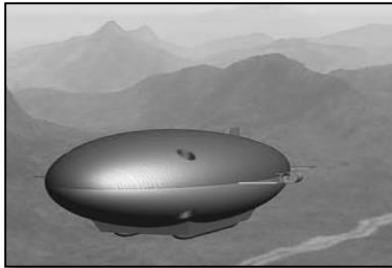

DARPA Aviation & Platform Demonstrators – Question One or Two Demonstrator Planning for Flight Test Redundancy

DARPA Aviation/Platform Demonstrators – Whether to Build a 2nd Demonstrator Concurrently (Those in Red)?



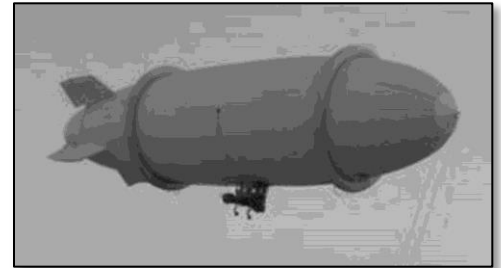
CALF-JAST 1994 ←



Walrus



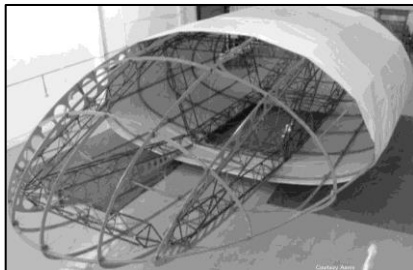
CRW



COSH



A160



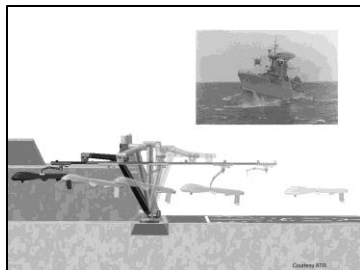
BAAV



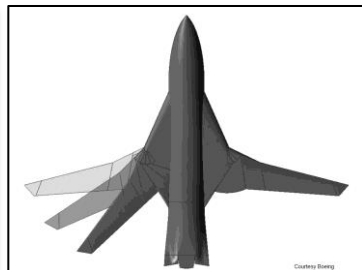
DP-5X



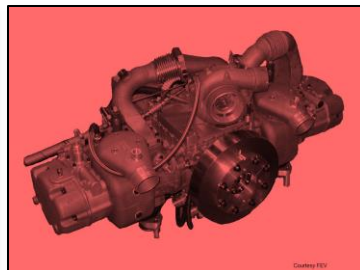
Morphing Aircraft Structures (MAS)



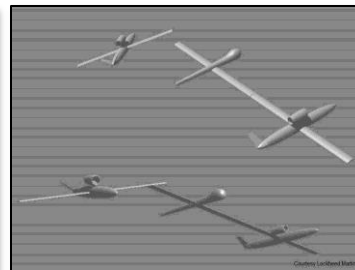
Sea Catcher



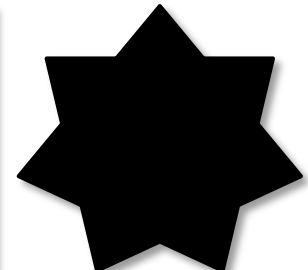
SWIFT



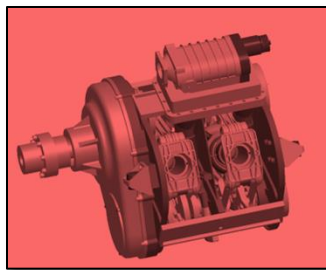
OPOC (Diesel)



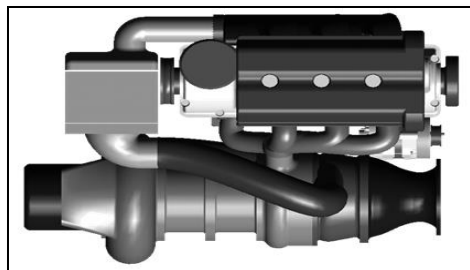
Long Rider



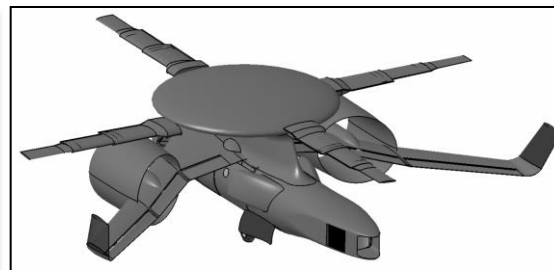
Other Technologies



Achates (Diesel)



Turbo-Compound Rotary (TCR)



DiscRotor



AMSMA (Morphing Aircraft)

DARPA Aviation/Platform Demonstrators – Purpose of Demonstrators – X-50A Dragonfly



- CRW flight demonstrator objectives:
 - Reaction driven rotor system
 - Stopped rotor for cruise flight
 - High-speed capable (375+ kts)
 - Turbofan powered
 - Survivable
- Dragonfly X-50A Aircraft 1
 - Flight tests in 2003
 - Destroyed, flight test loss in March 2004
- Dragonfly X-50A Aircraft 2
 - Flights tests late 2005 through 2006
 - Destroyed, flight test loss April 2006
- Hiatus Spring 2004 to Fall 2005 involves changes to:
 - Flight Sim & Control Law Update & Validation
 - Control Power Verification Testing
 - Hardware Mods/power system response
- At time of second accident, X-50A Dragonfly was the most successful stopped rotor program to date – enabled by availability of Aircraft 2



DARPA Aviation/Platform Demonstrators – Purpose of Demonstrators



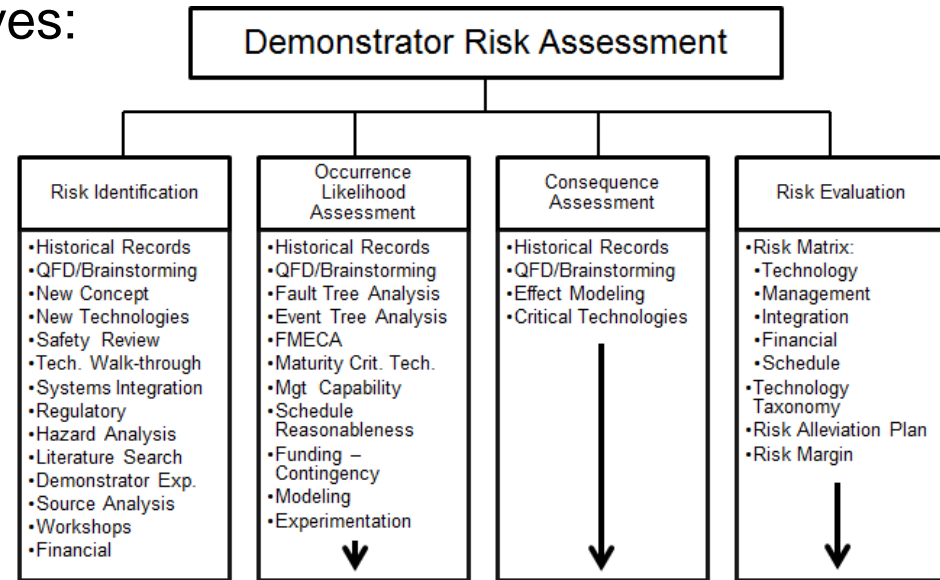
- Demonstrations are necessary to fully validate technological concepts:
 - Proof of concept
 - Feasibility
 - Performance
 - Advanced/critical technology first use or integration
 - New method or an idea
 - Showcasing the possible applications, for a new technology
- In aviation, a number demonstration approaches – to name some:
 - Analytical
 - Simulation
 - Component technologies – bench, wind tunnel
 - Iron Bird
 - Air vehicle or other inflight
- The flight air vehicle is the *Blue Ribbon* demonstrator but frequently becomes a rush to test and failure:
 - Technology is found to be too immature or insufficiently understood at design
 - Too little maturation development and experimentation – integration in particular
 - Schedule slippage and cost overruns in the
 - Flight demonstrator objectives often fuzzy – developed to sell the program – not to prove the science

DARPA Aviation/Platform Demonstrators – Demonstrator Strategy

- Why do a flight demonstrator ?
 - Technically necessary?
 - Have the technologies been well enough understood at the outset to predict a flight demonstrator?
 - Affordable?
 - Can other demonstrations do better (iron bird)? Or complement?
 - Is the demonstration packet properly balanced?
 - Are the goals respectable, possible and achievable – how do you know?
 - How will success be understood?
- Is the risk involved Demonstrations understood – but insufficiently understood to require redundancy despite a thoroughly convincing packet of preliminary lower cost ground demonstration?
- The case for a second flight demonstrator must be built on the basis of risk analysis – there is no other reason rising to this importance:
 - Some aspects can only be assessed in the air – high risk/likely
 - Without flight test no useful results can be achieved – high risk/consequence
 - Cost of a concurrent #2 demonstrator 15-27% program cost – lowers risk/likely
 - Assembly #2 lags and able to recover lessons learned – lowers risk/likely
 - Loss of single flight demonstrator kills program – high risk/likely

DARPA Aviation/Platform Demonstrators – Risk Analysis Builds Case for a Second Demonstrator

- CRW flight demonstrator objectives:
 1. Reaction driven rotor system
 2. Stopped rotor for cruise flight
 3. High-speed capable (375+ kts)
 4. Turbofan powered
 5. Survivable
- No Iron Bird was the strategic program planning error
- Objectives all very hard but 1, 2 and 4 required ground experimentation/demonstration because of integration and engineering challenges
- A risk analysis per the right would have established this – as it happens...even a second flight demonstrator was insufficient
- Nevertheless, this analysis helps – gives you the high risk/high pay-off but says a spare saves having nothing if you lose #1



Development Risk Matrix

