Progress Update 01

Embry Riddle Aeronautical University - College of Business and Engineering

Formulating the Aircraft of the Future

Meet Team APPA

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Cost/ Simulation Lead

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Performance Lead

Agenda

- Mission Objectives
- Design Configurations and Analysis
- Regulation Impact
- Market Strategies
- Costs Analysis

Mission Objectives

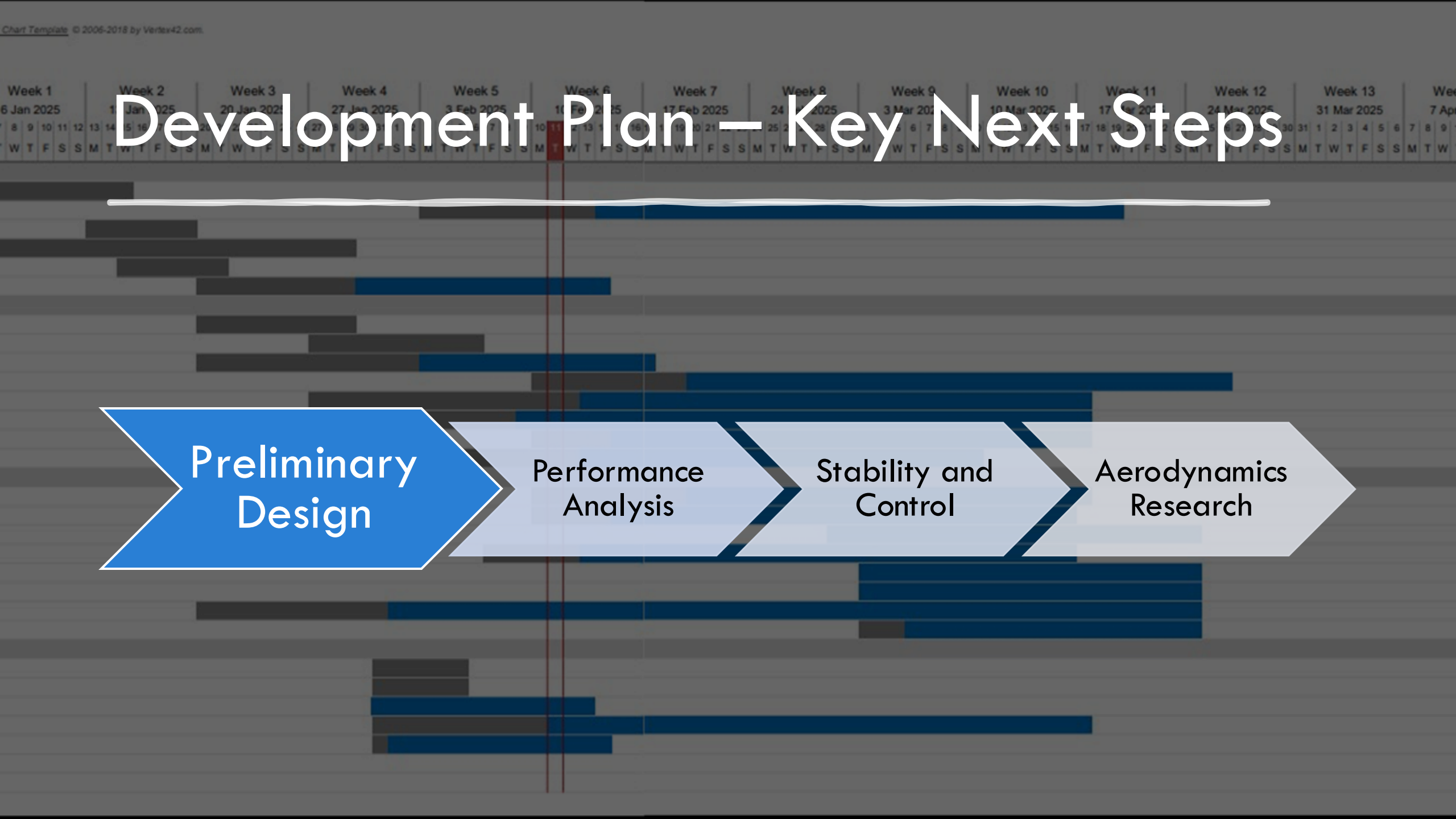
Highlight a new technological innovation

Fixed-wing, capacity of 10-20 passengers

Emphasize environmental considerations

Max. range at 1,500 nmi & optimized operating cost for 500 nmi

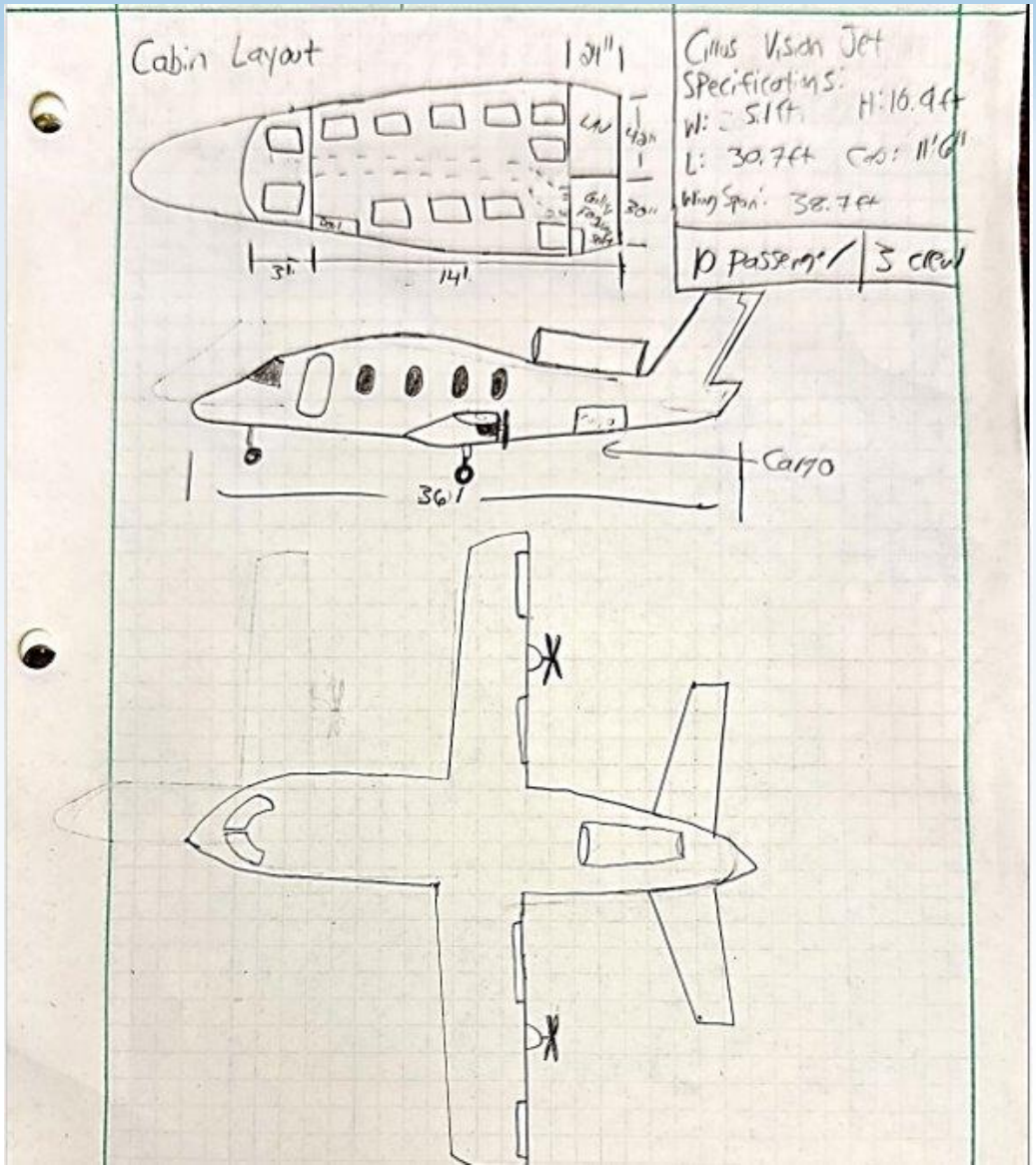
Development Plan – Key Next Steps



Decision Matrix

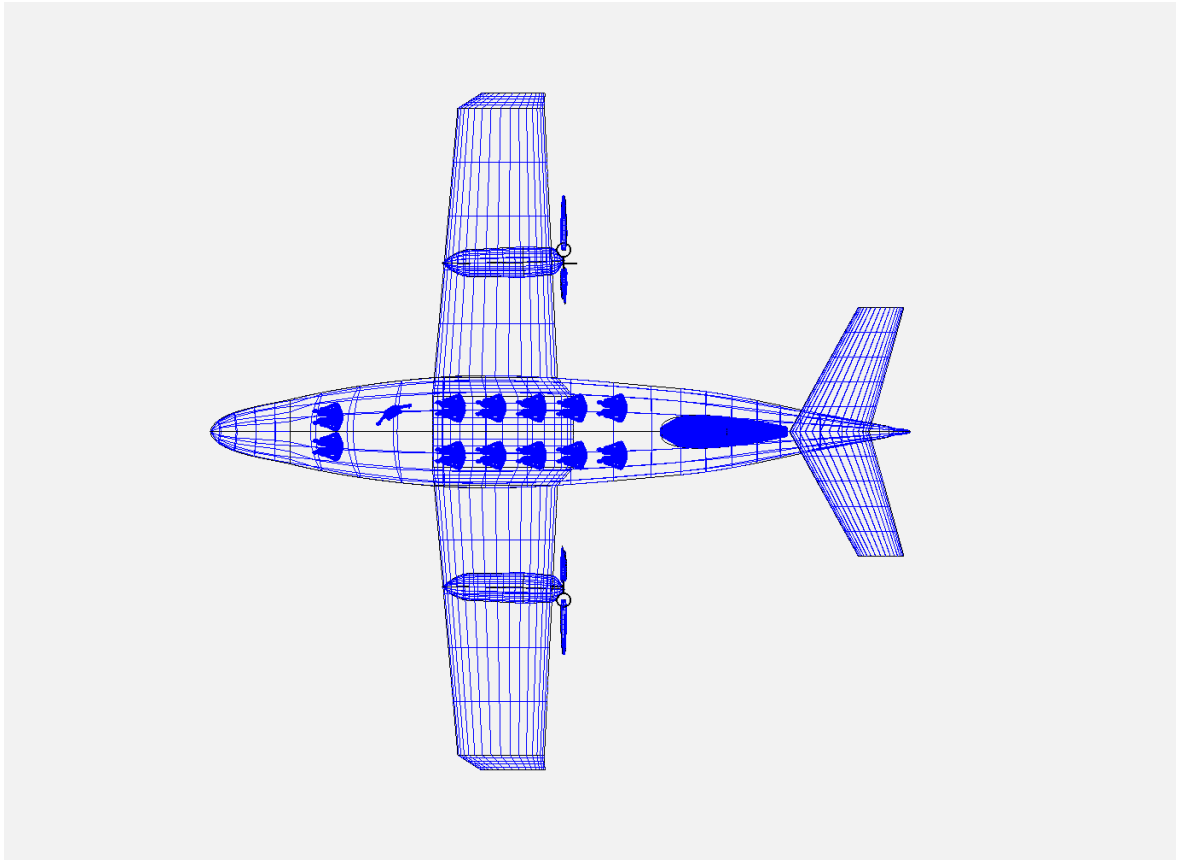
Solaris XIL-1

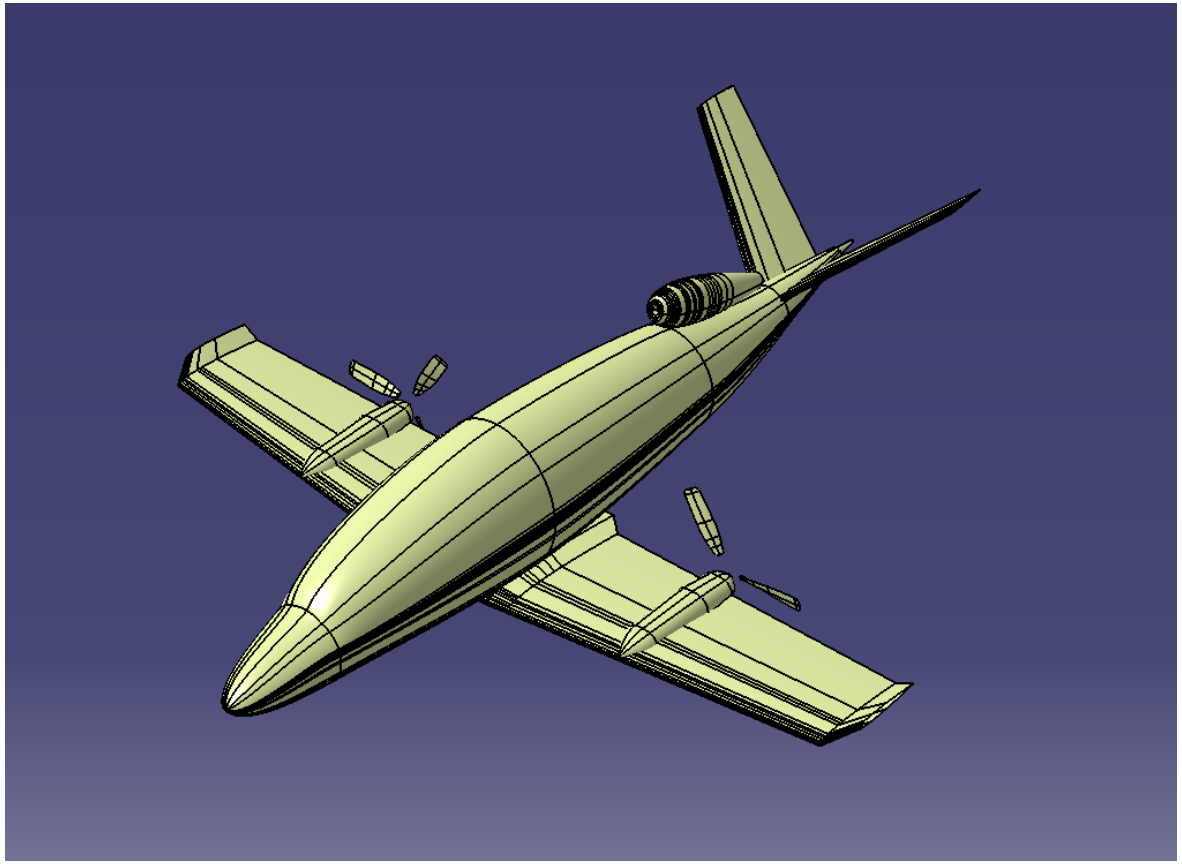
Feature	Weight 1-5	Configuration Score 1- Okay, 2- Good, 3-Best				
		Kiana	Alex	Kevin	Percy	Annabelle
Complexity (3- Least)	3	1	2	1	1	2
Cost of Materials	2	1	2	2	2	1
Propulsion System	2	2	3	2	3	2
Max Take Off Weight (3- least)	4	1	3	2	1	3
Environmental Efficiency	5	3	3	3	3	2
Reliability	4	2	2	3	2	2
Passengar Capacity - between 10 and 20	5	1	2	3	3	2
Cargo Capacity	3	3	2	1	2	3
Technology feasability	4	2	3	2	1	3
Aesthetics	3	2	3	3	1	1
Maintenance - Engine access	4	2	3	2	3	3
Operation - Cabin entry	3	3	3	3	2	3
Operation - Refueling	2	2	1	3	1	2
Operation - Piloting	3	3	2	2	2	3
Already Present Infrustructure	4	3	2	3	1	1
Retractable Landing Gear?	2	3	3	3	1	3
Stability	3	1	2	2	3	3
Manaueverability	2	1	2	3	1	1
Operating Cost	4	2	3	2	3	2
L/D Estimation	3	1	2	2	1	1
Total	**65**	**128**	**159**	**154**	**126**	**142**



Source: Alex Chidester

Modeling Solaris XIL-1





Performance Constraints

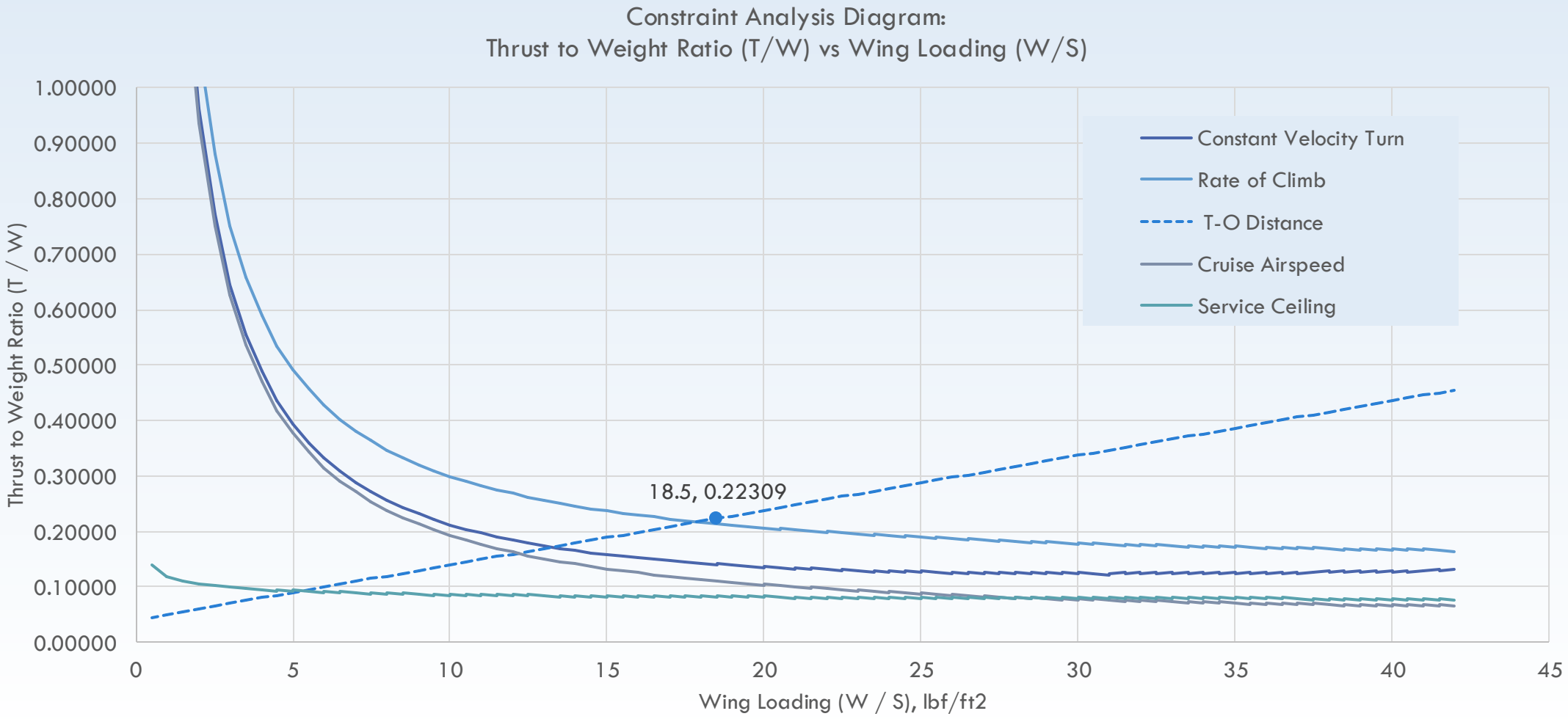
	Targeted Range	Rationale
Weight (MTOW)	~11000lb (MTOW)	Max weight under selected engine
Empty weight	~6000 lb	
Turbofan Thrust:	3600 lbf	VerdeGo Aero VH-5 or Garret TFE731-60
Fuel Capacity	3000 lb	Fuel Capacity to meet 1500 nmi range
T/W ratio	0.3-0.4	Ideal for short field performance
Required Electrical Power at cruise:	150-200 kWh	Power required to maintain 200 kts cruise
Aspect Ratio:	8.5-9.5	
Takeoff Roll at MTOW	4000 ft	Under optimized conditions, we expect takeoff performance around 2000 ft
Cruise Speed/Alt	200kts/15000 ft	Optimized Cruising Speed
Service Ceiling	20,000 ft	Maximum Altitude for Propellor driven cruise.

Constraint Analysis – Similar Aircraft

Aircraft Name	Powerplant (Thrust)	Length	Wingspan	MTOW	Tail Configuration	Pax: Capacity
Cirrus Vision Jet	Williams FJ33 (1846 lbf)	30' 6"	38'	6000	V-Tail	6
Eclipse 400	P&W PW600 (1200 lbf)	28' 7"	36'	4800	V-Tail	6
Piper PA-47 Piper Jet	Williams FJ44 (2820 lbf)	35' 8"	44' 3"	7250	Standard Vertical Tail	7

*red color is most similar to our design in terms of size and power

Constraint Analysis Diagram



Regulations: Engineer

- Normal Category Airplane
- FAA Title 14 CFR Part 23
  - Level 4 High Speed
- Under 19 passengers
- Under 19,000 MCTOW
- No flight attendants required

Regulations: Business

- Part 135 – Commercial Operations
- Part 91 – Corporate/Private Operations
- Will require type rating as new aircraft
- IFR-certified autopilot mandatory for commercial ops
- Freedoms of Air do not apply

Stakeholders: Government and Military Use

Short Range VIP

Lower-level officials can have access to private transport leading to more secure and efficient government travel

Med Evac

Aircraft with STOL features can access more places in rougher and remote areas

Law Enforcement

Border Patrol and aerial surveillance can be done in a much more sustainable way

NOAA

New equipment that represents an upgrade over existing technology

Naval ops

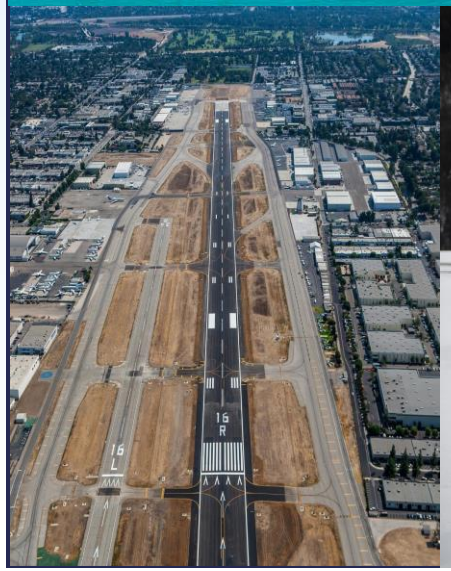
Coast guard search and rescue operations. Light carriers or amphibious assault ships.

Market Strategies

01 Intra-European Aviation

02 Short Range Point-to-Point

03 Executive Travel



CDG Paris International Airport

ATH Athens International Airport

IST Istanbul International Airport

LHR London Heathrow Airport

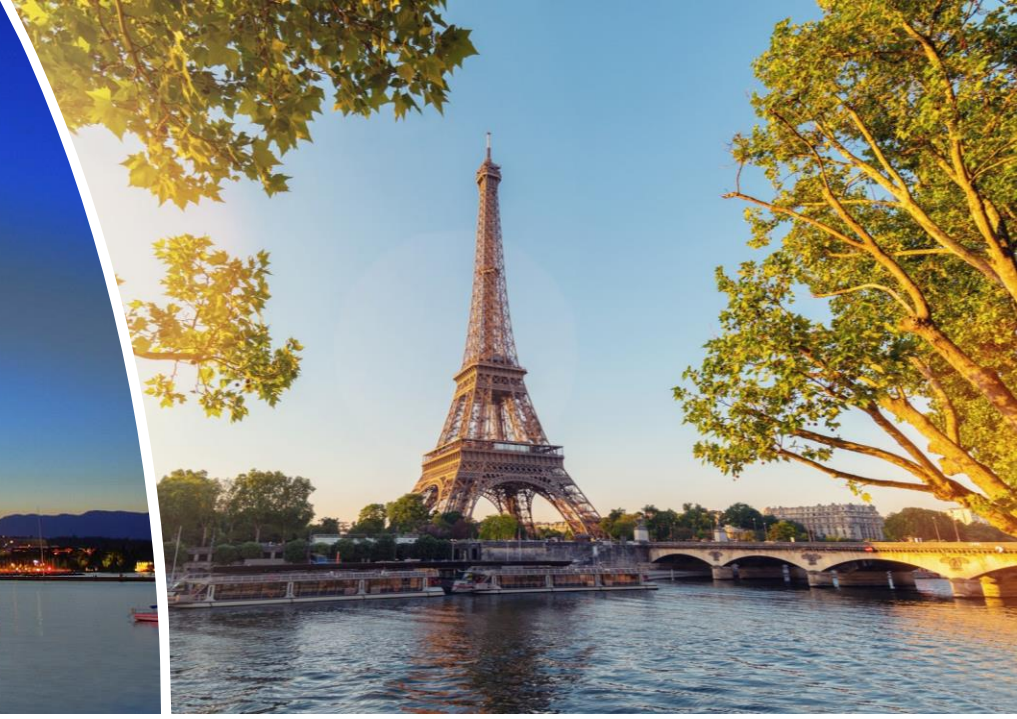
DFW DALLAS FORT WORTH INTERNATIONAL AIRPORT

Maximum Range Routes

- JFK – DFW – 1,390 NM
- LHR – ATH – 1,485 NM
- CDG – IST – 1,488 NM

Important Routes

- Paris – Nice 430 NM
- London – Paris 200 NM
- Geneva – Paris 230 NM
- London – Nice 650 NM
- London – Mykonos 1,350 NM
- New York – Miami 950 NM



Popular EU Routes

Average distance of 356.4 miles

Route	Annual Flights	Distance (km)	Distance (miles	Flight Time (hrs)
London – Paris	3,357	343	**185.2**	~1
London – Nice	2,896	1,029	**555.6**	~2
Paris – Geneva	2,556	410	**221.4**	~1
London – Geneva	2,502	741	**400.1**	~1.5
London – Zurich	2,331	777	**419.5**	~1.5

Significant European Corporate Traffic

- LHR
  LGW
- CDG
  IST
- FRA
- AMS

State of the European BizAv Market

Fleet Composition and Availability:

As of February 2024, the European Union and Turkey housed a fleet of 4,883 business jets and turboprops, with 7.7% (375 aircraft) available for sale, up from 5.3% (253 aircraft) in February 2023.

Market Growth and Projections:

The European business jet market is projected to grow from $5.2 billion in 2025 to $7.08 billion by 2030, reflecting a compound annual growth rate (CAGR) of 6.36%.

Market Dynamics:

The European market remains a major hub of the global Business Aviation sector, though demand for aircraft has fallen back somewhat from its recent peak.

Flight Operations and Trends:

In 2024, Europe recorded 10.7 million flights, a 5% increase from 2023, reaching 96% of 2019 levels.

Business aviation flights in Europe were up 7.5% in the first half of 2024 compared to the same period in 2019.

Attractiveness of the European Market

Sustainability Focus: Europe has a strong regulatory and public push for sustainable aviation, with increased emphasis on reducing carbon emissions and adopting greener alternatives.

Public Perception & Protests: The industry has faced public scrutiny, including protests such as the spray-painting of private jets in 2023 and disruptions at the **Corporate Jet Investor** conference in London.

Regulatory Challenges: The EU has introduced stricter emissions policies, such as the **Fit for 55** initiative, aiming to reduce aviation emissions by 55% by 2030.

Advancing Green Technologies: Sustainable Aviation Fuel (SAF) and hybrid-electric aircraft are gaining traction as potential solutions to align with environmental expectations.

Competitive Advantage: Incorporating hybrid technology into aircraft can enhance acceptance in the European market, making business aviation more aligned with sustainability goals.

Financial Analysis of Corporate Aviation

- Cost per Hour
- Cost per Seat
- Cost per NM
- Revenue Passenger Miles

Cost Evaluations

- Empty Weight (We): 6000 lb
- Max Velocity (V) : 300 knots (506 ft/s)
- Number of flight test aircraft (FTA): 2
- Number to be produced in 5 years (Q): 50

Table 1: Formulas used from Aircraft Design by Daniel P. Raymer

Development	Production	Operational
$28,185,500	$757,470,000 For 100 aircraft	$195,000

Costs per Hour, Mile and Seat:

Seat Capacity	Average Cost Per Hour	Average Range	Cost per seat
3	$888.59	687.0	$296.20
4	$838.45	400.0	$209.61
5	$1,298.17	1460.5	$259.63
6	$1,747.15	1580.7	$291.19
7	$2,103.98	2261.0	$300.57
8	$3,011.36	2738.0	$376.42
9	$2,817.53	2941.0	$313.06
10	$3,208.03	3909.7	$320.80
12	$3,747.01	5667.7	$312.25
13	$4,460.96	4718.8	$343.15
14	$4,747.16	4363.0	$339.08
15	$3,544.71	2946.0	$236.31
18	$4,807.37	7102.7	$267.08
19	$7,146.04	5727.2	$376.11

Fixed Costs

Category	Midsize Jet (Estimates)
Aircraft Acquisition Cost (Ownership)	$15M - $25M
Depreciation (Annual)	$750K - $1.5M
Hangar Fees (Annual)	$30K - $60K
Crew Salaries & Training (Annual)	$500K - $1M
Insurance (Annual)	$50K - $250K
Fuel Cost per Hour	$3,500 - $5,000
Maintenance & Repairs per Hour	$800 - $1,500
Landing & Handling Fees per Flight	$500 - $2,000
Catering & Passenger Services per Flight	$500 - $1,500
Charter Rate per Hour (Revenue)	$5,000 - $8,000

Thank You