 2

This Lecture We will talk about
several topics:

- Aim of Aircraft Production
- Aircraft as Production Object
- Aircraft Production Departments



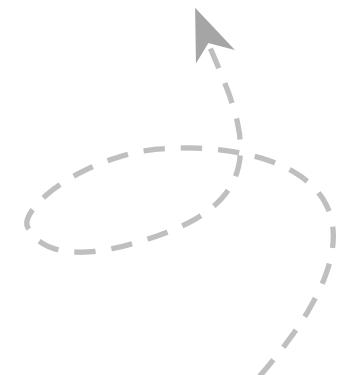
Aim of Aircraft Production



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- The aim of aircraft production is to manufacture aircraft with designed flight technical, operational characteristics and cost that meets the requirements of the consumer and/or stakeholder.

New zero-emission concept aircraft
<https://www.airbus.com/newsroom/press-releases/en/2020/09/airbus-reveals-new-zeroemission-concept-aircraft.html>

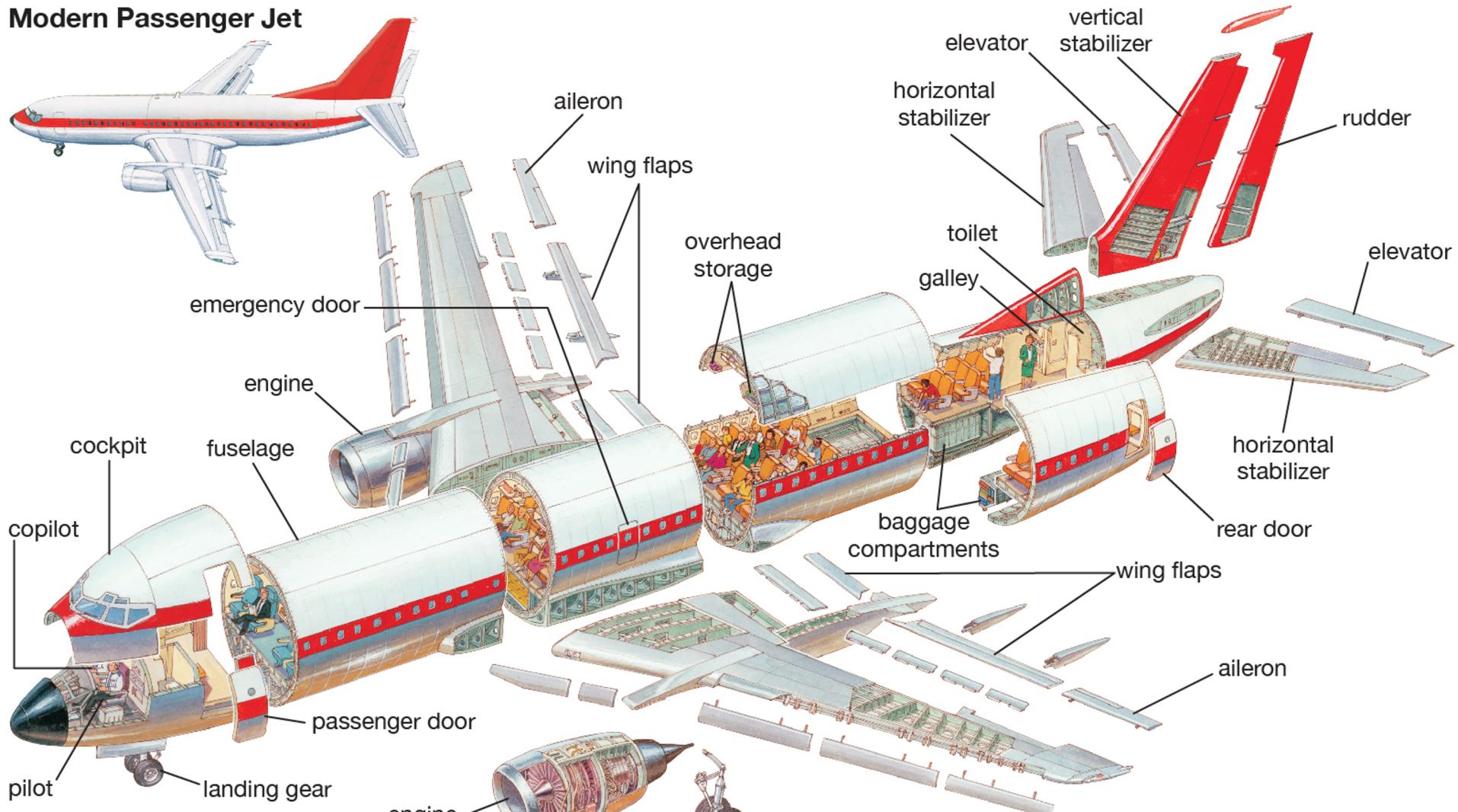


Aircraft as Production Object

How do we split aircraft in parts for more
effective production

Aircraft – very complex production set of operations

Modern Passenger Jet



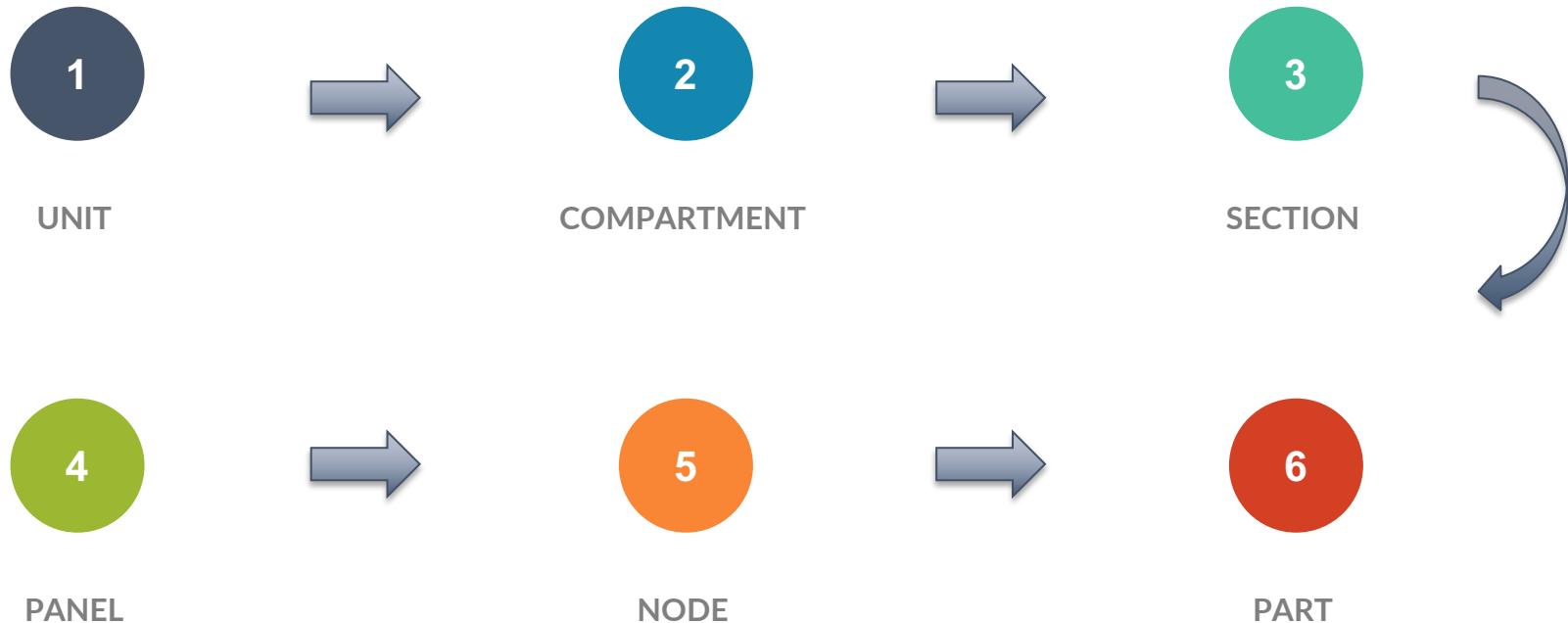
Common Aircraft Elements

- Fuselage
- Wings
- Empennage (Tail)
- Power Plant
- Landing Gears

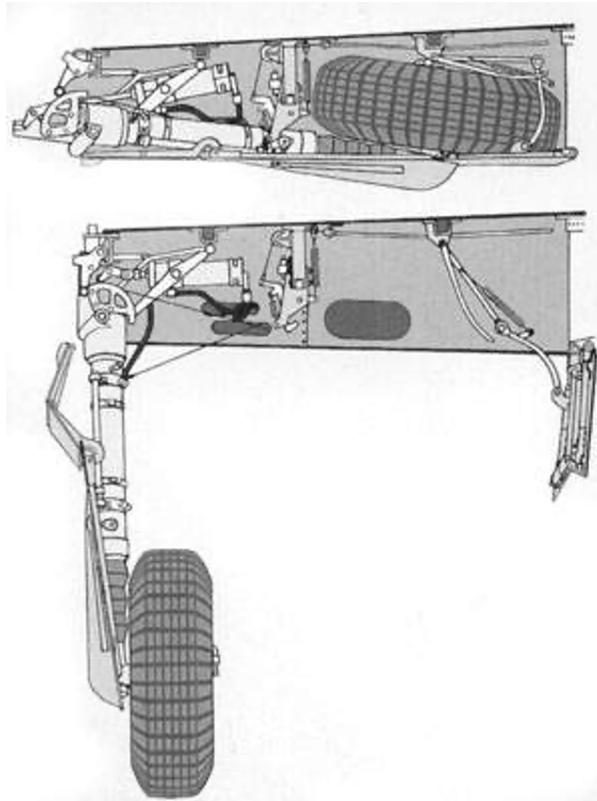
Construction separation of the aircraft influences the efficiency of design, production and operation

Aircraft Elements – APT View

From the perspective of Aircraft Production efficiency processes it is common to split the whole structure into 6 forms from common to specific:



Aircraft Elements – APT View



Unit is the largest independent airframe part of an aircraft (for example, the fuselage, wing, keel, stabilizer, aileron, flap, nacelle, etc.).

Mig 3 landing gear in two positions

Aircraft Elements – APT View

Compartment is independent part of the unit formed by its transverse or under angle to the base axes of the units with connectors or joints and having a cross-sectional closed contour (for example, the nose of the fuselage, its middle and tail parts of the fuselage).



APU Compartment Airbus A320

<https://autogear.ru/article/381/424/vspomogatel'naya-silovaya-ustanovka-tehnicheskie-harakteristiki-naznachenie-ustroystvo-i-resursnyie-pokazateli/>

Aircraft Elements – APT View

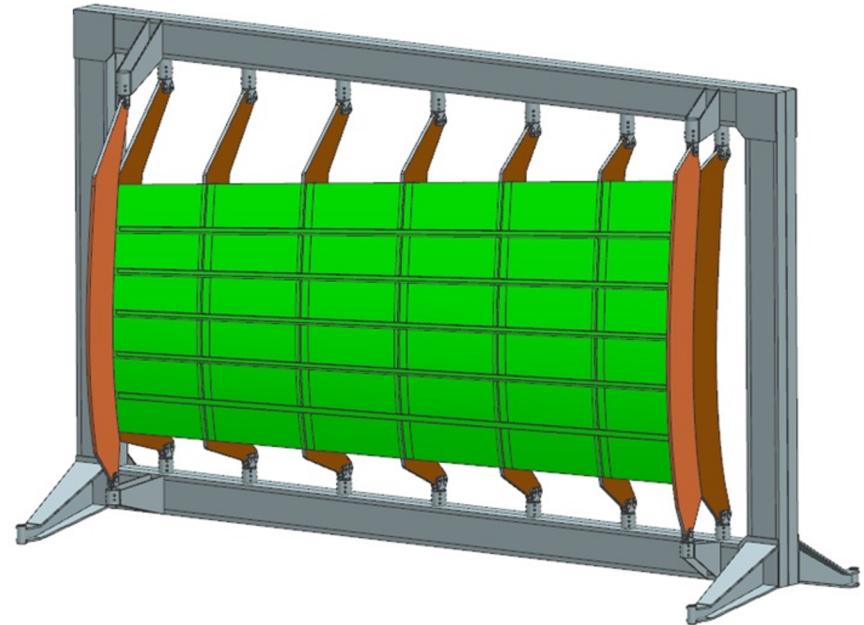


Section - a part of the unit or compartment formed by its longitudinal connectors or joints and does not have a closed loop.

SSJ 100 fuselage section

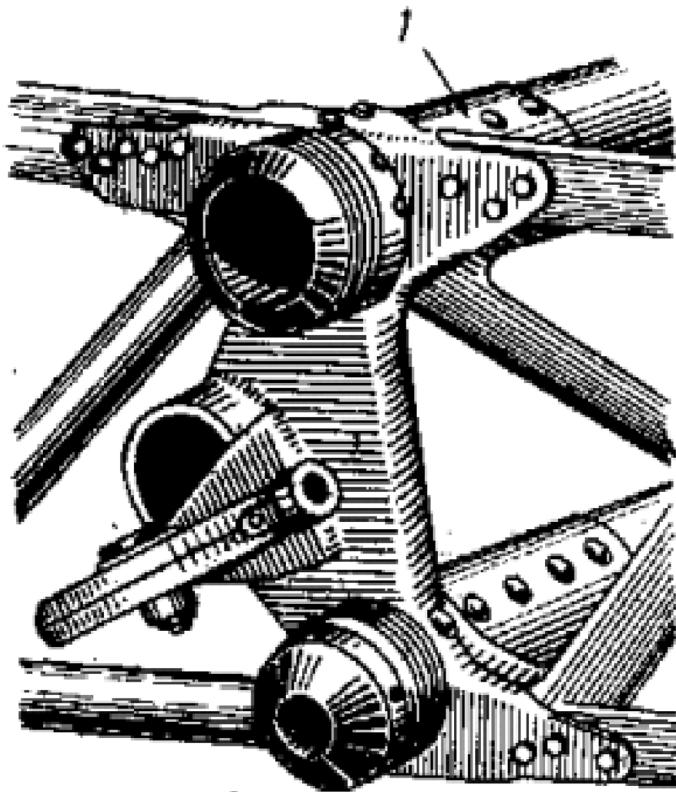
Aircraft Elements – APT View

Panel - an independent part of a compartment, section or unit, having an open-ended structure, open on one side, consisting of from the sheathing sheets and the elements of the longitudinal and transverse river set (such as wing panels, etc.).



3D Model of the wing panel assembly

Aircraft Elements – APT View



Node - a part of a panel, section, compartment or unit, consisting of several interconnected parts (prefabricated ribs, frames you, spars, etc.).

I 16 (1930s soviet fighter) aircraft wing node assembly

Aircraft Elements – APT View

Part is a product made of a homogeneous material without the use of assembly operations.



Aircraft Brake Linings

<https://pilotshq.com/products/cleveland-aircraft-brake-linings-066-09100>

Aircraft Elements – APT View

Construction Separation into elements let us:

In case of development

Reduce development time using labor division and performance of design work in specialized work teams



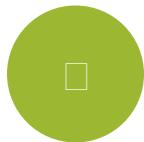
In case of production

Shorten the production cycle by parallel production of airframe individual elements, increase labor productivity, apply specialization and production cooperation



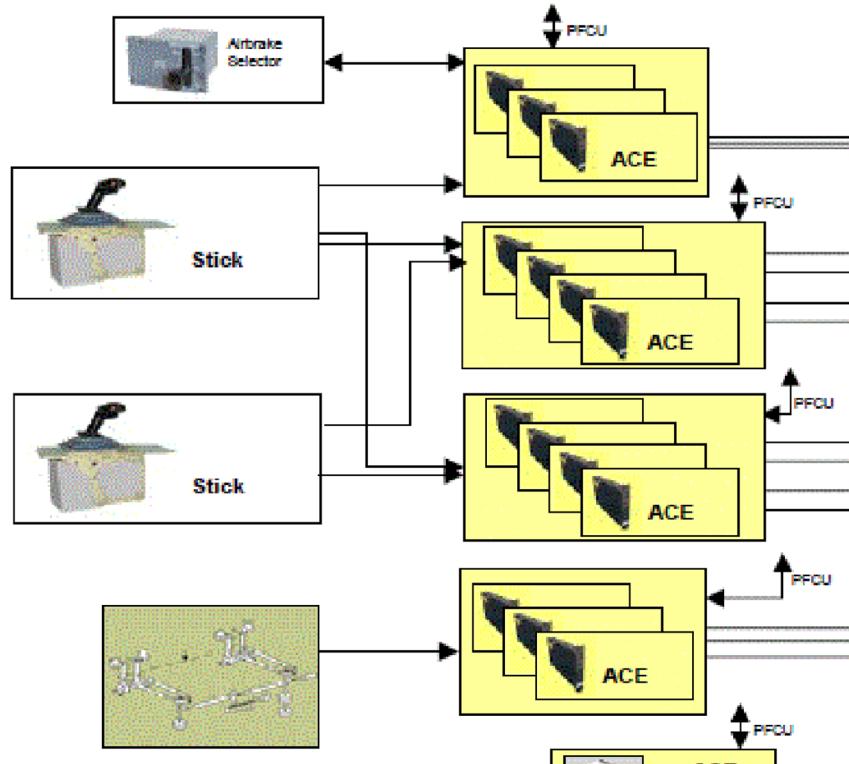
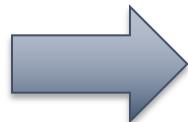
In case of operation

Ensure the transportation of the aircraft, reduce cycles, labor and material costs for maintenance and repair



Aircraft Elements – APT View

What Else?



Onboard Systems

SSJ 100 part of ACS system logic schema:

<http://superjet.wikidot.com/wiki:aircraft-control>

Aircraft Elements – Onboard Systems

The onboard systems of the aircraft are divided into the following structural technological (assembly) units

1

System Complexes

Example:

Aircraft Control System Complex

4

Zones

Example:

Aircraft Control Sidestick Zone

2

Systems

Example:

Landing Gear Hydraulic System

5

Panels

Example:

Landing gear control Fuse Panel

3

Areas (Circuit, Sectors)

Example:

Fuel Pump Pipe Areas

6

Commutation Blocks

Example:

Thrust autopilot Commutation Block

Features of Aerospace Manufacturing

How does aircraft production
specifically differs from other
complex productions?

Features of Aerospace Manufacturing

1. Large number of components, details, and materials used in the final product.



The CFM56-7B is the exclusive engine for the Boeing Next-Generation single-aisle airliner. In total, over 8,000 CFM56-7B engines are in service on 737 aircraft, making it the most popular engine-aircraft combination in commercial aviation. Totally ~4000 spare part per one engine (<https://www.cfmaeroengines.com/engines/cfm56/>)

Features of Aerospace Manufacturing

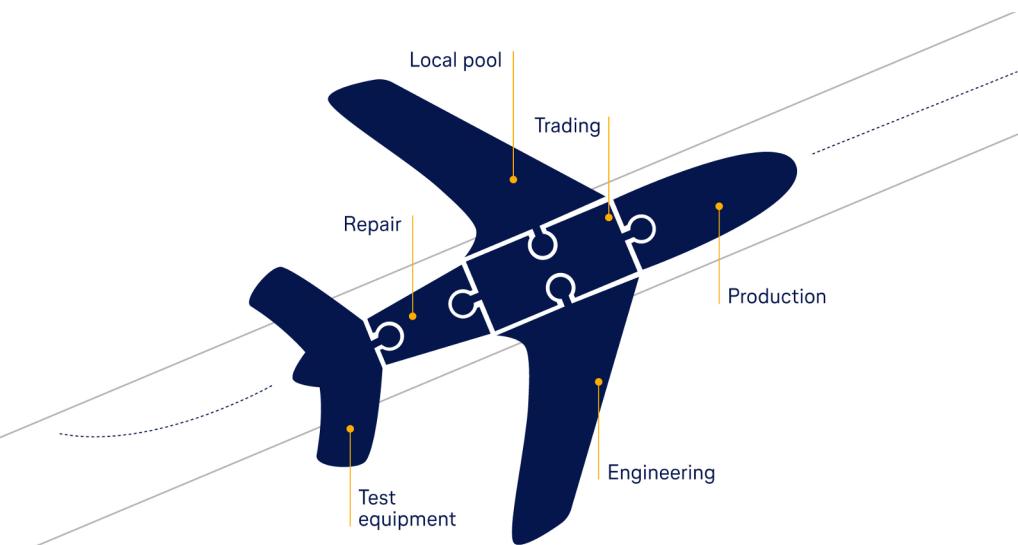
2. Complex curvature shape of parts

Lack of parts stiffness.



A manufacturing process for producing the blade preforms comprises cutting titanium plate material into rectangular prism shaped pieces of suitable length and thickness. Each piece is cut lengthwise along an inclined plane to form two separate tapered panels which become the blade flank components. (<https://www.forcebeyond.com/titanium-jet-engine-blades/>)

Features of Aerospace Manufacturing



3. Big amount of operations connected with assembly processes, regulations and tests.

4. Major requirements for high reliability and quality of product.

<https://aviation.stackexchange.com/questions/14999/why-is-the-manufacturing-process-of-an-aircraft-mostly-manual>

<https://www.lufthansa-technik.com/shop-replaceable-units>

Features of Aerospace Manufacturing

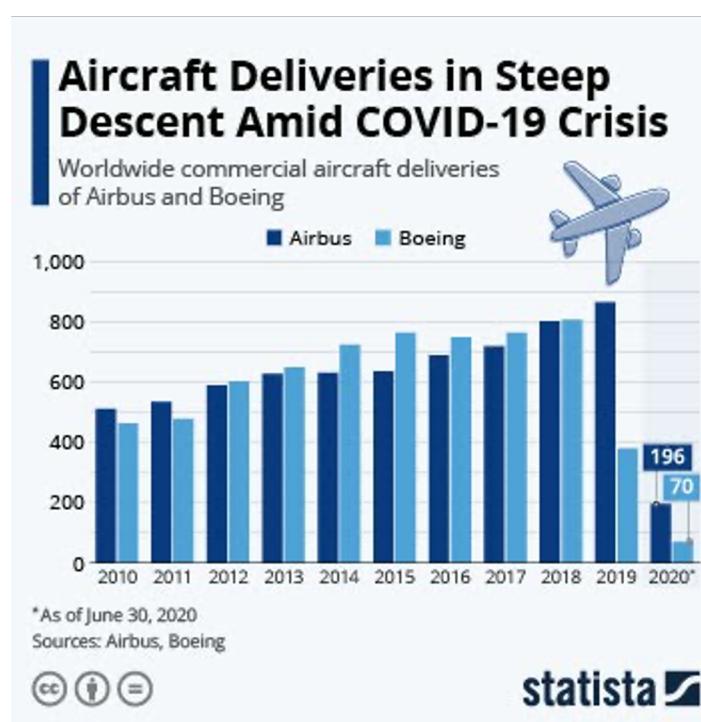
<https://airwaysmag.com/traveler/onboard-interjet-ssj-100-mia-cun/>



5. Wide cooperation between various enterprises.

Features of Aerospace Manufacturing

7. Relatively Small production output
8. Large scale and amount of work on preparation for production.



Volkswagen motor vehicles output for pre-covid 2018 is 11018 million cars.

(<https://www.statista.com/chart/19713/airbus-vs-boeing-deliveries/>)

Features of Aerospace Manufacturing

9. Over 25 percent of all production equipment should be spent for assembly activities, which is significantly exceed the same equipment for general engineering industries. In this case huge production facilities required.



Airbus A350 XWB assembly line.
(<http://www.ato.ru/gallery/images/sborochnyy-ceh>)

Features of Aerospace Manufacturing

10. Large amount of manual labor when performing assembly, installation, adjustment and test work



AN 148 Assembly Process

<https://day.kyiv.ua/ru/article/ekonomika/russia-goodbye-ili-taki-net>

Aircraft Production Department Units

Aircraft Production Department Units



Workshop is the main production unit of an enterprise that performs a certain part of the production process.

Production of Su-30 and Yak-130 aircraft in Irkutsk

<http://life-pics.ru/articles/85-proizvodstvo-samoletov-su-30-i-yak-130-v-irkutske.html>

Aircraft Production Department Units



Production site - a group of work places organized according to the principles: **substantive** (only a certain type of product is made), **technological** (only a certain type of operation is performed) or **subject-technological**.

Optimized Production site of
SIEGENIA GRUPPE

<https://www.siegenia.com/ru/company/news-archiv/196632>

Aircraft Production Department Units



Workplace is an elementary unit of the enterprise structure

Workplace for CNC machine operator

<https://mendel-group.ru/portfolio/verstaki-i-stoly-rabochie/rabochee-mesto-kombi-dlya-operatora-stanka-s-chpu/>

Questions

Please send your questions using special form and leave your name aswell, so teacher can connect with you.