

Outline

- Overview of BIG BLUE Phase I
- Postflight Evaluation
- BIG BLUE Phase II
- **Low-Altitude Flight Tests**
 - *Fall 2003 flights*
 - *Flight characteristics*
 - *Current and future efforts*
- Morphing Wings Research



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Fall 2003 Flights

Flight Progression

- *Simulated Wings*
- *ILC Wings*
- *DAQ[†]*
- *Onboard Video[†]*
- *Full Configuration*

[†] *First w/o and then w/ ILC wings*

<i>Flight Date</i>	<i># Flights</i>	<i>Capabilities and Comments</i>
September 8, 2003	5	
September 12, 2003	3	
September 19, 2003	5	
September 26, 2003	5	ILC Wings (1 flight) – ground-view video
October 3, 2003	3	
October 15, 2003	3	ILC Wings (3 flights) – ground-view video
October 22, 2003	2	ILC Wings (2 flights) – onboard b&w video
October 23, 2003	3	ILC Wings (2 flights) – failing at plenum after 2 nd flight
October 29, 2003	2	
October 30, 2003	1	
November 4, 2003	3	
November 7, 2003	2	ILC Wings – not enough wind
November 10, 2003	2	ILC Wings – not enough wind (even for car launch)
November 11, 2003	4	ILC Wings (2) – crash; 2 simulated wing flights



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Sep. 26, 2003



First flight of ILC Wings (ILC ground cured);
Wing flexing noted at root after flight



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Early Flight Video

QuickTime™ and a
DV/DVCPRO - NTSC decompressor
are needed to see this picture.



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Flight Testing Kick-Off: Oct. 3

QuickTime™ and a DV/DVCPRO - NTSC decompressor are needed to see this picture.

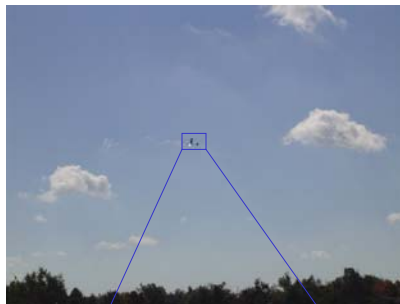


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October 15, 2003



- Successful flights of ILC wings
- First onboard DAQ test (flight successful, data collection not successful)
- Weighted plane to include ATV weight (too heavy to fly)
- Smaller fuselage on future flights



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ILC Wing Flights



UK

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October 22, 2003



Flight 1 (from onboard camera)



Flight 2 (from ground)



UK

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November 7-10, 2003



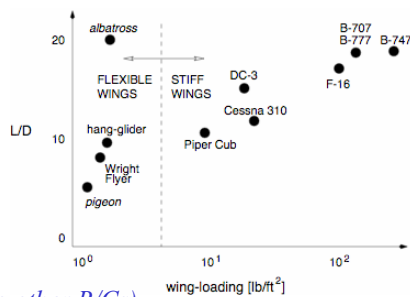
- Full configuration flights
- Addition of color camera, transmitter, and DAQ, make aircraft weight marginal
- Wing flexing causing a problem with flight stability
- Supports to reduce flexing increase drag (flexing not eliminated)



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Some Flight Characteristics

- Dutch roll seen at low speeds (take-off), but aircraft very stable otherwise; c.g. an issue since wings make up an atypical (significant) weight fraction
- Wing loading
 - Simulated wings: $W/S = 3 \text{ lb/ft}^2$
 - ILC wings: $W/S = 3.15 \text{ lb/ft}^2$
 - Borders between flexible (birds) and stiff (aircraft) regimes (see Great Flight diagram)
 - Velocity high for size (relative to other R/Cs)
- Power loading largely unknown



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Ways to Improve Future Flights

- Lighter (and stronger!) fuselage
 - *Composite fuselage will reduce fuselage weight by ~50%*
- Larger/better performing engine
 - *Increase T/W ratio of engine by using gasoline powered engine; more problematic to use, but has higher energy density*
- Take-off Distance
 - *Increase distance to take-off speed; use catapult or runway for takeoffs, perhaps landings*



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Next Steps for BIG BLUE

- DAQ
 - *Airspeed and airspeed control (regulating RC control)*
 - *Acceleration (turning and pull-out)*
- Hot Air Balloon “Launch”
 - *Pull-out from nose-down launch at 1,000 – 1,500 ft*
 - *Including video, DAQ and abort parachute*



John Herbst’s Hot-Air Balloon

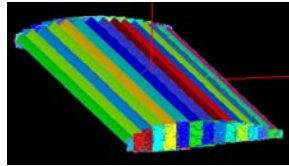


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Current & Future Efforts

- Repair wings to get inflight video
- Flight Data Tests
 - *Using in-house DAQ and Micropilot (GPS, attitude, airspeed, altitude)*
 - *Glide slope, lift/drag*
- Wind Tunnel Tests & CFD using TetrUSS

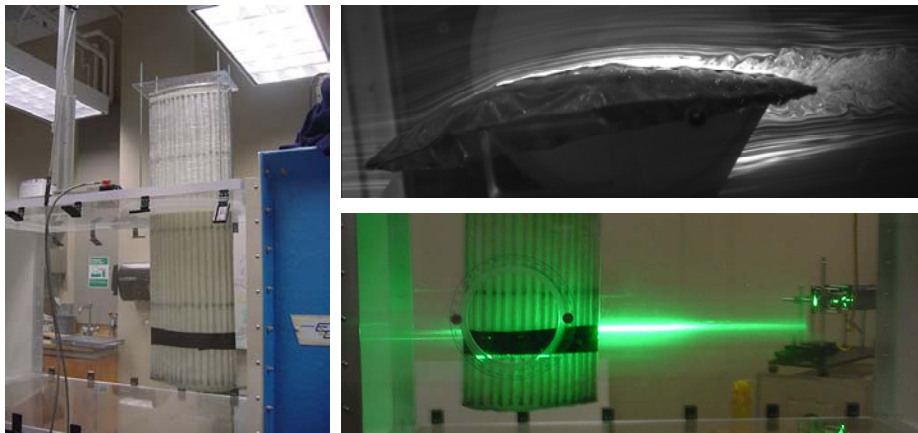
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.



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Wind Tunnel Testing

- PIV (flow field), 7-Hole Probe (lift/drag from wake), balance



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