Hybrid Airships

15 February 2011

The Honorable Zachary J. Lemnios

Assistant Secretary of Defense for Research and Engineering

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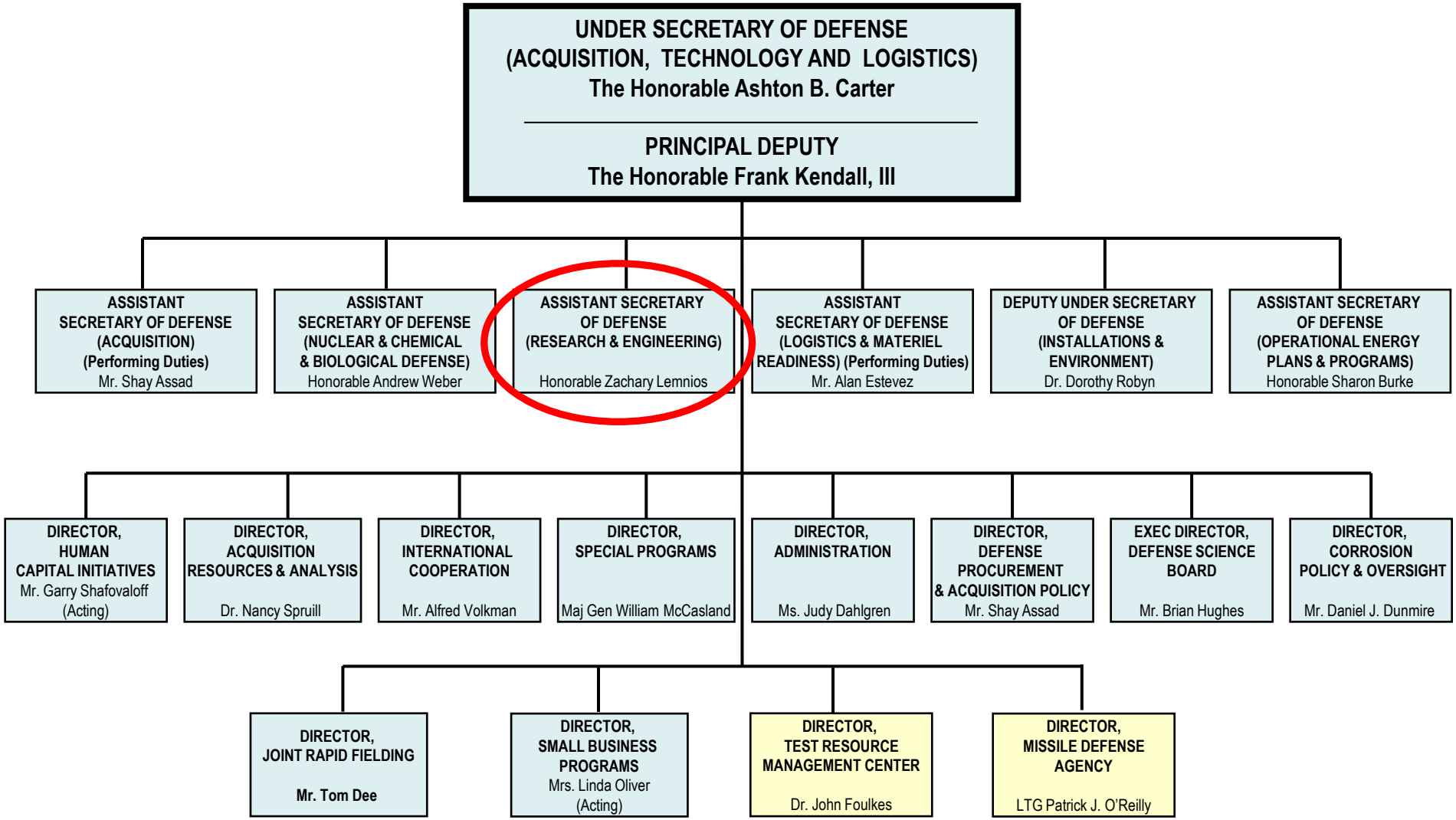
AT&L Organization



Updated 02/14/2011

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General Timeline of DoD Hybrid Aircraft Interest

Interest in "classic" airships (primarily Navy)

Joint Staff J-4 sees SkyKitten, commissions SkyCat 1000 Engineering Study

DARPA Walrus initiated

DARPA continues Aeros risk reduction

DARPA Walrus cancelled

NASA & OSD begin Project Pelican

Navy investigates airships for fleet air defense

"HAMR" and "HULA" concepts developed

LEMV Contract Award

DUSD (AT&L) sees technology—asks DARPA to test

As AF interest grows, Navy withdraws

1920s-1950s // *late 1980s* *early 1990s* *2000* *2003* *2006* *'08* *'09* *2010* *2011*

Westinghouse Sentinel 1000

Akron, Macon, Shenandoah, etc.

ATG SkyCat series

L-M "AeroCraft"

Aeros Int'l Aeroscraft

L-M ADP P-791

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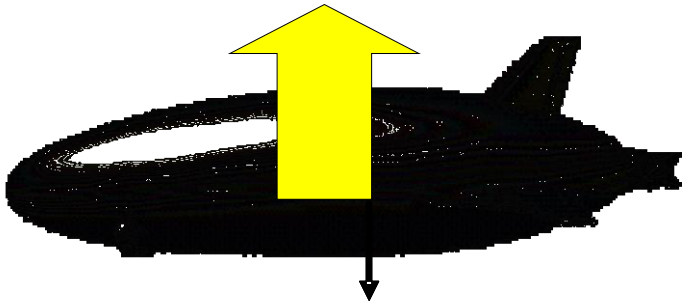
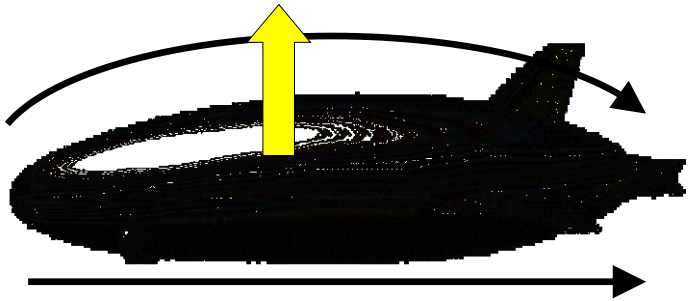


Aerostatic Lift (60-100%)
Generated by helium gas



Aerodynamic Lift (up to 40%)
Generated by lifting body hull in cruise flight

Vectored Thrust Lift (up to 25%)
Take off & landing & zero airspeed

An air vehicle which combines:

- **Aerostatic** lift (buoyant) with
- **Aerodynamic** lift (wing-borne) and
- sometimes, direct (propulsive) lift

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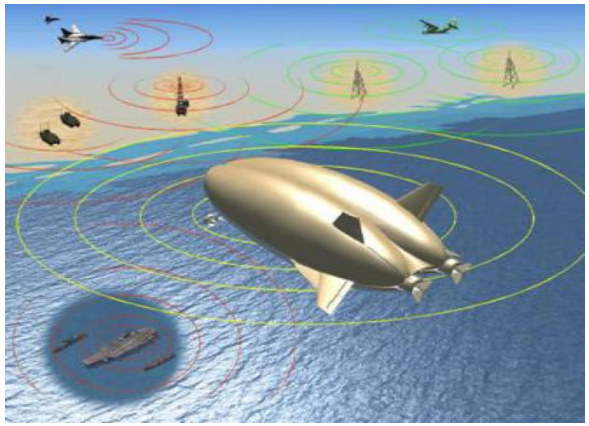
Potential Mission Sets

- **Heavy Cargo Airlift**
  - Carry large loads directly from point-of-origin to point-of-need
  - Faster closure times to point-of-need
  - Operate independent of most fixed infrastructure
  - Ship to Shore cargo operations

- **Intelligence Surveillance Reconnaissance / Communications**
  - Tactical communications network backbone
  - Cell tower in the sky
  - Robust sensor payloads
  - Ability to stay aloft for days-weeks



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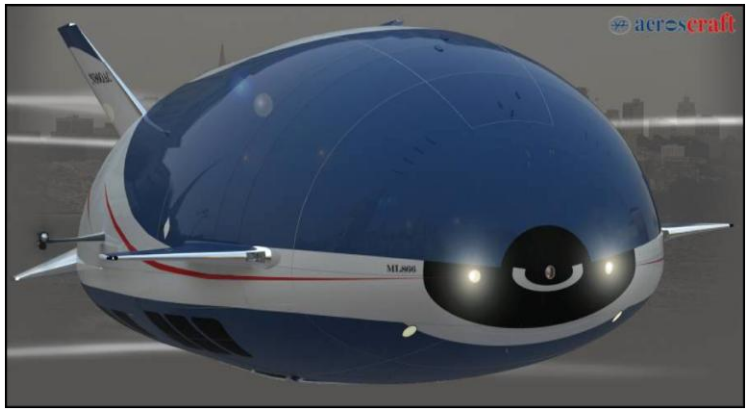
Pelican Technology Demonstrator

- **ASD(R&E) and NASA joint effort**
- **Builds on DARPA investments**
- **Reduces risk**
  - Develop Variable Buoyancy system
  - Develop modern rigid structure tech
  - Study scalability & survivability
- **Objectives**
  - Ballast-free operations
  - Vertical Take Off and Landing (VTOL) at maximum gross weight
  - Rigid Structure
- **Status**
  - Funding request in PB FY12
  - Flight demonstration FY2013



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Long Endurance Multi-Int Vehicle (LEMV) Technology Demonstrator

Approx. 300L X 150W X 80H (ft)

- **US Army and ISR TF joint effort**
- **Builds on previous JCTD investment**
- **Performance Objectives**
  - 21 days aloft with 2,500lb payload
  - 20,000 ft Mean Sea Level Altitude
  - 20 knots cruise/80 knots dash
- **Sensor Suite**
  - Full Motion Video
  - Signal Intelligence (SIGINT)
  - Tactical Data Link(s)
  - Communication Relay
  - Ground Moving Target Indicator (GMTI) Radar
- **Scheduled to fly late summer 2011**

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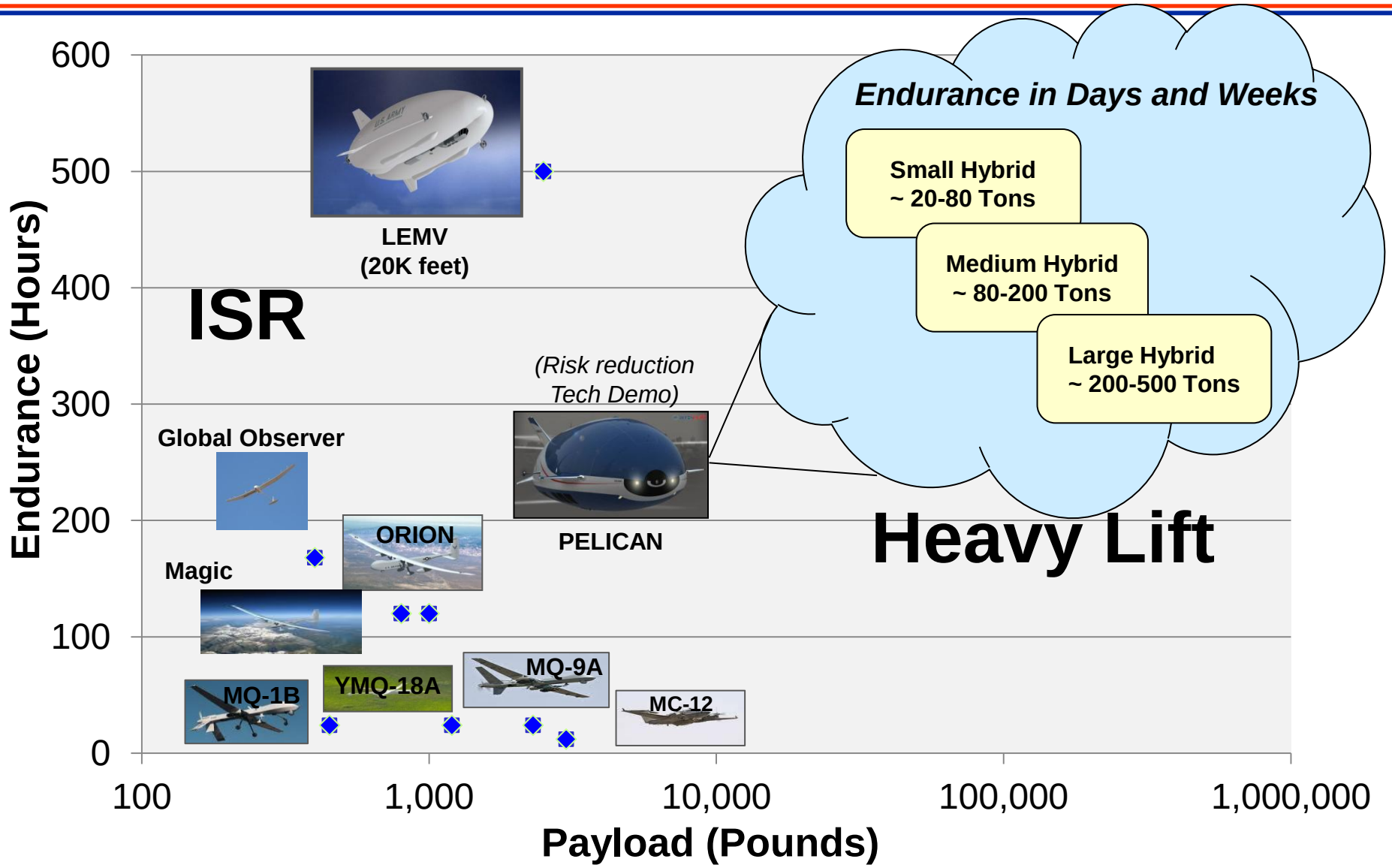
Payload vs. Endurance



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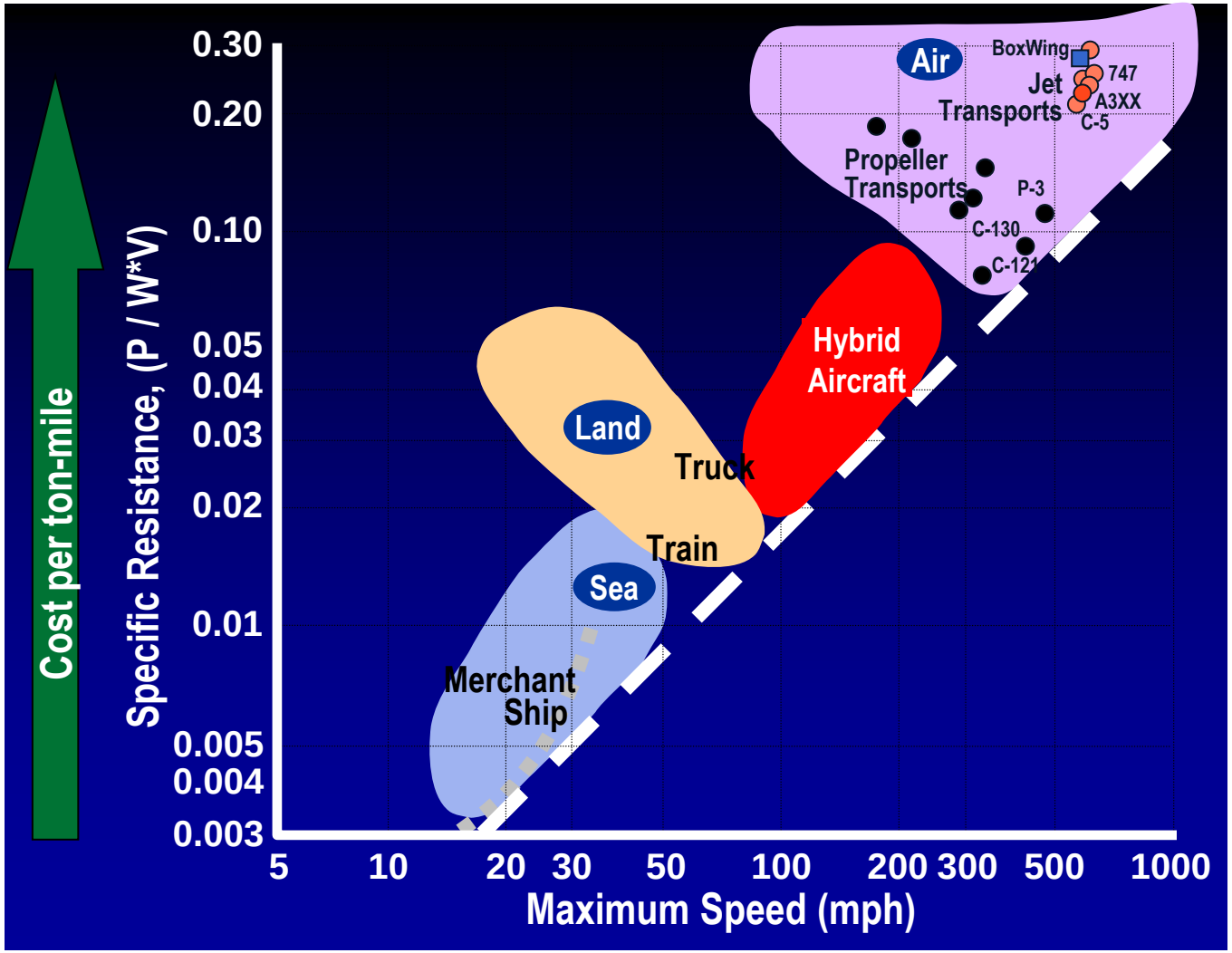
Cost versus Speed



Courtesy: ASME, Journal of Mechanical Engineering, Volume 72, 1950, Pages 775-781, "What Price Speed – Specific Power Required for Propulsion of Vehicles" by **Gabrielli and Von Karman**

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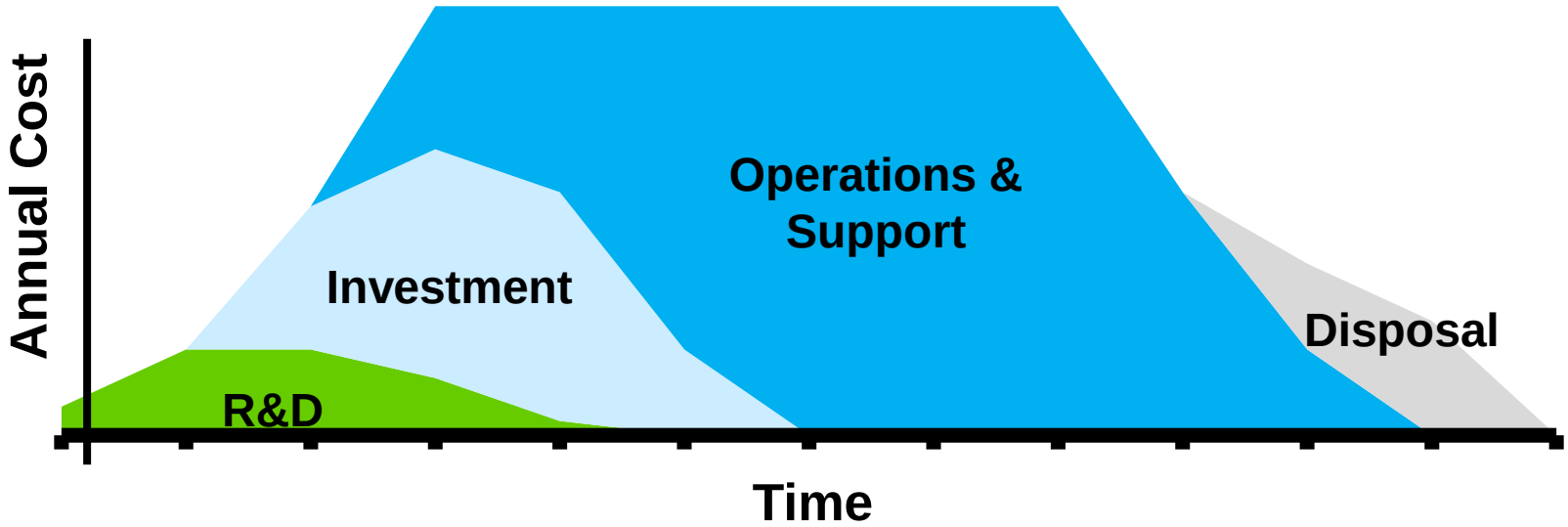
Fully Burdened Cost as a Critical Performance Parameter



- **Research & Development**
  - Concept to first production
  - Design, integration, test, demo
  - Prototype
- **Investment**
  - Production & Deployment
  - Initial training, spares, repair
- **Operations & Support**
  - Maintenance
  - Operating personnel footprint
  - Deployment cost
  - Equipment, supplies
- **Disposal**
  - Demilitarization

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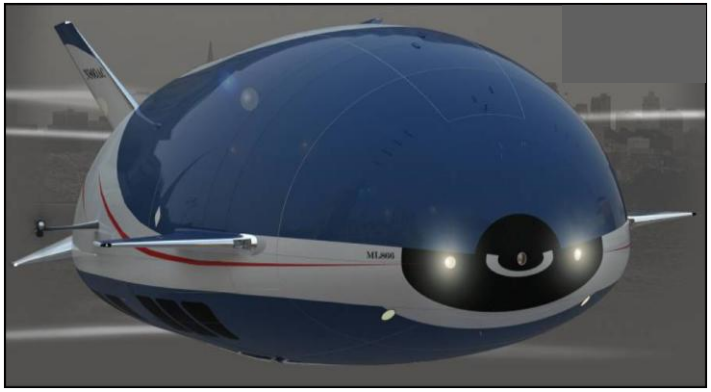
Challenges Forward

- **Technical:**
  - Structural material limitations
  - Buoyancy Control
  - Integration
  - Scale
- **Operational/CONOPS:**
  - Weather
  - Maintenance support
  - Manned, Unmanned, or Optionally Manned
  - Survivability
  - Ground operations
  - On/Off load operations
  - Cost



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