RISK-BASED APPROACH FOR BUSINESS JETS

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EASA BUSINESS JETS WORKSHOP

3RD DECEMBER 2019

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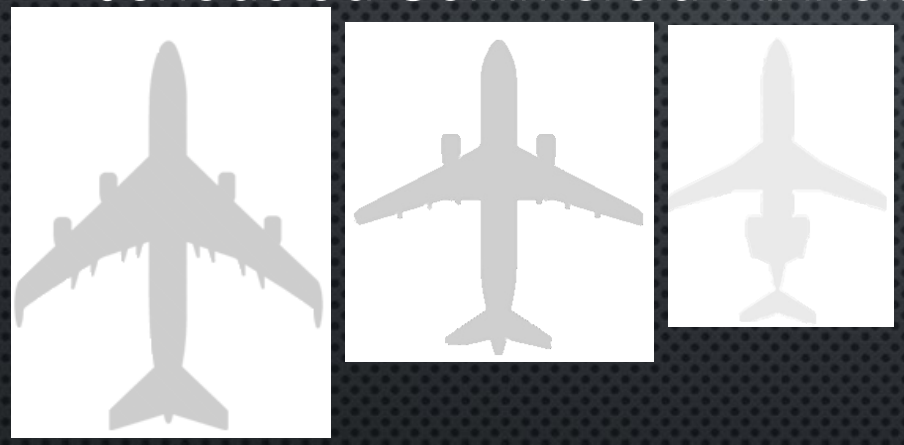
1. GAMA Background
2. How to Define a Business Jet
3. How are Business Jets different?
4. Safety Continuum for Business Jets
5. Key Issues & Way Forward

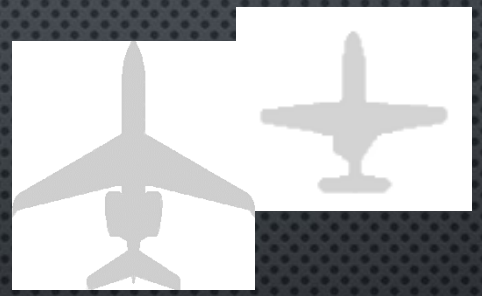
"GENERAL AVIATION"

Scheduled Commercial Airliners



Military Aviation

Business Jets



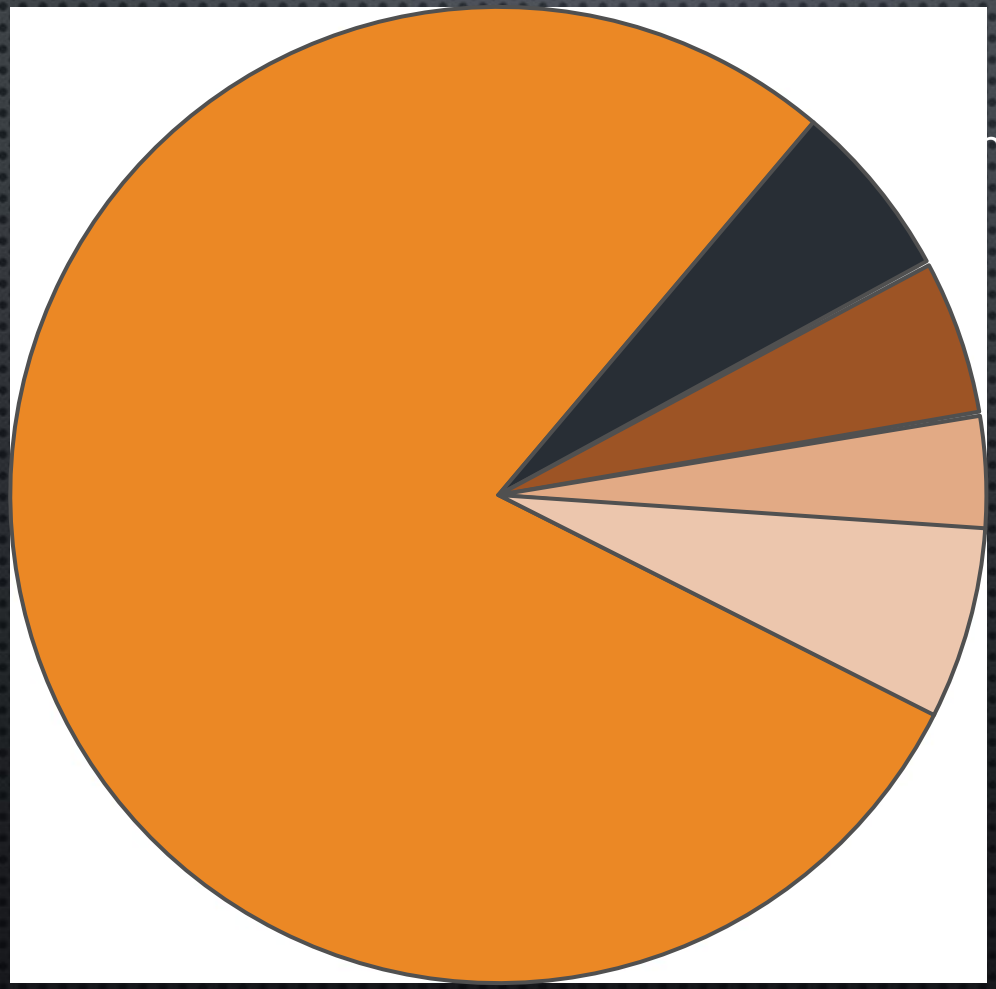
Turboprops

Piston Airplanes

Turbine & Piston Rotorcraft

General Aviation

GLOBAL CIVIL TC AIRCRAFT POPULATION
≈ 334,000



Mostly Certified
Piston Aeroplanes
but also Gliders, Lighter Than Air, Experimental, Etc.
≈ 265,000

mmercial Airliners
≈ 19,000

Business Jets
≈ 17,000

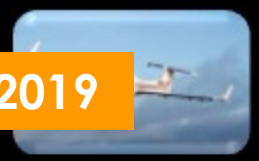
Turboprops
≈ 12,500

Rotorcraft
≈ 20,500

(Jetnet LLC, Flight Global, IAOPA World Assembly)





GAMA Member Companies – Nov. 2019















AIRCRAFT

Air Tractor
Airbus Helicopters
AVIC General
Bell
Boeing Business Jets
Bombardier Business Aircraft
Cirrus Aircraft
CubCrafters
DAHER
Dassault Aviation
Diamond Aircraft
Embraer
Flight Design
Gulfstream Aerospace
Honda Aircraft
Mahindra Aerospace
Mooney International
Nextant Aerospace
Pilatus Aircraft
Piper Aircraft
Pipistrel
Quest Aircraft Company
Schweizer
Siemens AG
Textron Aviation
Viking Air
Waco Aircraft

ENGINES

BRP Powertrain-Rotax
Continental Motors
GE Aviation
GE Honda Aero Engines
Honeywell BA & GA
Lycoming Engines
Pratt & Whitney Canada
Rolls-Royce
Williams International

AVIONICS

Aero-Mach Labs
Appareo
Aspen Avionics
Astronautics
Avidyne
Collins Aerospace
Esterline CMC
Garmin International
Genesys Aerosystems
Innovative Solutions & Support
L3Harris
Thales Canada
True Blue Power
Universal Avionics

COMPONENTS/SERVICES

ABS Jets
ATP
Avfuel
BBA Aviation
Blackhawk Aerospace
Boeing Global Services
Bosch General Aviation
BRS Aerospace
CAE SimuFlite
CAMP Systems
CAV Ice Protection
Catherineau
CiES
Click Bond, Inc.
Duncan Aviation
Elliott Aviation
Extant Aerospace
FlightAware
FlightSafety International
ForeFlight
Gogo Business Aviation
Greenwich AeroGroup
Hartzell Propeller
Jet Aviation
Jet Support Services
Kaman Corporation
Lee Aerospace
Luxaviation Group
Meggitt Sensing Systems
Meiya Group
PPG Aerospace
Raisbeck Engineering
Redbird Flight Simulations
Signature Flight Support
SimCom International
StandardAero
Tamarack Aerospace
TRU Simulation + Training
Ultra-ICE
Unitech Aerospace
Wipaire
Woodward
World Fuel Services
Yingling Aviation

ASSOCIATE FULL

Aerion Corporation
Eviation
ICON Aircraft
Joby Aviation
Kitty Hawk Corp.
Lilium
Uber Elevate

ASSOCIATE EPIC

A³ by Airbus
Alakai Technologies
Ampaire
AutoFlightX
AVIAGE Systems
Bye Aerospace
Community Air Mobility Initiative
Daedalean
Embry-Riddle
ESAero
Karem Aircraft
magniX Technologies
Piasecki Aircraft
Robotic Skies
Ruixiang GA Manufacturing
SkyRyse
Skyports Limited
SmartSky Networks
Unither Bioelectronics
Vertical Aerospace
Volocopter
Xwing
ZeroAvia

HOW TO DEFINE 'BUSINESS JET' IN EASA REGULATIONS

Mass

- MCTOM <54,500kg (CS-25 Appendix S)

Passenger Capacity

- MOPSC <= 19 passengers (CAT.OP.MPA.140)

Operational Usage

- Commercial vs. Non-Commercial (Part-CAT / Part-NCC)

WHAT ARE THE KEY DIFFERENCES BETWEEN BUSINESS AVIATION AND PUBLIC AIRLINE TRANSPORT?

- Lower Occupancy / density
- Different / unique Utilisation
- Non-standard interiors
- Different security needs/risks
- Higher altitude operation
- Smaller airfields
- More advanced avionics/systems
- Different passenger profile
- Non-scheduled routes
- Includes GA/Part-23 aircraft – HPA
- Operators with small fleets and smaller organisations

WHAT IS THE SAFETY CONTINUUM?

Further accommodations needed within CS-25? Or a CS-23 "Level 5"?

Already addressed with the 4 certification levels defined in CS-23 Amdt.5

…BUT Business Jet owners/operators have very high expectations for safety, reliability and high technology

EASA has recognised the concept of the safety continuum in CS-23 Amendment 5 and has the stated objective to develop a safety continuum for rotorcraft in the EASA Rotorcraft Safety Roadmap.

WHAT IS THE SAFETY CONTINUUM?

CS-23 IS A GOOD PLACE TO START.

- USING WEIGHT AND PROPULSION TYPES AS PRIMARY DISTINGUISHING FACTORS,
- AC 23.1309-1E GIVES US FOUR *CERTIFICATION CLASSES OF AIRPLANES*

Type I

Cessna 172

Classes of Airplanes:	Allowable Quantitative Probabilities and Software (SW) and Complex Hardware (HW) Development Assurance Levels (Note 2)				
Class I (Typically SRE 6,000 pounds or less)	No Probability or SW and HW Development Assurance Levels Requirement	$<10^{-3}$ Note 1 P=D	$<10^{-4}$ Notes 1 and 4 P=C, S=D	$<10^{-5}$ Note 4 P=C, S=D	$<10^{-6}$ Note 3 P=C, S=C
Class II (Typically MRE, STE, or MTE 6,000 pounds or less)	No Probability or SW and HW Development Assurance Levels Requirement	$<10^{-3}$ Note 1 P=D	$<10^{-5}$ Notes 1 and 4 P=C, S=D	$<10^{-6}$ Note 4 P=C, S=C	$<10^{-7}$ Note 3 P=C, S=C
Class III (Typically SRE, STE, MRE, and MTE greater than 6,000 pounds)	No Probability or SW and HW Development Assurance Levels Requirement	$<10^{-3}$ Note 1 P=D	$<10^{-5}$ Notes 1 and 4 P=C, S=D	$<10^{-7}$ Note 4 P=C, S=C	$<10^{-8}$ Note 3 P=B, S=C
Class IV (Typically Commuter Category)	No Probability or SW and HW Development Assurance Levels Requirement	$<10^{-3}$ Note 1 P=D	$<10^{-5}$ Notes 1 and 4 P=C, S=D	$<10^{-7}$ Note 4 P=B, S=C	$<10^{-9}$ Note 3 P=A, S=B

Type IV

Cessna CJ4

The Safety Continuum is “common sense”.

WHAT IS THE SAFETY CONTINUUM?

Weight and *Propulsion Types* are not enough…

So what other variables should we consider?

From the AIR Workforce Briefing of 2014:

Tailored certification requirements based on

- Performance
- Complexity
- Usage

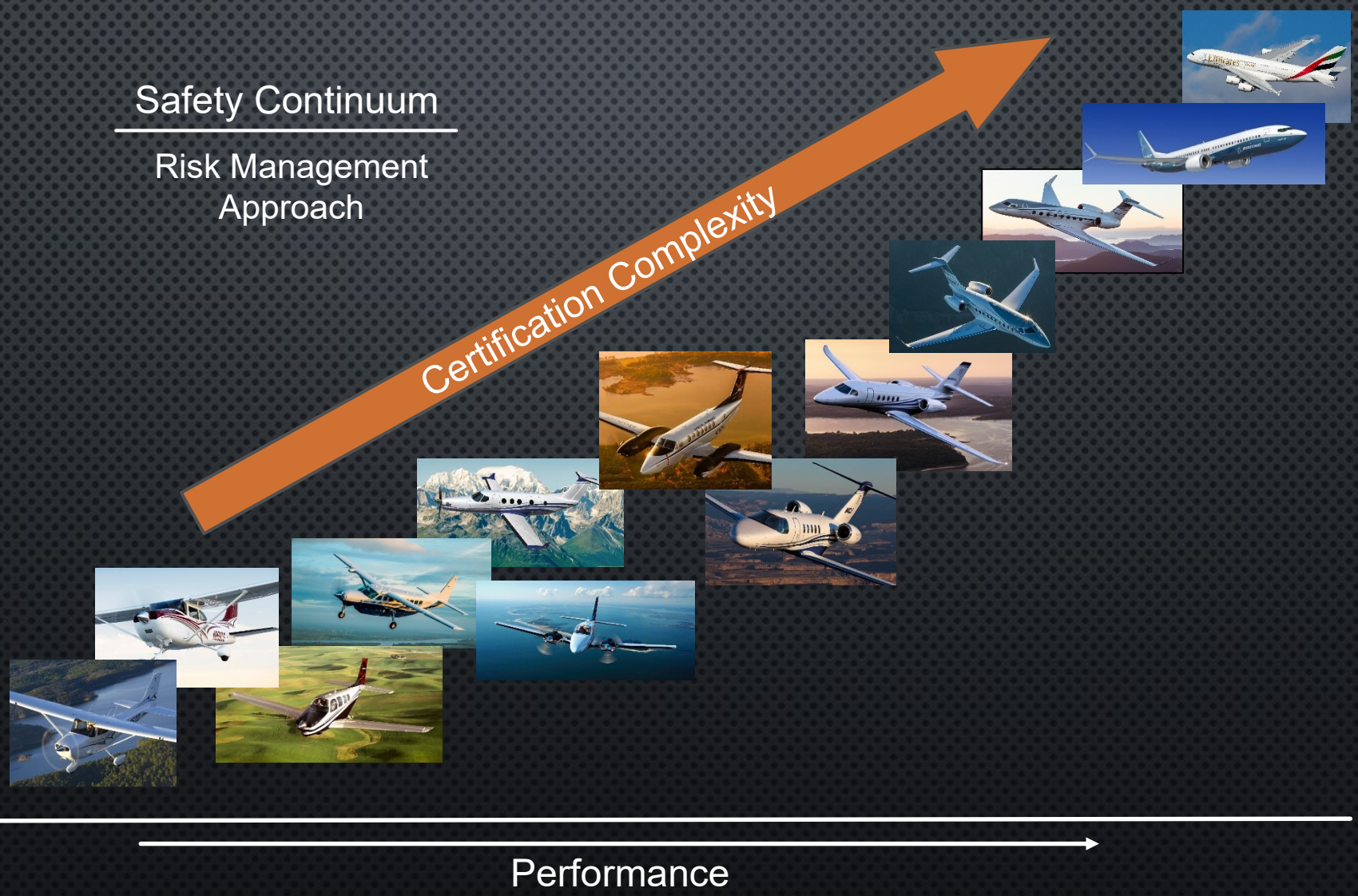
Federal Register, Vol 81, No. 251, Pg. 96573

"The FAA's safety continuum philosophy is that one level of safety is not appropriate for all aviation"

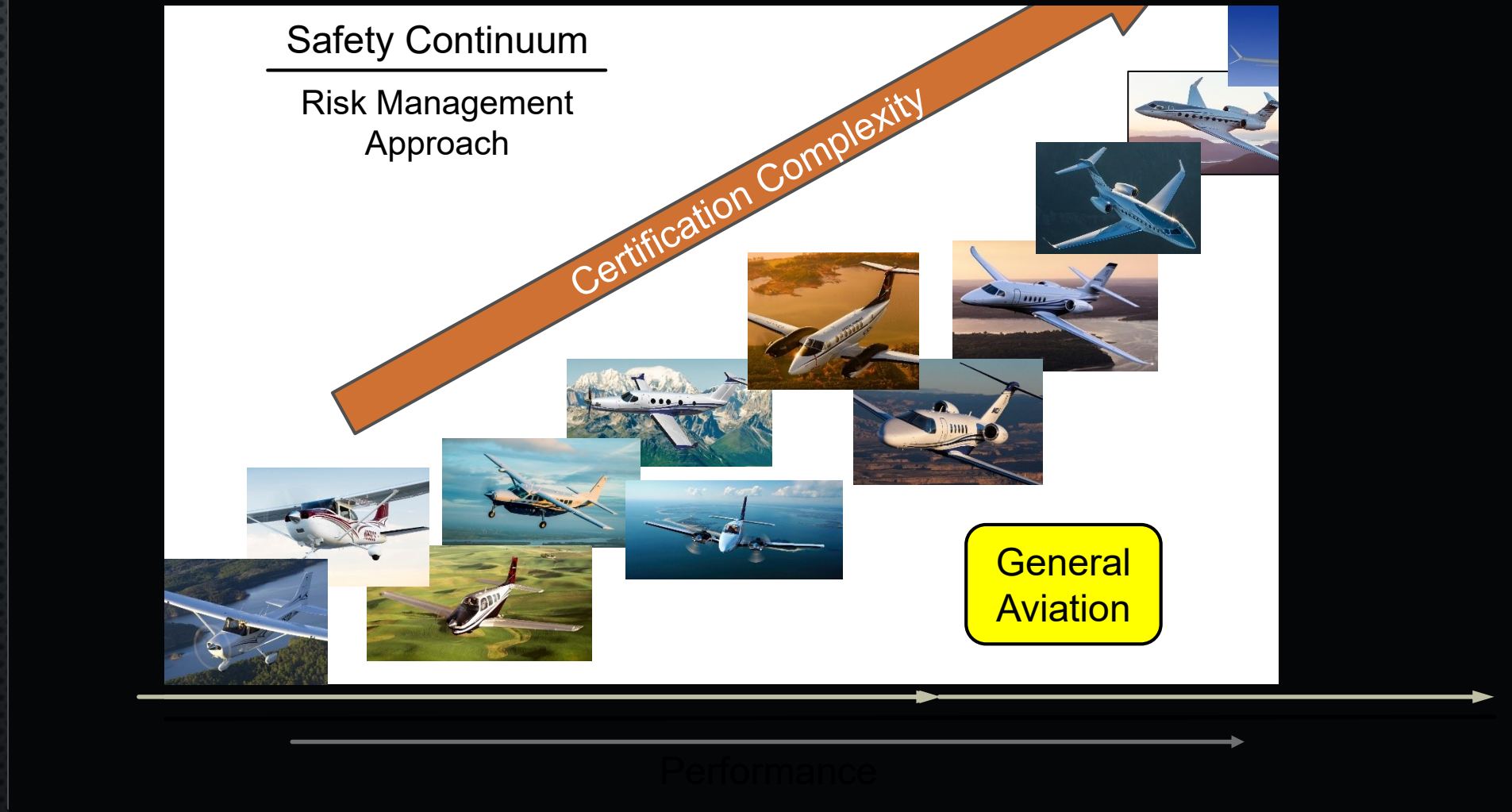
Regulatory review has been pending since the FAA Modernization and Reform Act of 2012.

There is an opportunity for EASA to take the lead here!

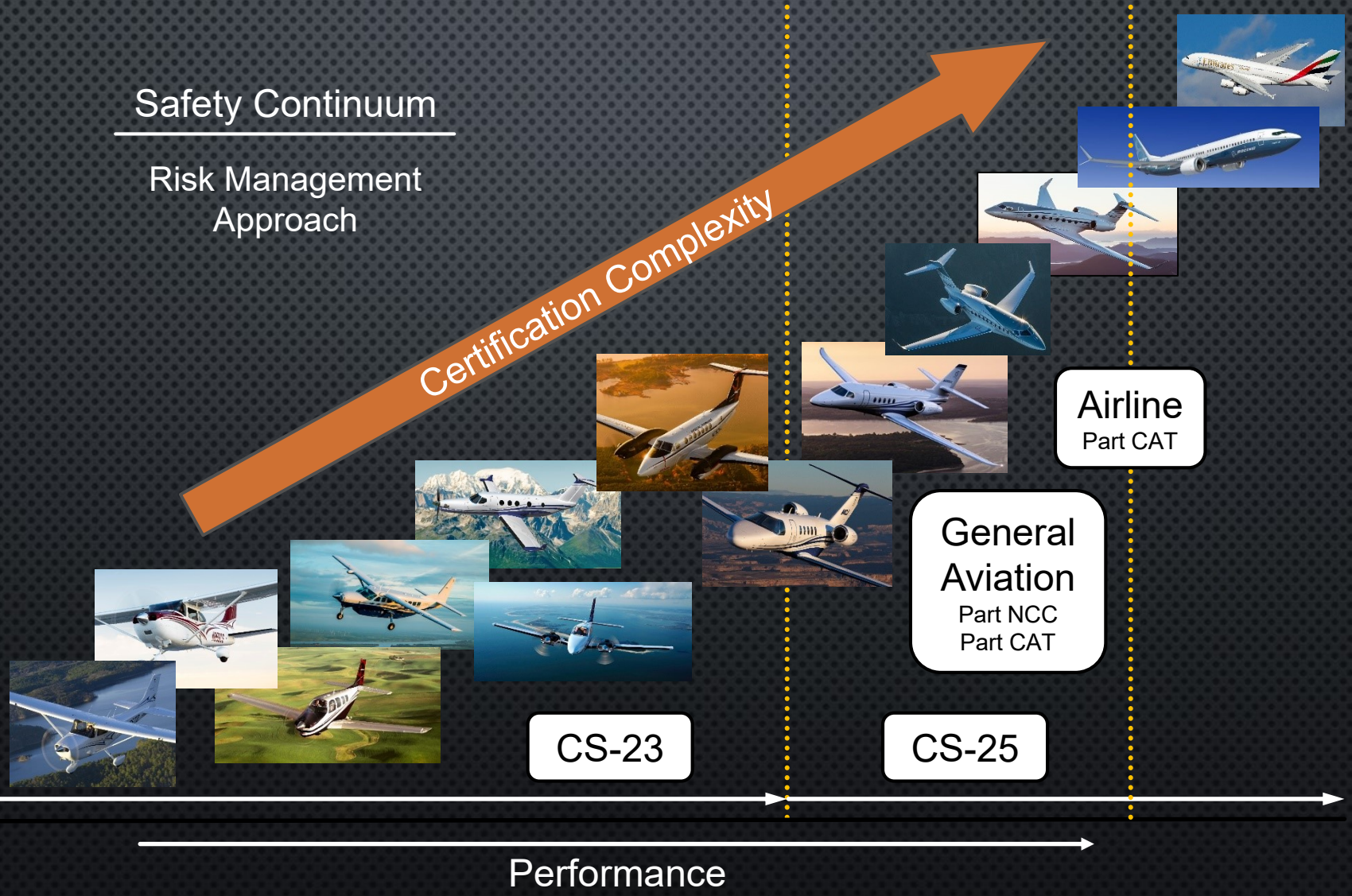
CS-25 GENERAL AVIATION



CS-25 GENERAL AVIATION



CS-25 GENERAL AVIATION

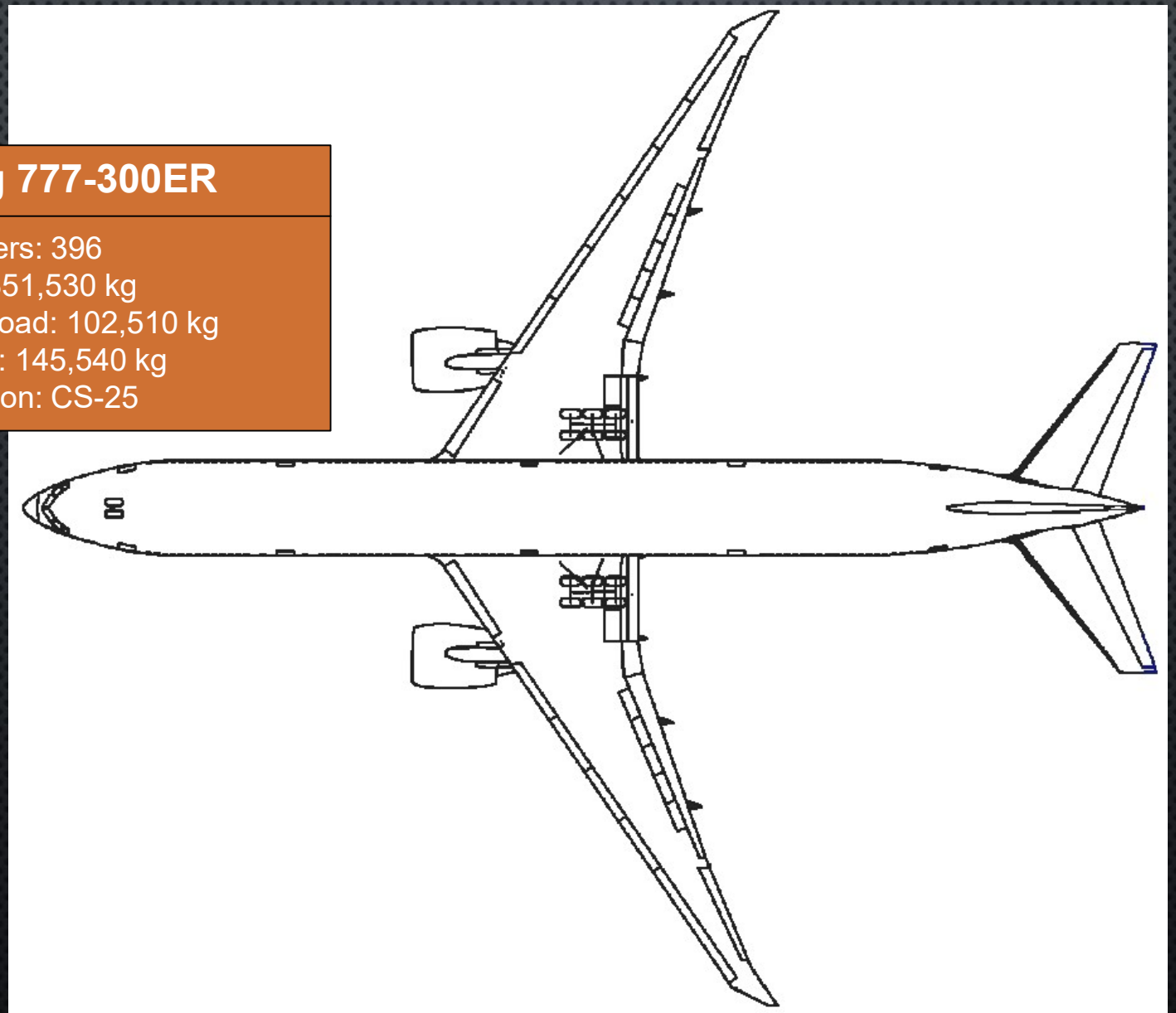


PART 25 GENERAL AVIATION

SIZING UP AIRPLANES

Boeing 777-300ER

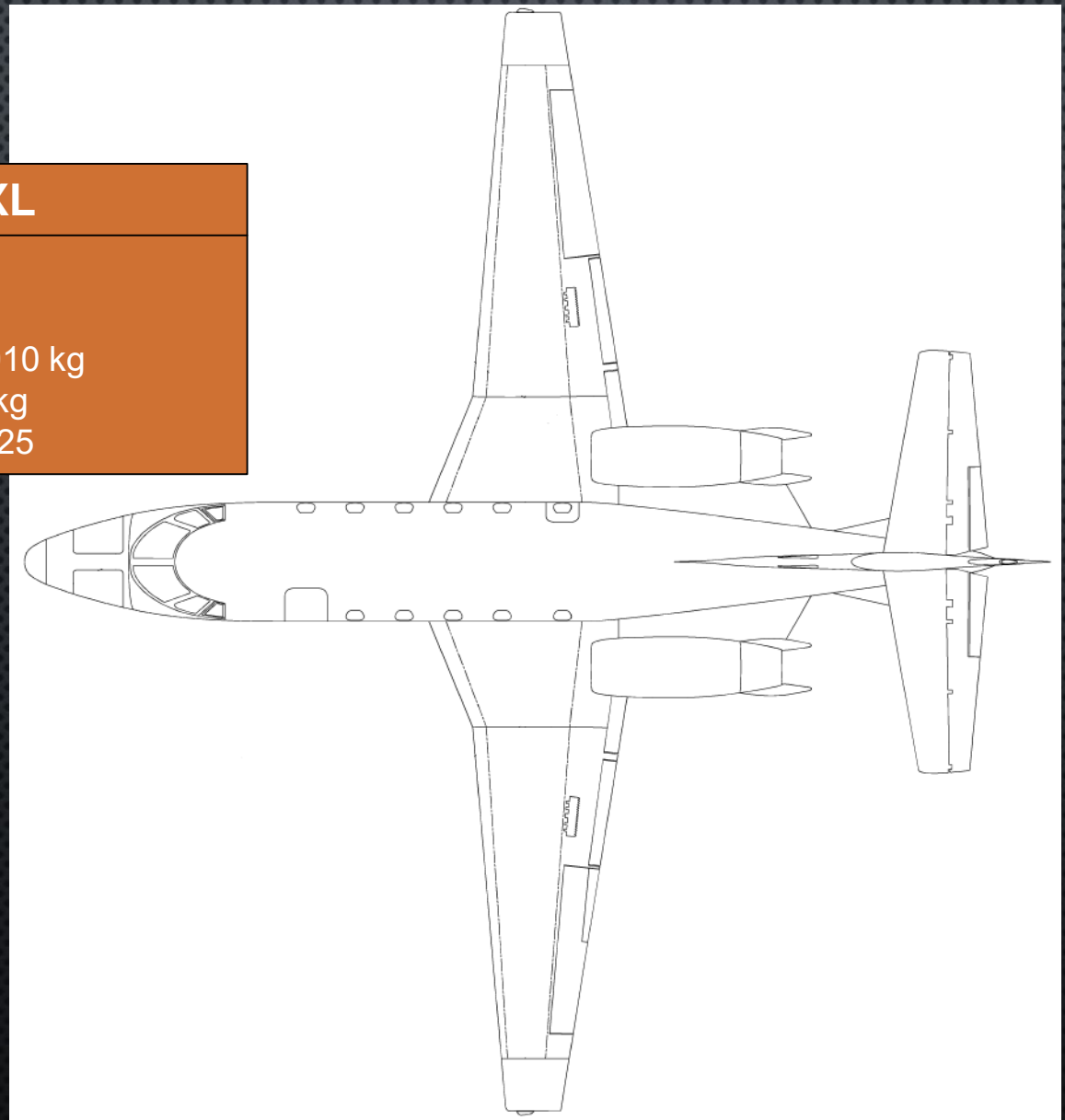
Passengers: 396
MTOW: 351,530 kg
Max Payload: 102,510 kg
Max Fuel: 145,540 kg
Certification: CS-25



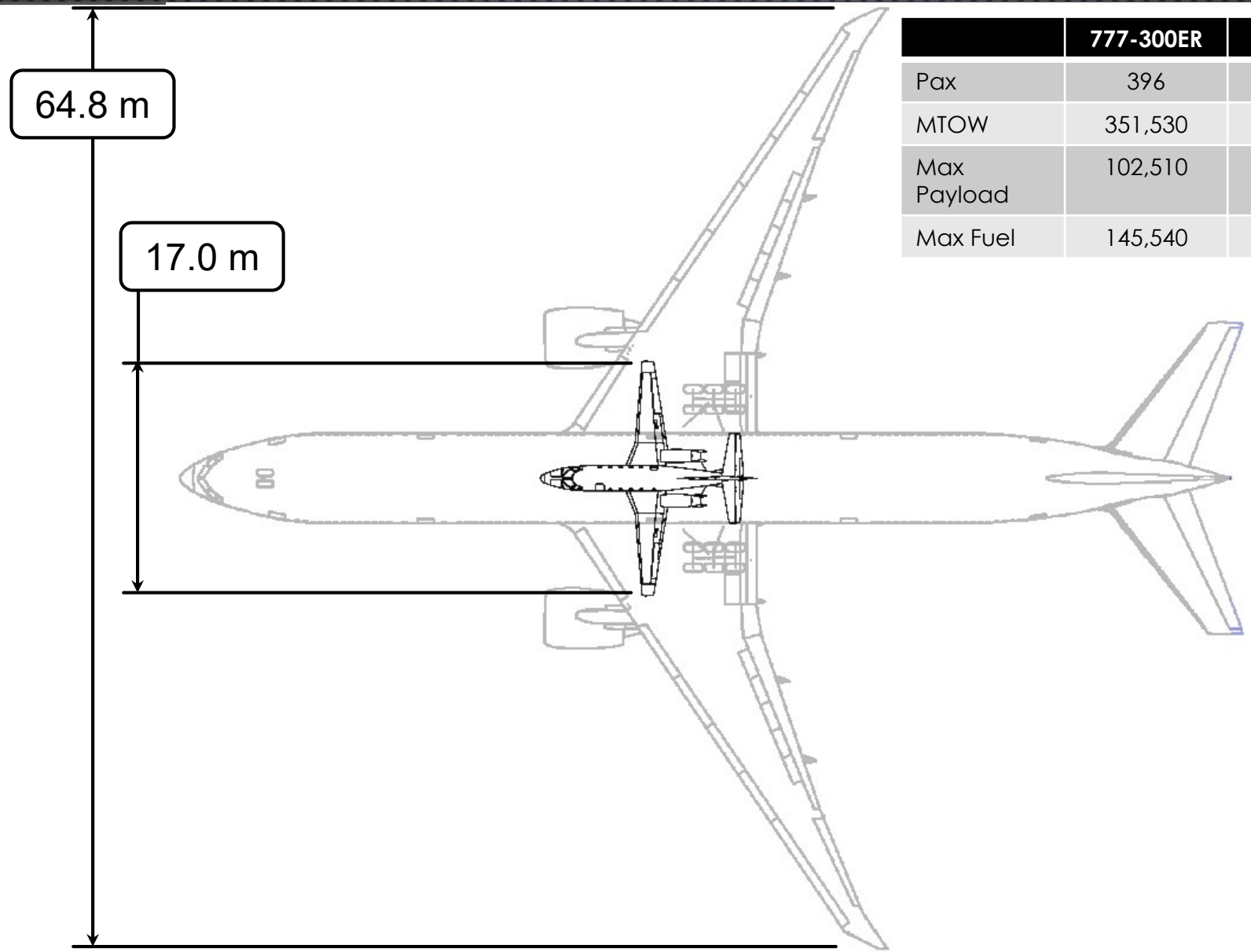
SIZING UP AIRPLANES

Cessna 560XL

Passengers: 10
MTOW: 9,160 kg
Max Payload: 1,010 kg
Max Fuel: 3,080 kg
Certification: CS-25



SIZING UP AIRPLANES

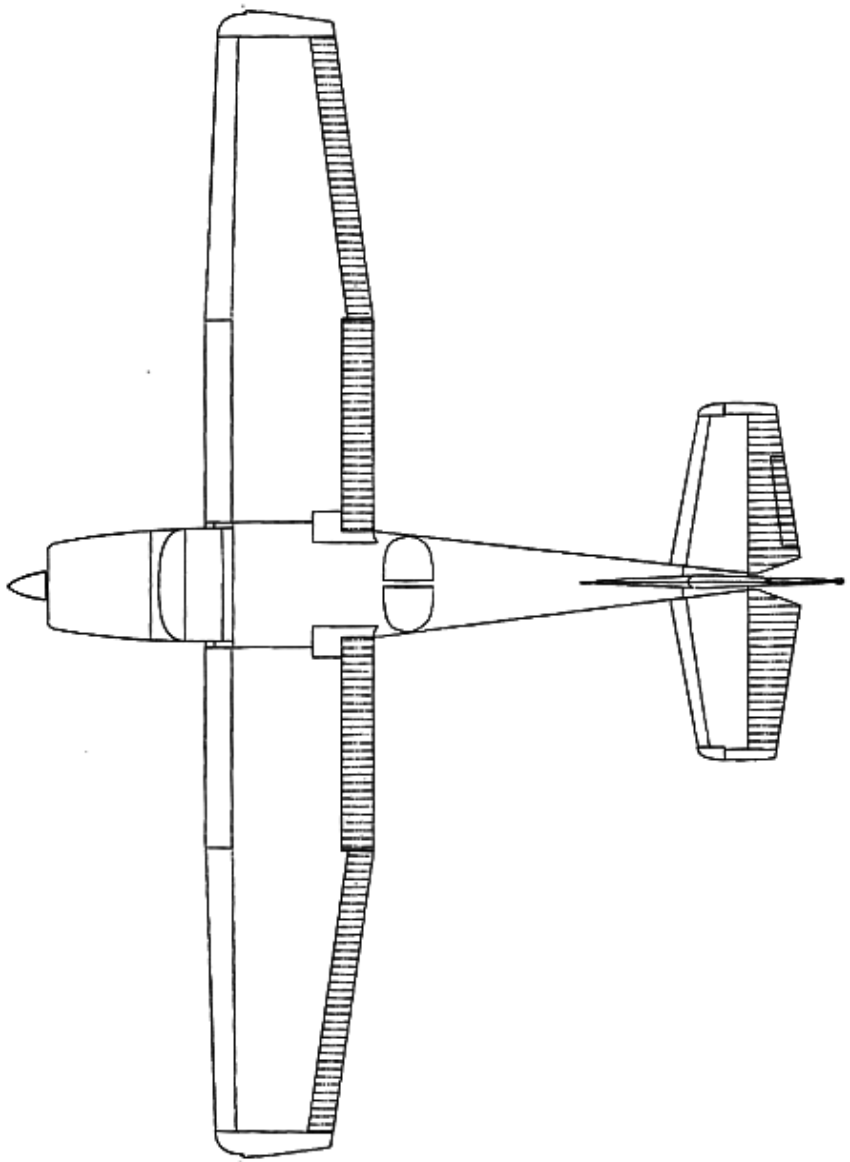


	777-300ER	560XL	%
Pax	396	10	2.5%
MTOW	351,530	9,160	2.6%
Max Payload	102,510	1,010	1.0%
Max Fuel	145,540	3,080	2.1%

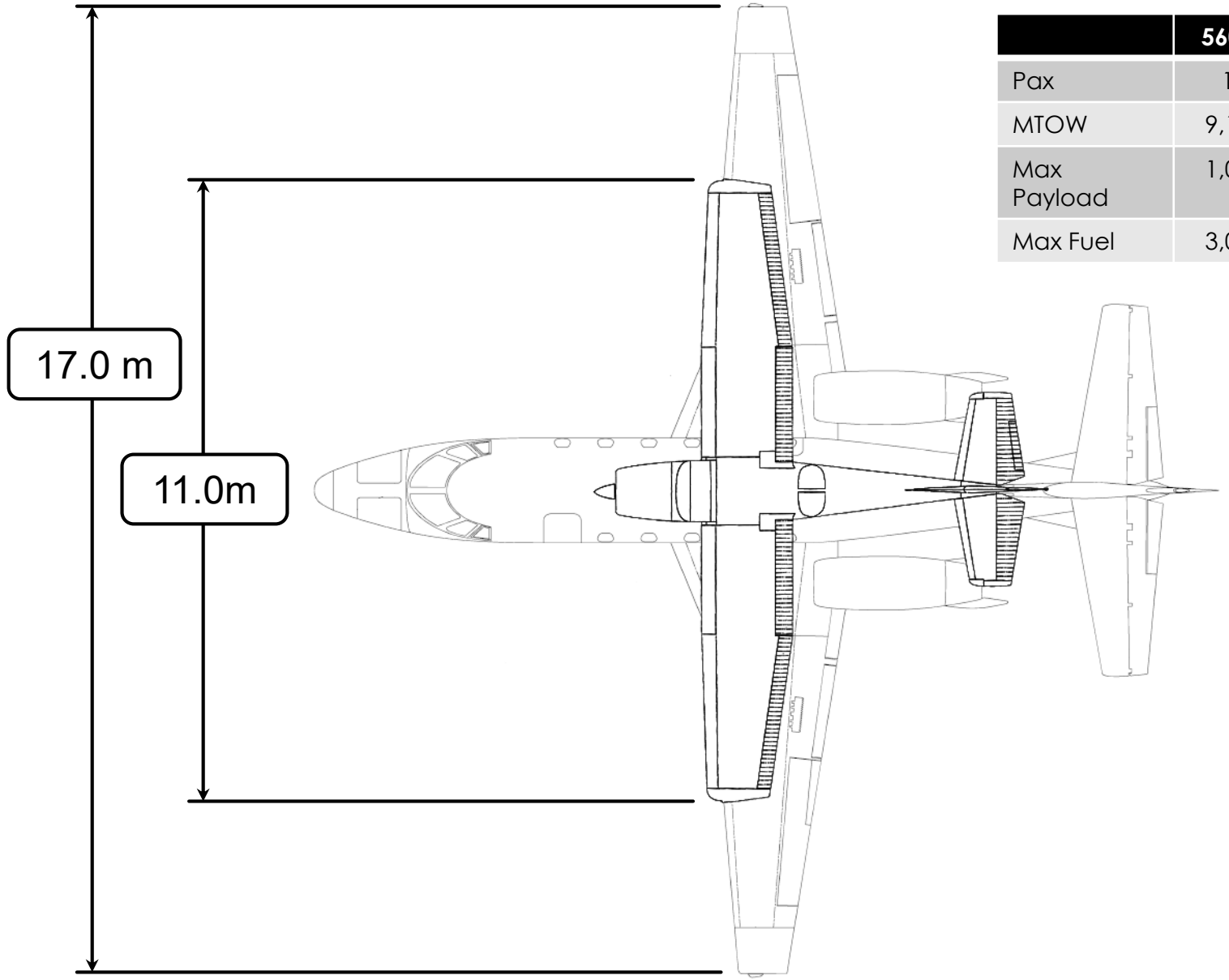
SIZING UP AIRPLANES

Cessna 172R

Passengers: 4
MTOW: 1,110 kg
Max Payload: 336 kg
Max Fuel: 152 kg
Certification: CS-23



SIZING UP AIRPLANES

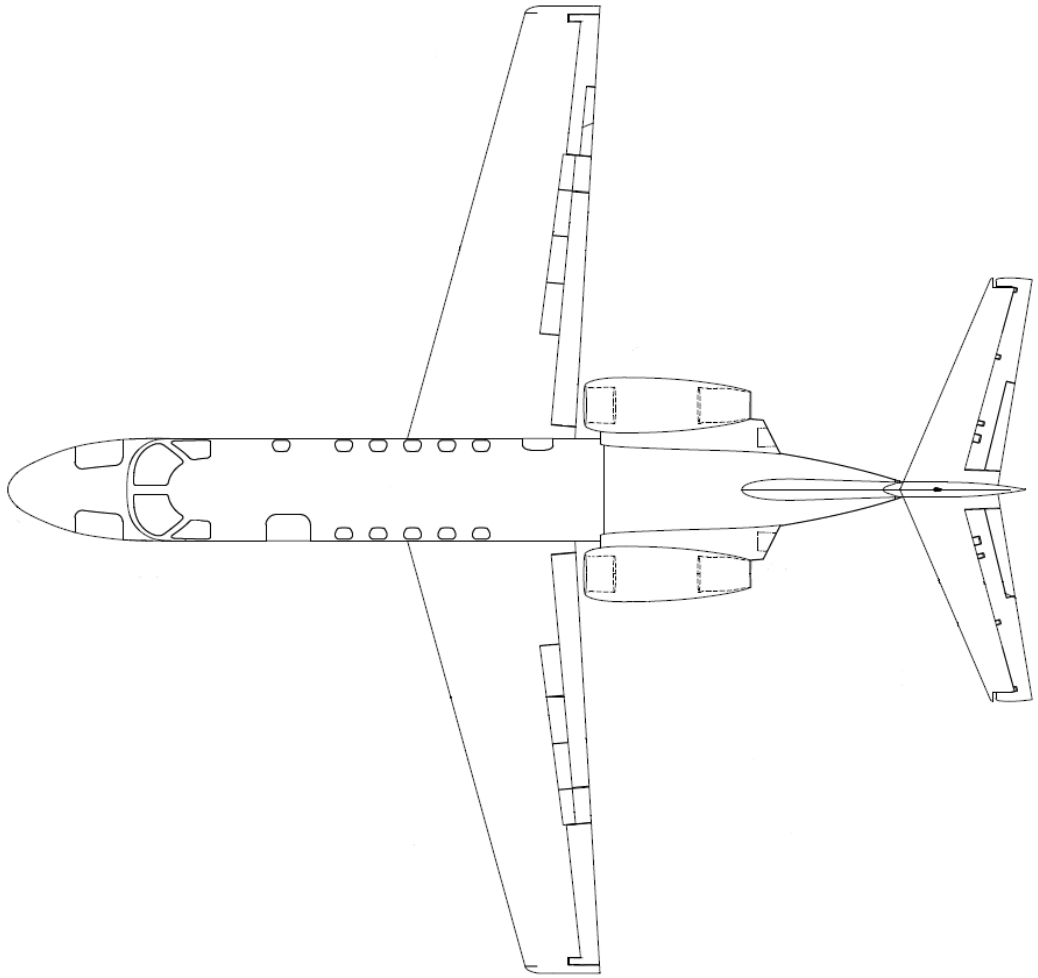


	560XL	172R	%
Pax	10	4	40.0%
MTOW	9,160	1,110	12.1%
Max Payload	1,010	336	33.0%
Max Fuel	3,080	152	5.0%

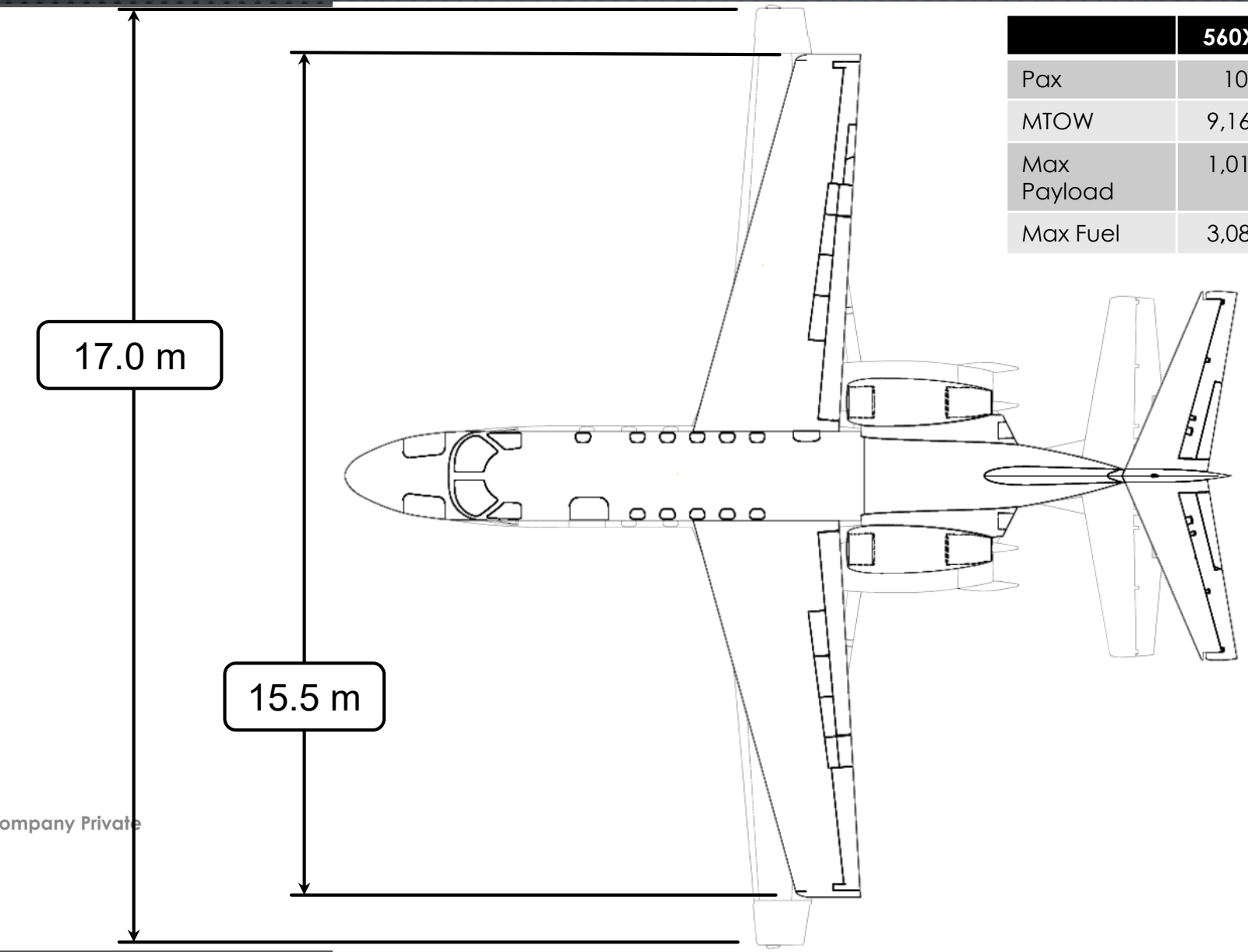
SIZING UP AIRPLANES

Cessna 525C (CJ4)

Passengers: 10
MTOW: 7,760 kg
Max Payload: 1007 kg
Max Fuel: 2,644 kg
Certification: CS-23

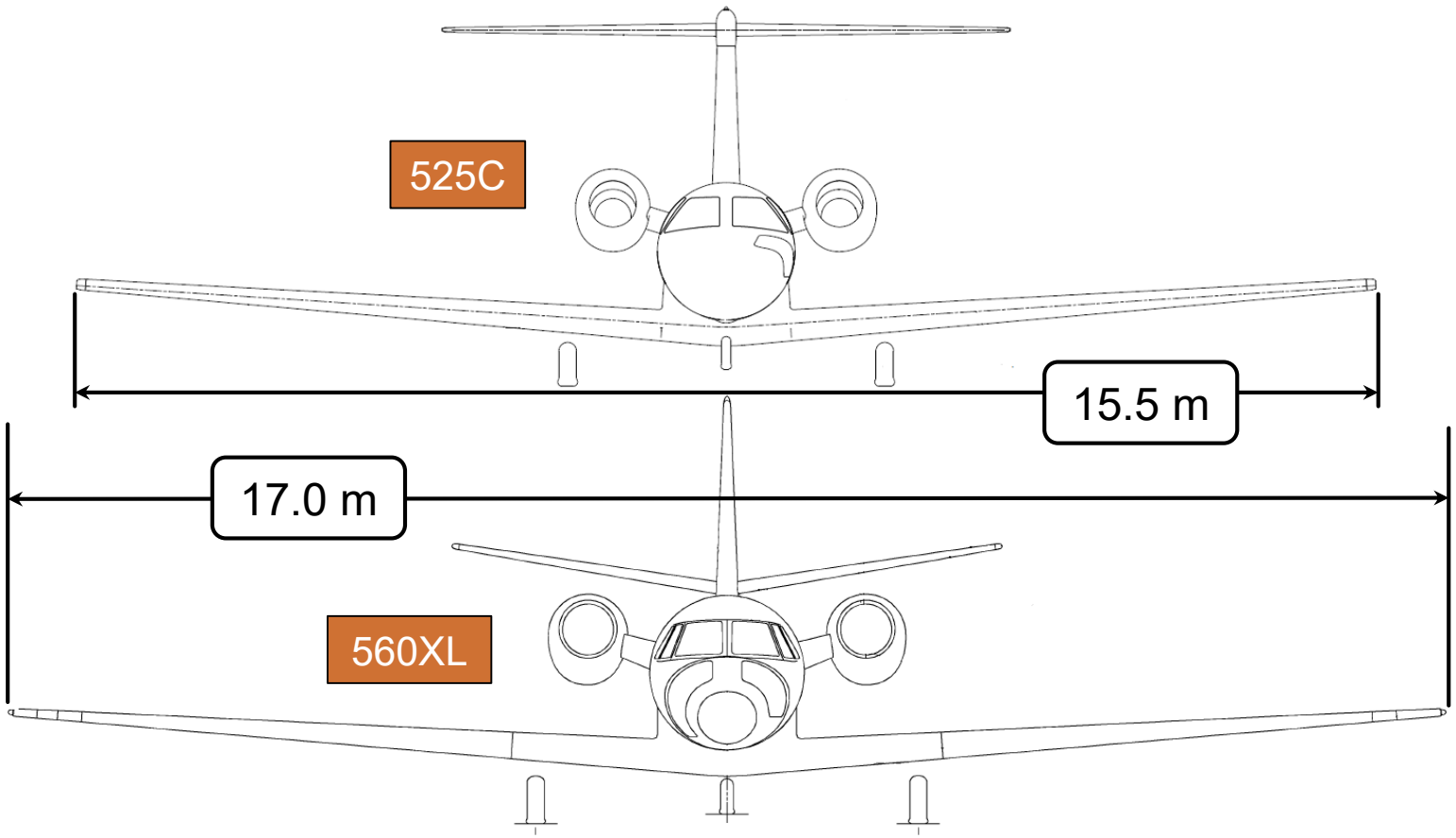


SIZING UP AIRPLANES

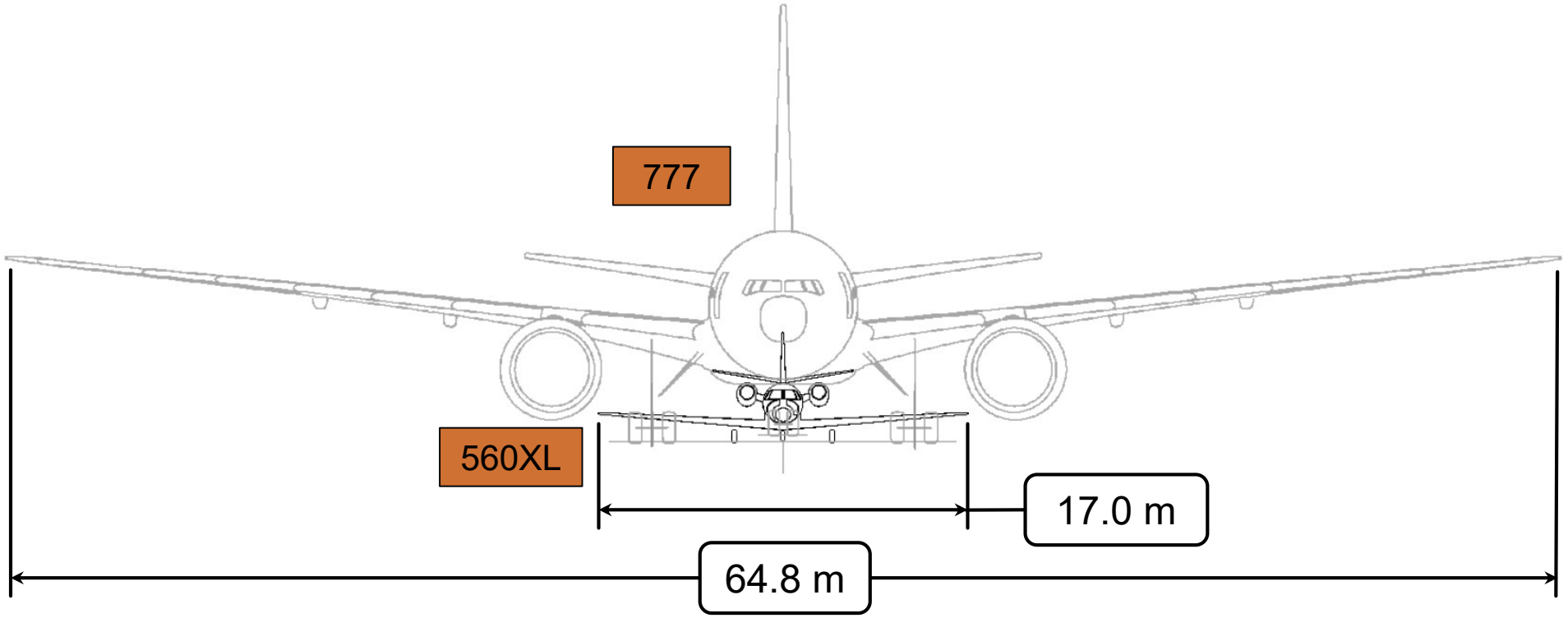


	560XL	525C	%
Pax	10	10	100%
MTOW	9,160	7,760	84.7%
Max Payload	1,010	1,007	99.1%
Max Fuel	3,080	2,644	85.8%

SIZING UP AIRPLANES



SIZING UP AIRPLANES



It Really Should Be “Common Sense”

SIZING UP AIRPLANES

A Broader Look

Model	CS	Passengers	MTOW (kg)	Max Payload (lb)	Max Fuel Capacity (lb)	Estimated Cost €M
Cessna CJ4	23	8	7,777	1,021	2,641	€ 8
Cessna 560XL (XLS+)	25	9	9,182	1,018	3,086	€ 2
Cessna 680A	25	9	14,000	1,156	5,179	€ 16
Cessna 700	25	12	17,955	1,364	6,596	€ 24
Embraer ERJ145XR	25	50	24,150	5,921	5,955	€ 22
Gulfstream G450	25	19	33,909	2,727	13,409	€ 35
Bombardier CRJ1000	25	104	41,727	11,991	8,841	€ 23
Gulfstream 650ER	25	19	47,091	2,955	21,909	€ 54
Boeing 737-700	25	149	77,727	16,540	21,044	€ 74
Boeing 777-300ER	25	396	352,273	102,727	145,847	€ 278

SIZING UP AIRPLANES

A Broader Look

Model	CS	Passengers	MTOW (kg)	Max Payload (lb)	Max Fuel Capacity (lb)	Estimated Cost €M
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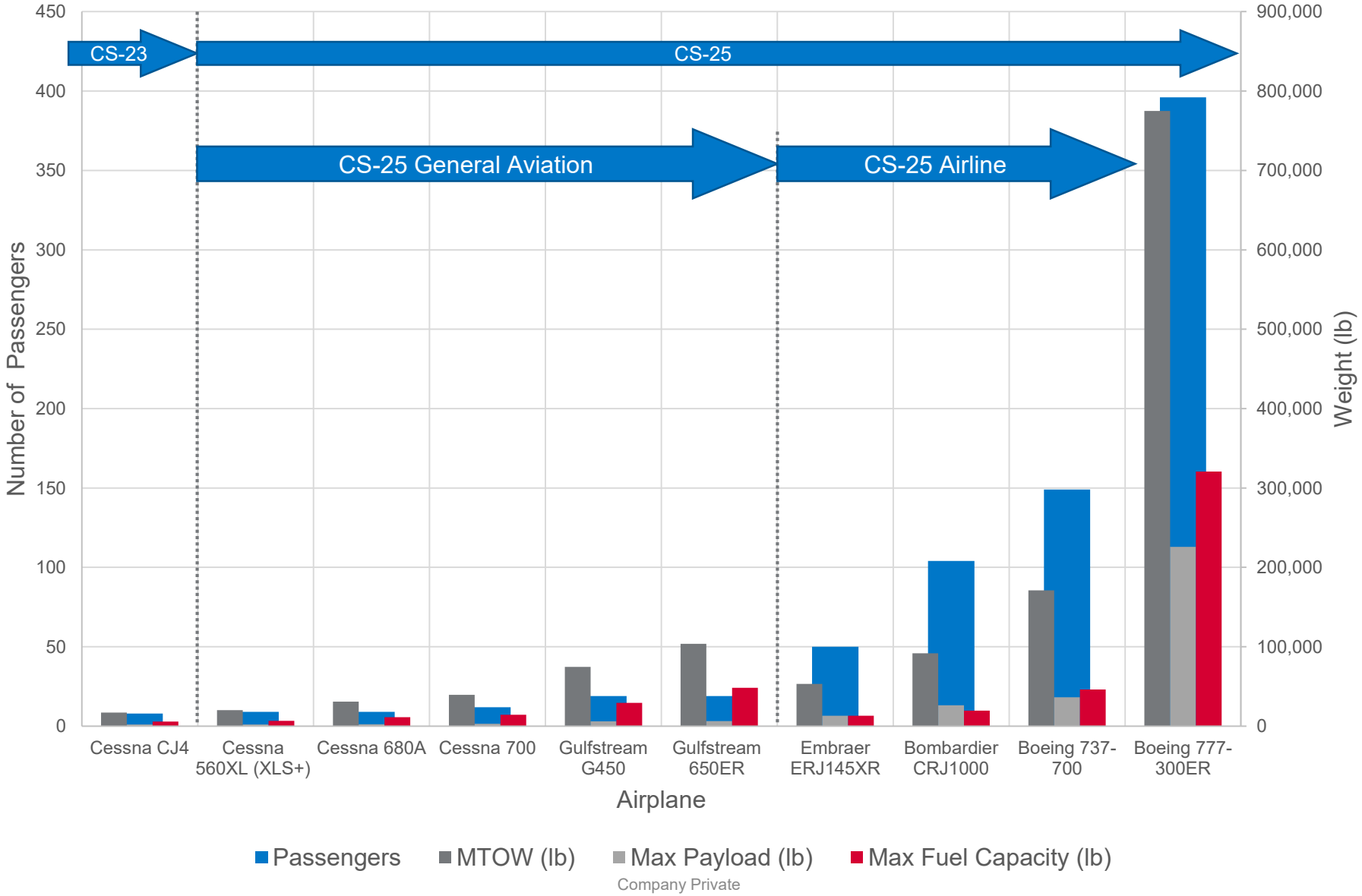
Cessna 680A	25	9*	14,000	1,156	5,179	€ 16
Cessna 700	25	12*	17,955	1,364	6,596	€ 24
Embraer ERJ145XR	25	50	24,150	5,921	5,955	€ 22
Gulfstream G450	25	19*	33,909	2,727	13,409	€ 35
Bombardier CRJ1000	25	104	41,727	11,991	8,841	€ 23
Gulfstream 650ER	25	19*	47,091	2,955	21,909	€ 54
Boeing 737-700	25	149	77,727	16,540	21,044	€ 74
Boeing 777-300ER	25	396	352,273	102,727	145,847	€ 278

** Business jet seating configurations are typically much lower the certified capacity*

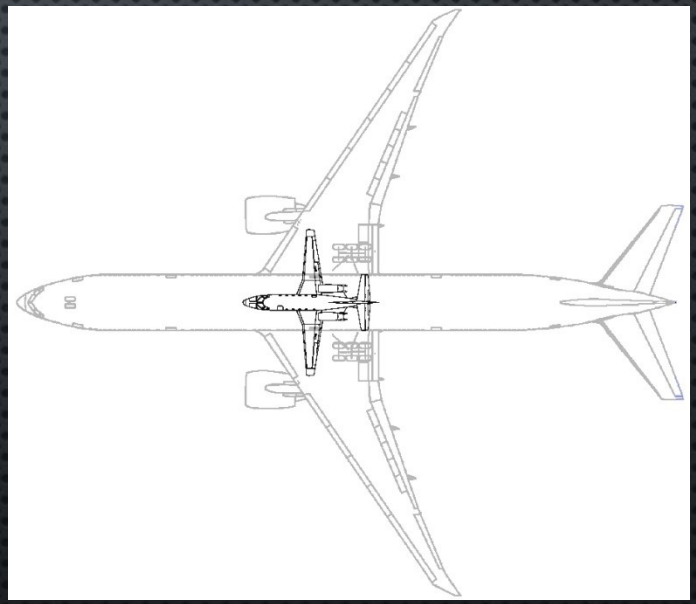
SIZING UP AIRPLANES



SIZING UP AIRPLANES

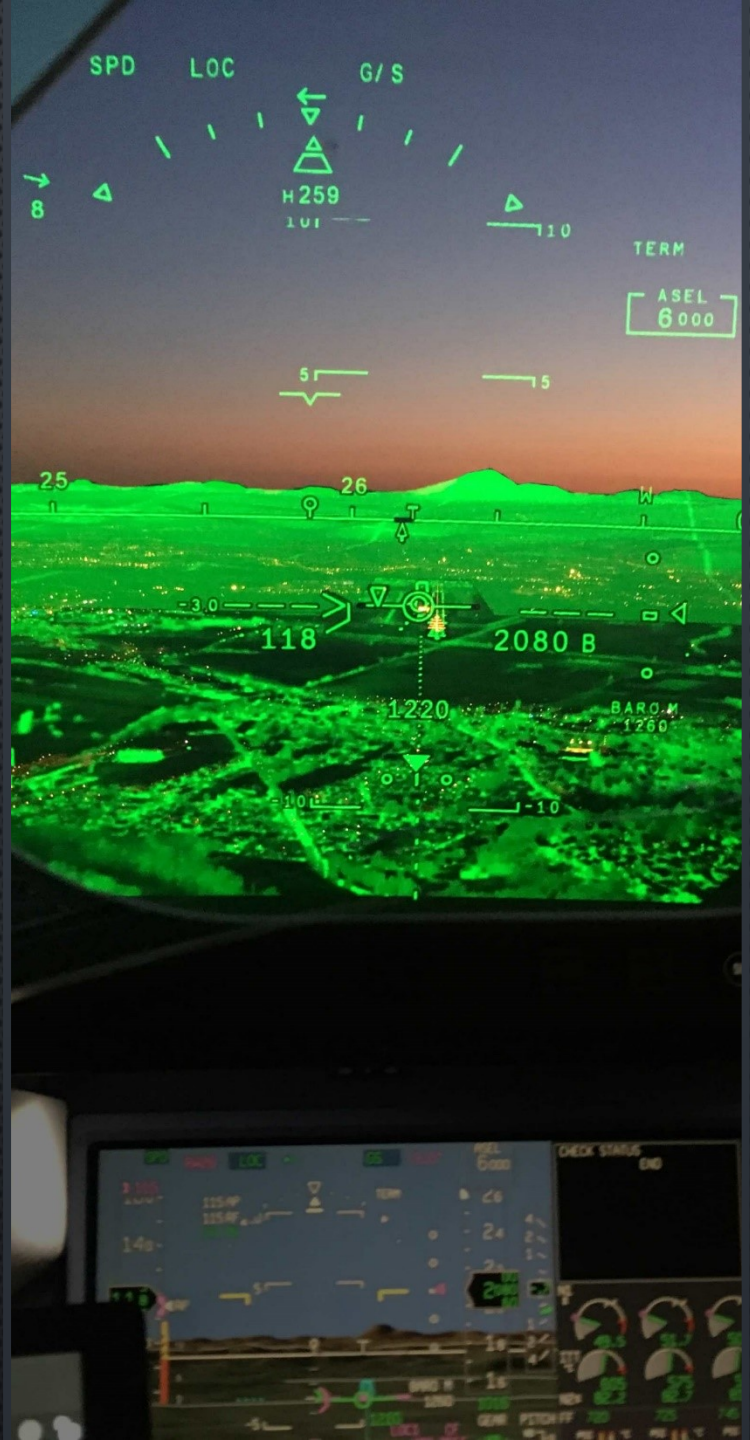
CS-25 GA vs. CS-25 Airline

- GA Passenger count is much lower, typically equal to or less than 19
- GA maximum payload is much lower
- Maximum fuel capacity can be just as high for GA since they have comparable range
- Acquisition cost is a function of MTOW
- Larger airplanes can absorb more certification cost burden than smaller airplanes



CERTIFICATION & VALIDATION PROCESSES NEED TO ENABLE INNOVATION

- BUSINESS JET MANUFACTURERS ARE LEADING THE INDUSTRY IN INNOVATION
- VALIDATING AUTHORITY PILOTS MUST BE MADE AVAILABLE AND THEY MUST BE FAMILIAR WITH:
  - THE PRODUCT
  - THE SYSTEMS BEING IMPLEMENTED
  - THE OPERATING ENVIRONMENT OF BUSINESS JETS
  - PROFICIENT IN THE TEST PILOT TECHNIQUES THAT ARE NEEDED FOR THE POINTS THEY INTEND TO FLY
- RECOMMENDATION
  - INCREASE AVAILABILITY OF PILOTS FOR OEM FAMILIARIZATION VISITS,
  - REQUIRE TEST CREWS HAVE TYPE RATINGS IN SAME OR SIMILAR PRODUCTS FROM THE SAME MANUFACTURER
  - ENSURE TEST PILOTS HAVE RECENT EXPERIENCE AND SKILLS NEEDED TO ENSURE A SAFE AND EFFICIENT FLIGHT TEST ENVIRONMENT



ALL WEATHER OPERATIONS (RMT.0379)

- Business Aviation Community Has Significant Experience with Technologies under Consideration in AWO Rulemaking Task
- EASA is Leveraging Subject Matter Expert Group as Opposed to Traditional Rulemaking Group
- A number of aeroplane and avionics companies are participating as Subject Matter Experts
- Feedback from Stakeholders Post-NPA Related to HUD and EFVS:
  - Significant changes since NPA (e.g., flare prompt, runway outline, accepted flight test procedures
  - EFVS integrated with flight guidance system
  - Concept of EFVS operations as visual operation should be recognized
  - Possible divergence from other regulators
- ASD and GAMA Jointly Requested that EASA Ensure All Technical Issues Have Been Fully Reviewed Prior to Finalizing

CERTIFICATION & FLIGHT STANDARDS ISSUES

Flight standards & Certification / OSD Coordination:

- Interface issues
- Better Regulation Approach needed in Ops regulations

Enabling New Technology

- EFB
- HUD
- EFVS

Flight Ops by OEMs

- Flight Test
- Production Test Flights
- Customer demo flights

Proportionality:

- Generic IPs read across from Transport a/c
- Proportionality needed in CS-25 SEI Lists

Training & Maintenance Impact

- Pilot training costs for Business Jets can be **up to double** the costs of Airbus A320 type training
- Part-66 Technician type rating training more expensive for BizAv MROs & facing a skills shortage in Europe.

CONCLUSIONS

- GAMA welcomes formation of dedicated EASA Business Jets Certification team
- We propose to develop a Business Jets Roadmap addressing:
  - safety continuum between CS-23 and CS-25
  - new technology issues
  - A "Better Regulation" approach to OPS regulations
- …to be presented at the 2ND EASA business Jets Workshop