

# Innovation Creativity Motivating our Kids

An Oshkosh 2010 presentation

By Burt Rutan



This presentation's content is based on Burt Rutan's own work experiences and hobbies.



# Aviation's Renaissance

## 1908 to 1914

- Early 1908, < 12 pilots
  - Then, “I can do it”.
- By 1912
  - Hundreds of aircraft types in 39 countries.
  - Aircraft invented by ‘Natural Selection’.



# Exposure During Childhood Leads to Adult Creativity

Inspiration begins early – Kids ages 3 to 14

# Kids Were Inspired by Aviation's Renaissance – these kids



- **Every one** of those that inspired **me**.
  - Wernher von Braun
  - Kelly Johnson
  - Charles Lindbergh
  - Jack Northrop
  - Ed Heinemann
  - Howard Hughes
  - Sergei Korolev
  - Alexander Lippisch
  - Bill Lear
- They were **all** kids during aviation's Renaissance.



# Standout Memories

## The Real Inspiration

- The Disney-Werner von Braun Vision, Disneyland television 1955
- The “Moonliner” at Tomorrowland 1954



# Aerospace Activity 1946 to 1957

## During my Childhood (age 3 to 14)



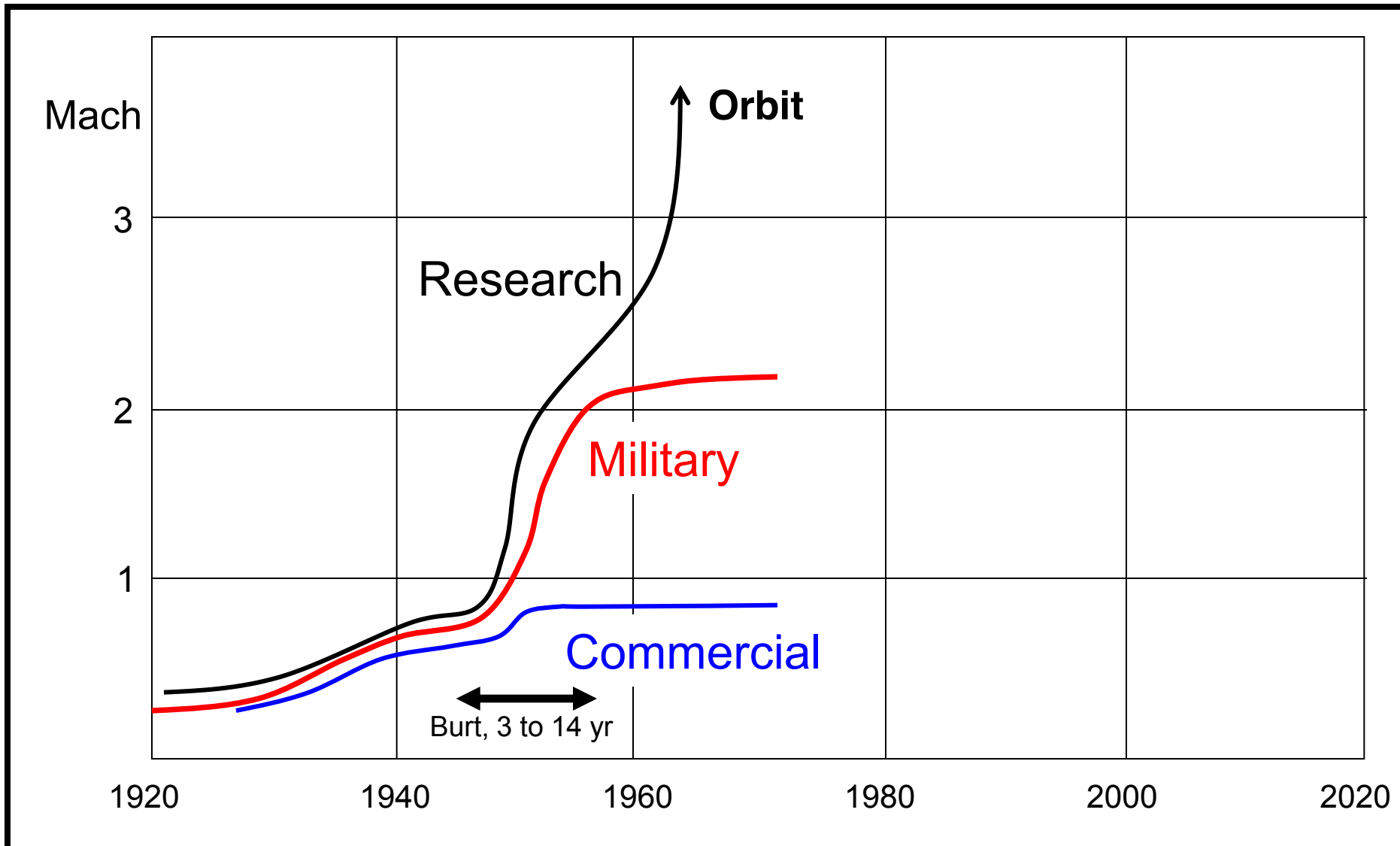
The Jet Age starts. The Missile Age starts.

# Childhood Activities Were Driven by Aviation Progress





# A Jump in Aviation Performance: My inspiration during childhood



# Next, A life with Toy Airplanes

## An AMA Presentation, Jan 2010

1948 (age 5)



2009 (age 66)



# The Early Years - 1950s

## A Passion for Airplanes and Competition



# First Controlline Stunt Model ~1955 (age 12)



Controline Stunt  
1957 (age 14)



Small Endurance Controline  
1956 (age 13)



Record Endurance Controline  
Nine-foot span  
1956 (age 13)



# WAM Contests

San Francisco Bay Area  
1956 to 1959 (age 13 to 16)





## Modeling Pop's Bonanza

Controline Scale 1957 - 1959  
Flown in 1959 Nationals at Los Alamitos

# AMA 1960 Nationals at Dallas (age 17)

## Nine events entered

Nordic Towline glider A-1 and A-2; inspiration for SS1 Feathered reentry?





# Fairchild F-27 Scale Model

Won Senior CL Scale  
1960 Nationals at Dallas



# The demise of the F-27



## Rutan's first Canard Design:

Push-Pull Twin RC

1962 at Cal Poly SLO (age 19)



## VariViggen design

tested in

Homebuilt Wind Tunnel

1962 at Cal Poly SLO



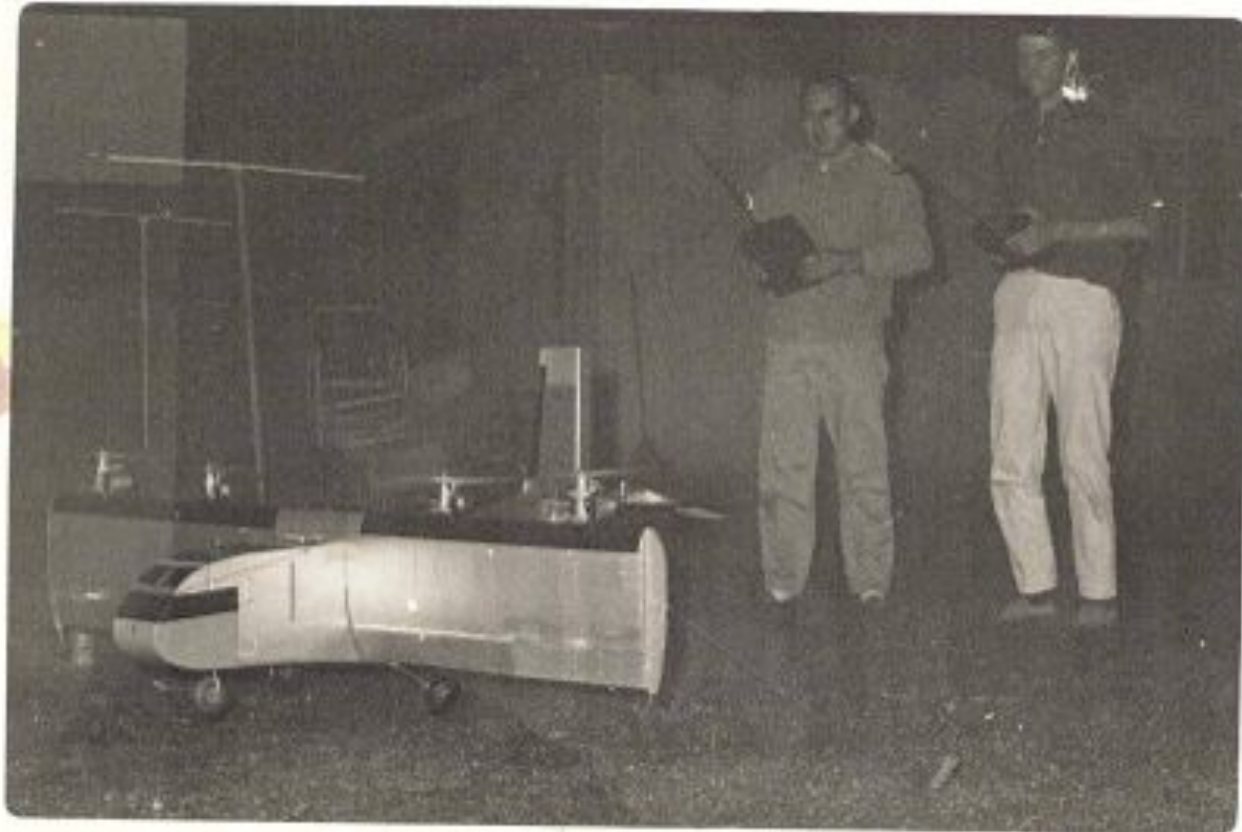


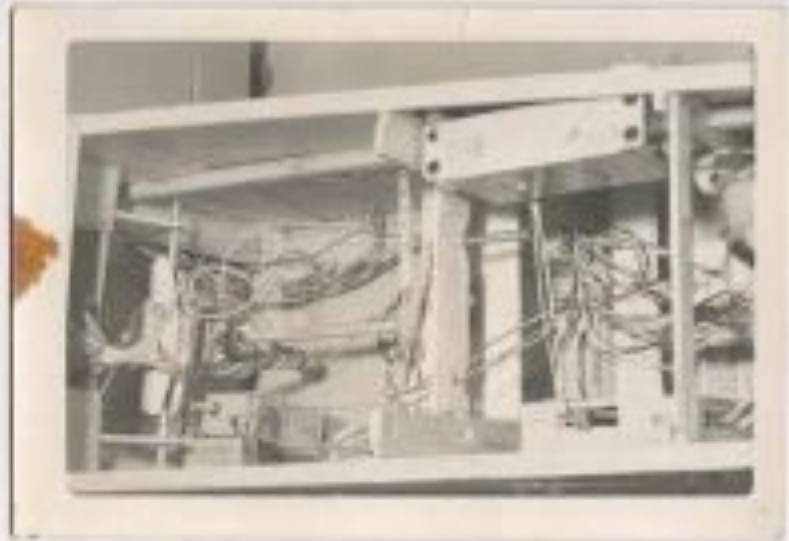
## Tilt-Wing VSTOL XC-142A

Five Engine RC

Two Receivers and Two RC Pilots

At Edwards AFB - 1965





# Another Homebuilt 'Wind Tunnel'

Car-top testing of VariViggen aerodynamics

1967



# Model-type structure Used on first homebuilt

VariViggen fabrication  
1967-1971



# Director of Development, Bede Aircraft

1972 to 1974

Design Projects: BD-5J and BD-5 Trainer







RAF  
1973 to 1985



# The Models of RAF

1973 to 1985



# The Classic Film, 'Death Race 2000'

featured the VariViggen - 1974





Manned Flight Test  
Scaled Composites  
1982-2009

# Some Models at Scaled

“Land Shark” for SpaceShipOne tail stall modifications 2003



Display Models  
1987



# The Very Best Place to Store an Old Airplane



# Innovation

Getting results from research efforts

Observations from a lifetime doing R & D



# Air Force Flight Test 1965 to 1972

The “whole-package” experience.

Best training for an aircraft designer





# A 'Jump Down' - 1972

## Founded Rutan Aircraft Factory

The entrepreneur can control his destiny



# The Rutan Aircraft Homebuilts

## Small Business - based on Fun



Grass-Roots Education



# Scaled Composites Company

Founded 1982, now employs 380.  
**We are hiring! See Jen and Elliot**

- Aircraft Research and Development.
- Concept Design through Manned Flight Test.
- Varied Customers, including Aerospace Primes.



# The Importance of Technical Innovation

## Our need for breakthroughs

- Key factor in the development of intelligence
- Satisfies desire for continuous improvement
- Technical progress defines our species

# Exposure During Childhood Leads to Adult Creativity

- Inspiration begins early – Kids ages 3 to 14

# Breakthroughs: Factors that drive our creativity

- Survival - From a real or perceived threat
  - A conquering adversary
  - Business survival - McCready Kremer prize
  - Environmental crisis
- To avoid embarrassment of perceived defeat
  - Apollo moon program
- Enjoyment
  - 'Fun' to accomplish difficult goal

# Breakthroughs: When

- When do breakthroughs occur?
  - During or shortly after:
    - Crisis, chaos, “bad” times.
  - Not:
    - During tranquil, stable, “good” times.
    - When highest priority is equal status of populous.
- We are creative when threatened.

# Breakthroughs: When

- We did not go to Mars in 80s & 90s (“good” times).
- But, we went to the Moon in 60s “bad” times:
  - Highest fear period of Cold War.
  - Bay of Pigs & Cuban Missile Crisis.
  - Chaos of unpopular Vietnam war.
  - Political murders: JFK, MLK, RFK.
  - Domestic race riots.



# Breakthroughs: How

- 'Confidence in Nonsense' is allowed.
- Breakthroughs occur by:
  - Risk; trying things that may not work.
  - Looking for something else – stumble into it.

# Breakthroughs: How

- Breakthroughs cannot be specified by massive funding.
  - Example: Low cost space access was the **goal** of the Space Shuttle Program.
- Breakthroughs occur due to the working environment.
  - Kelly Johnson 'Skunk Works'.

# Breakthrough Observations

R & D experience has **inverse** relationships.

- Value of product....Self-perceived sophistication of customer.
- Content of new technologies....Program timeline – Apollo vs. Ares/Orion.
- Product's worth....Risk-averse role of managers – Saturn/Apollo vs. Ares/Orion.

# How to Achieve Breakthroughs

## Creativity vs. productivity elements

### • **Productivity**

- Managed by: Spec/Schedule
- Involves: Analysis/Iteration
- Process must be defined
- Accuracy is critical
- Mistakes are bad
- Many can be trained to design
- Can grade progress
- Sensible approach is desired

### • **Creativity**

- Managed only by: Goal
- Involves: invention/thought
- Process cannot be defined
- Accuracy unimportant
- Multiple failures expected
- Unclear who can create
- Can only grade goal (y/n)
- Confidence in Nonsense is ok

# How to Achieve Breakthroughs:

## Creativity requires a specific environment

- **Productivity**

- Equipment: Extensive analysis Hardware/Software
- Engineers need indirect shop interface
- Continuous data access
- Typical office distractions are expected
- Continuous schedule tracking
- Boring environment requires human interaction

- **Creativity**

- Equipment: Sketchpad or SketchCAD
- Creators have authority in laboratory
- Occasional research info
- Extensive solitude/relaxed environment required (nature)
- No schedule, no time focus
- Innovators must have *fun*

# The Management of Innovators

Manager's **only** tasks: Set goal and get funding.

- Set difficult goal (50% should say impossible).
- Reward achievement of goal (power of a prize).
- Let the innovator decide what risks to take.
- Leave them alone and keep others out.
- Applaud courage and expect multiple failures.
- Allow *fun*.

Managers:  
Want Innovation?  
Do **not** “manage”.

*“If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea.”*

*-Antoine de Saint-Exupery*

# Our Responsibility Now - Create Progress to Inspire our Kids

- Our Technology leaders had their inspiration in exciting times.
- Periods of extreme technical progress:
  - Aviation's Renaissance, 1908 to 1912
  - My inspiration, 1946 to 1957, post WWII
  - Gagarin to Skylab, 1961 to 1973



# The Inspiration for Space Exploration

## Restructuring of Government manned spaceflight

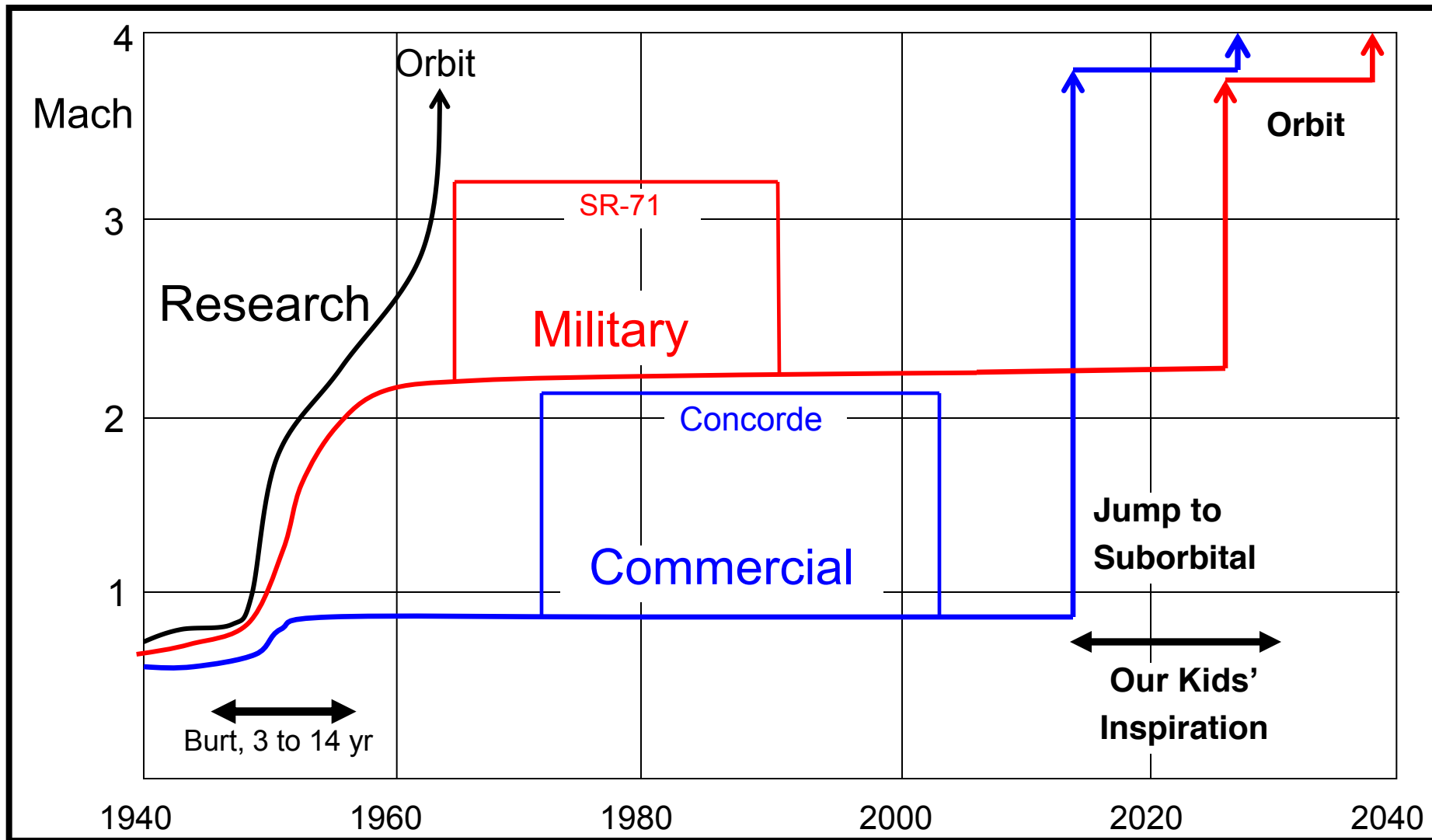
- Competitive 'New-space' can do LEO, but NASA must do forefront exploration.
- Move to commercial sounds attractive, but does it have real advantages? The tech oversight and the ISS safety requirements limit innovation.
- Clearly SpaceX and Orbital will succeed on LEO access, but will it end at the Gemini capability? (1965), or will they really explore?



Sorry about that, kid.



# A Prediction: Commercial Performance May Exceed Military



# U. S. Competitive Position: Science and Engineering Education

- The education statistics are bleak.
  - Science/engineering vs. lawyers/media/politicians/actors\*
  - \* And other criminals
- The real reason – We are boring our youth.
  - Development vs. research
- The solution – take real risks, to motivate our kids.
  - Exploration
  - Adventure
  - Breakthroughs
- Strive to be great, not to be ‘equal’.

# Take Big Risks

Most impressive aircraft - Lockheed SR-71

Designed in 1959, only 14 years after first USAF jet.  
First flown in 1963.

Abandoned in 1998, retreated to 1956 U-2.



P-80  
1945



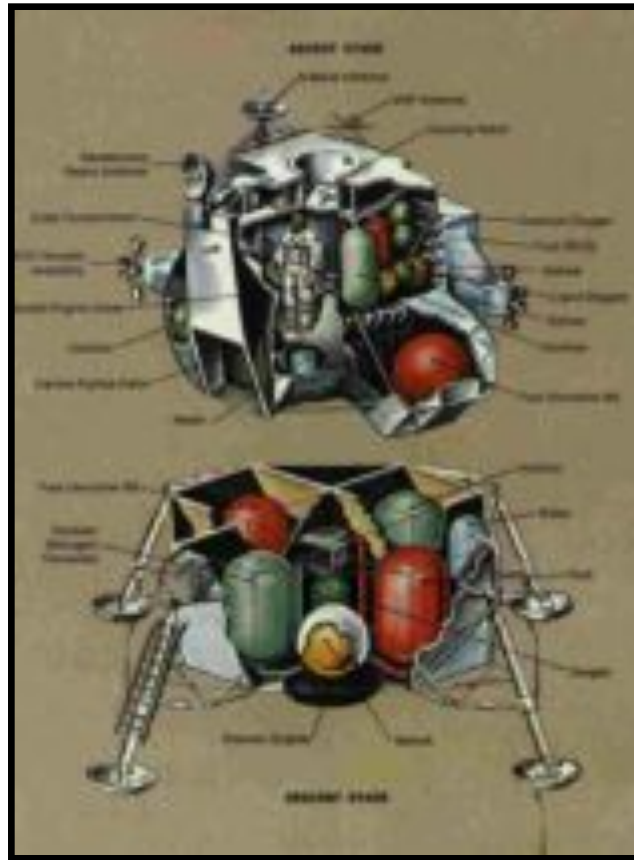
# Take Big Risks

## The Most Impressive Spaceship - Lunar Module

Designed in 1964, three years after Gagarin.

First flight 1968.

Abandoned capability in 1973.



# The Future

## A **Super** Renaissance?

- Factors that Enabled Original Renaissance
  - Basic Physical and Chemical Science
  - Printing Press (communication)
- Recent Advances - These will enable a SR
  - Computational Explosion & Super Internet
  - Corralling Chaos, Quantum Mechanics
  - Virtual Reality.... Resolution > our human sensors
  - Manufacturing at the molecule level; home factory
  - Zero-Point Energy or another TBD energy source
- The Next 30 Years - Dramatically Different

# Humanity's future in a connected world

- Our need for physical travel disappears, if a virtual mode is available – We will ‘travel’ more than before.
- Countries – defined by values and beliefs, not by geography. Chose a different ‘country’ without changing where you sleep.
- Exploration and Discovery – Increased activity is essential.
- Humanity – Its definition is a moving target. We are just getting started ‘being human’.

# Questions?

