



GAMA

GENERAL AVIATION MANUFACTURERS
ASSOCIATION

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2. WHAT IS 'EPIC'?
3. ELECTRIC-HYBRID AIRCRAFT INDUSTRY
4. GLOBAL REGULATORY ROADMAP
5. FUTURE CHALLENGES

“GENERAL AVIATION”



Scheduled Commercial Airliners



Military Aviation



Business Jets



Turboprops



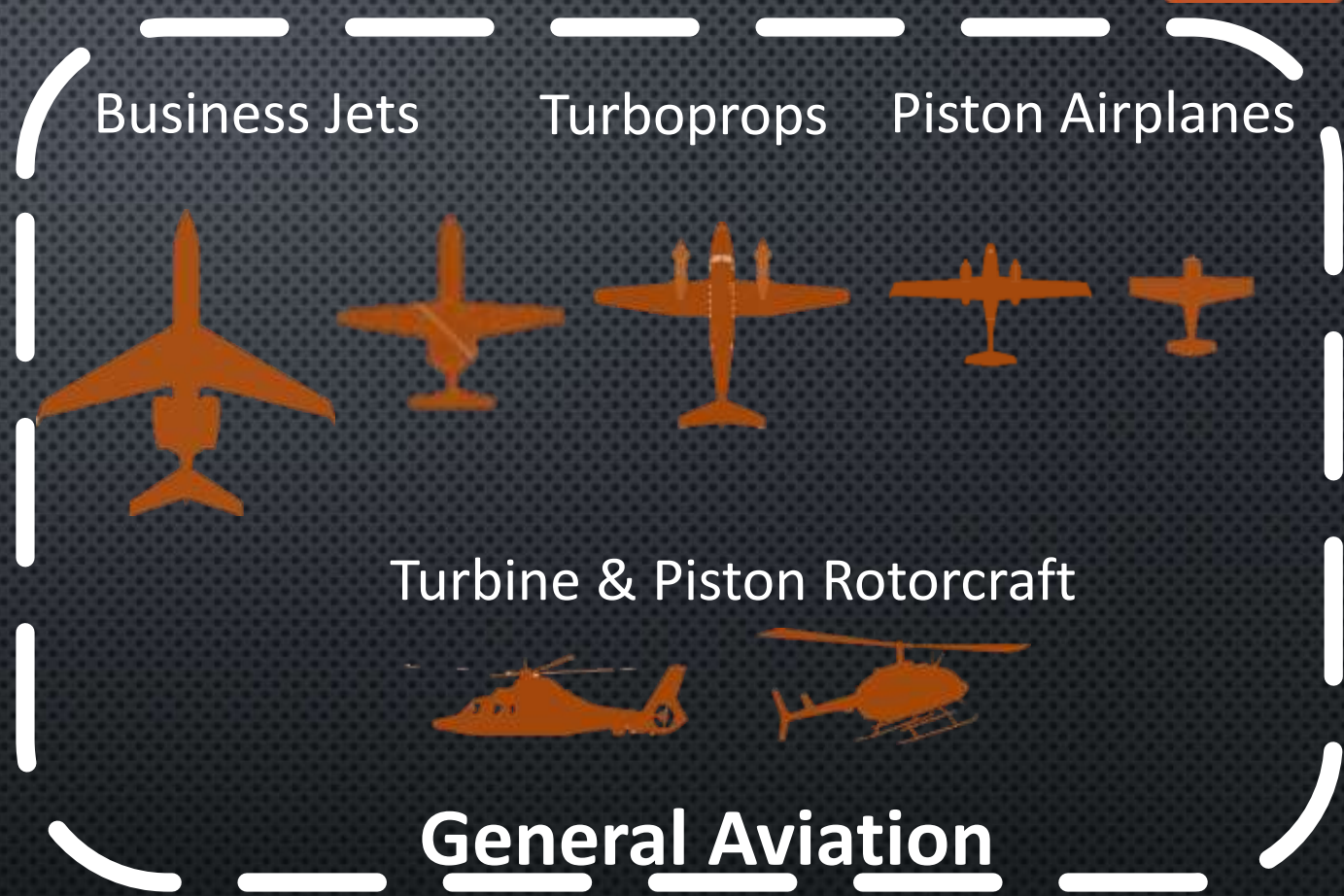
Piston Airplanes



Turbine & Piston Rotorcraft



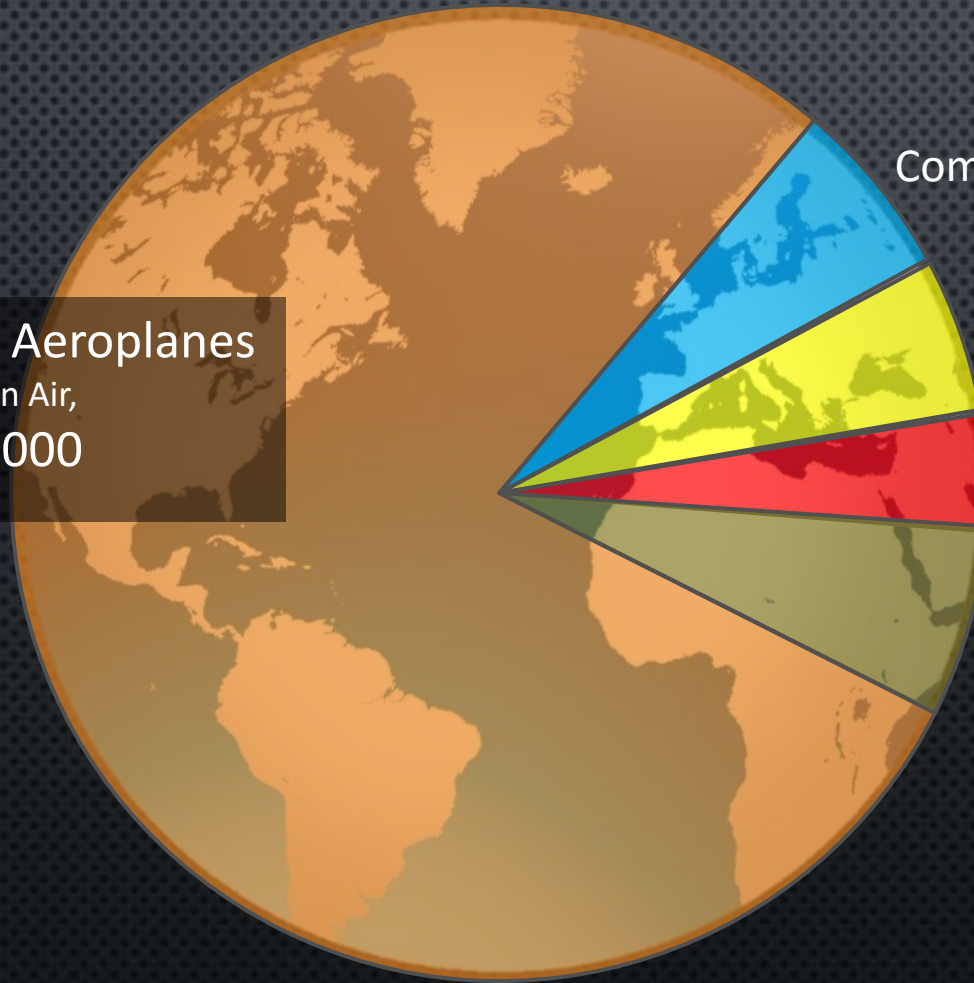
General Aviation



GLOBAL CIVIL TC AIRCRAFT POPULATION ≈ 334,000



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



Commercial Airliners ≈ 19,000



Business Jets ≈ 17,000



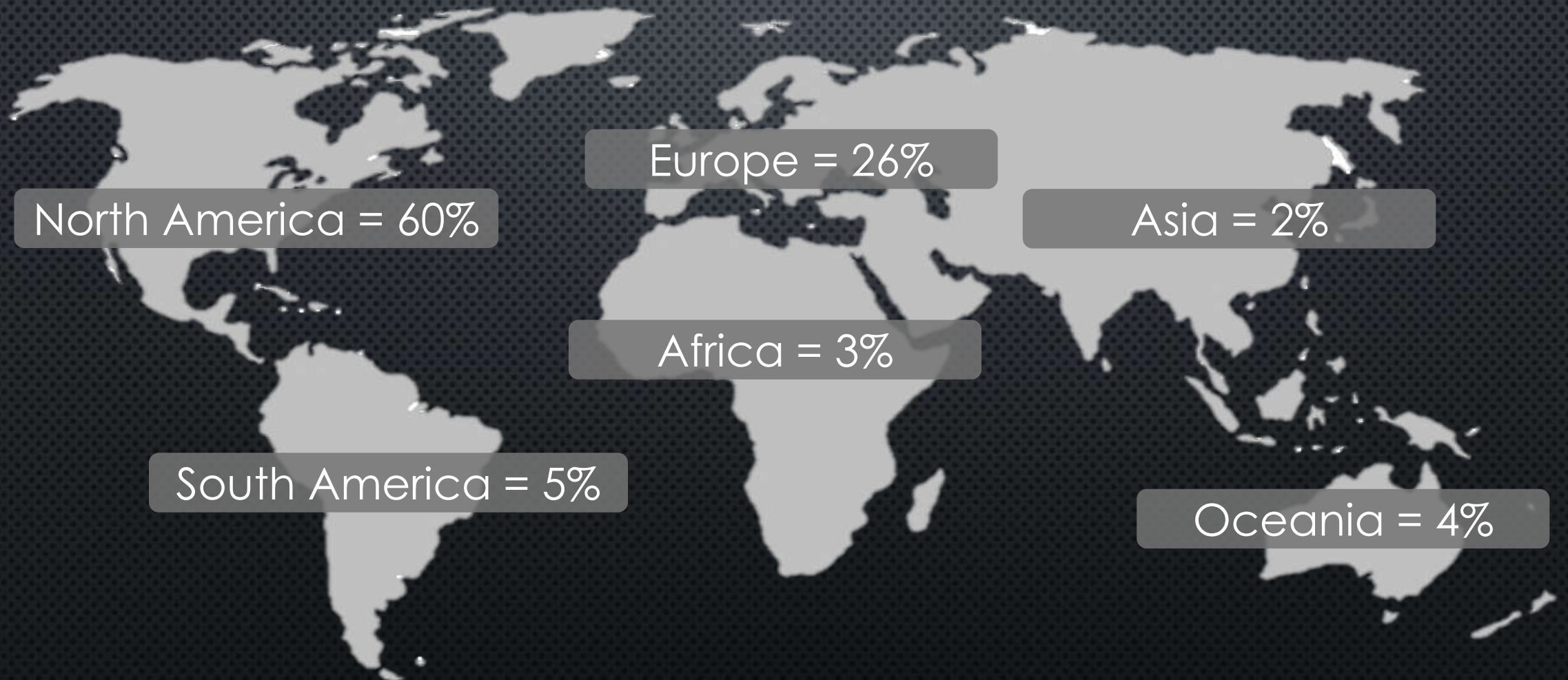
Turboprops ≈ 12,500



Rotorcraft ≈ 20,500



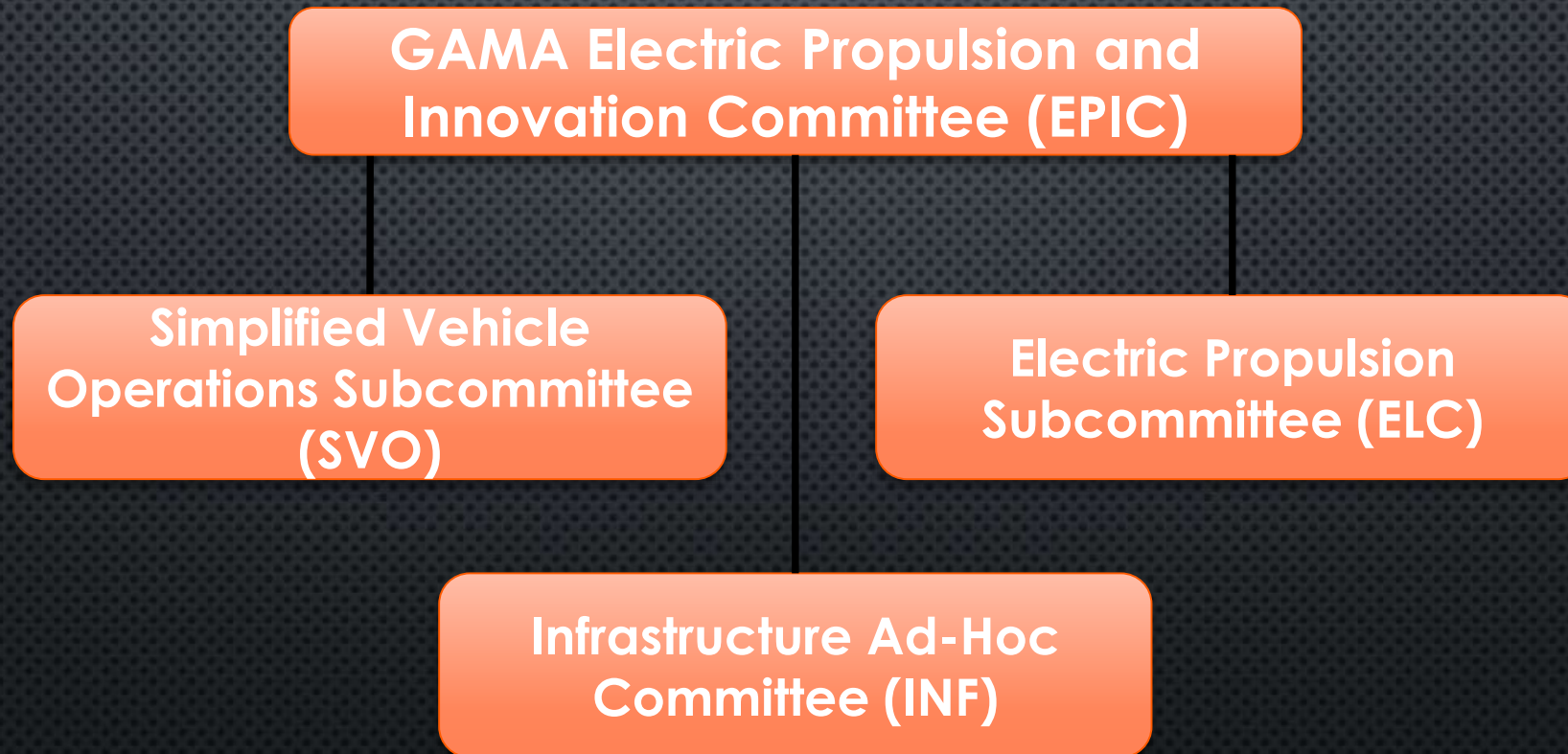
GLOBAL GA DISTRIBUTION





ELECTRIC PROPULSION & INNOVATION COMMITTEE (EPIC)

EPIC STRUCTURE



GAMA EPIC COMMITTEE MEMBERS



WORLD'S FIRST ALL ELECTRIC AIRSHOW DURING GAMA EPIC MEETING 4.APRIL.2017



HYBRID & ELECTRIC AIRPLANES



E-VTOL



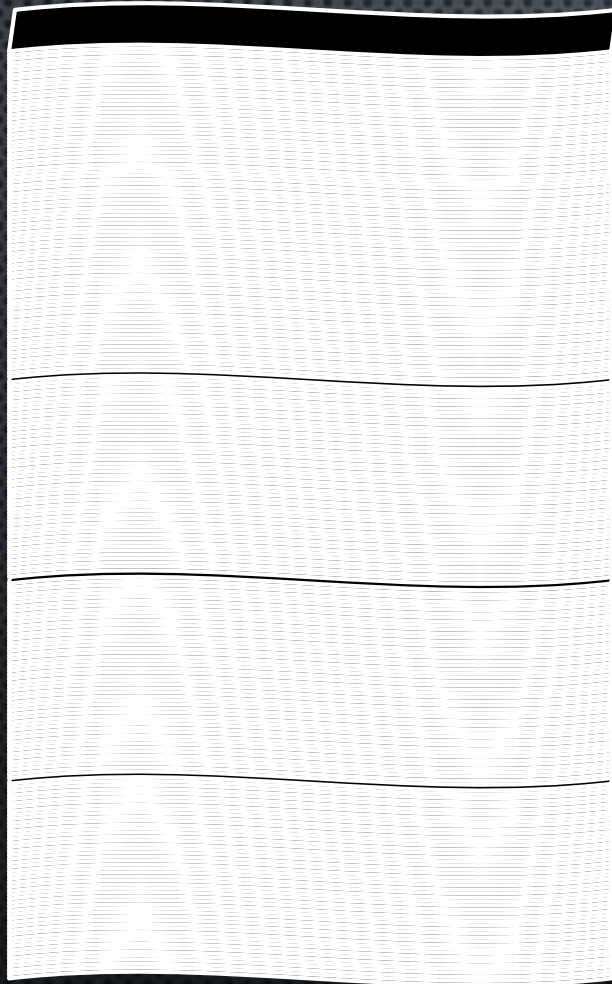
E-VTOL – CONCEPTS & DEMONSTRATORS



REGULATORY ENVIRONMENT

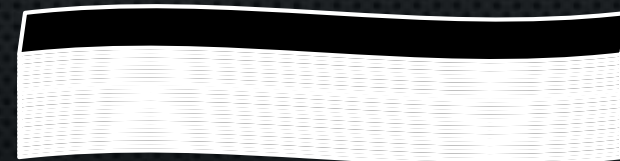
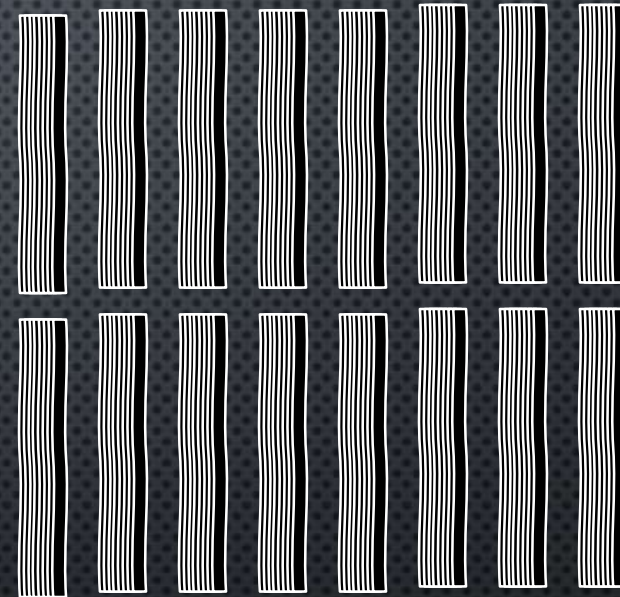
A) AIRCRAFT CERTIFICATION

PART 23 – A BIG OPPORTUNITY



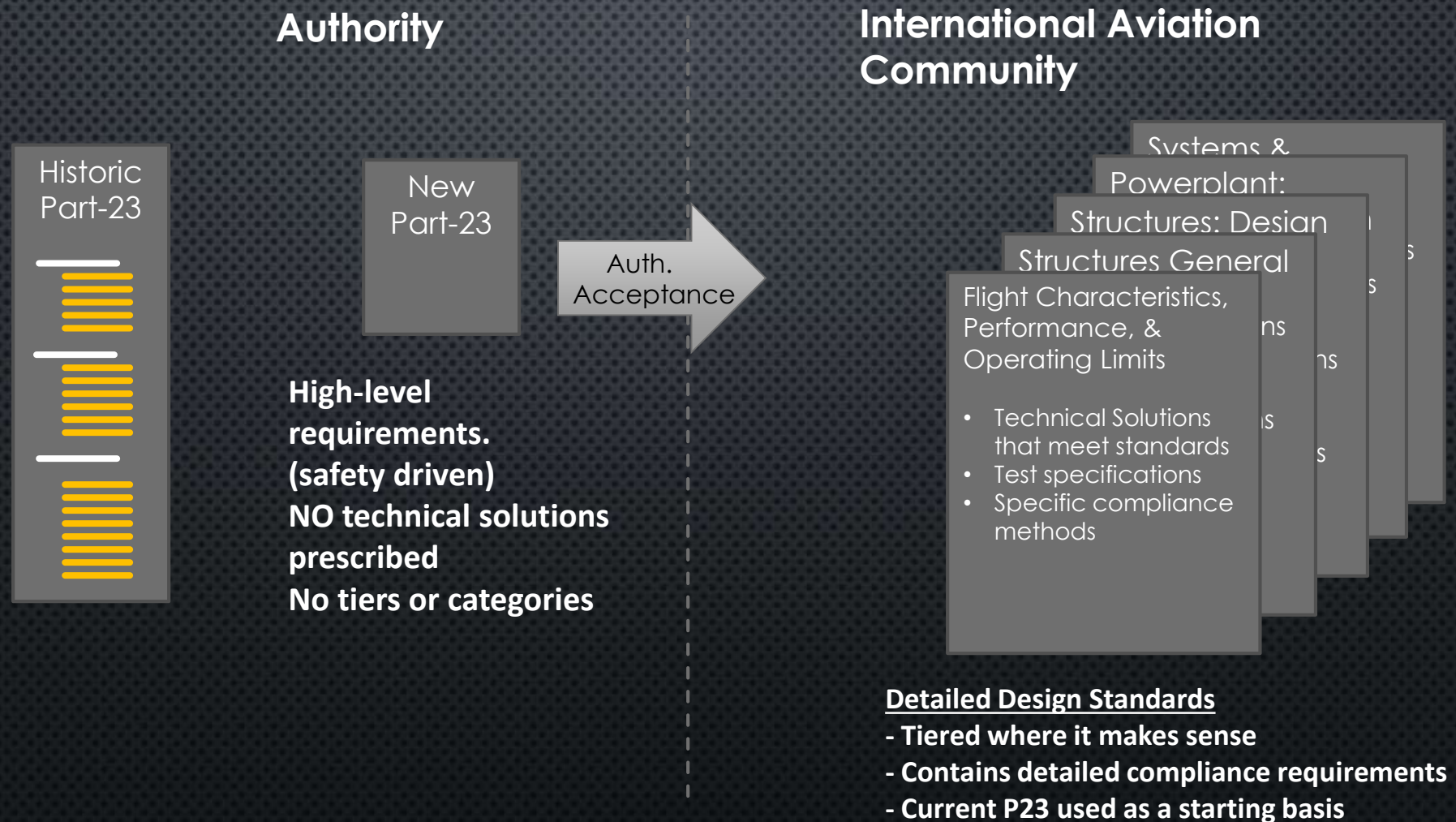
Part 23-63 (377 Regulations)

Consensus Stds.



Part 23-64 (71 Regulations)

SEPARATING SAFETY REQUIREMENTS FROM METHODS OF COMPLIANCE



ELECTRIC PROPULSION REGULATORY ENVIRONMENT: Q1-2016



	ANAC	CAAC	EASA	FAA	Transport Canada
Sport Aero					
Sm. Aero					
Lg. Aero					
Rotorcraft					
Engine					
Prop					

ELECTRIC PROPULSION REGULATORY ENVIRONMENT: Q1-2017



	ANAC	CAAC	EASA	FAA	Transport Canada
Sport Aero					
Sm. Aero					
Lg. Aero					
Rotorcraft					
Engine					
Prop					

ELECTRIC PROPULSION REGULATORY ENVIRONMENT: Q3-2017



	ANAC	CAAC	EASA	FAA	Transport Canada
Sport Aero	Yellow	Green	Green	Yellow/Red Diagonal	Yellow/Red Diagonal
Sm. Aero	Yellow/Red Diagonal	Yellow/Red Diagonal	Green	Green	Yellow/Red Diagonal
Lg. Aero	Red	Red	Yellow	Yellow	Red
Rotorcraft	Red	Red	Red	Red	Red
Engine	Red	Red	Yellow/Red Diagonal	Yellow/Red Diagonal	Red
Prop	Red	Red	Yellow/Red Diagonal	Yellow/Red Diagonal	Red

REGULATORY ENVIRONMENT

B) OTHER REGULATORY ASPECTS

PILOT LICENSING STANDARDS



Piston Engine



Turboprop Engine



Turbofan Engine



Electric Motor



Hybrid Motor

PILOT LICENSING STANDARDS



Single Engine Pilot

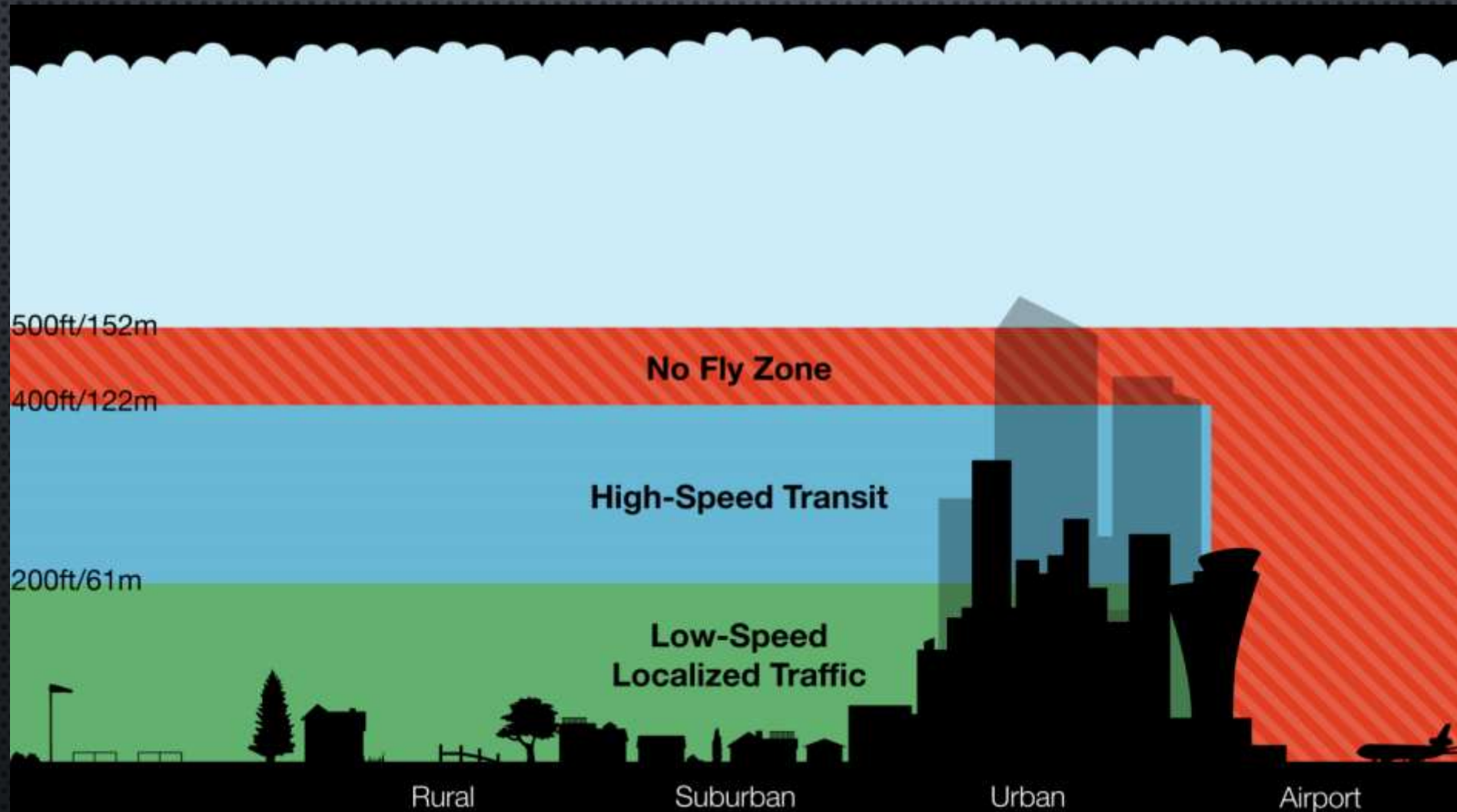


Multi Engine Pilot



?

OPERATIONAL CONSIDERATIONS



INFRASTRUCTURE



GAMA PUBLICATION 16



GAMA PUBLICATION NO. 16 – HYBRID & ELECTRIC PROPULSION PERFORMANCE MEASUREMENT

Version: 1.0

2.3 Traffic Pattern Flight

The traffic pattern flight scenario is intended to simulate traditional traffic pattern training work at a non-towered airport. The total energy required for the trip includes pre-flight, taxi, takeoff, completing the pattern, landing, normal shutdown and reserve energy. When following the standard for a traffic pattern, as detailed below, the number of traffic patterns, training time, and/or refuel (recharge) time are variables that can be measured and provided.



Number of Patterns: xxxxxx Flight Time: xxxxx (min.)
Refuel Time: xxxxx (min.) Total Energy: xxxxx (KWb)
Total Payload: xxxxxx (lbs.)

Airport Altitude: Sea Level (0 ft)

Conditions: ISA / no wind

Runway: Hard smooth surface no shorter than 2,500 ft

Pre-Flight & Start: Conduct normal preflight & startup procedures

Taxi: 1500 ft

Take off: Normal takeoff procedures

Climb: Runway heading at V_x to 50 ft AGL or clear of obstacles then runway heading at V_y to 600 ft AGL at no slower than 500 fpm, it is permissible to turn crosswind and downwind during the climb once above 500 ft AGL to a pattern altitude of 1000 ft AGL.

Traffic Pattern:

- Runway track at V_y to 50 ft AGL, then V_x to 500 ft AGL.
- Turn to crosswind while climbing to at least 1000 ft AGL.
- Turn to downwind and maintain 1000 ft AGL until abeam landing point.
- Fly conventional base and final legs and touchdown at no faster than V_{ls} .
- Execute a rolling take off again or taxi to parking.
- Continue with training maneuvers as desired (assuming sufficient energy for safe landing plus reserve energy).

Landing: Fly conventional downwind leg at 1000 ft AGL, until abeam landing point and begin descending fly conventional base and turn final and land.

Taxi: 1,500 ft to parking spot

Park & Shutdown: Conduct normal parking and shutdown procedures

Reserve: 30 minutes reserve at cruise power (based on speed & altitude used for downwind legs above) remaining at end of flight.

Notes on Measured Parameters:

Number of Traffic Patterns: Number of complete circuits of the traffic pattern

Flight Time: Time measured from first takeoff to last landing

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GAMA PUBLICATION NO. 16

HYBRID & ELECTRIC PROPULSION PERFORMANCE MEASUREMENT

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Version: 1.0
3 February 2017

PLAN FOR SIMPLIFIED OPERATIONS



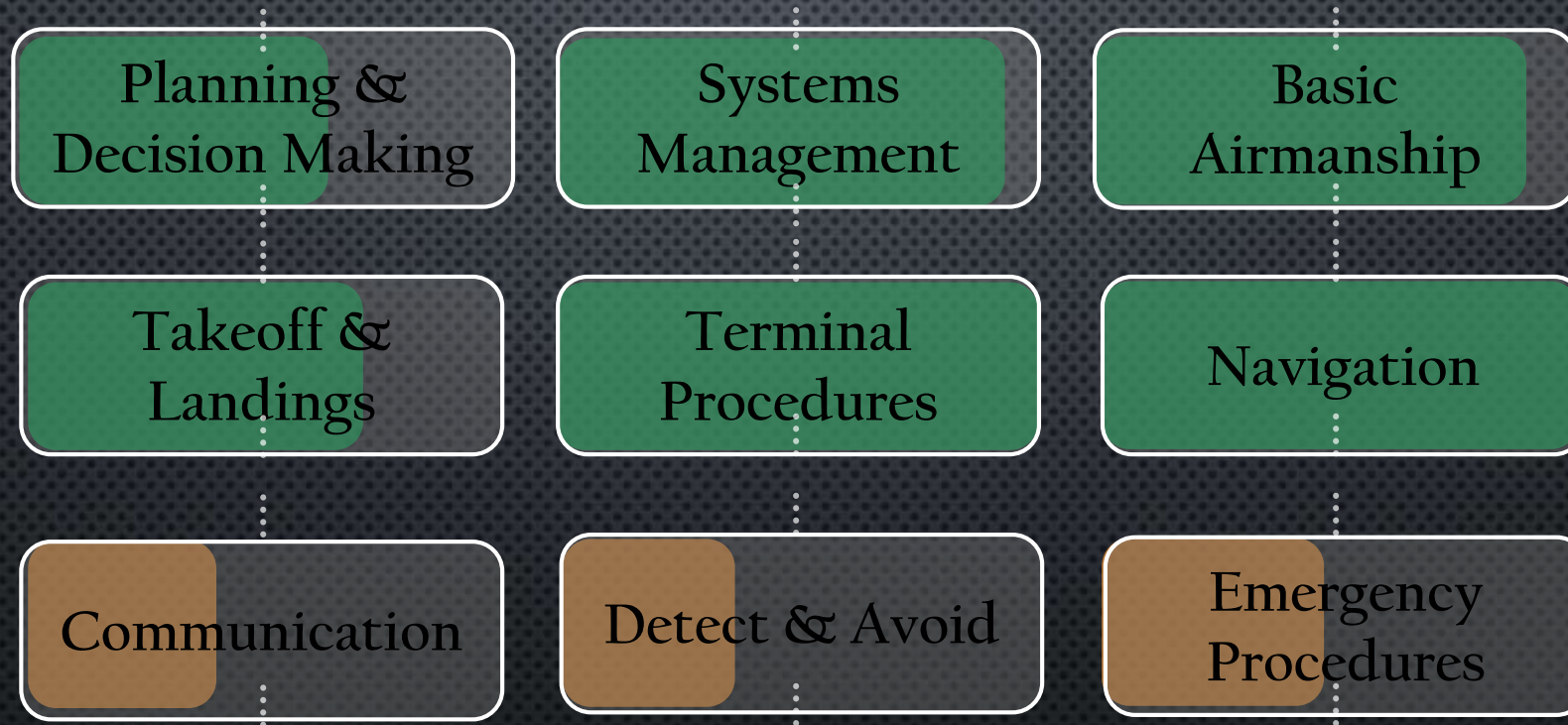
USC14CFR§91.171



VOR Equipment Check Log					Aircraft:	N: 356ND	
Type of Check:							
1. VOT				+ or - 4 Degrees		Must have been completed within the previous 30 days when operating IFR Reference: FAR 91.171	
2. VOR Designated Point - Ground				+ or - 4 Degrees			
3. VOR Designated Point - Air				+ or - 6 Degrees			
4. Dual VOR Systems				4 Degree Difference			
5. Enroute - Self Selected				+ or - 6 Degrees			
Date	Location or Facility	Type Check	Bearing Error		Pilot's Signature		
			VOR 1	VOR 2			
10. Dec. 16	OTT	Air	± 0°	± 0°			
9. Jan. 17	MAB	Grd	+1°	+1°			
9. Feb. 17	SEA	Grd	± 0°	± 0°			
1. Mar. 17	OTT	Air	± 0°	± 0°			
6. May 17	SEA	Air	+1°	± 1°			
21. Jun 17	MAB	Grd	+1°	+1°			
10. July 17	MAB	Grd	± 0°	± 0°			
18. Aug. 17	SEA	Air	± 0°	± 0°			
1. Oct. 17	OTT	Air	± 1°	± 1°			



DECONSTRUCTED PILOT



*Boxes Represent FAA Pilot Training Areas

*Green Represents Current State of Technology (Average Pilot Capabilities are Half-Full)



FOR ONCE YOU HAVE TASTED FLIGHT YOU WILL WALK THE
EARTH WITH YOUR EYES TURNED SKYWARDS, FOR THERE YOU
HAVE BEEN AND THERE YOU WILL LONG TO RETURN”

– LEONARDO DA VINCI –

1452 - 1519

