AIAA Heavy Lift Aircraft
C-X Leviathan

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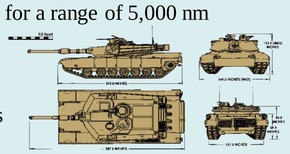
JET SET GO!

MISSION OBJECTIVE

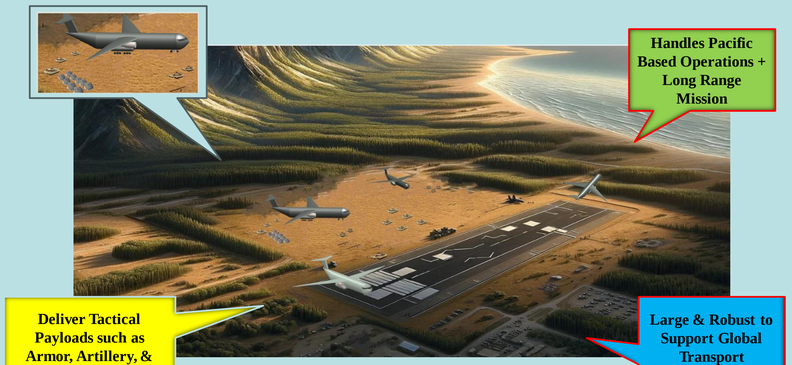
In efforts to reinvent the current major strategic transport aircrafts utilized by the USAF Air Mobility (C-17 and C-5M), a proposed design has been developed to ensure the improved capabilities of a new Heavy-Lift Aircraft that fulfill the following mission specifications:

- Cruise speed of Mach 0.80
- Max payload of 430,000 lb over an unrefueled range of 2,500 nm
- Mid payload of 295,000 lb payload for a range of 5,000 nm
- Ferry range of 8,000 nm

Payload Specifications:
- 3 x M-1 Abrams Main Battle Tanks
- 48 x 463L Pallets
- 100 passengers on separate deck
- 330 troops on main cargo deck



M1A2 Abrams Main Battle Tank (MBT) [1]



DESIGN CHARACTERISTICS

Restrictions:
- Existing airbreathing powerplant(s)
- Sizeable for ICAO code F airports, or code E with operational constraints
- Operational field of 9,000 ft x 150 ft at Sea Level

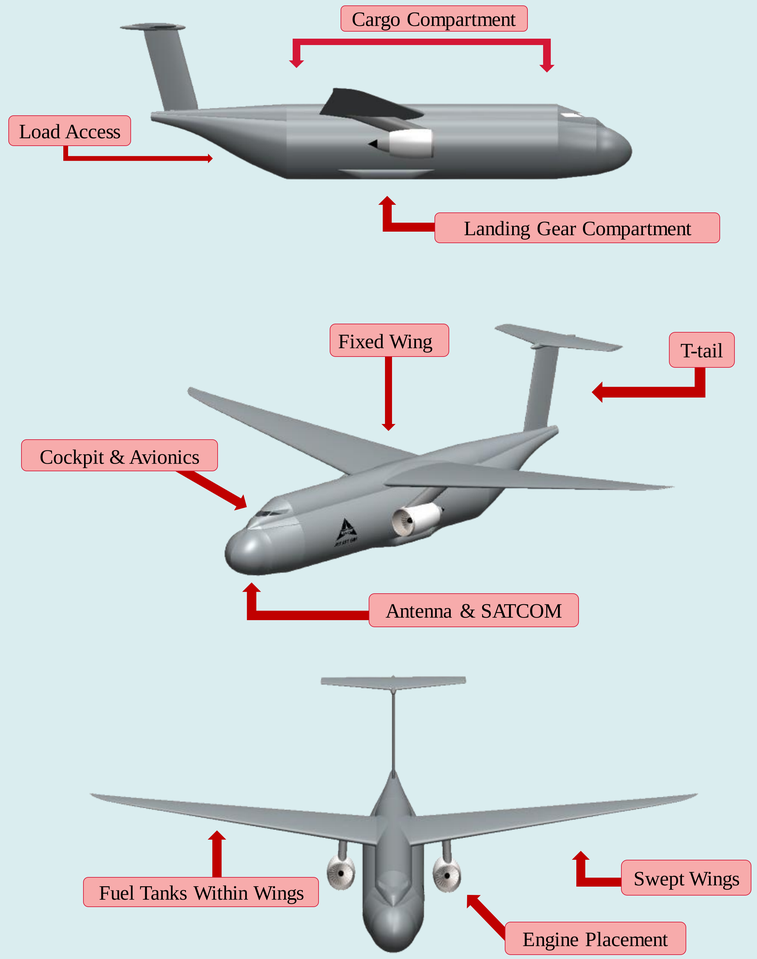
Design Focus:
- Payload capacity
- Range and speed
- Cargo handling
- Operational flexibility

GE90-115b [2]

Range	Payload
2,725 nm	430,000 lbs. (9% greater than required)
5,200.9 nm	295,000 lbs. (4% greater than required)
8,185.1 nm	Ferry range (2.3% greater than required)

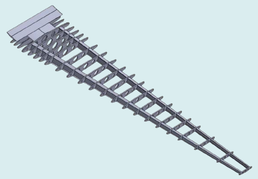
Aircraft Characteristics	
Max Takeoff Weight	837,550 lbs
Wingspan	238 ft
Length	220 ft
Height	68 ft
Thrust	115,000 lbf/engine

DESIGN



FUTURE IMPROVEMENTS

To optimize the current HLA design, the team proposes to:
- ❖ Implement a blended wing body (BWB) structural design
- ❖ Consider a backup engine in the tail
- ❖ Update self-loading capabilities
- ❖ Improve robustness of wing structure
- ❖ Select lighter materials



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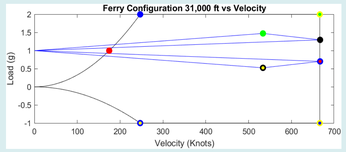
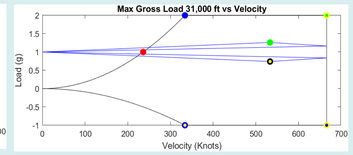
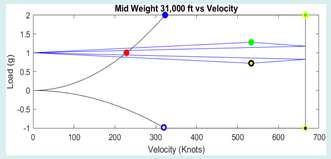
RESULTS + ANALYSIS

V-N DIAGRAMS

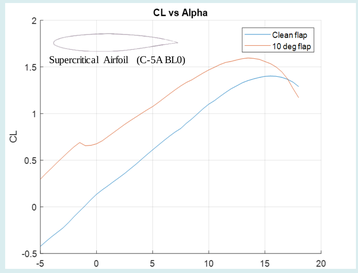






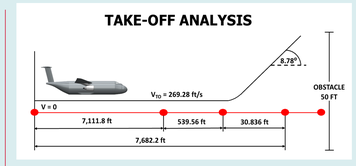
- Vs = Stall Speed in level flight
  Vc = Cruise Speed
- Upper Blue = Cruise speed gust load factor
- Lower Blue = Diving speed gust load factor
- A = Highest turn rate, max load factor, lowest speed
- B = Max Dynamic Pressure
- C = Max Negative Dynamic Pressure

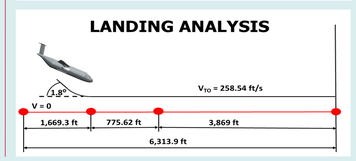
AERODYNAMICS



- The chosen airfoil meets the necessary lift loads.
- Achieved long ranges and fuel consumption reduction.

OPERATIONS





STABILITY

	Mode	Real	Imaginary (±)	Stability	MIL-F-8785B REQ.	MIL-F-8785B Result	MET ?
Longitudinal Axis	1 (Phugoid)	-0.3422	0.9508	STABLE	$\zeta > 0.04$	$\zeta = 0.33$ $\omega n = 1.01$	MET
	2 (Short Period)	-0.0027	0.0689	STABLE	$\omega n < 0.2$	$\zeta = 0.039$ $\omega n = 0.069$	MET
Lateral Axis	3 (Spiral)	-0.015	N/A	STABLE	> 12s	15s	MET
	4 (Rolling Convergence)	-0.298	N/A	STABLE	< 1.0	-0.298	MET
	5 (Dutch Roll)	-0.145	1.186	STABLE	$\zeta > 0.19$	$\zeta = 0.039$ $\omega n = 0.069$	MET

ACKNOWLEDGEMENTS

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REFERENCES

[1] Drake, M. L., "Heavy Lift Mobility Platform," *AIAA Design Competitions* Available: https://www.aiaa.org/docs/default-source/uploadedfiles/membership-and-communities/university-students/design-competitions/2023-24-heavy_lift_rfp.pdf?sfvrsn=aecb7517_0.

[2] *GE90-115B*. Available: https://www.mtu.de/engines/commercial-aircraft-engines/widebody-jets/ge90-110b/-115b/

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