

# Electric flight Keynote

## Burt Rutan Osh 2010



# Rutan Background Includes Energy Efficiency

Now building a 34-acre PV solar energy farm.



Solar elect system on VariEze - 1976

My Desert Pyramid House  
“Ultimate energy-efficient house” (Pop Sci Nov 1989).  
Primary car was zero-emissions EV-1, 1997 to 2004.



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.

## Why Electric Aircraft? (2)

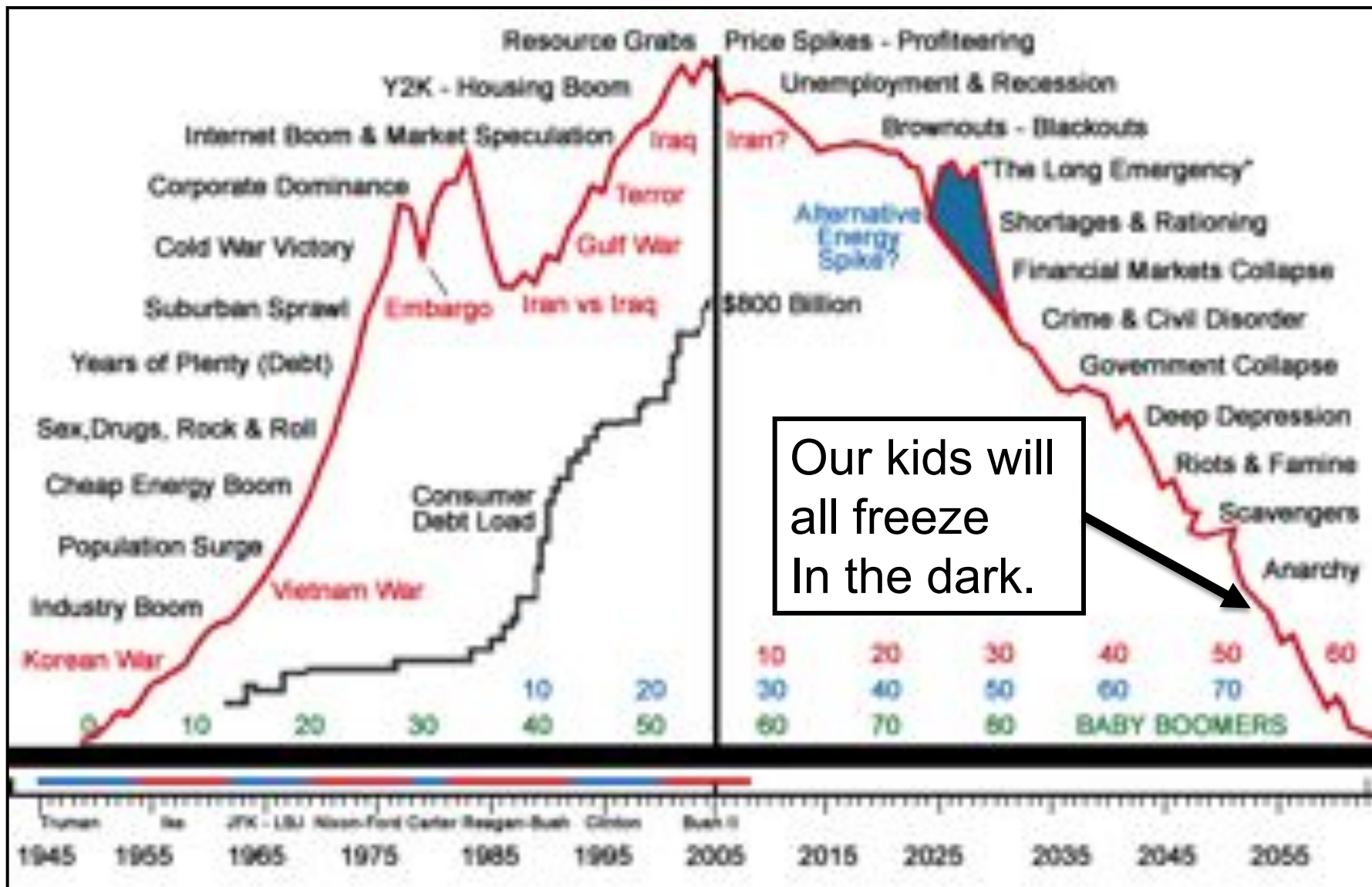
- For a “Green Planet”? **No.**
  - A green planet results from a CO<sub>2</sub>-fertilized atmosphere, not a CO<sub>2</sub>-starved atmosphere.
  - We became close to catastrophe several million years ago, with atmospheric CO<sub>2</sub> low enough to threaten all but sea life (<150 ppm kills plant life).
  - When CO<sub>2</sub> was 5 to 20 times current the planet was nearly all green, pole to pole. Diversification enhanced, deserts were few.

## Why Electric Aircraft? (3)

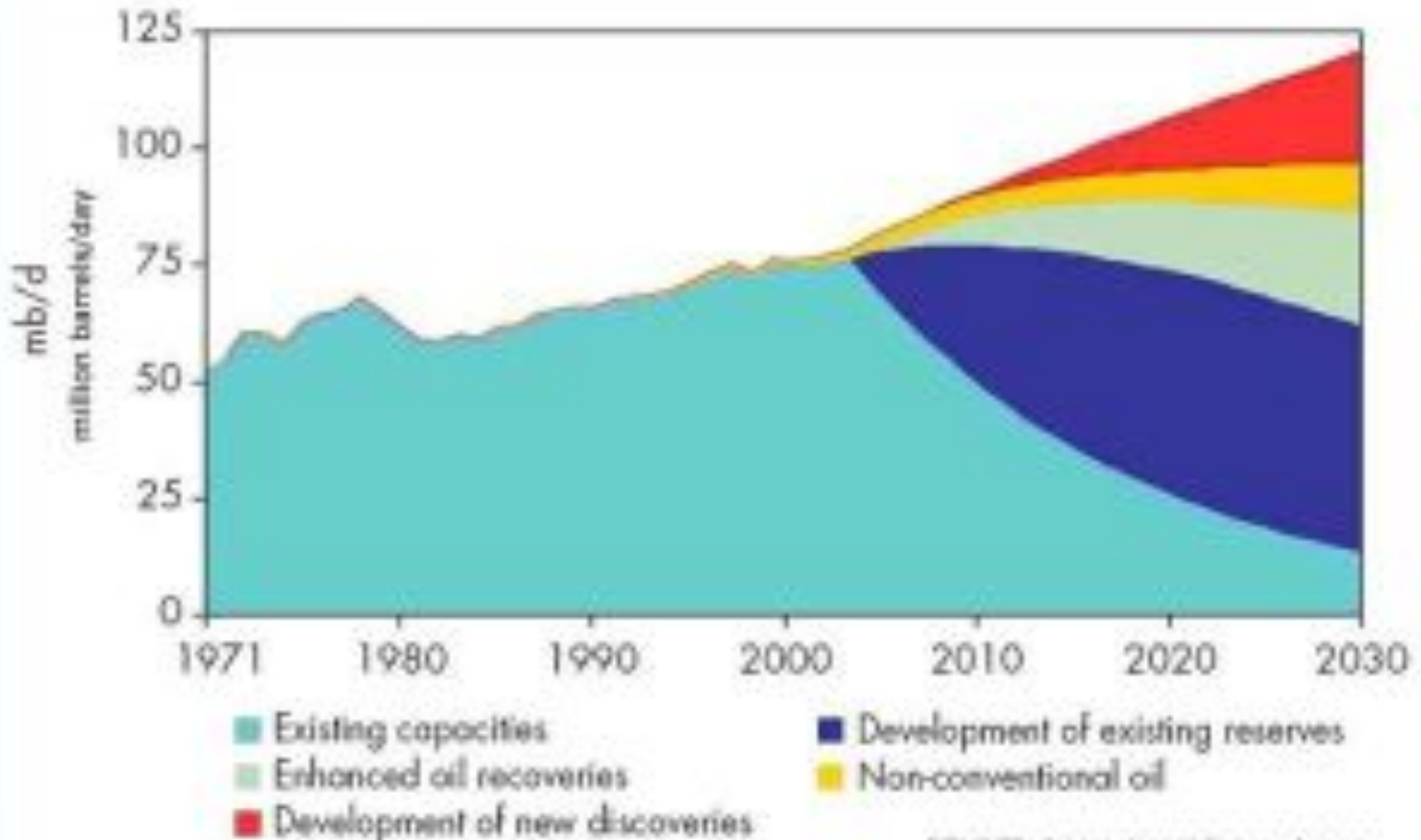
- For “Oil Energy Independence” or “Peak Oil” reasons? **No.**
  - “Peak Lithium” for batteries - demand will soon increase cost, long before oil shortages occur.
  - “Peak Neodymium” (rare earth for motor magnets) – China has 95% of the resource and has already started limiting exports. Appears more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

# What is "Peak Oil"?

## First, the scare chart.



# But, “Peak Oil” is a myth: A chart not intended to scare.



SOURCE: International Energy Agency



## 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



Source of Data:

Oil Prices- [www.ioga.com/Special/crudaoil\\_Hist.htm](http://www.ioga.com/Special/crudaoil_Hist.htm)

CPI-U Inflation Index- [www.bls.gov](http://www.bls.gov)

Questions?