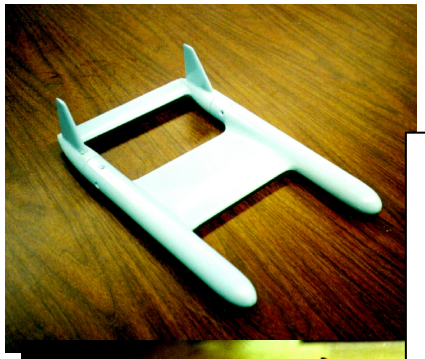
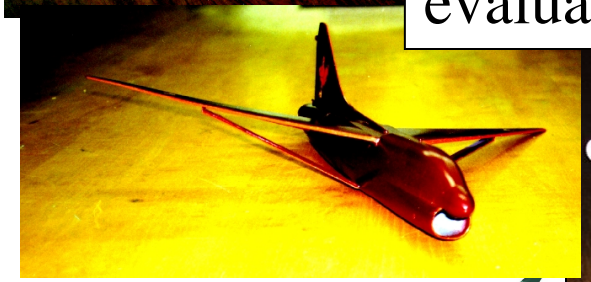
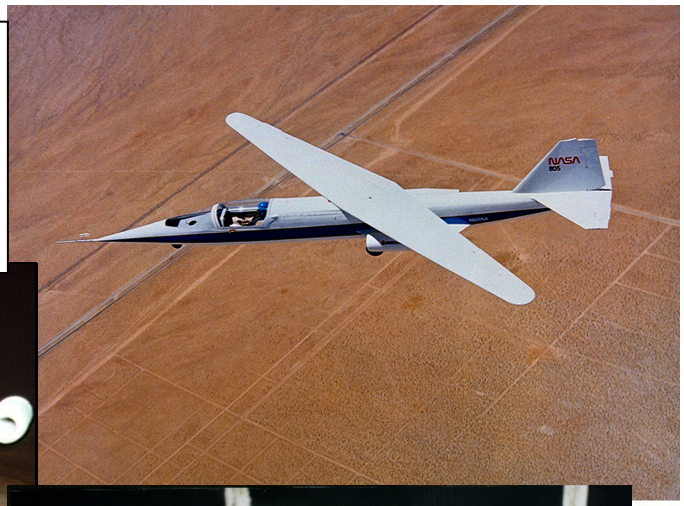
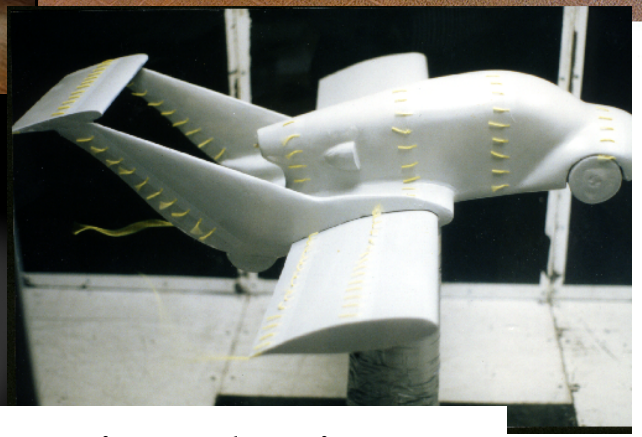
# "Typical" advanced concepts that show up on Mason's desk



These configurations all deserve a decent aero evaluation - can "we" do it?







What are the fundamental supporting physics concepts for these ideas?

# AIAA Aerospace Sciences Mtg, Orlando, 2010

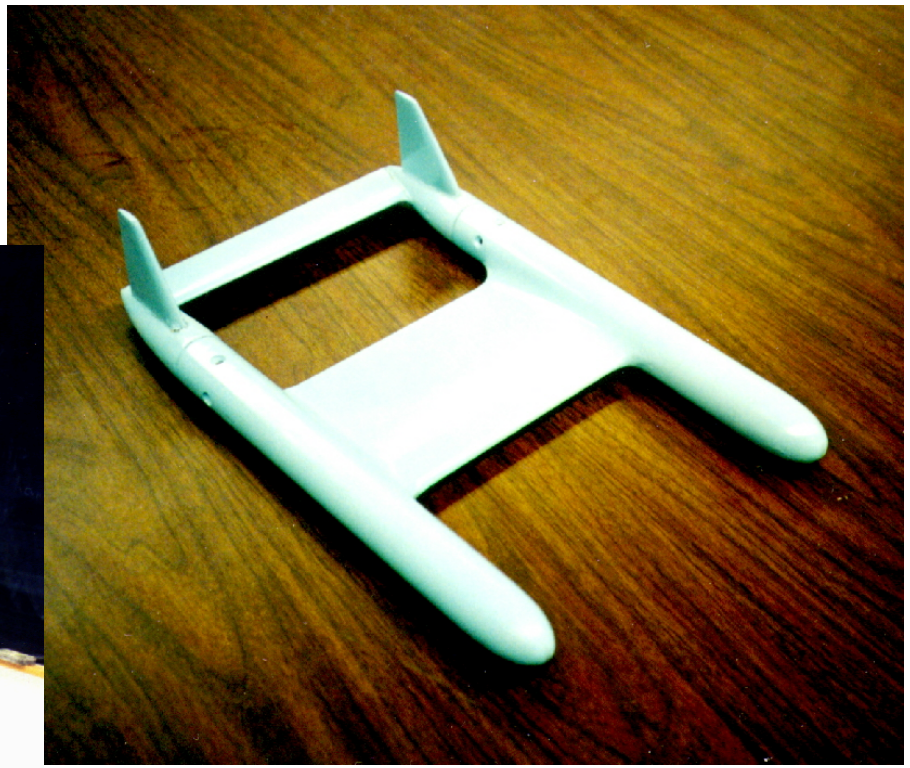
examples of topics of current interest

Aircraft Design and Fluid Dynamics sessions had related topics

**APPLIED AERODYNAMICS**

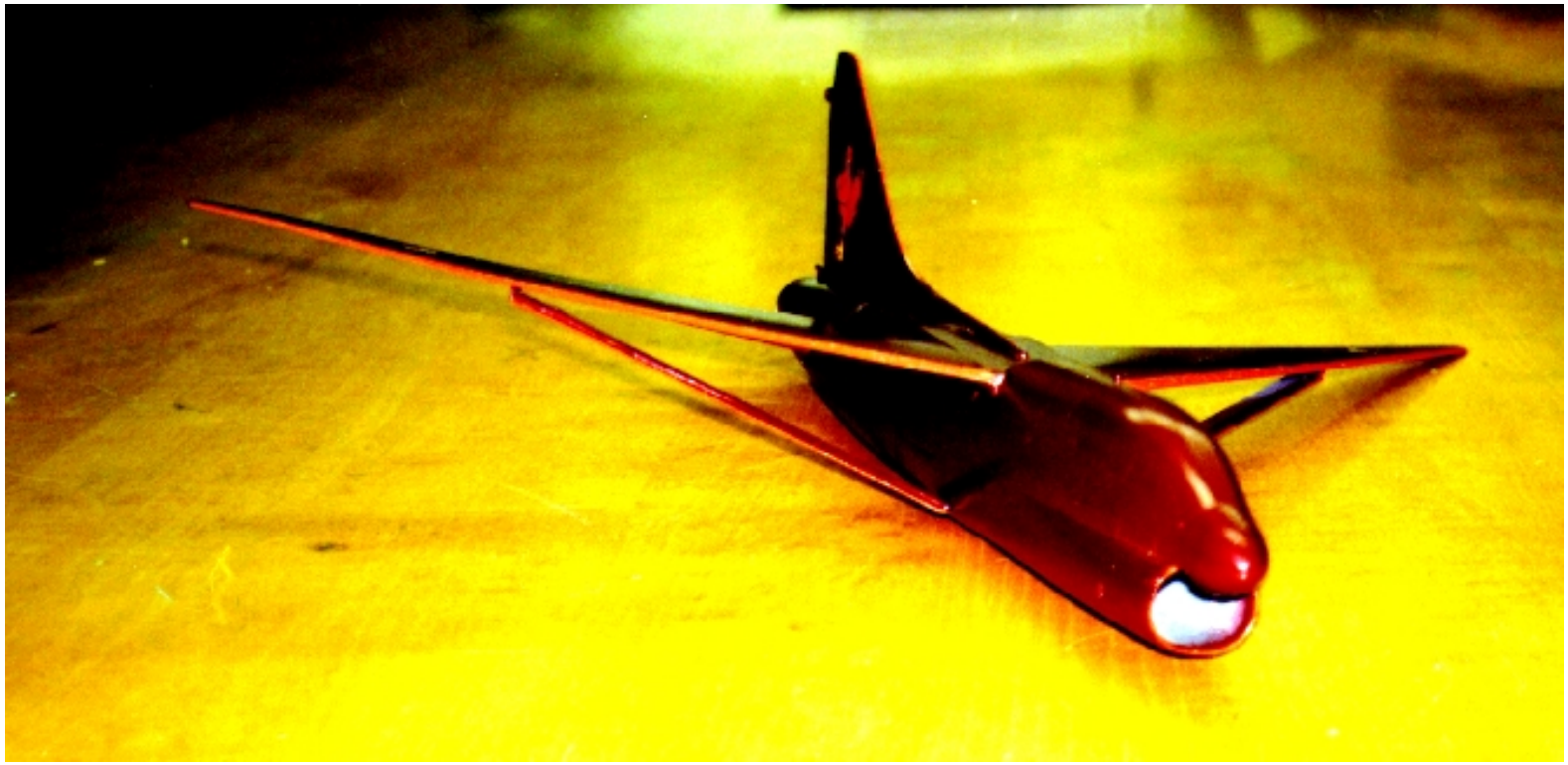
| | |
|---|---|
| 7-APA-1 | Aerodynamic-Structural Dynamics Interaction |
| 8-APA-2 | Airfoil/Wing/Configuration Aerodynamics |
| 9-APA-3 | Low Speed, Low Reynolds Number Aerodynamics |
| 45-APA-4 | Applied CFD in Engineering |
| 46-APA-5 | Unsteady Aerodynamics I |
| 47-APA-6 | Vortical/Vortex Flows |
| 79-APA-7 | Applied CFD to Configurations and Experimental Validation |
| 80-APA-8 | Moving Body CFD Simulation I |
| 81-APA-9 | Unsteady Aerodynamics II |
| 113-APA-10 | Propeller/Rotorcraft Aerodynamics |
| 114-APA-11 | Weapons Carriage and Store Separation |
| 115-APA-12 | Wind Tunnel and Flight Testing Aerodynamics |
| 149-APA-13 | Active Flow Control II |
| 150-APA-14 | Moving Body CFD Simulation II |
| 151-APA-15 | Transonic, Supersonic, Hypersonic Aerodynamics I |
| 152-APA-16 | Unsteady Aerodynamics III |
| 184-APA-17 | Create-AV: Testing and Evaluation of High Performance Computing Software I |
| 185-APA-18 | High Angle of Attack and High Lift Aerodynamics |
| 186-APA-19 | Transonic, Supersonic, Hypersonic Aerodynamics II |
| 187-APA-20 | VSTOL/STOL Aerodynamics |
| 220-APA-21 | Active Flow Control III |
| 221-APA-22 | Aerodynamic Design Methodologies |
| 222-APA-23 | Create-AV: Testing and Evaluation of High Performance Computing Software II |
| 223-APA-24 | Icing or Roughness Effects on Vehicle Aerodynamics |
| 224-APA-25 | Innovative Aerodynamic Concepts and Designs |
| 256-APA-26 | Active Flow Control IV |
| 257-APA-27 | Miscellaneous Topics in CFD and Applied Aerodynamics |
| 258-APA-28 | Optimization Methods in Applied Aerodynamics |
| 259-APA-29 | Unmanned Aerial Vehicle Designs/Tests |

# The “Inboard Wing”



Samantha is now at HondaJet

# The Strut Braced Wing



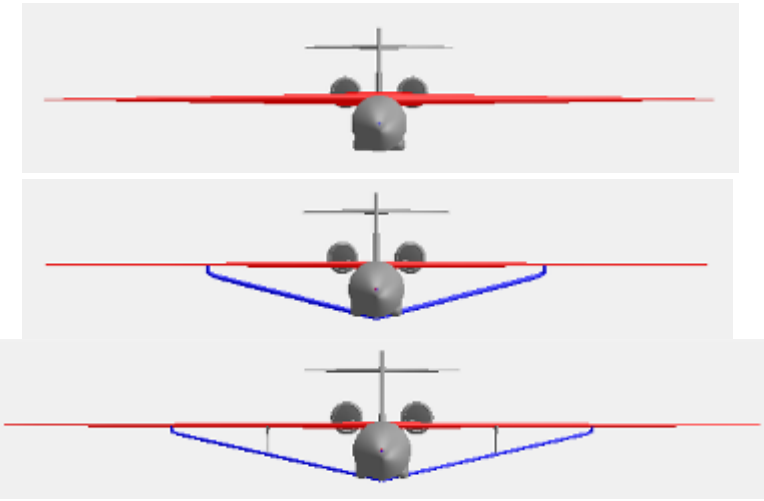
A rewinged A-7 design by a 1999-2000 Senior Design Team

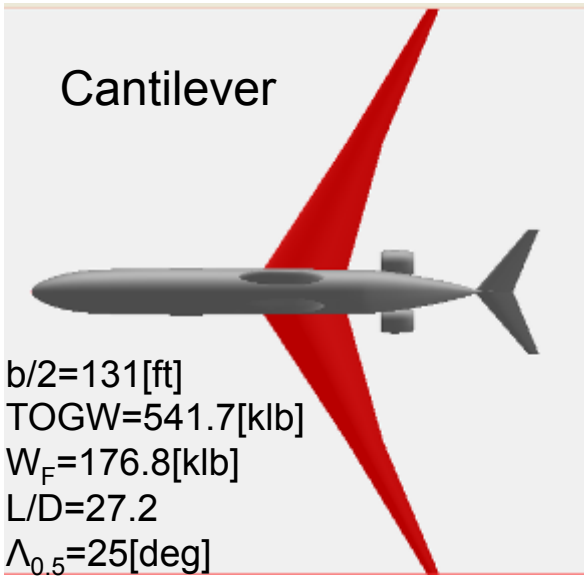
# Still Under Study: Dec. 08 NASA Review

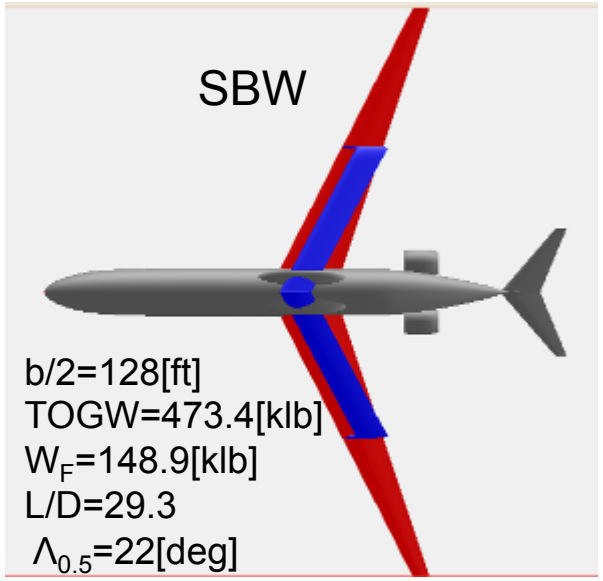
Cantilever

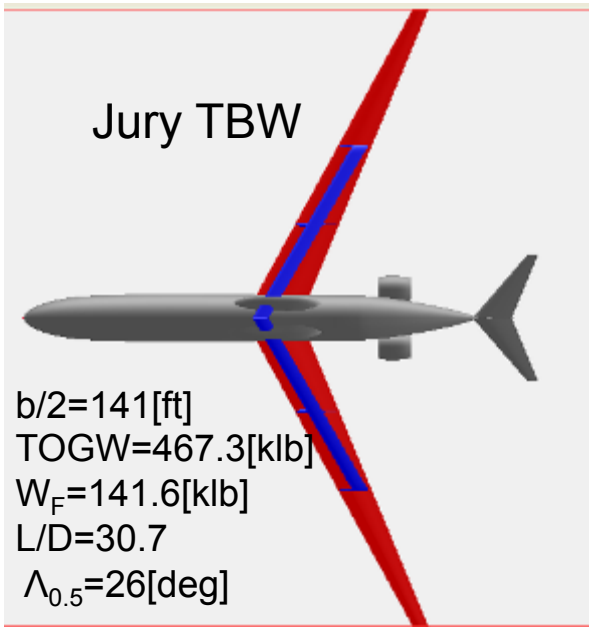
SBW

Jury TBW





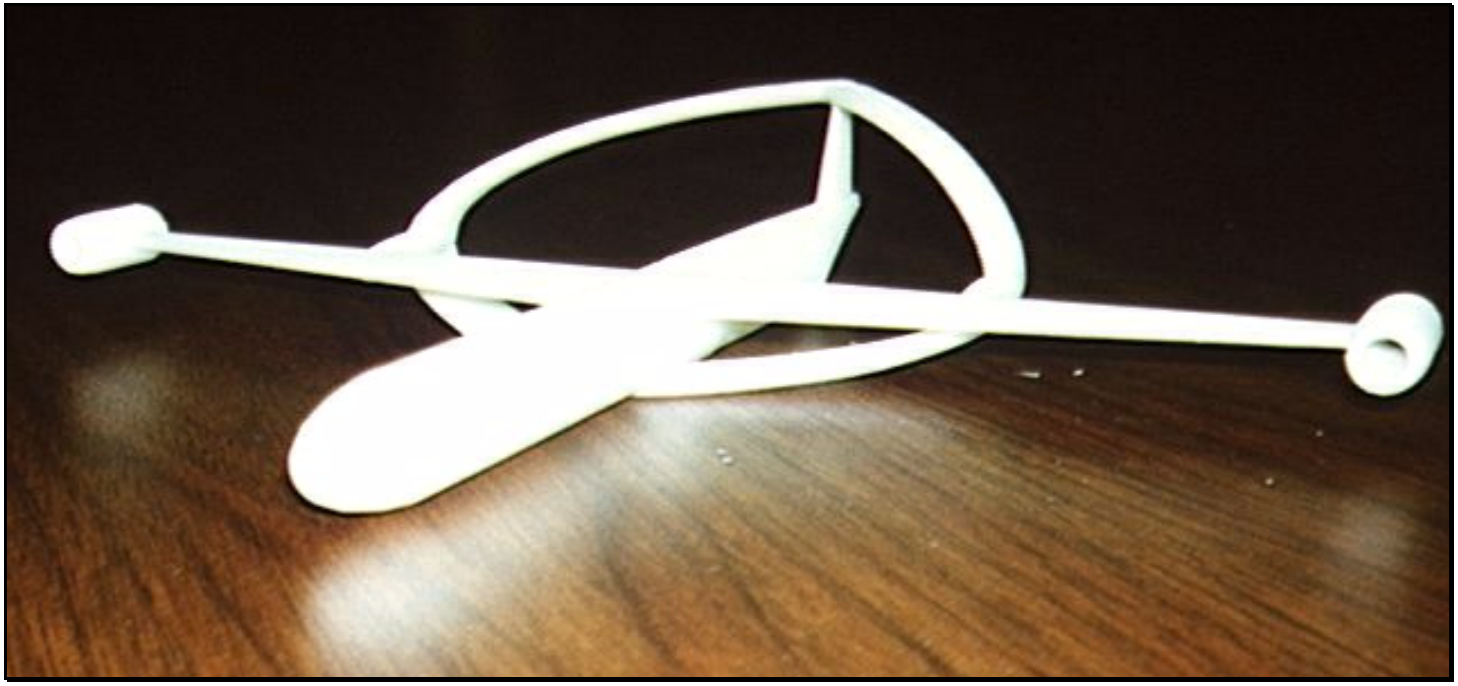



# Aviation Week Daily Updates: Jan 12, 2015

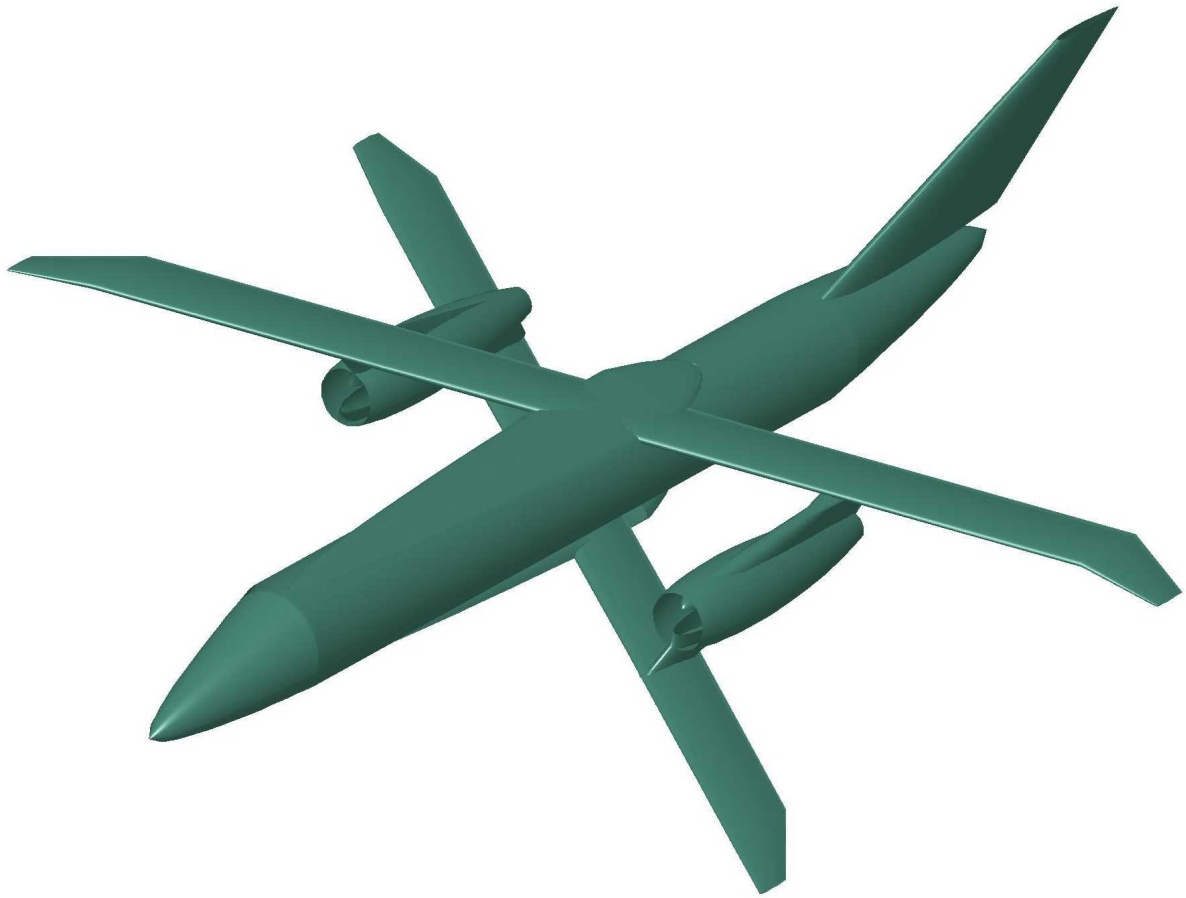
## Truss-Braced Wing Shows Promise In Boeing And NASA Tests

After wind-tunnel tests showed that the flutter weight penalty of a long-span, low-drag truss-braced wing (TBW) is small enough to make the configuration feasible for future energy-saving airliners, NASA and Boeing are planning additional tests to assess the design's aerodynamic performance. Aeroelastic analysis of the TBW design was conducted under Phase 2 of Boeing Research & Technologies' (BR&T) NASA-funded Subsonic Ultra Green Aircraft Research (Sugar) program to ...

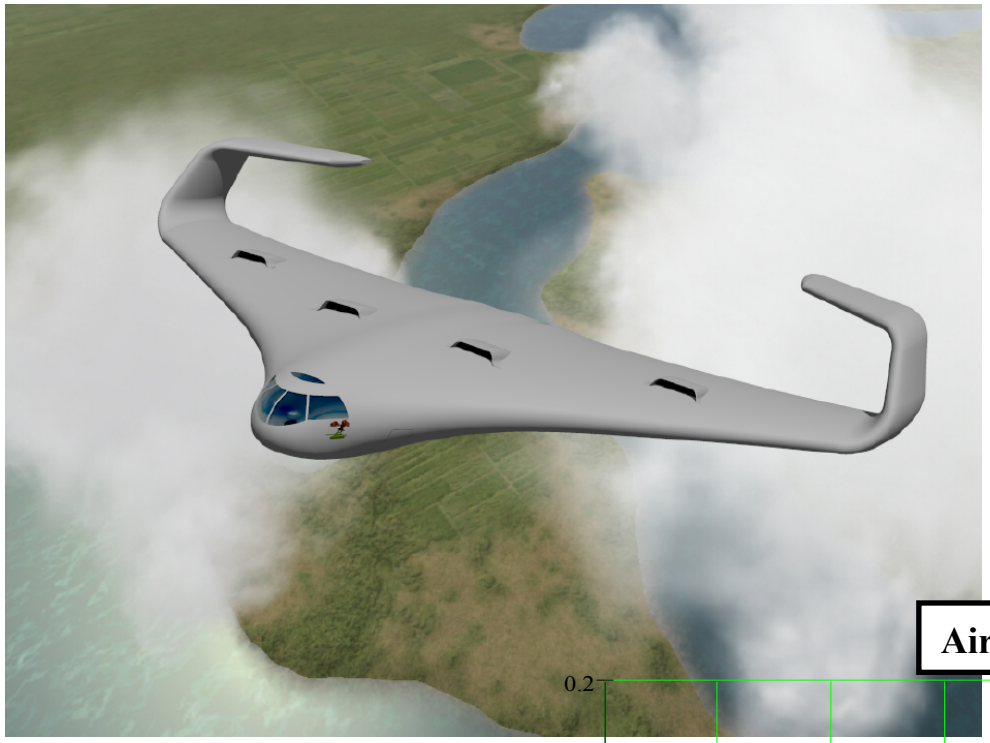
# Prof. Schetz Imagineering



# Askin Isikveren's X-Wing

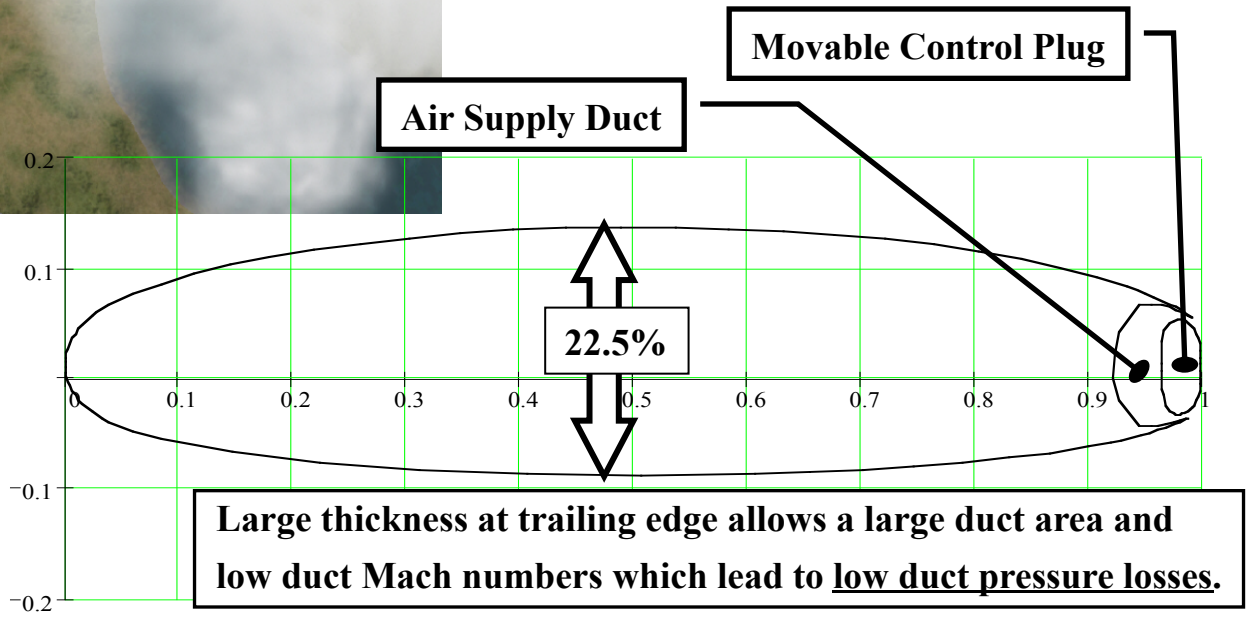


# C-wing blended wing body w/distributed propulsion (Jim Snyder)



**C-130 Replacement?**

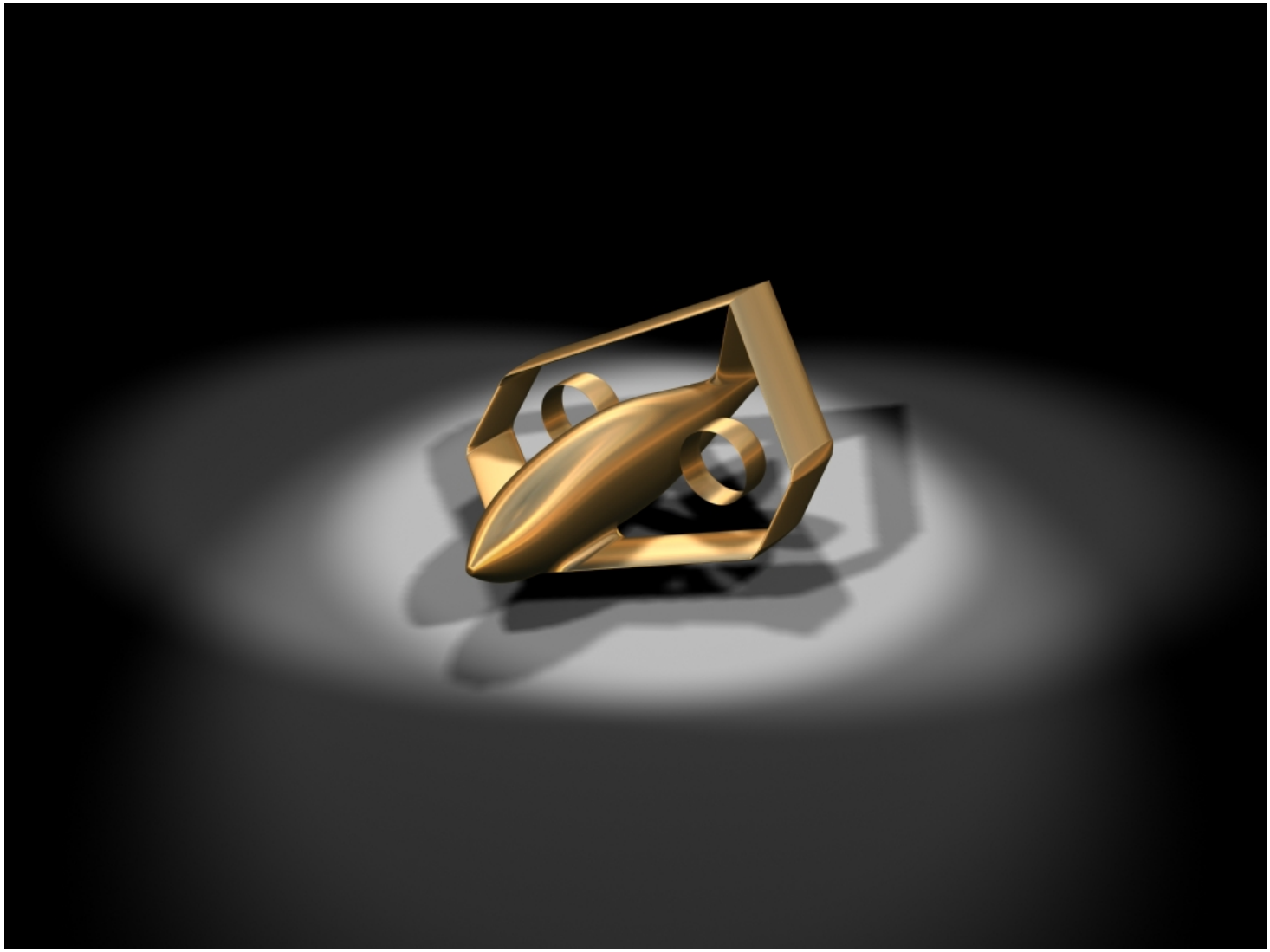
Thick blown airfoils



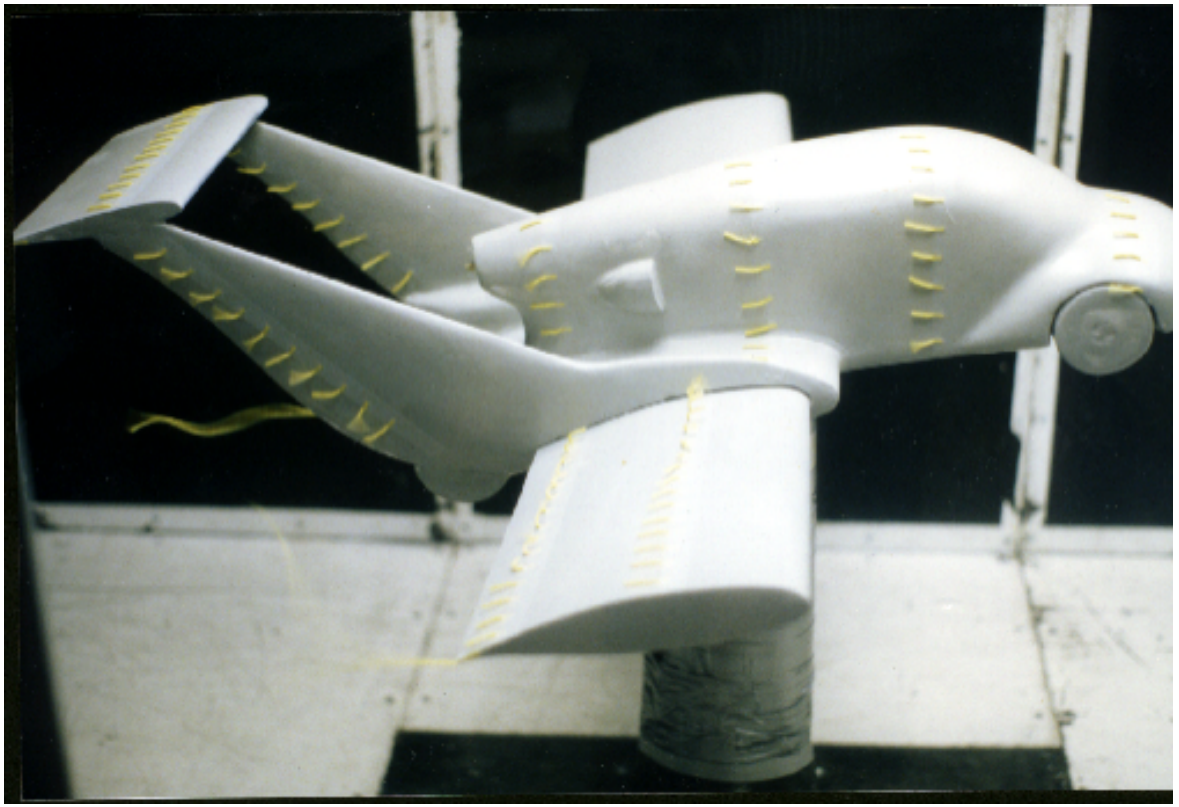

**Large thickness at trailing edge allows a large duct area and low duct Mach numbers which lead to low duct pressure losses.**

Current Air Force Study!

# Ikelos
# - joint VT-LU design concept -



# The Flying Car!
# - by a VT senior design team -



**Terrafugia flew their's March 5, 2009!**

# One never knows what's going to show up!

The stealthy "bird of prey" from McDonnell Douglas


Note inlet location

# One that went away

Boeing investigated a near-Sonic Cruiser ($M = 0.98$)
- over the period from 1999 - 2002 -

**This technology used in Dreamliner – flew Dec. 15, 2009**

# Who would have thought?

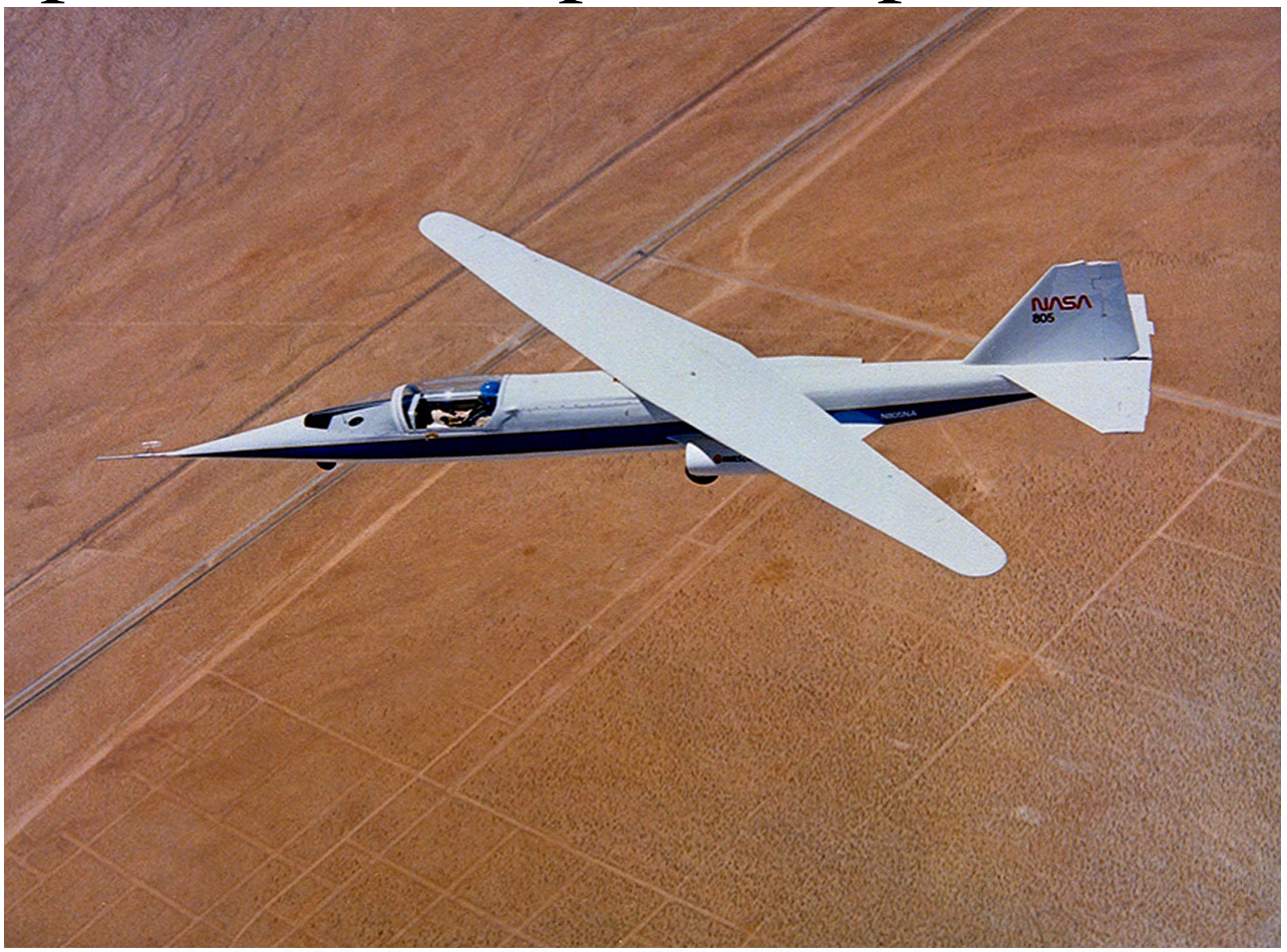
# Launched From

and


**Supersonic Flight and 68,000 ft. Dec. 17, 2003**
**Won the X-Prize in 2004**

**White Knight Two - 1st Flight Dec. 23, 2008**

# RT Jones' Oblique Wing
## - an important concept for supersonic flight -




Dryden Flight Reserach Center ECN-13302B Photographed 1980
AD-1

DARPA worked on "Switchblade"

# Hope for Low-Sonic Boom Noise Flight

A modified F-5E demonstrated a low-noise boom on Aug. 27, 2003

So-called "boom shaping" can be used to reduce the part of the boom that hits the ground.

NASA Press Release, Sept. 4, 2003

NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/Gallery/Photo/index.html
NASA Photo: EC03–0210–1 Date: August 2, 2003 Photo By: Carla Thomas

Northrop–Grumman Corporation's modified U.S. Navy F–5E Shaped Sonic Boom Demonstration (SSBD) aircraft.

# Or, the Quiet Spike!

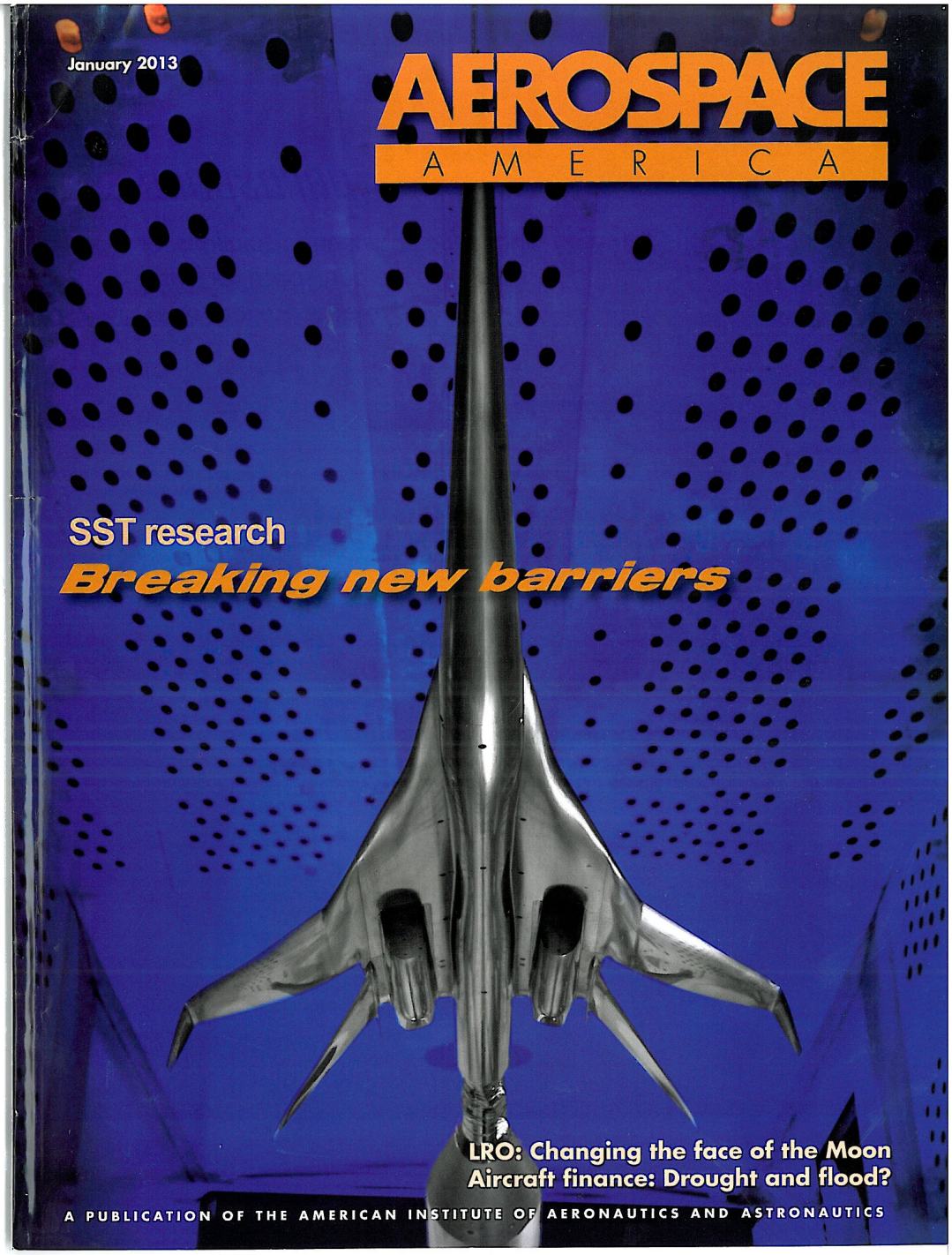

NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/Gallery/Photo/index.html
NASA Photo: ED06–0187–18 Date: October 3, 2006 Photo By: Jim Ross

NASA F–15B #836 in flight with Quiet Spike attached.

**Gulstream is thinking about doing this: X-54A next!**

# NASA Keeps Working

January 2013



# A supersonic business jet by Aerion

*now partnered with Airbus*

*and with a 3rd engine*

# Hypersonics Lives!


Dryden Flight Research Center ED98-44824-1
X-43/Hyper -X aircraft. NASA/Dryden Illustration by Steve Lighthill

Now working on the scramjet waverider X-51!

# The Cormorant - from a submarine

January 2007

Innovation from the Skunk Works for DARPA

# And Cars too!




Advanced Airfoils,
and a
Gruney Flap!

# UAVs - a major part of the future


NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/gallery/photo/index.html
NASA Photo: ED02-0161-2 Date: June 24, 2002 Photo by: Nick Galante

Pathfinder-Plus flight in Hawaii

# And finally, Micro UAVs!

## *Black Widow*

## *AeroVironment, Inc.*

- 6-inch span fixed-wing aircraft
- Live video downlink
- Portable launch/control box
- Pneumatic launcher
- 60 gram mass
- 22-minute endurance
- Estimated 10 km range
- Electric propulsion

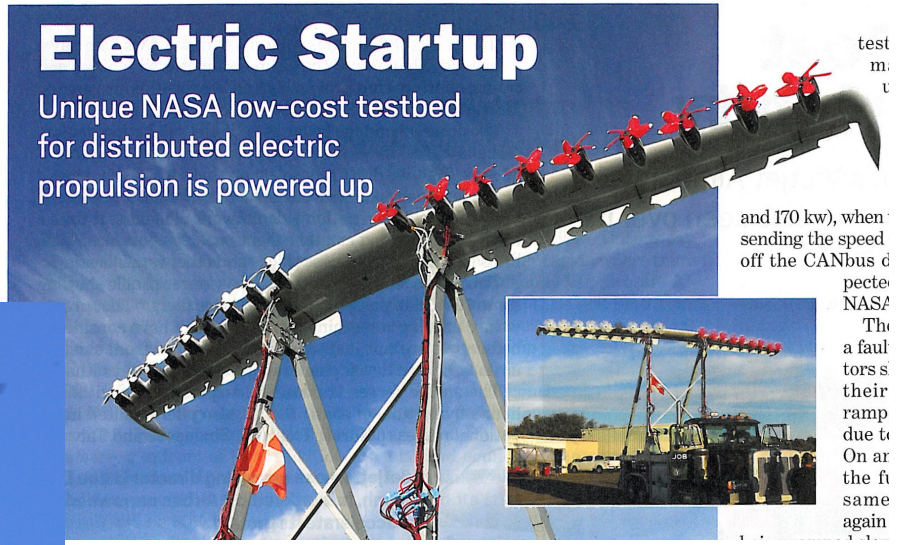
## *Achievements*

- World MAV endurance record of 22 minutes
- Smallest video camera ever flown on a UAV: 2 grams
- Smallest live video downlink ever flown on a UAV
- World's smallest, lightest multi-function, fully proportional radio control system: 3 grams
- First aircraft to be flown "heads-down" indoors

**Joel Grasmeyer, MS VT 1998 - team member!**

# Now, Distributed Propulsion

Aerospace America, December 2014




AvWk, Dec 1/8, 2014

# Be Prepared
# Think Fundamentals

- You never know what might happen