Electric flight Keynote
Burt Rutan Osh 2010
Rutan Background Includes Energy Efficiency

Now building a 34-acre PV solar energy farm.

My Desert Pyramid House

Solar elect system on VariEze - 1976

Loss of my EV-1 Electric car in 2004. General Motors crushed them all
RAF gets solar water heat

1978
Out future for electric powered flight is now highly likely, not just a passing fad.

Practical continuous endurance solar flight is now demonstrated. Zephyr UAV just flew 2 weeks, 336hr. Solar Impulse flew manned 26-hour mission recently. Next gen performance improvements will see a high volume of electric aircraft for many applications.
The Design Challenge:

While impractical for most aircraft, special purpose applications will be the initial justification.

The availability of this new propulsion system is a very attractive challenge for a designer to develop an all-new aircraft optimized around the new propulsion hardware.....A designer’s dream.
Electric powered manned aircraft. Applications are limited now, but will likely increase in the future

- Tiny battery energy storage makes current electric airplanes impractical. However their flexibility and promised simplicity still attracts the hunt for applications.
- Energy storage efficiency improvements will drive the acceptance of future applications (or cheaper extension cords).
Initial (today’s) applications for an electric lightplane:

Self-launching sailplane.

Solo operation for launch. Reduces off-field landing risk. Likely multiple motors with folding or retracting props.
Propulsion backup for single-engine aircraft.

Two snap-on leading edge pods. Power for approach and go-around. The ’comfort’ of a twin. Instant power for high density altitude takeoffs.
Aerobatic show-plane – likely four-motor, reversing props.

High control power for low, or no q flight. Hover at any attitude. Backward flight. Run 4 for no torque effect, reverse 2 for high torque effects. Extreme acceleration, angular rates, etc.
Urban transporter.

For short-range commutes around ground congestion.

Launch-recovery: catch/catapult, wall snag, pendulum, steep runway, hover, etc
A practical aircraft for Dynamic Soaring.

Allows efficient launch into DS conditions.

Allows recovery after DS.
Why Electric Aircraft? (1)

- History shows new propulsion technology is the main reason we have large advances in aircraft.
  - Turbojet/turbofan example – low utility at first (range, cost, reliability & fuel availability). Special purpose initially, then expanded to be the norm for transportation and warplanes.
• For a “Green Planet”? **No.**
  
  – A green planet results from a CO$_2$-fertilized atmosphere, not a CO$_2$-starved atmosphere.
  
  – We became close to catastrophe several million years ago, with atmospheric CO$_2$ low enough to threaten all but sea life (<150 ppm kills plant life).
  
  – When CO$_2$ was 5 to 20 times current the planet was nearly all green, pole to pole. Diversification enhanced, deserts were few.
Why Electric Aircraft? (3)

• For “Oil Energy Independence” or “Peak Oil” reasons? **No.**
  – “Peak Lithium” for batteries - demand will soon increase cost, long before oil shortages occur.
  – “Peak Neodymium” (rare earth for motor magnets) – China has 95% of the resource and has already started limiting exports. Appears more critical than Oil Independence.
What is “Peak Oil”?
First, the scare chart.

Our kids will all freeze in the dark.
But, “Peak Oil” is a myth: A chart not intended to scare.
However, predictions for “Peak” Oil, Lithium and Neodymium are all wrong.

- Oil reserves have been calculated for 90 years and each decade the prediction of ‘years remaining’ has increased.
- The alarmists always leave something out – the creativity of the human mind; the ability to find better ways to find and mine the resource or to find alternatives.
- None of earth’s resources will be critical in the future as long as creative minds are free.
Inflation Adjusted
Monthly CRUDE OIL PRICES
(1946-Present) in January 2010 Dollars
© www.InflationData.com
Updated 3/11/2010

Dec. 1979 Monthly Ave. Peak
$107.35 in January 2010 Dollars

June 2008 Monthly Ave. Oil Price
$125.10 in January 2010 Dollars

Nominal Peak $38 (Mo. Ave. Price)
Intraday Prices peaked much higher

Inflation Adjusted Oil Price

Nominal Oil Price

Source of Data:
Oil Prices - www.eia.gov/forecasts/ieo/
CPI-U Inflation index - www.bls.gov
Questions?