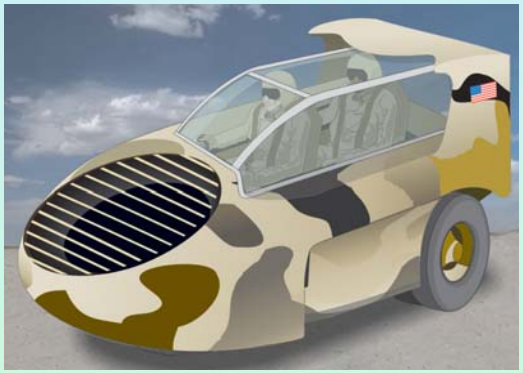
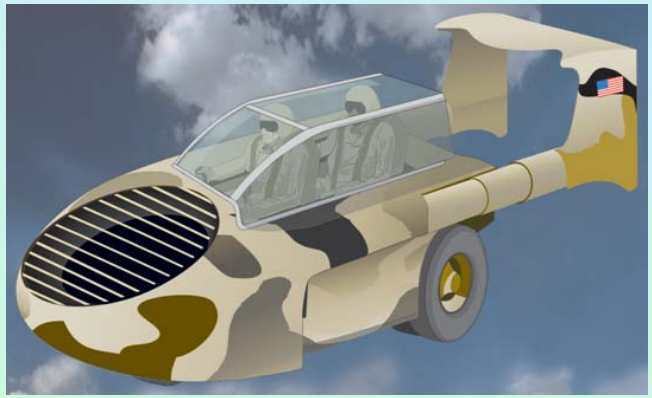
2007 Worldwide Personnel Recovery Conference

January 9-12, 2007, Omni Shoreham Hotel, Washington, DC

Small V/STOL Optionally Manned UAV for Personnel Recovery / Medical Evacuation





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Outline

1. **Conventional V/STOL Aircraft**
   Some Traditional Solutions and Challenges
   Shafts, Gears, Transmissions : the Enemies of V/STOL

2. **V/STOL Aircraft : A New Paradigm**
   Finding the 'Knee of the Curve' : The Optimum System, Challenges

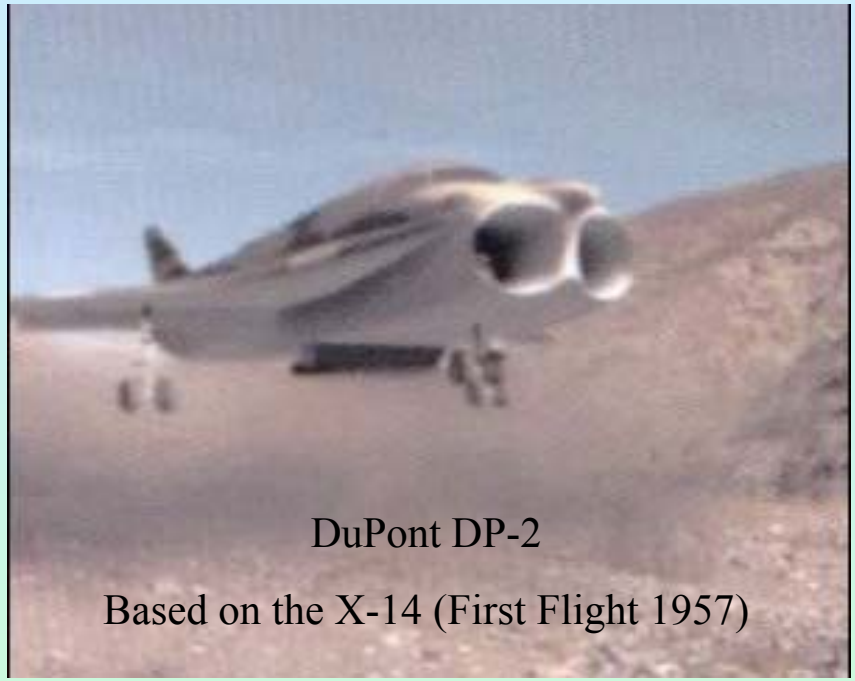
3. **AVX Fans and Lift/Thrust Systems**
   50:1 Bypass, 25:1 Thrust/Weight, Low Noise, Low InfraRed Emissions

4. **Optionally Manned UAV / AVX-12 PAV**
   for Personnel Recovery / Medical Evacuation

V/STOL Aircraft with Turbojets / Low-Bypass Fans

Harrier

the noisemaker



DuPont DP-2

Based on the X-14 (First Flight 1957)

Compact Lift System Offers High-Speed Potential, But

High Jet Velocity Raises Dust Clouds, Causes Thundering Noise

High Fuel Consumption Limits Range / Endurance.

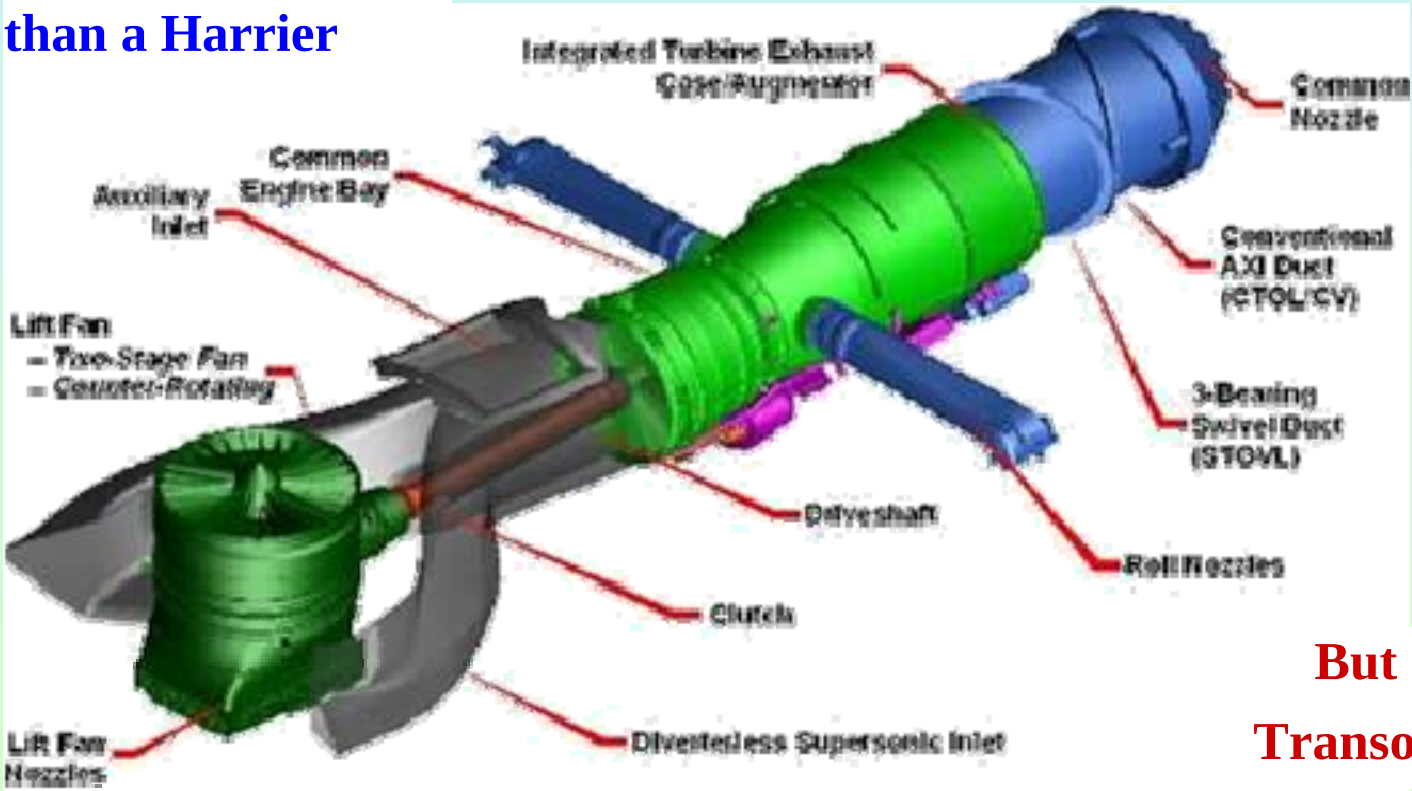
Transonic Exhaust has Greater Louver Losses,

High Fuel Consumption Limits Range / Endurance.

Lockheed F-35

Much Better

than a Harrier



But Optimized for

Transonic Operation

Helicopters

Look Good on a Golf Course

But,

Transonic Tips are Noisy,
Rotors Beat Up Quite a Storm,
There is Danger from Wires, Trees, Buildings,
Cannot be Operated in Urban Areas.

V-22 Tilt-Rotor

First Flight (XV-3) : 1955

IOC : 2007 (52 years later!)

Speed and Range are
Better than Helicopters,

But,

Greater Space Claim,
Danger from Wires / Trees / Buildings,
Cannot be Operated in Urban Areas,
Complex, Heavy Transmission System.

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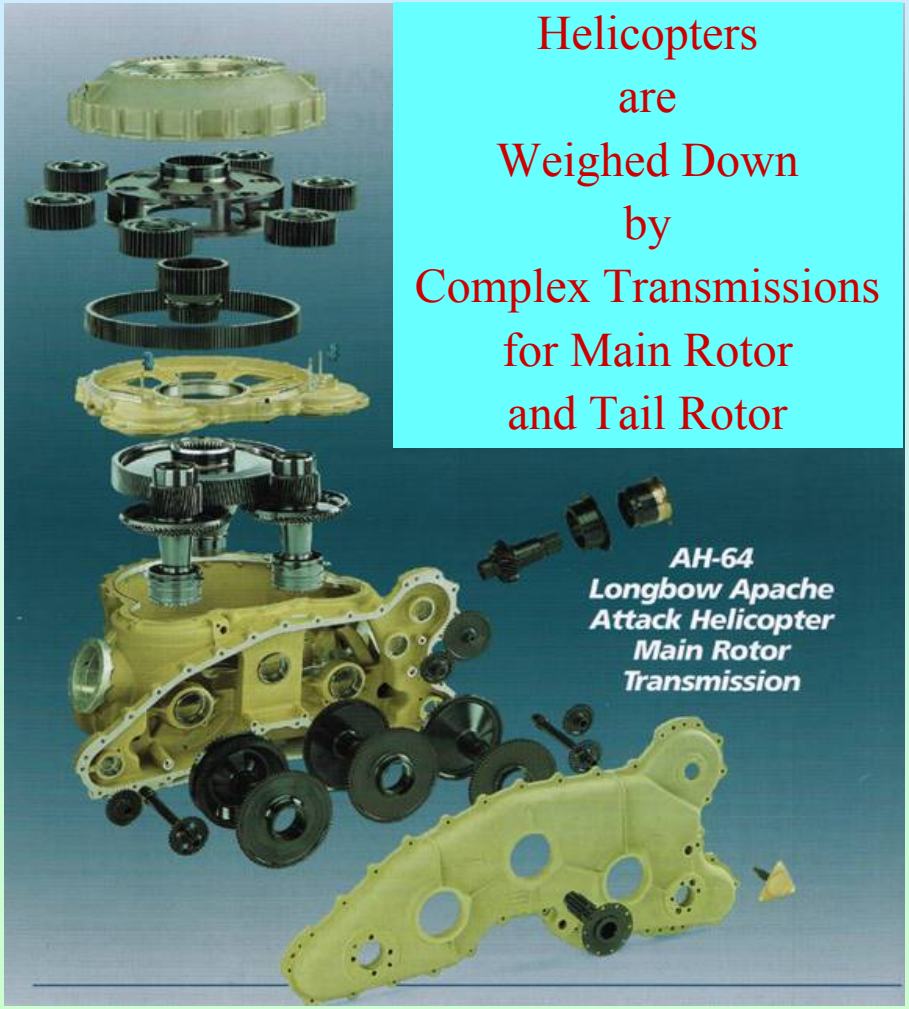
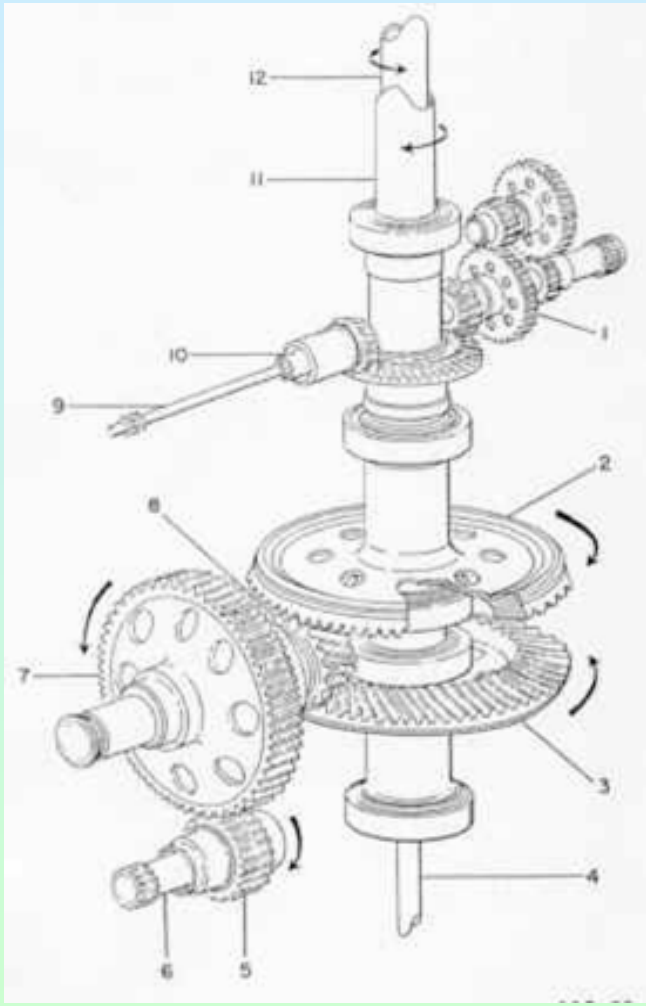
Shaft, Clutches & Gears : The Enemy of V/STOL

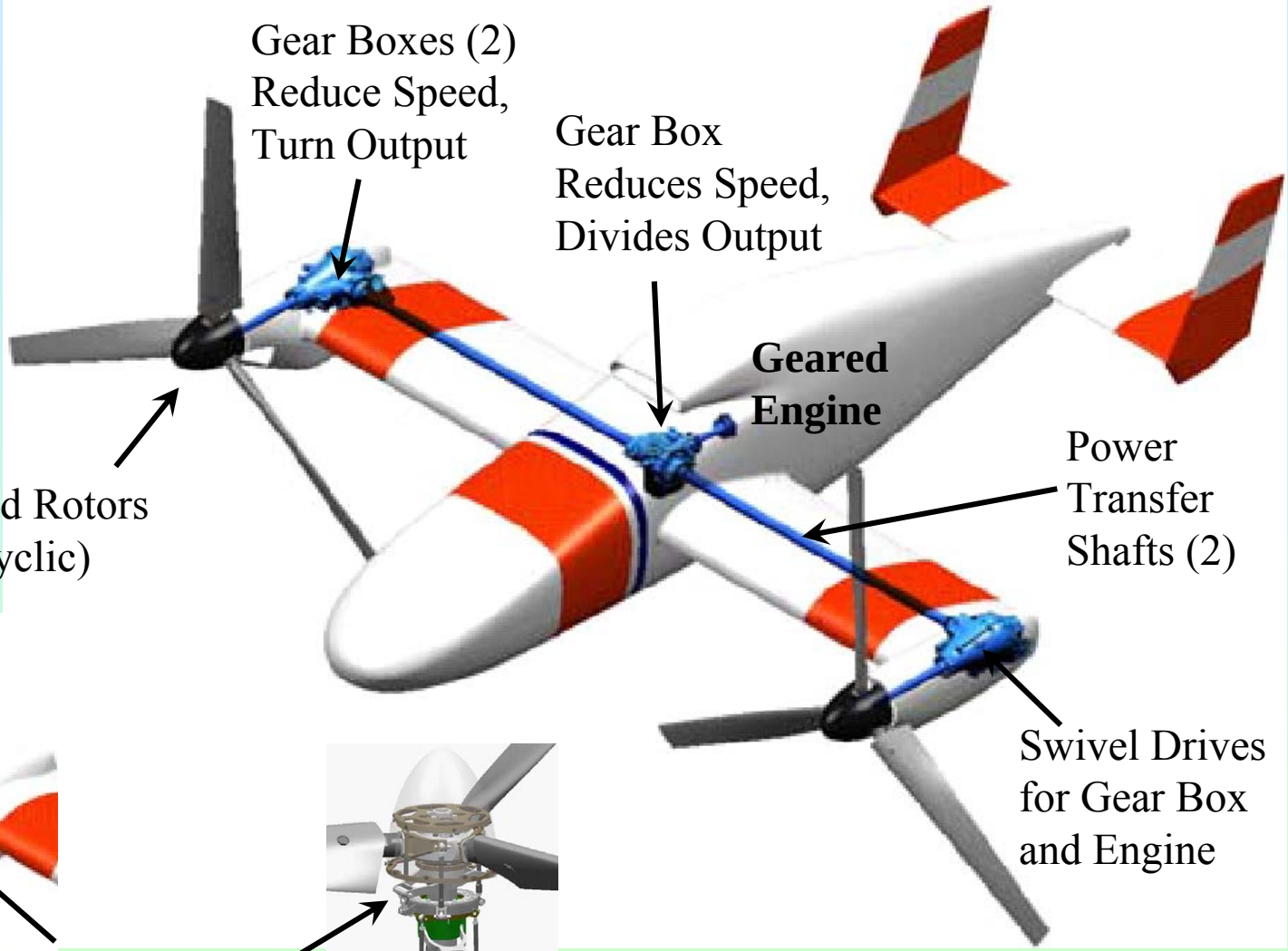
Helicopters
are
Weighed Down
by
Complex Transmissions
for Main Rotor
and Tail Rotor



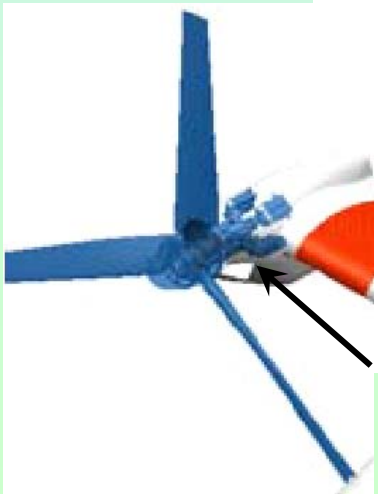


CH-53E Needs 44 Hours of Maintenance per Flight Hour.
(Half-Hour AM Commute Needs 3 Mechanics Working All Day; PM Commute Needs 3 Mechanics Overnight).

Shaft, Clutches & Gears : The Enemy of V/STOL



Fully Articulated Rotors
(Collective + Cyclic)



Prop Drive
Systems (2)

"Simple, Reliable System"?
Not!

Helicopters, Tilt-Rotors and the Next V/STOL Aircraft

Mechanical Geared Pendulum Watches

Served Us Well, But

Have Been Replaced by

More Accurate, Less Expensive

Quartz Watches.

Lower Cost
Less Weight
More Accurate
+ Compass
Altimeter
Barometer
Thermometer

Slow, Smelly Horse-Carriages

Served Us Well, But

Have Been Replaced by

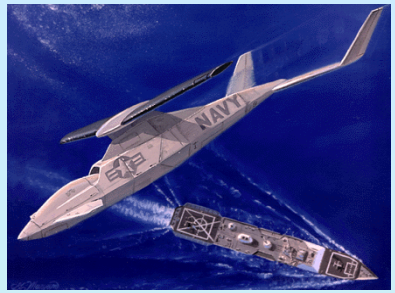
Faster, Easier to Drive,

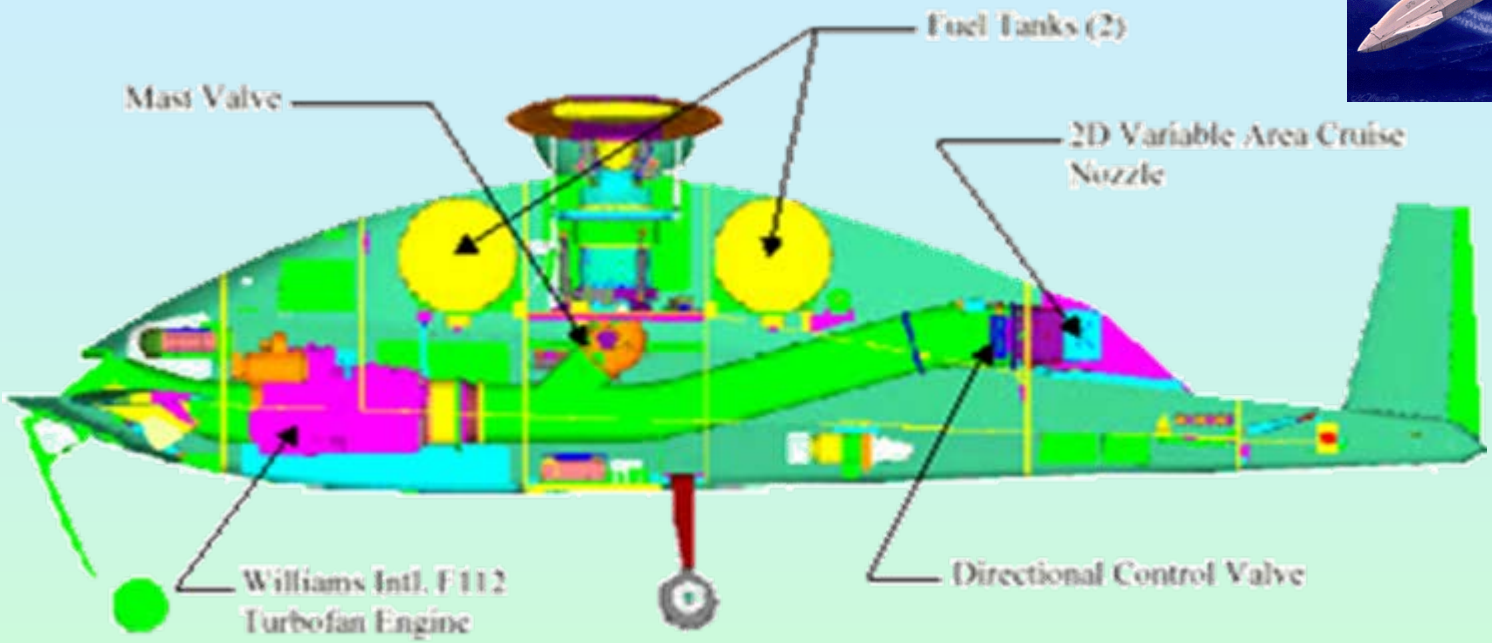
Less Expensive Automobiles.

Helicopters Too Have Served Us Well, But

Are Technologies Now Feasible to Replace the Helicopter?

Boeing Dragonfly Canard Rotor/Wing (CRW)





Avoids the Geared Transmissions, Can Achieve Faster Speeds, But

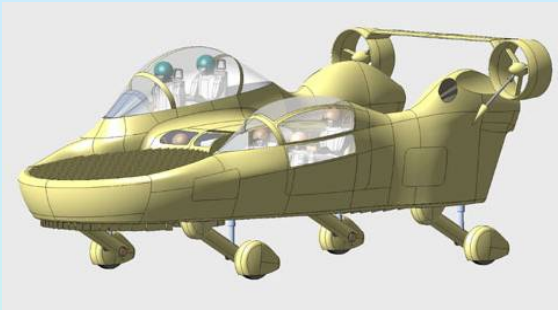
Retains Large Rotor (Risk of Collision with Trees / Wires / Buildings / Cities),

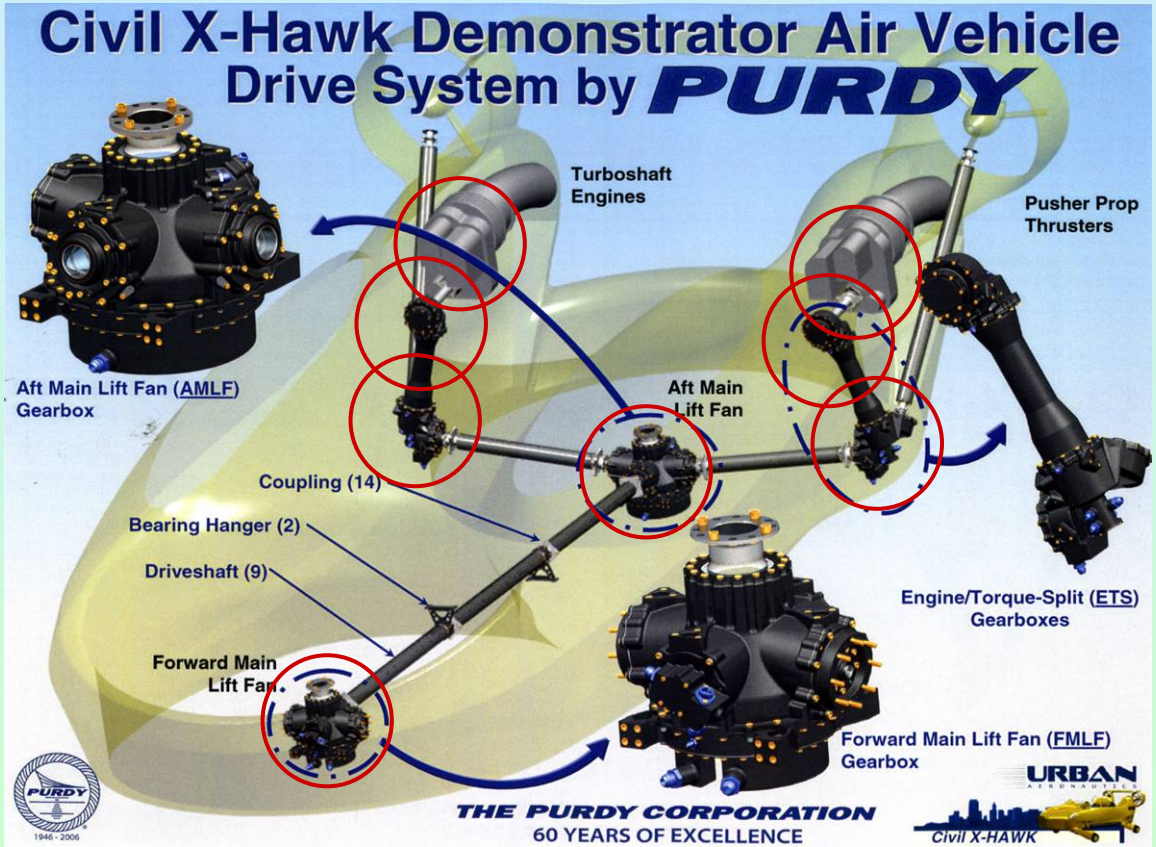
Retains Rotor Articulation System (Complexity, Increased Losses in Gas Duct).

Both Prototypes Have Crashed,

The Second due to the Effects of Rotor Downwash on the Aft Fuselage.

Helicopter in a Box? : The Bell / Urban Aero. X-Hawk





V/STOL Aircraft : *noun. definition :*

A Flock of Gear Boxes in Close Formation Flight, Tied Together by Shafts?

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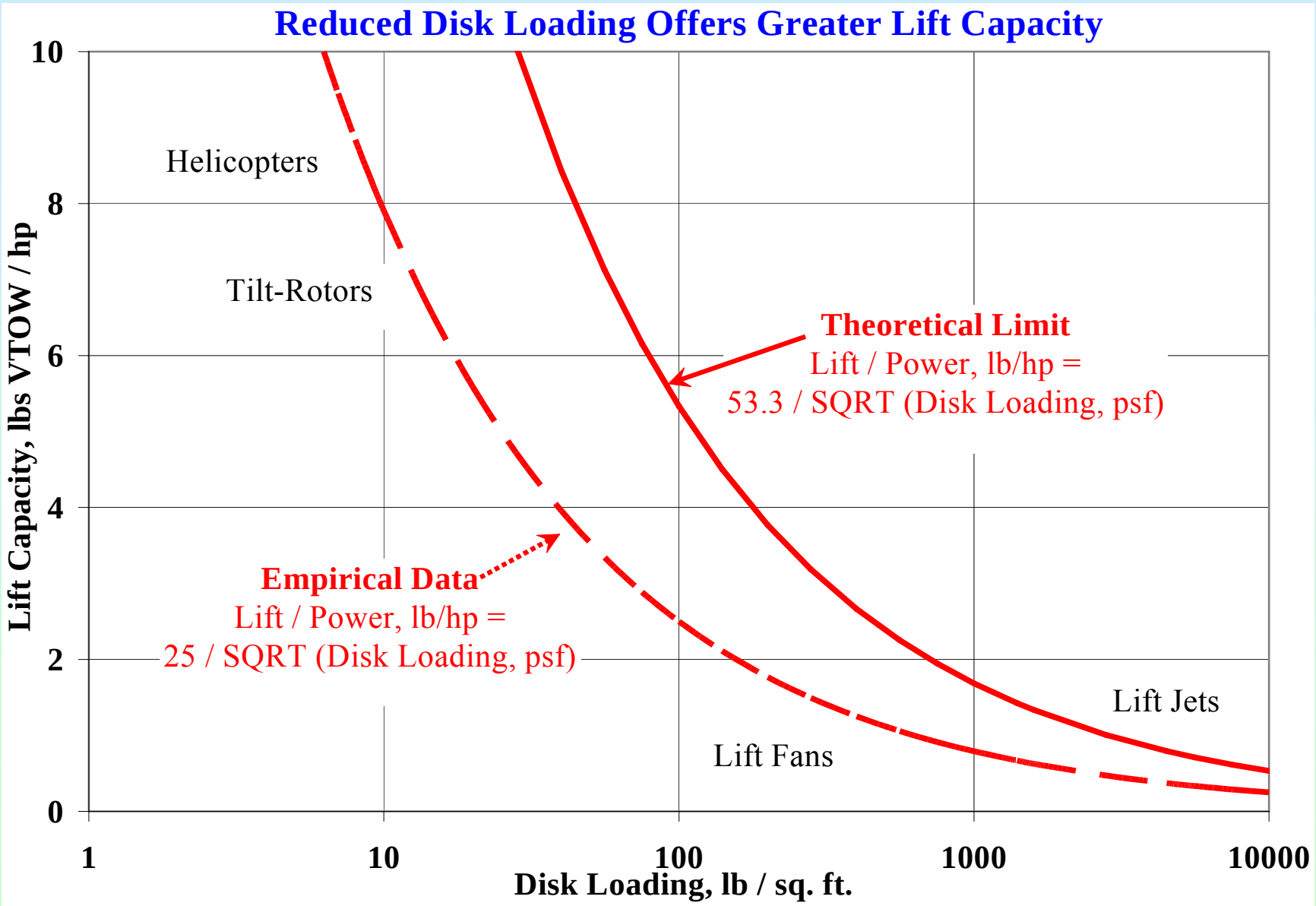
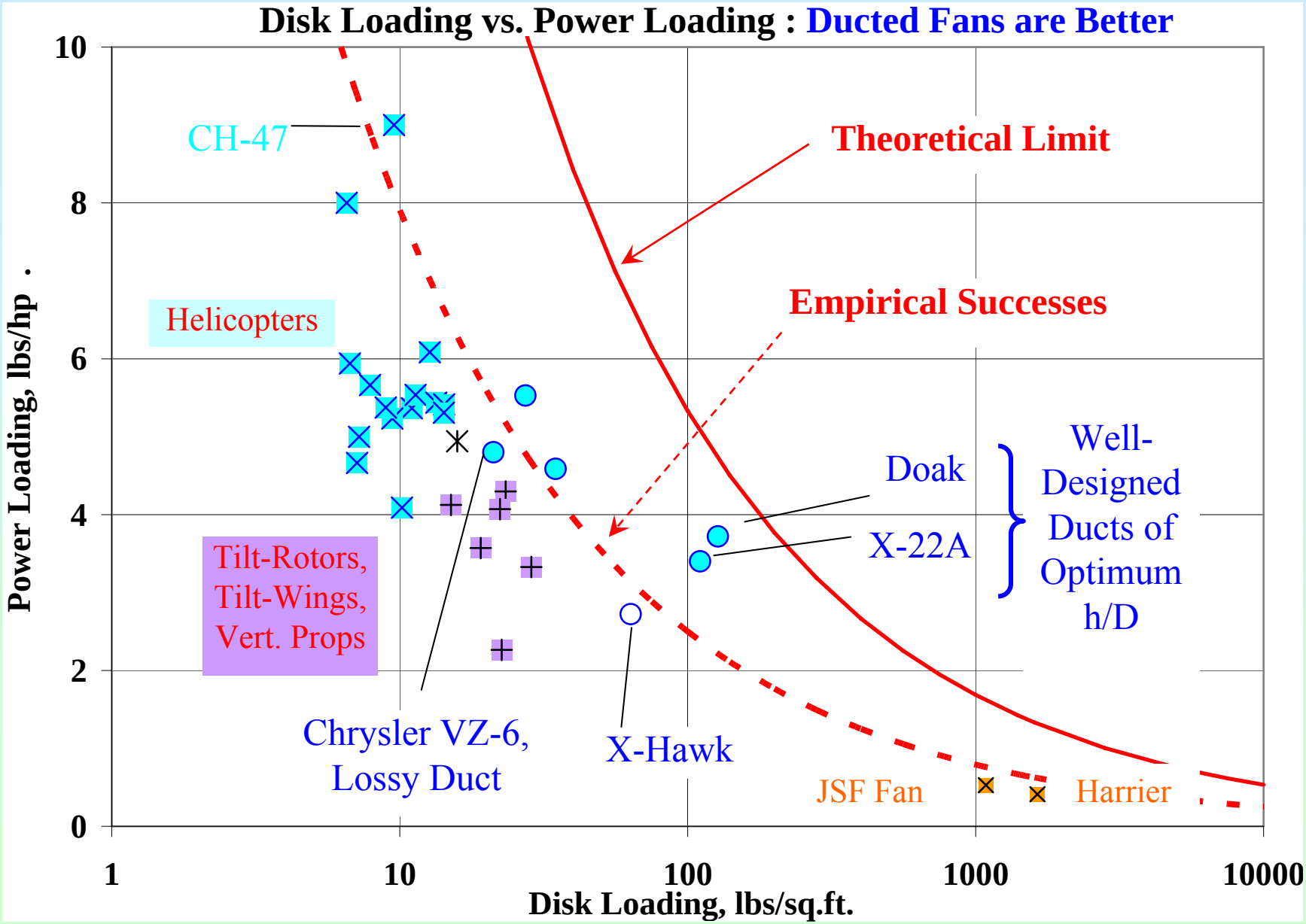
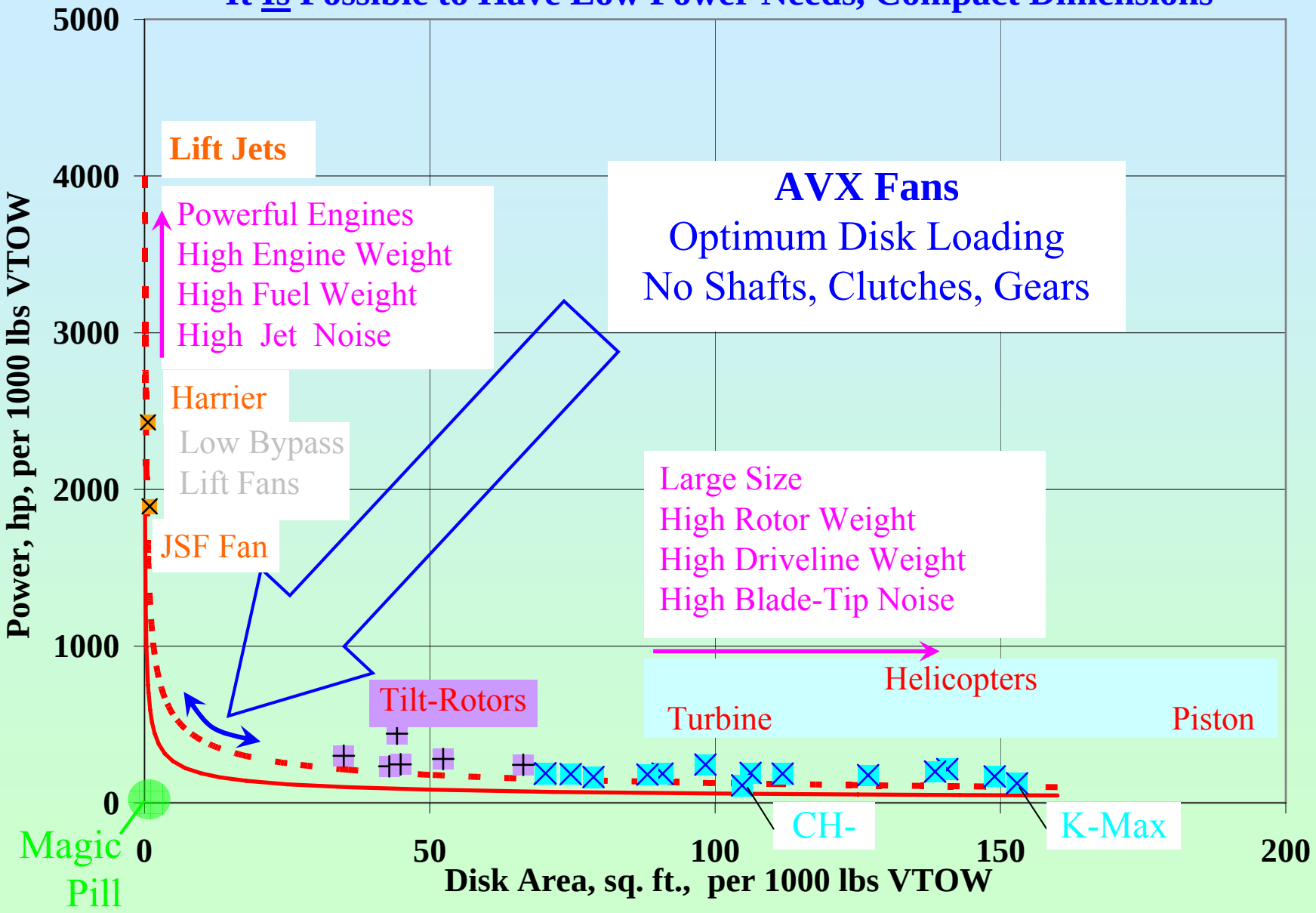
Reduced Disk Loading Offers Greater Lift Capacity



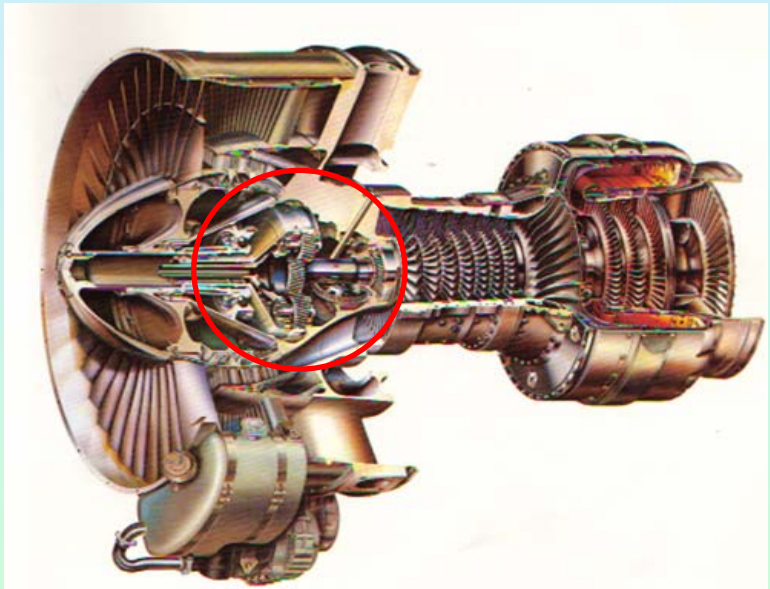


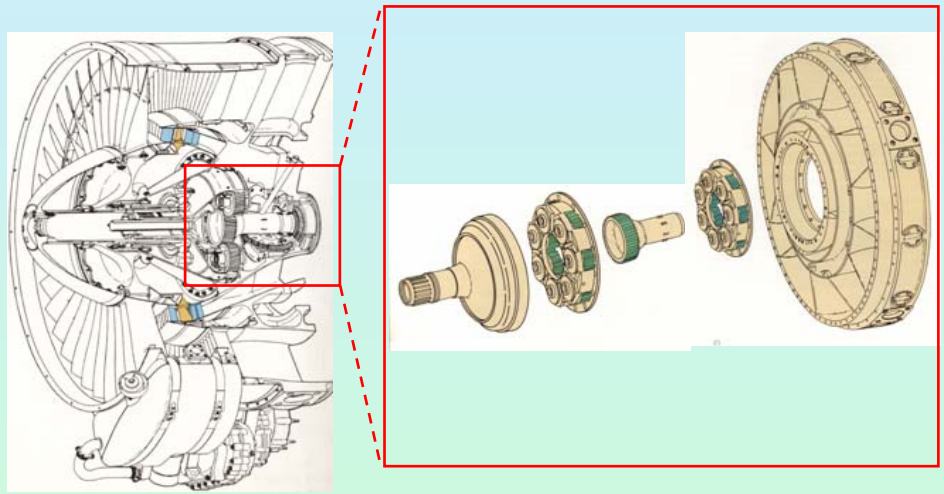
It Is Possible to Have Low Power Needs, Compact Dimensions

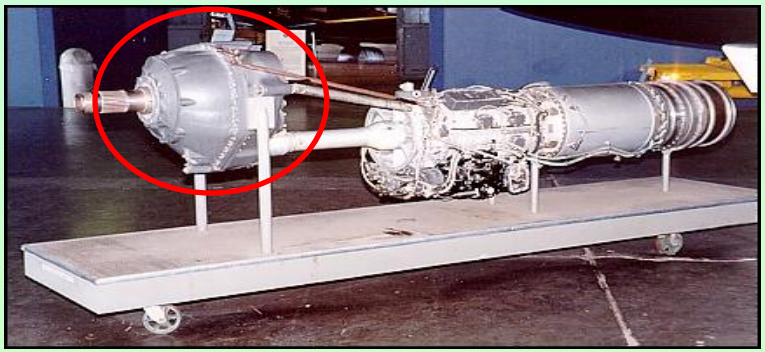


Challenges to Achieving the Optimum Disk Loading:

Conventional Turbo-Fans Are Limited to Moderate Bypass Ratios by the **Need for Gears**







Engines Have Become Lighter, More Compact

Over Time,

Gear-Boxes have Not Changed as Much.

AVX Fans : Scalable Lift / Thrust Systems

Ideal for V/STOL, Air Cushion and Surface Effect Vehicles

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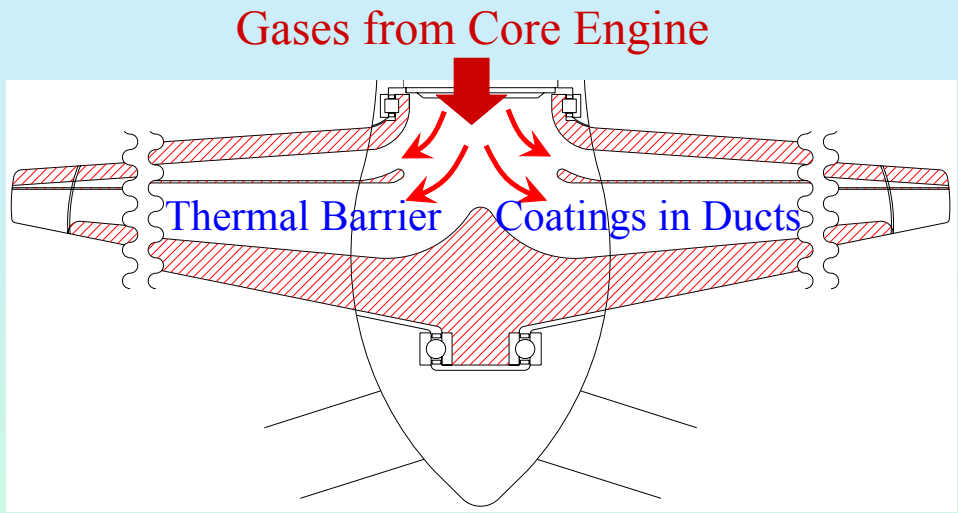
The AVX Fan™ System

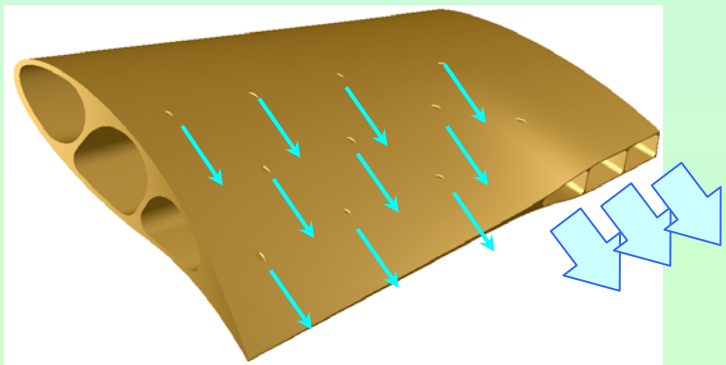
Eliminates Shafts and Gears, Saves Weight.

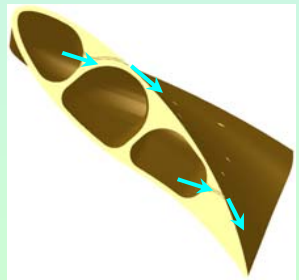
Hot Gases from a Core Engine
Are Effluxed through
Slots on Upper Surface of Fan Blades,
Nozzles on Blade Tips.

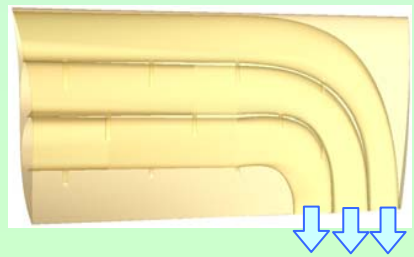


Fan Blades are Driven by Jet Reaction,
Have high CL by Slot Blowing.
Can have low Speed, Low Weight, Low Noise.

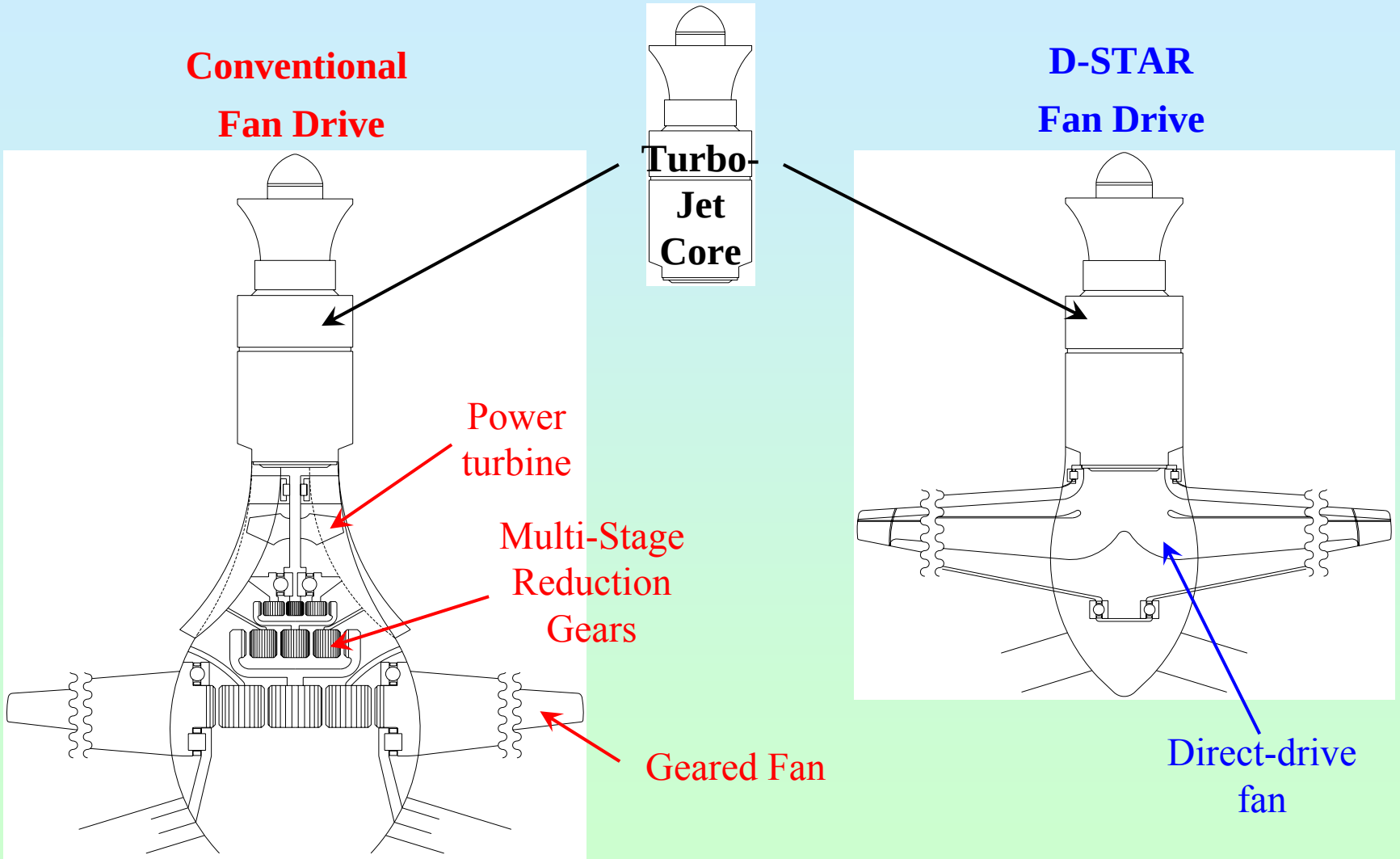
AVX Fans
are Immune to Stalling,
Can Tolerate
Distorted Inlet Flow.



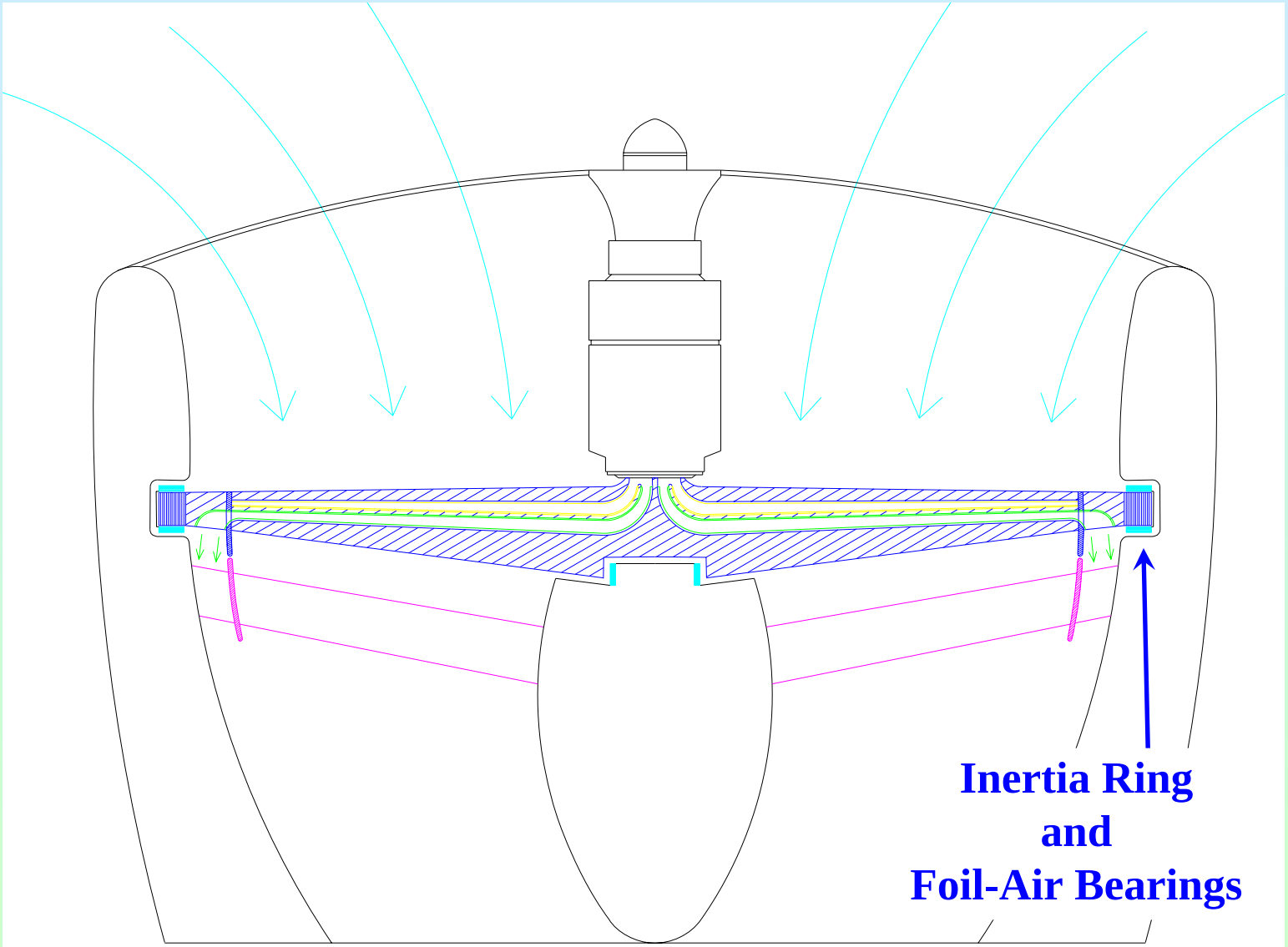




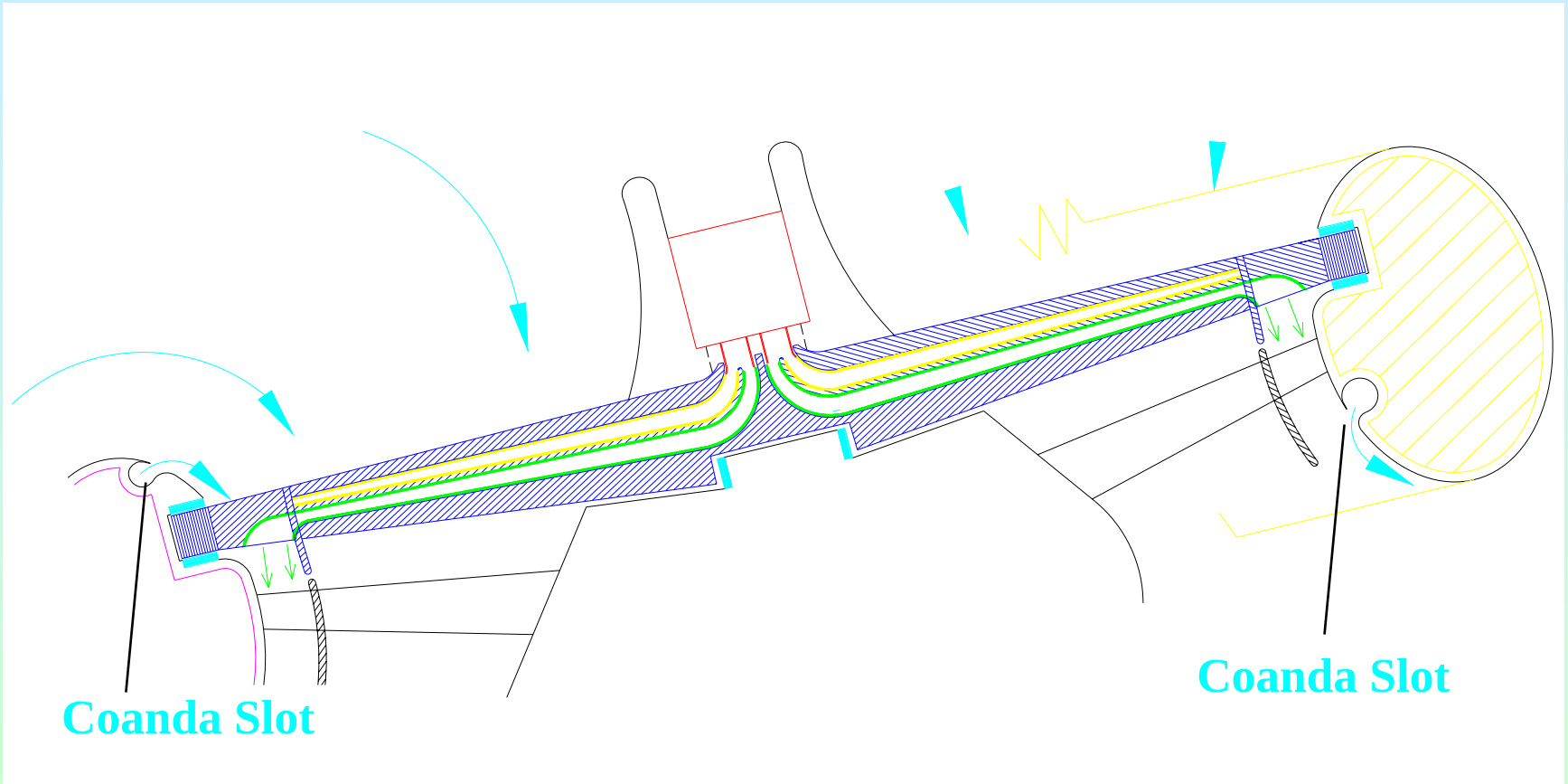
Geared Fans vs. AVX Fans



D-STAR / Aurayan AVX Fan™ Conceptual Design



The AVX Fan™ System in Duct with Coanda Slots

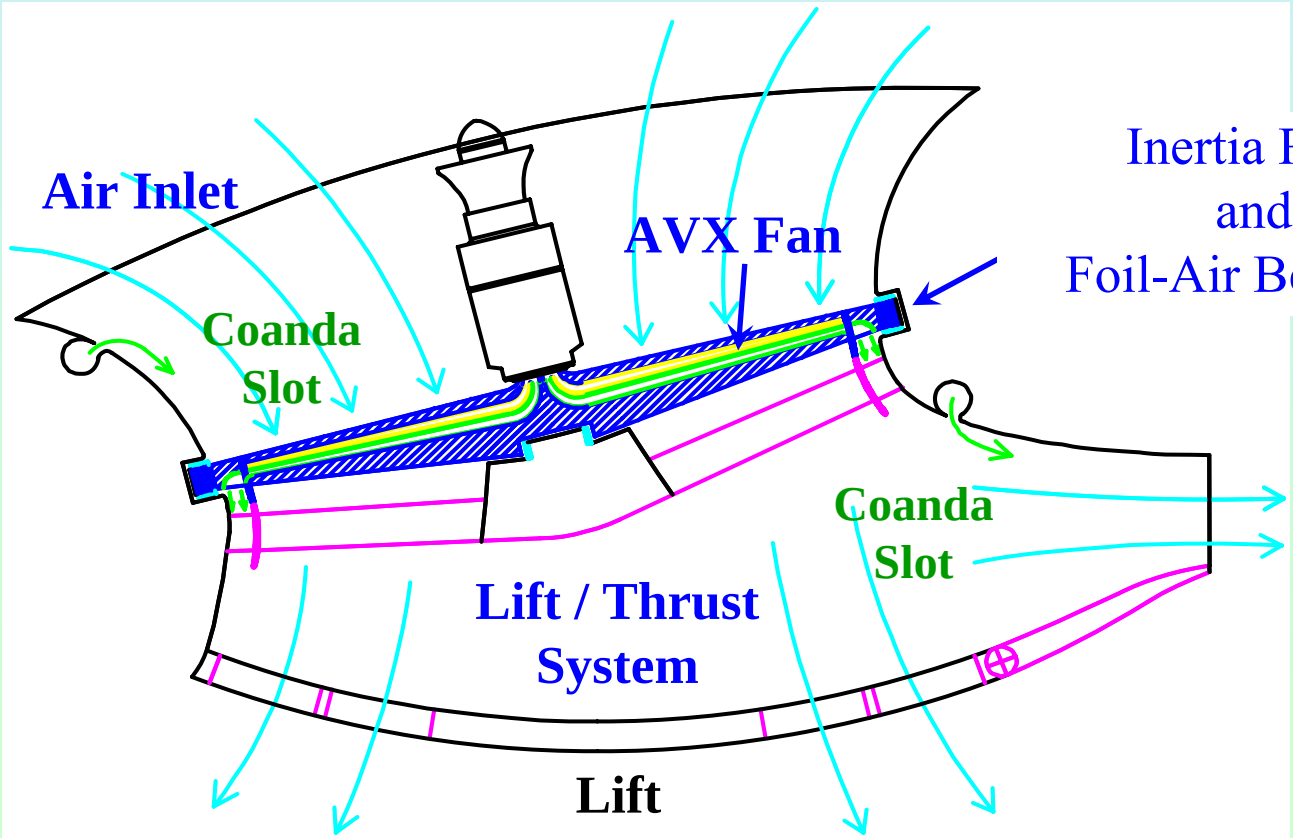


The D-STAR AVX Fan™ Lift / Thrust System

Engine and Fan are Angled in Duct

Duct has NACA Inlet, Blown Coanda Slot for High-Speed Flow Capture

Duct Exit has Louvers in Belly, Flap in Thrust Nozzle.



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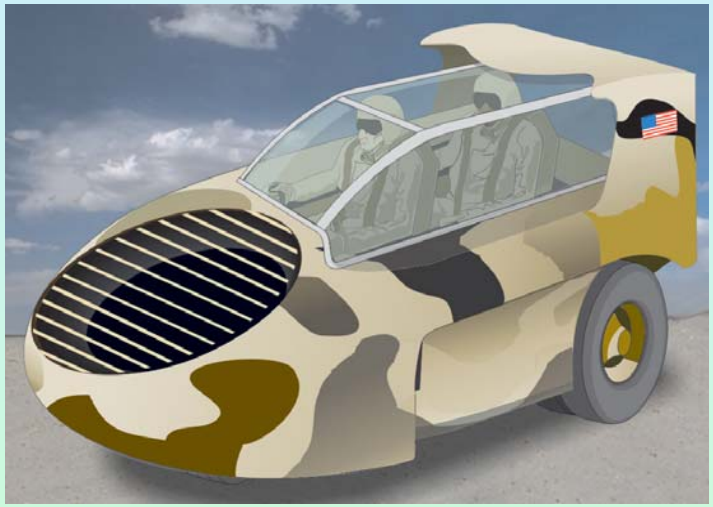
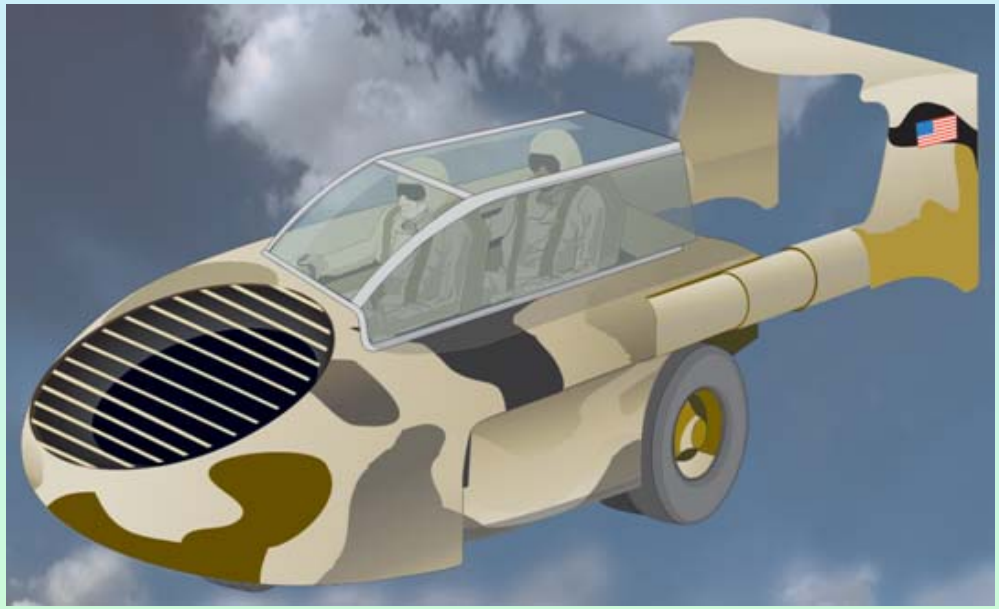




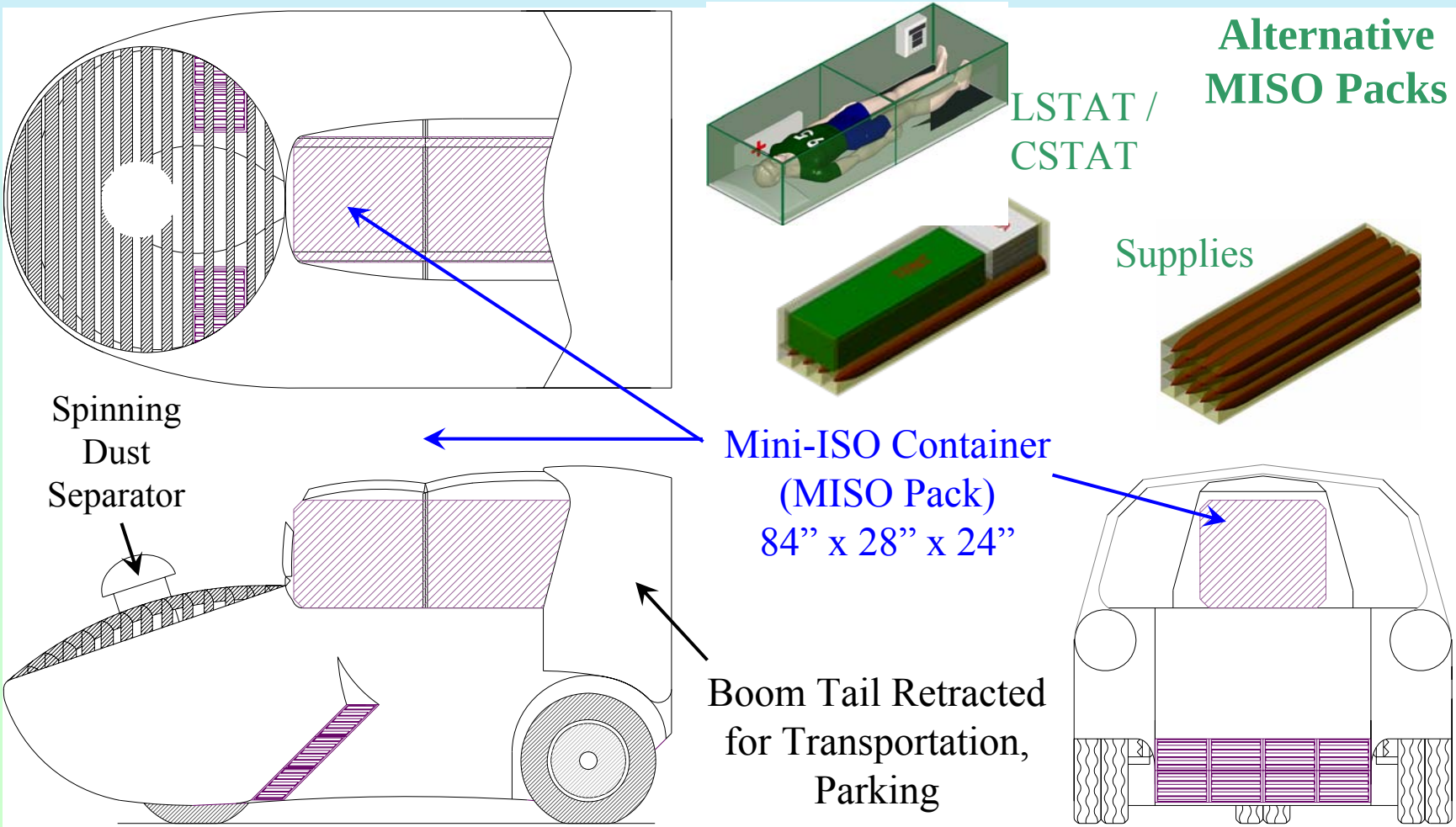
Carry 4 in a C-130, Self Loading / Unloading

Max. Speed 260 knots

Range 440 nmiles with 700 lbs., VTO

Range 820 nmiles with 500 lbs, U-STO

Optionally Manned UAV / AVX-12 PAV
for Personnel Recovery / Medical Evacuation



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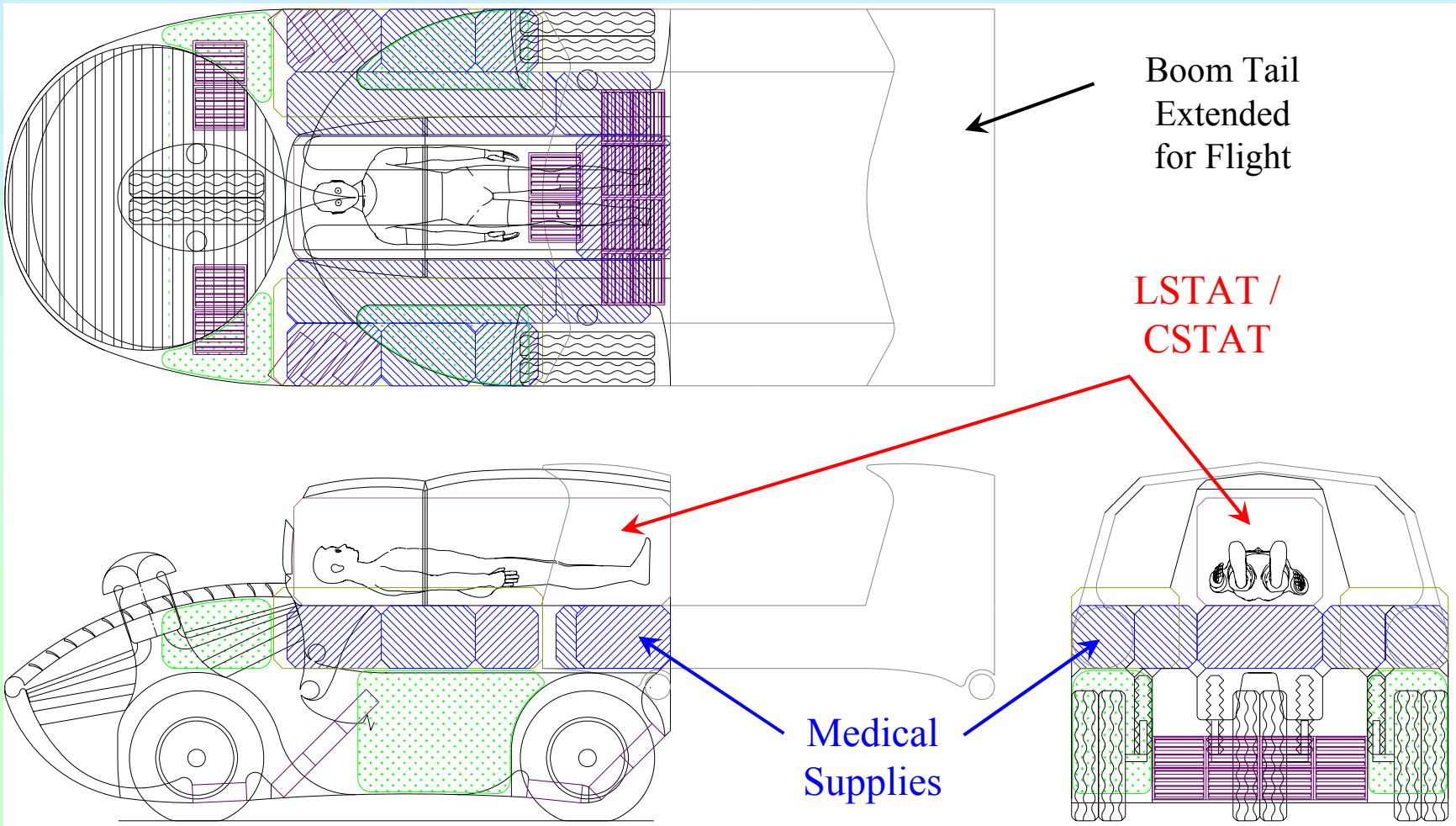

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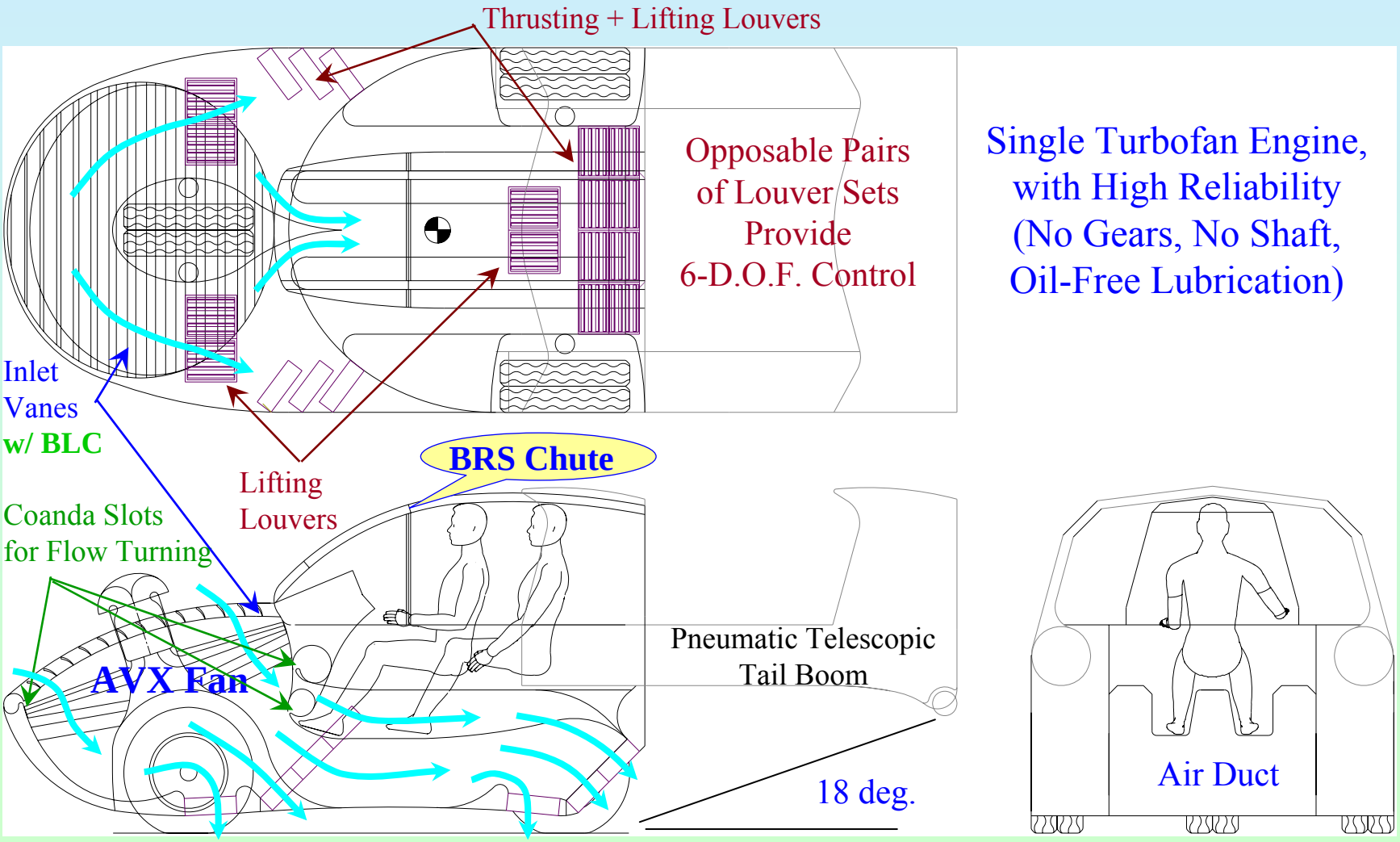

Optionally Manned UAV / AVX-12 PAV
for Personnel Recovery / Medical Evacuation

AVX-12 : Preliminary Analysis

Weights : Empty : 600 lbs, Max. Payload : 700 lbs; Fuel : 700 lbs;
VTOW : 2000 lbs

Dimensions : Body : 12 ft. 3” L, 7 ft W.

Power : Core Gas Generator (no fan or output shaft)
from a 800 hp class turbine engine.

Loadings : Fan Disk : 100 psf; Fan Power : 2.5 lbs/hp; Planform Area : 25 psf

Preliminary Performance Projections

Max. Speed : 260 knots

Range : 440 nmiles with 700 lbs., VTO
820 nmiles with 500 lbs, U-STO

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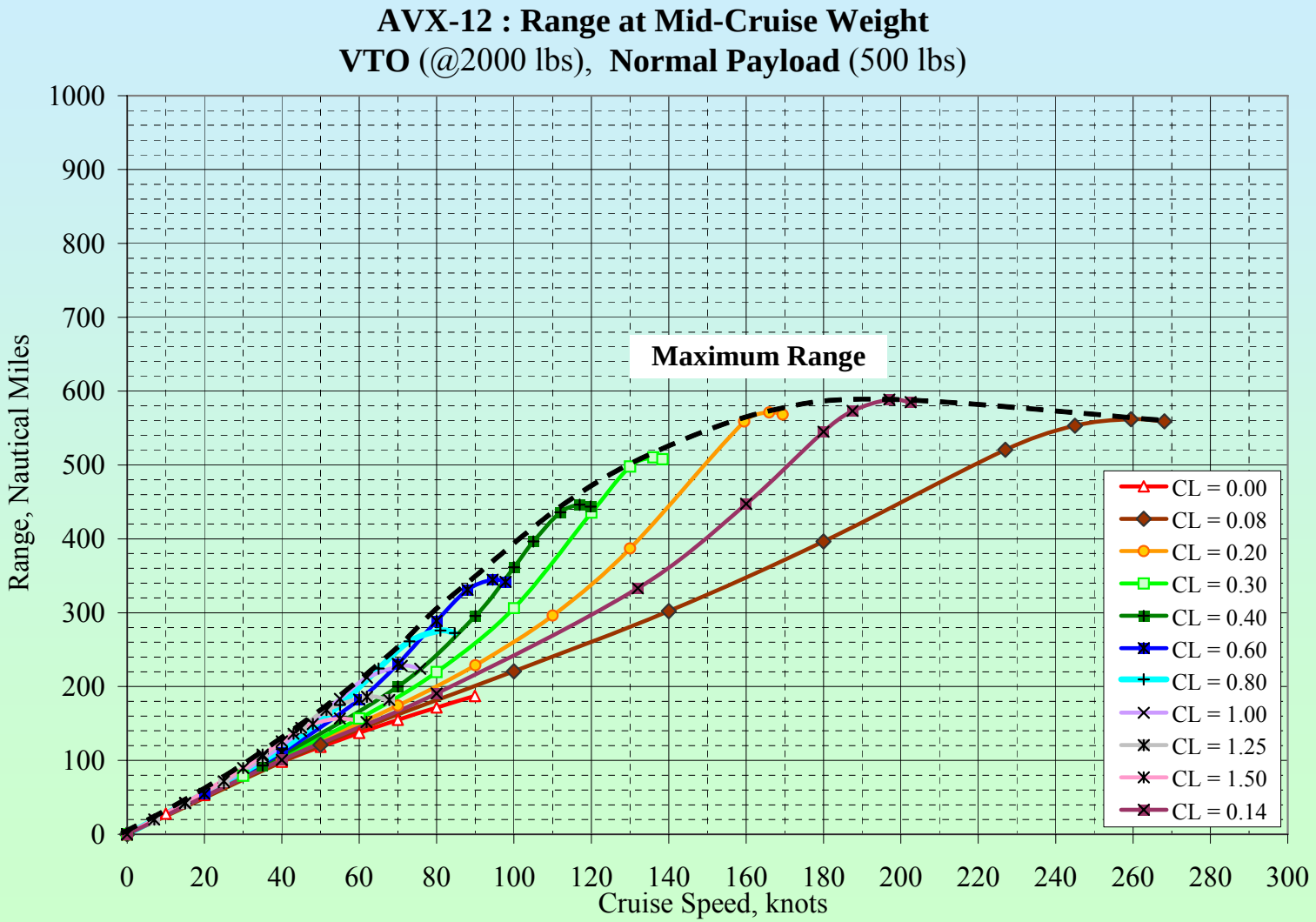

Conclusions

1. It is Time
   for Complex, Costly, Cumbersome Clap-Trap Contraptions
   Called Helicopters
   to be Replaced by Compact, Quiet, Lower Cost Air Vehicles.

2. The Trade-Off between Power and Rotor Size Leads to an Optimum ≈ 100 psf Disk Loading, 10 lbs/hp Power Loading.

   But, this Optimum must be Achieved
   without Heavy, Maintenance-Prone Shafts & Gears.

3. The AVX-12 PAV / UAV by D-STAR / AurAayan
   Offers Low Cost & Low Complexity
   Safe and Quiet Operation
   Ability to Operate in Urban / Forested Areas
   Excellent Speed, Range and Endurance.