AIRPLANE LIFE CYCLE

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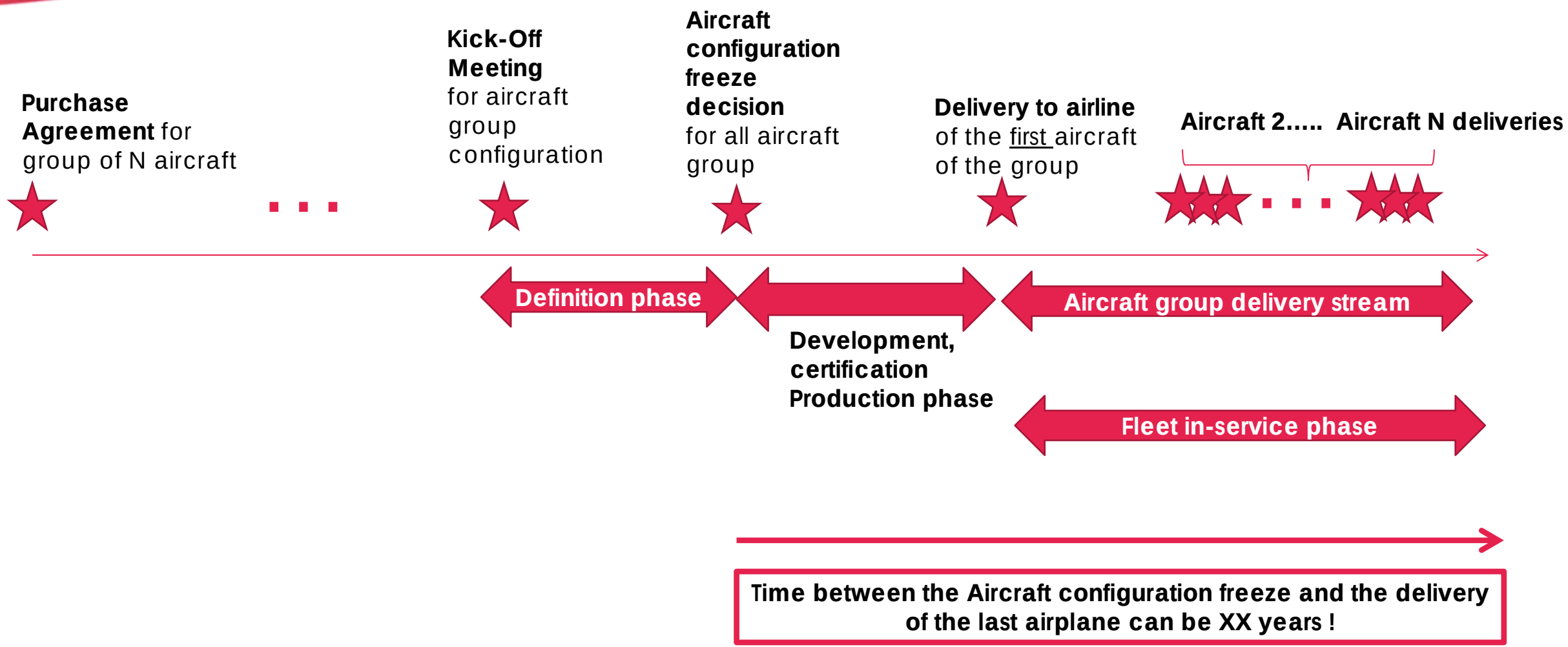
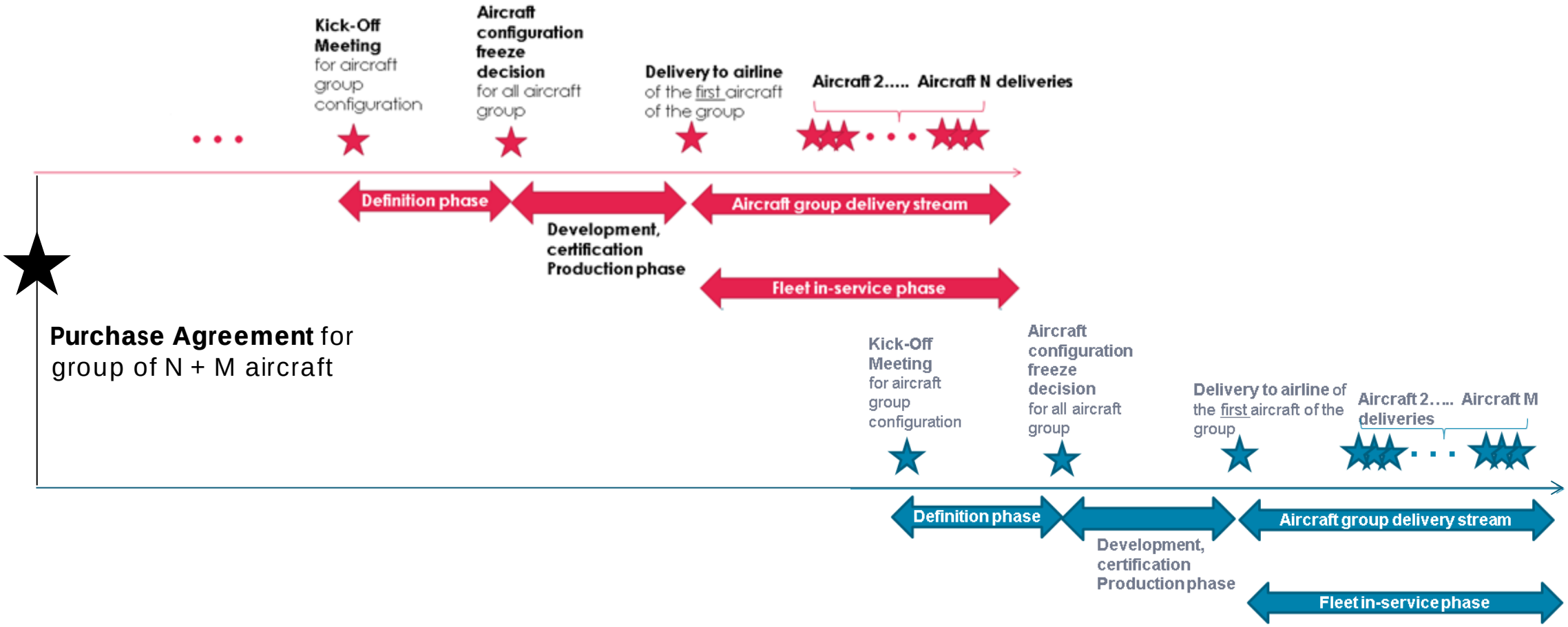
AIRPLANE PRODUCTION CYCLE



AIRPLANE PRODUCTION CYCLE

If an airline wants to have N number of aircraft with a cabin configuration, and M number of aircraft with a different cabin configuration – the process below needs to happen twice

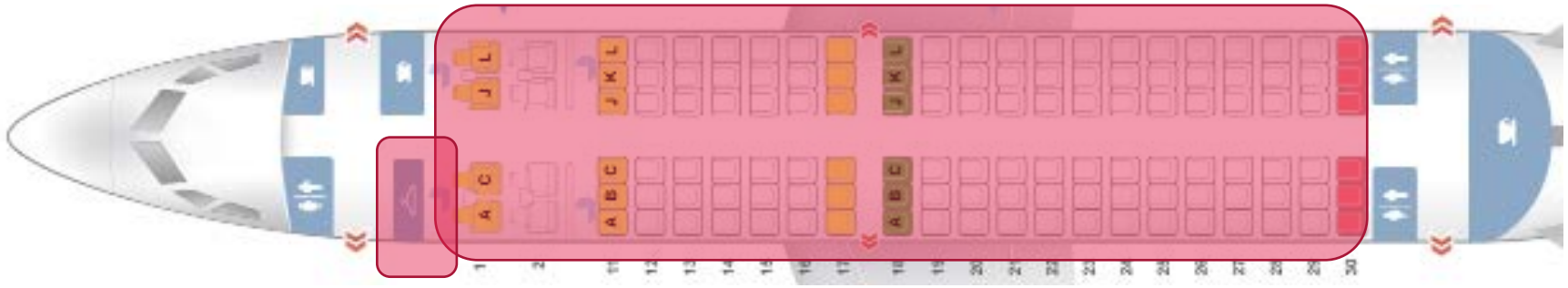


AIRPLANE PRODUCTION CYCLE SUMMARY

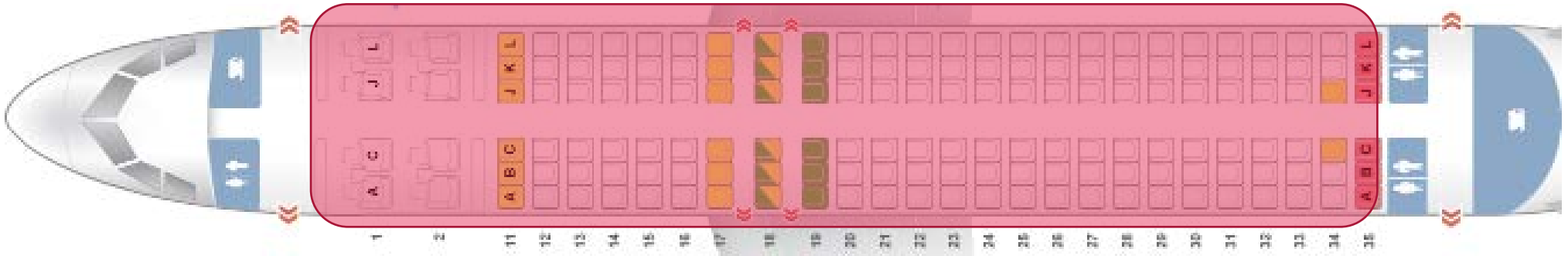
- Airlines might need different aircraft configurations for different routes
  - A number of aircraft will operate longer flights → will need First Class and more galley space
  - B number of aircraft will operator shorter routes → will need Economy Class and less galley space
- Airlines minimize the number of different fleets/cabin configurations as it impacts costs (Additional crew training, different catering, different reservation system, less flexibility in rotating aircraft…)
  - Even if the change was introduced in a second fleet only, lack of fleet commonality would induce additional costs for the airline
- Single aisle aircraft definition and production cycle is typically much shorter than wide bodies
- From design freeze to delivery is less than a year. After design freeze, no changes can be accommodated
  - By introducing late unexpected changes, the production line is negatively impacted (eg: domino effect to following aircraft)

KICKOFF MEETING AND DEFINITION

Areas typically changed during configuration development



B737-700



A320

Day 1

Purchase Agreement

Day 1 + B

Kickoff meeting and Definition Phase

Day 1 + C

Aircraft Cabin Configuration

Development, Certification, Production
For single aisle aircraft this is less than 1 year

Day 1 + D

Delivery: 1st aircraft

PRM lavs mandate as of this date

Day 1 + E

Delivery 2nd aircraft

Day 1 + F

Delivery 3rd aircraft

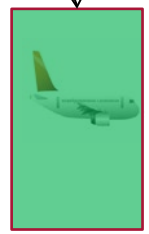
Day 1 + C + 5 years

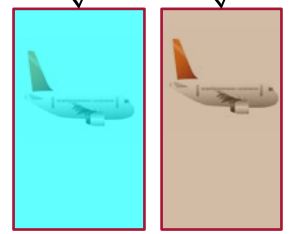
Delivery 4th aircraft

Design and engineering is complete for the group of 4 airplanes (in this example) at this time, even though the whole airplane group may not be delivered for 5 years.

These airplane interiors are all the same

What happens if new PRM Lavs are mandated in the middle of a delivery stream?





WHAT DOES THIS MEAN FOR THE ACCESSIBLE LAV COMMITTEE ?

If new PRM lavs are required in the middle of a delivery stream:

- Process needs to restart again for all the remaining aircraft
- New engineering is necessary
- New build plans are necessary, assembly line overall delivery stream affected
- Supply base would need to build new lavs, supplier contracts need to be renegotiated
- Airline operations are impacted

This activity was not part of the business plan

Requires time and additional resources

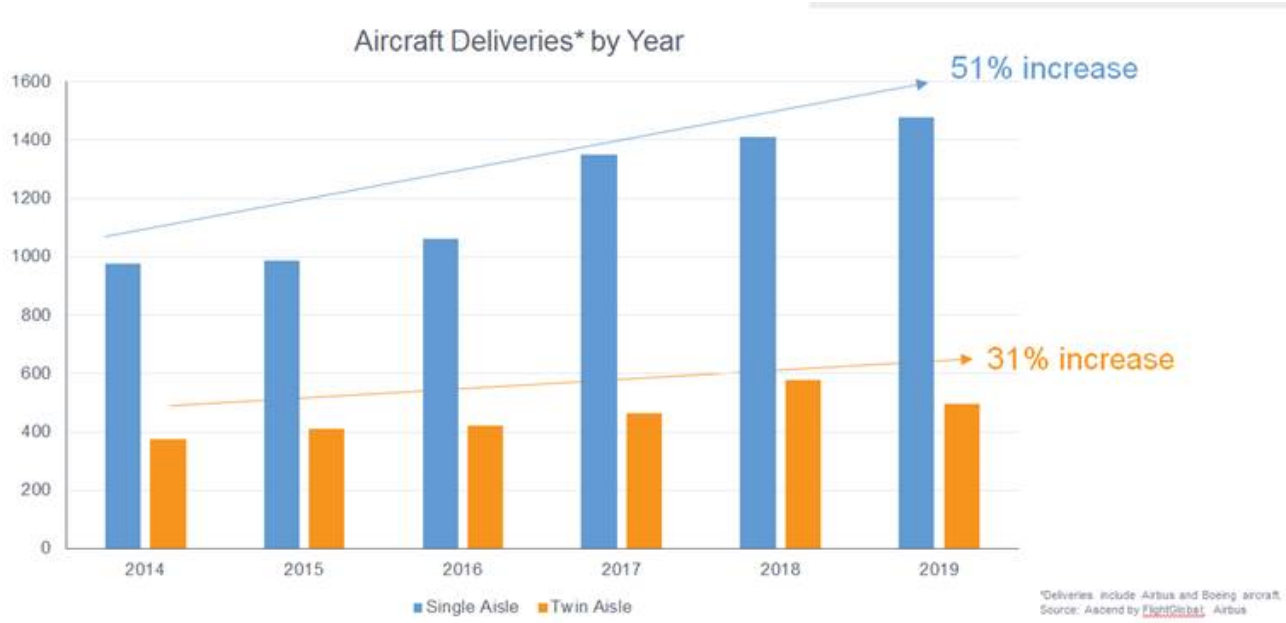
For a tier 2 concept:

- Includes significant new recurring engineering hours for each of the airline configurations
- Affects the airline operations route structure (due to pax count/config), crew training, catering, maintenance cycles

Cabin monuments are the longest lead time items in aircraft production !

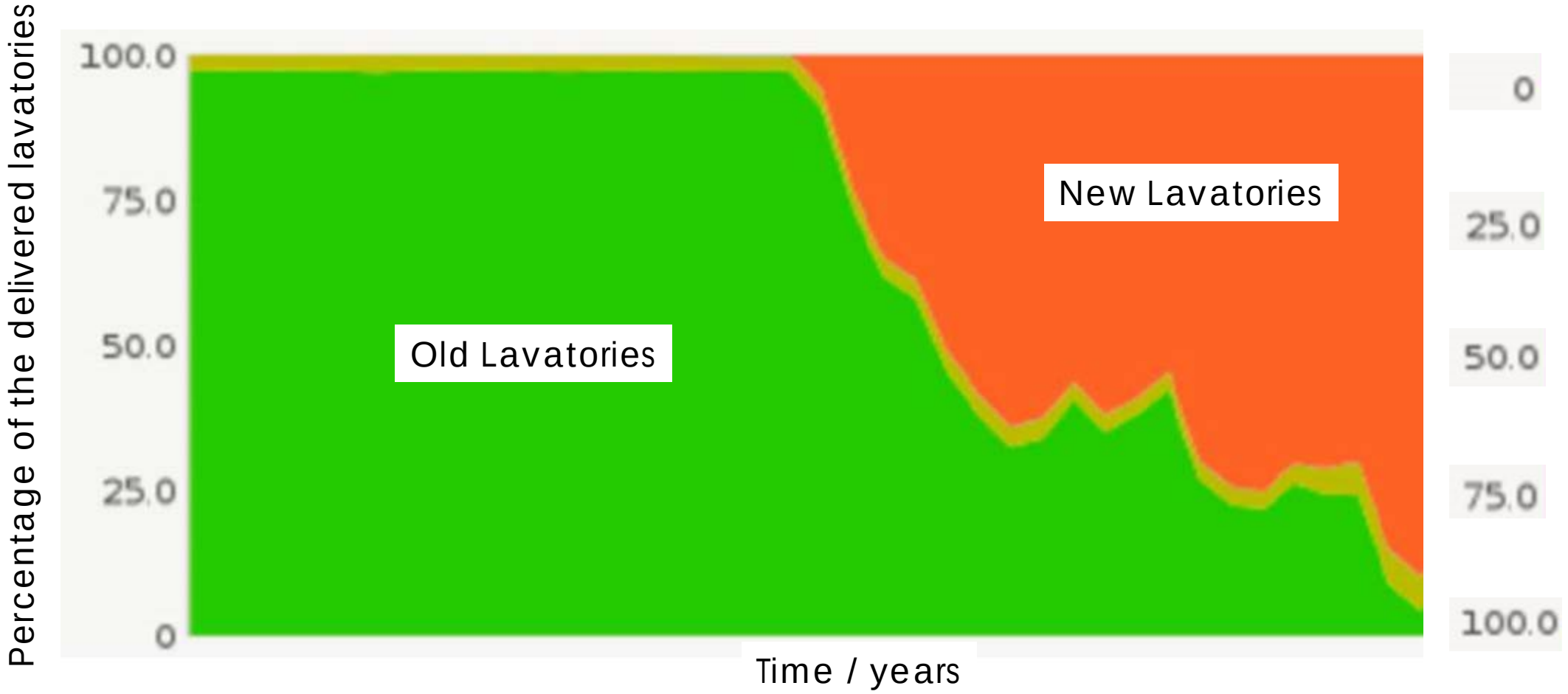
VOLUME OF AIRPLANES

- **Single aisle aircraft production rates increasing rapidly**
- OEMs have never produced as many aircraft as today:
  - 737 current product rate is 42/mth with a plan for 47/mth in 2017, 52/mth in 2018, and 57/mth in 2019
  - This is only possible if airplane design and build is stable
  - This results in less time available between cabin configuration freeze and delivery
  - Change into this highly compressed production system may not always be possible
  - Supply chain may be unable to support
  - Resources for non-recurring and recurring design may not be available
  - The cost may be prohibitive
    - Engineering resources
    - Supply chain cost assertions
    - Crew training
    - Revised route structures
    - Revised catering capability and plans
    - Revised maintenance procedures



INDUSTRIAL “RAMP UP”

- **Lavatory suppliers and OEMs need time to gradually change their production systems**



TAKE AWAY POINTS

- If accessible lavs are mandated, the implementation plan is critical and a detailed understanding of the airplane development cycle and operational impact must be considered to ensure adequate costs and benefits are captured.

- Given the speed of process, design changes are much more difficult to implement in single aisle aircraft than for twin aisle aircraft.

- Considering the high volume of aircraft produced, and shorter Single Aisle aircraft production cycle, time is of the essence in OEMs Assembly Line.