

THE  
**COMMERCE**  
OF  
\$MALL \$ATELLITE\$  
AUG 2-7, 2014



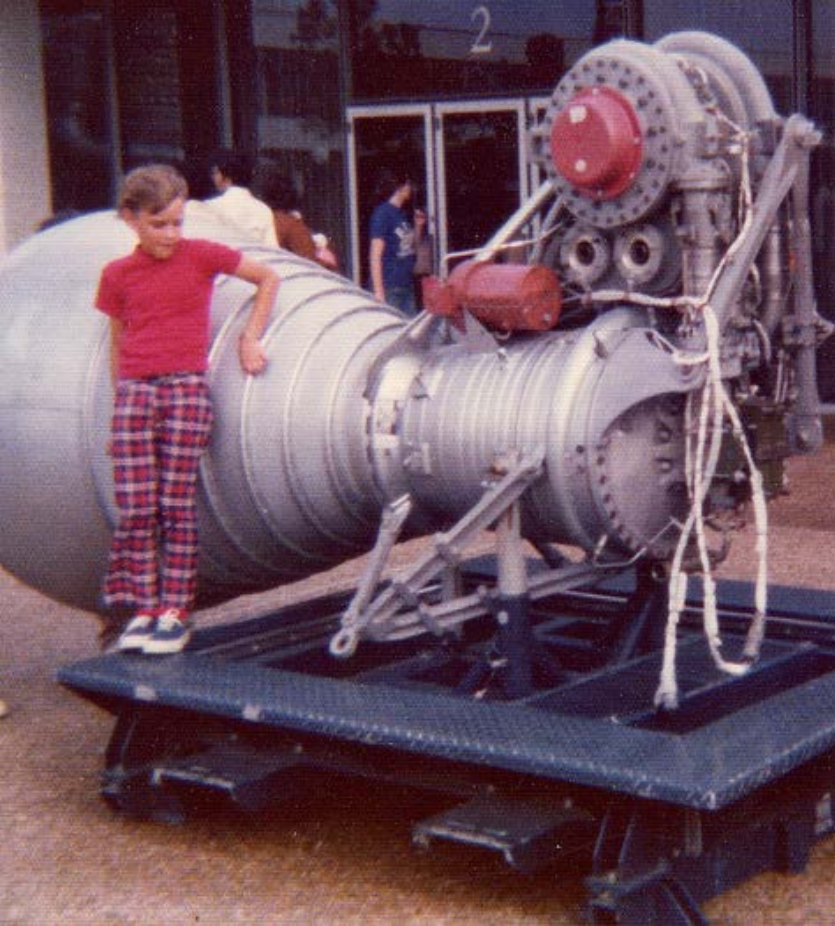
Disruptions in Space  
Steve@DFJ.com

**STEVE JURVETSON**

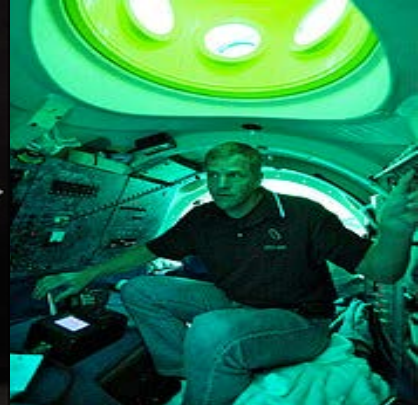


**DFJ**

# Childhood Influences













# Rocketry Evangelism

HBR  
LIST  
2009

## Launching a Better Brain

**BY STEVE JURVETSON** Our education systems and workplaces plunge us into deep mental ruts. They reward competencies that are self-reinforcing, not diversifying, and they encourage people to acquire domain expertise rather than ask stupid questions and learn new things. We need to find our way out of these ruts and rekindle the creativity that many of us left behind in childhood.

As a kid, I loved playing with Legos. Now I build and launch model rockets. (In 2003, when I was browsing the local hobby shop for something fun to do with my son, I saw some rocket kits on the wall. My childhood was rediscovered!) Besides being flat-out fun, rocketry helps preserve my childlike mind, which continually learns and grows through play and discovery.

Human cognitive development peaks in the teen years, plateaus into our late thirties, and then begins a gradual descent that lasts until death. Rarely can people orchestrate their lives to provide regular mental pursuits capable of combating that decline.

The common wisdom is that after childhood we have a fixed number of neurons, which gradually die off during our lives, and that these neurons are organized in a fixed architecture. Not true: New neurons are born throughout life, and synaptic connections are being formed and erased all the time. This phenomenon is called neuroplasticity.

Cognitive exercise—or the lack of it—can dial the rate of rewiring up or down.

This explains, in part, why—besides having fun—I would want to shoot off rockets in the desert. To be sure, my business life is engaging and demanding. But its rhythms are familiar and often predictable. So I've learned to seek out unaccustomed inputs. I keep challenging my mind by mastering new skills. (Last year I learned how to fiberglass and how to take a rocket superionic.)

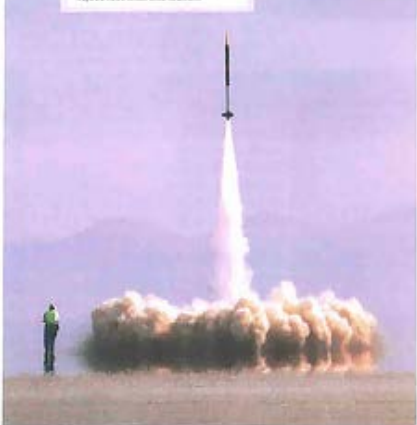
My work, which involves evaluating start-up businesses and their leaders, benefits from this. I am comfortable in the midst of new ideas and approaches, from nanotechnology to synthetic biology. And I'm not an odd man out in this regard—my firm's experience shows that a playful culture bears fruit.

Rocketry may not be for everyone. But I can't imagine a single business leader who wouldn't benefit from engaging in some pursuit—novel writing, wood carving, Civil War reenactment, whatever—that transcends the routine world and challenges the brain. Cognitive exercise will keep you agile, adaptive, and fit for life, in business and beyond.

And if you'd like to try rocketry, let me know, at [stevej@boxba.com](mailto:stevej@boxba.com).



Right: Blastoff captured from above by a video camera attached to one of the author's rockets. Below: A fellow rocketeer achieved an altitude of 46,000 feet with this launch.

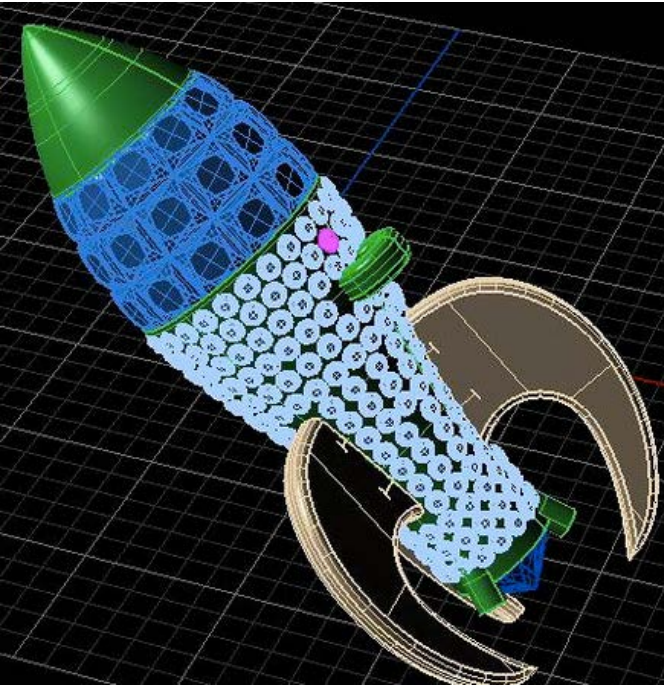


Steve Jurvetson





# Geek Chic







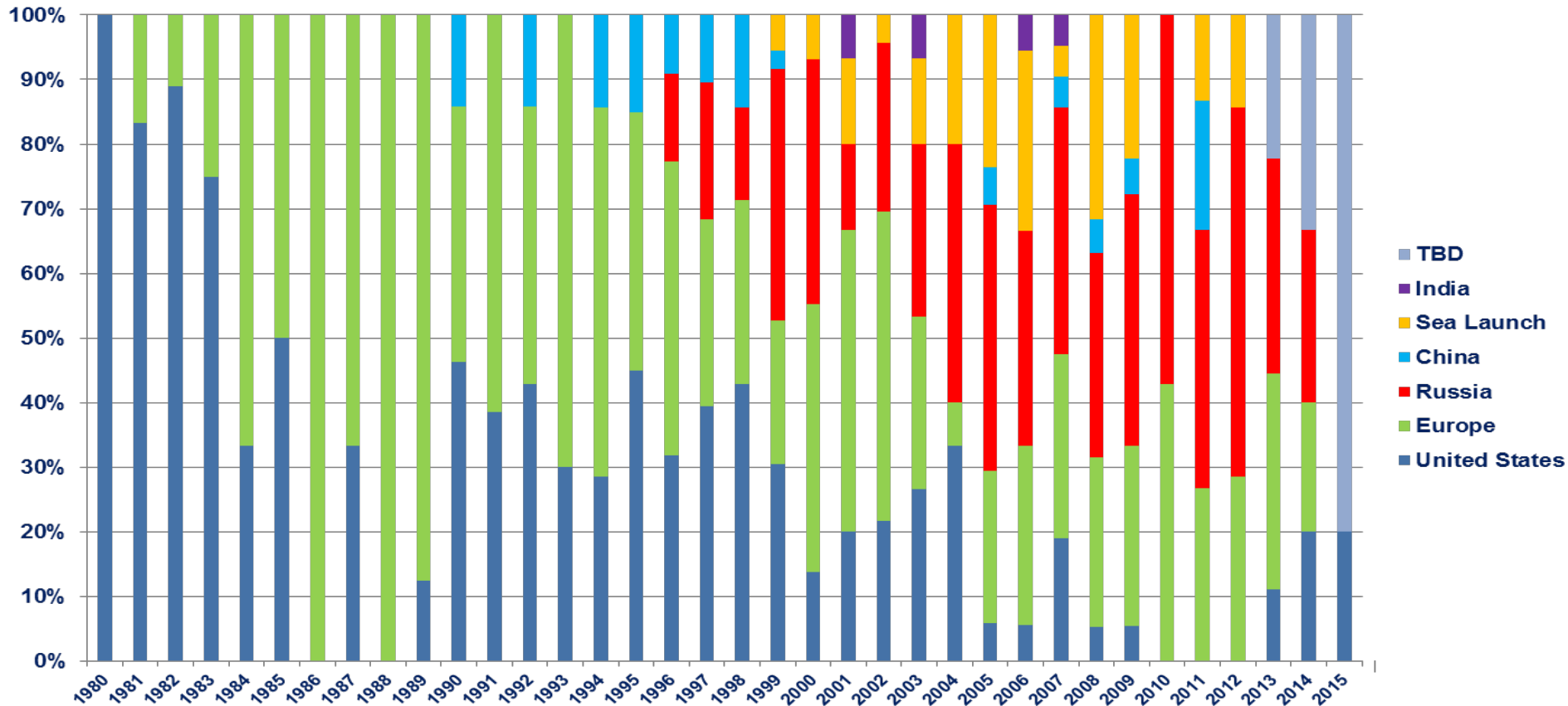
SPACEX



# Commercial Launch



# Commercial Space Market Share





**“Escaping from Earth will not always be astronomically expensive. This will come... through the development of reusable boosters, which can be flown for hundreds of missions, like normal aircraft.” — Sir Arthur Clarke**



# Landing Legs











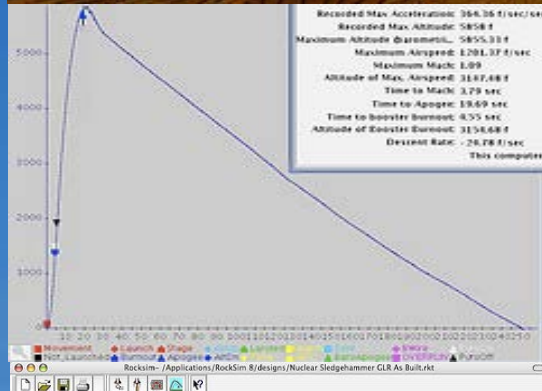
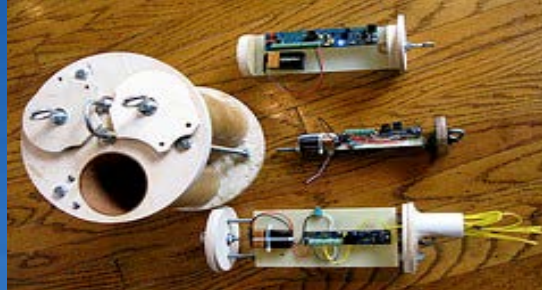


# How To Train Your Dragon 2



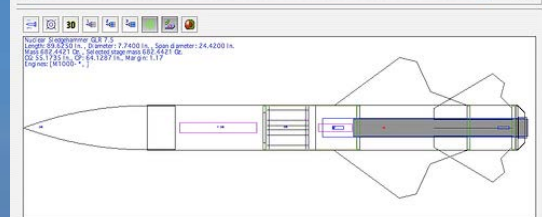






Rocket design attributes | Rocket design components | Mass override | Cd override | Flight simulations

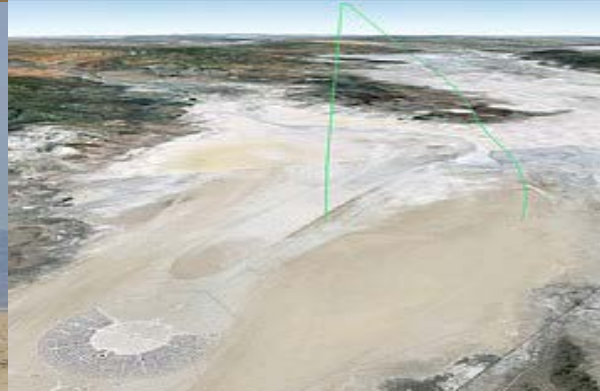
Simulation	Results	Engines loaded	Max altitude Feet	Max velocity Feet/sec	Max acceleration Feet/sec <sup>2</sup>	Time to apogee	Velocity at deploy Feet/sec	Altitude Feet
1	2	[M1000-]	9720.70	835.34	663.55	24.28	0.02	
2	1	[M1315W-]	8741.67	871.20	663.17	22.56	10.84	
3	0	[M1400-]	8219.03	866.51	663.57	21.71	8.42	



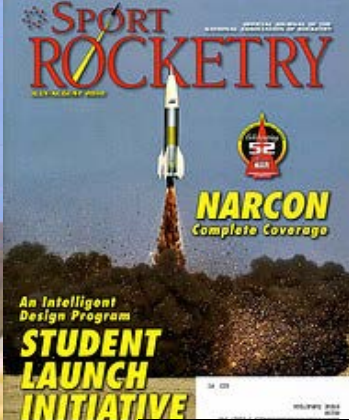
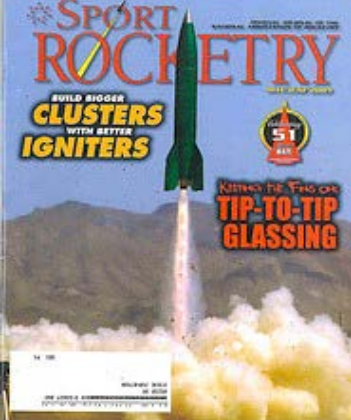
Prepare for launch...













## RocketMavericks



"Space travel is returning to where it started: with maverick pioneers dreaming of journeys to orbit and beyond, some carrying out rocket experiments in their own backyards. The rise of citizen astronauts has already begun."

Sir Arthur Clarke, 2007





N40 48 764  
W119 08 702

Hdg: 72.3  
Speed: 320

Time 18:51:10  
Alt 31810 KCOGTV KCMO TV



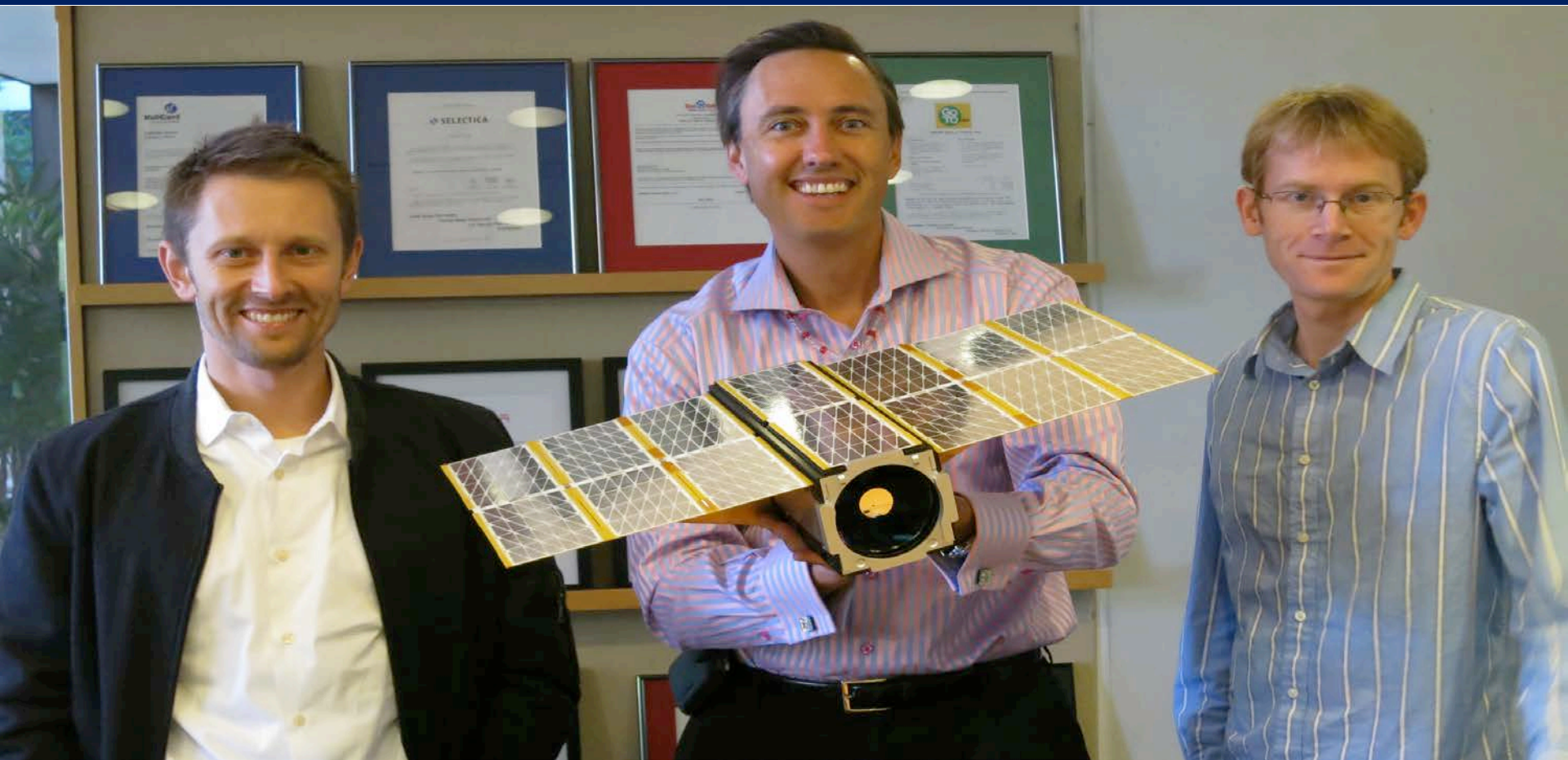
# PhoneSat testing in the Black Rock Desert





# PhoneSat remains at MakerFaire 2014







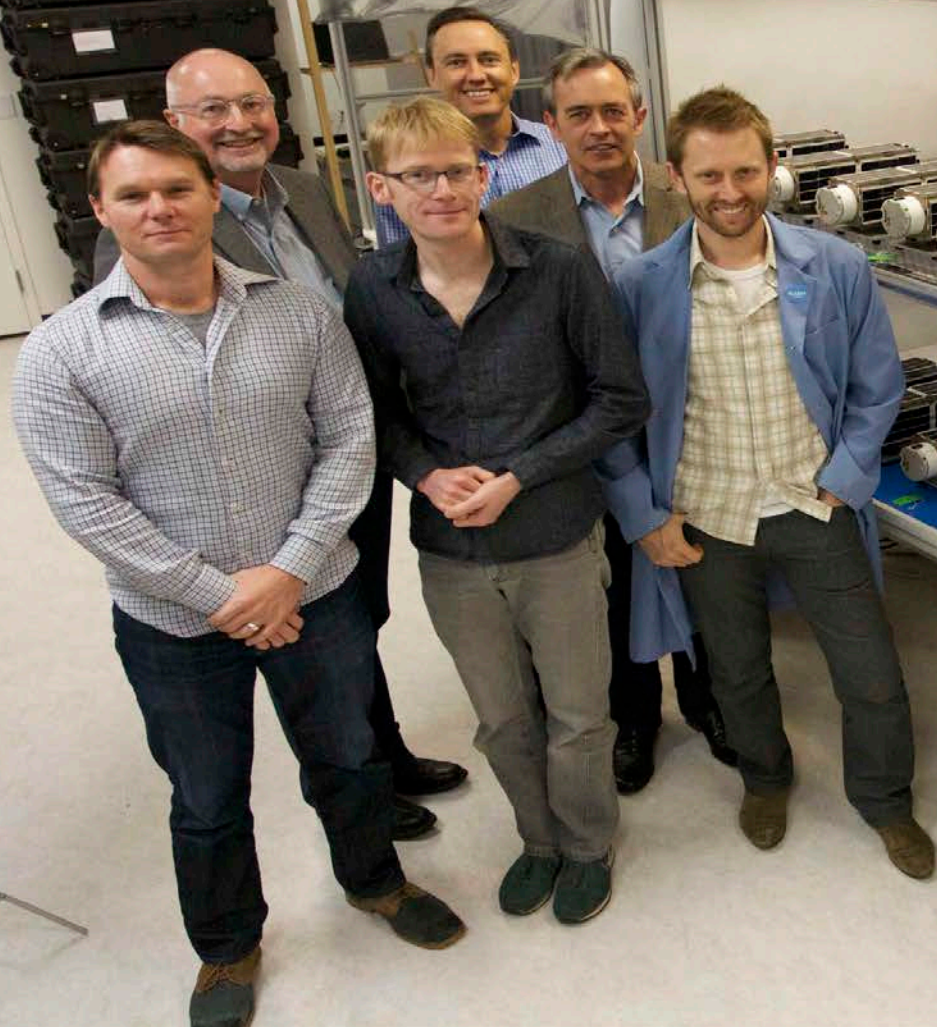








# Flock of Doves










UC Davis



FIRST LIGHT FLOCK 1 - FEBRUARY 2014

Calvin Fisher



An aerial photograph showing a patchwork of agricultural fields. Several large, circular fields are prominent, some with vibrant green crops and others with brown or orange hues, possibly indicating different stages of growth or different crops. The fields are separated by narrow roads and drainage ditches.

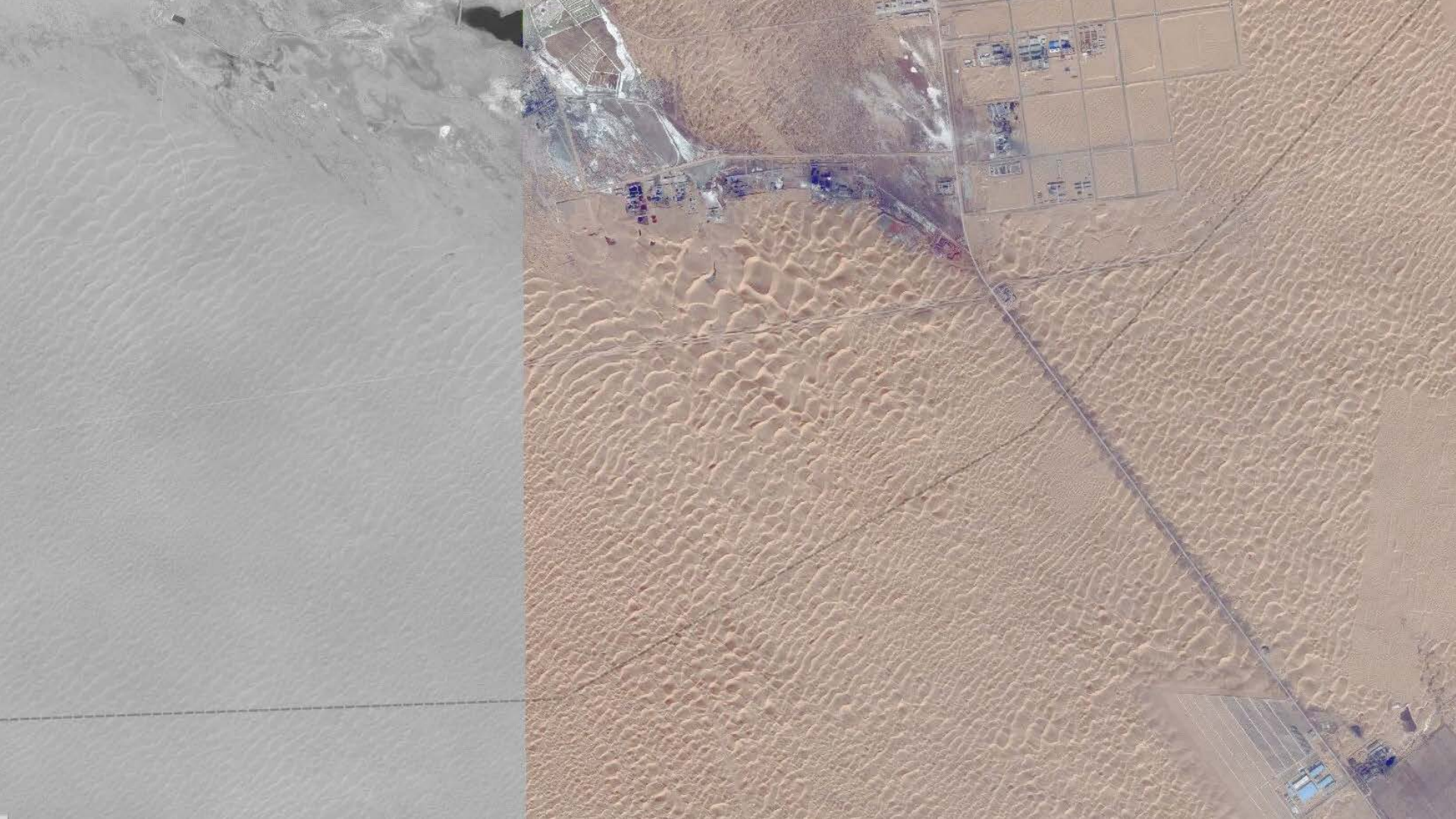
**15 months:  
6 launches  
71 satellites in orbit  
New build every 6 weeks**











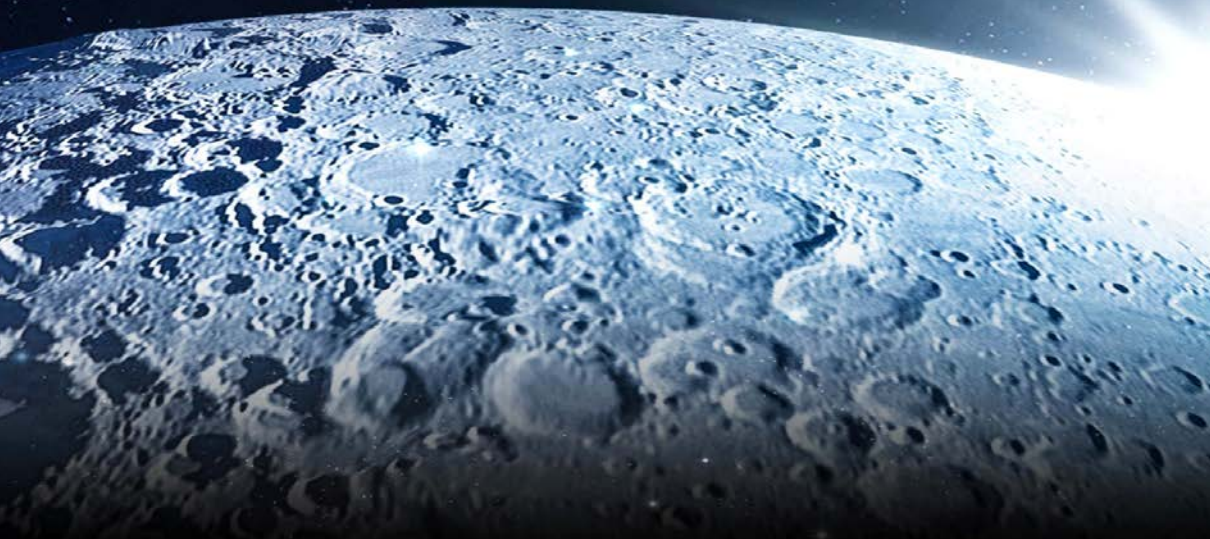


# Low Cost Strategies for Lunar Settlement

A One Day Workshop to Backup the Biosphere

Saturday August 23rd 2014 | 9am to 5.30pm

At Draper Fisher Jurvetson, 2882 Sand Hill Rd #150,  
Menlo Park, CA 94025



SPONSORS:



PLANETARY  
SUSTAINABILITY  
NETWORK

# Disruptive Innovation — Why now?

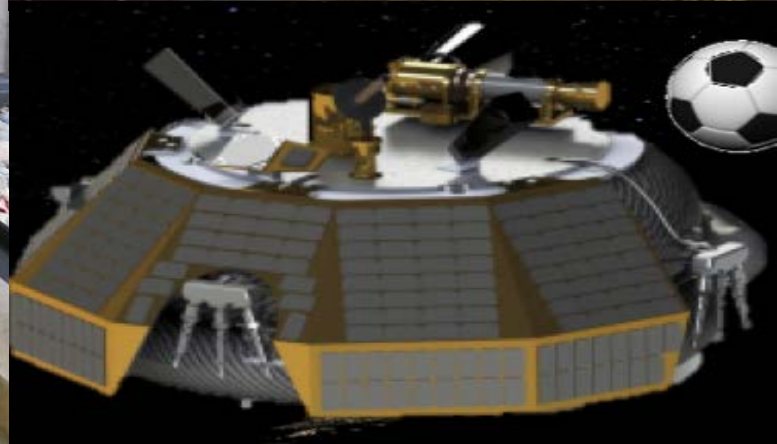
- **Cheaper Access**
- **Simulation**
- **Commodity Hardware**
- **Dematerialization of Value**
- **Global Markets**
  
- **Agile Aerospace**







# 3D Printing







John Young  
JULY 18, 1966

Michael Collins  
Gemini X

**“This is the best view of the universe that a human has ever had. We are gliding across the world in total silence, with absolute smoothness; a motion of stately grace which makes me feel God-like as I stand erect in my sideways chariot, cruising the night sky.” — Michael Collins, *Carrying the Fire***



Photo by Don Petit





"it's so small...  
and it looks like it  
couldn't put up a  
very good defense  
against a celestial  
onslaught."  
— Neil Armstrong



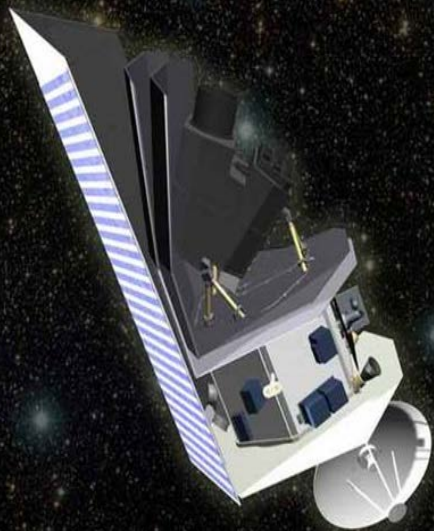


B612

Thousands of objects that  
could take 10 to 20 years  
to see from Earth

Poor detection efficiency  
from Earth

Nominal  
search region  
available  
from Earth



NEO Survey  
Observatory  
200° FOR

0.71 AU  
(Venus' Orbit)

Venus

1 AU  
(Earth's Orbit)

Earth

Sun



~0.70 AU  
(Spacecraft Orbit)

Search region available for the *NEO Survey Observatory*

Represented orbits  
are to scale



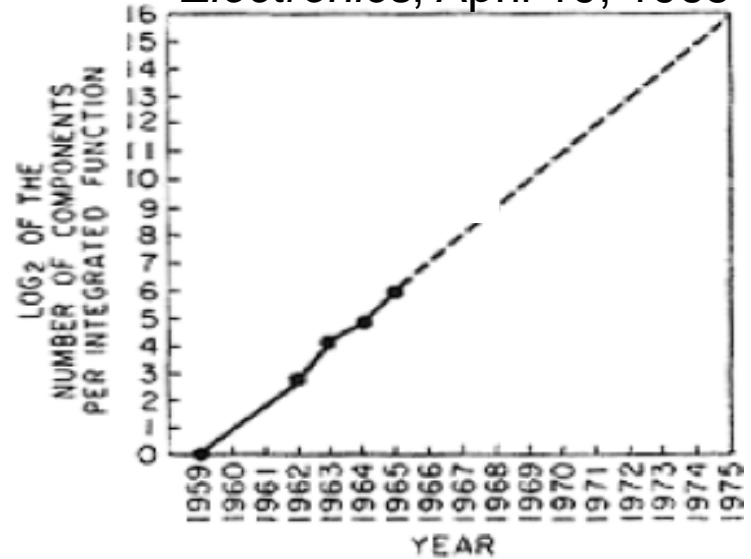
# New Space opportunities

- Low cost launch 
  - Novel Launch Vehicles – for tourism and small sats
- Rethinking LEO
  - Remote Sensing 
  - Broadband [\[world-vu.net\]](http://world-vu.net)
- Ultimate Recycling & Sustainability Challenge
  - Energy harvesting, storage, and transmission
  - Resource extraction
  - Organic waste conversion, water purification
  - Syn Bio: Anaerobic bioconversion

# Evermore Moore

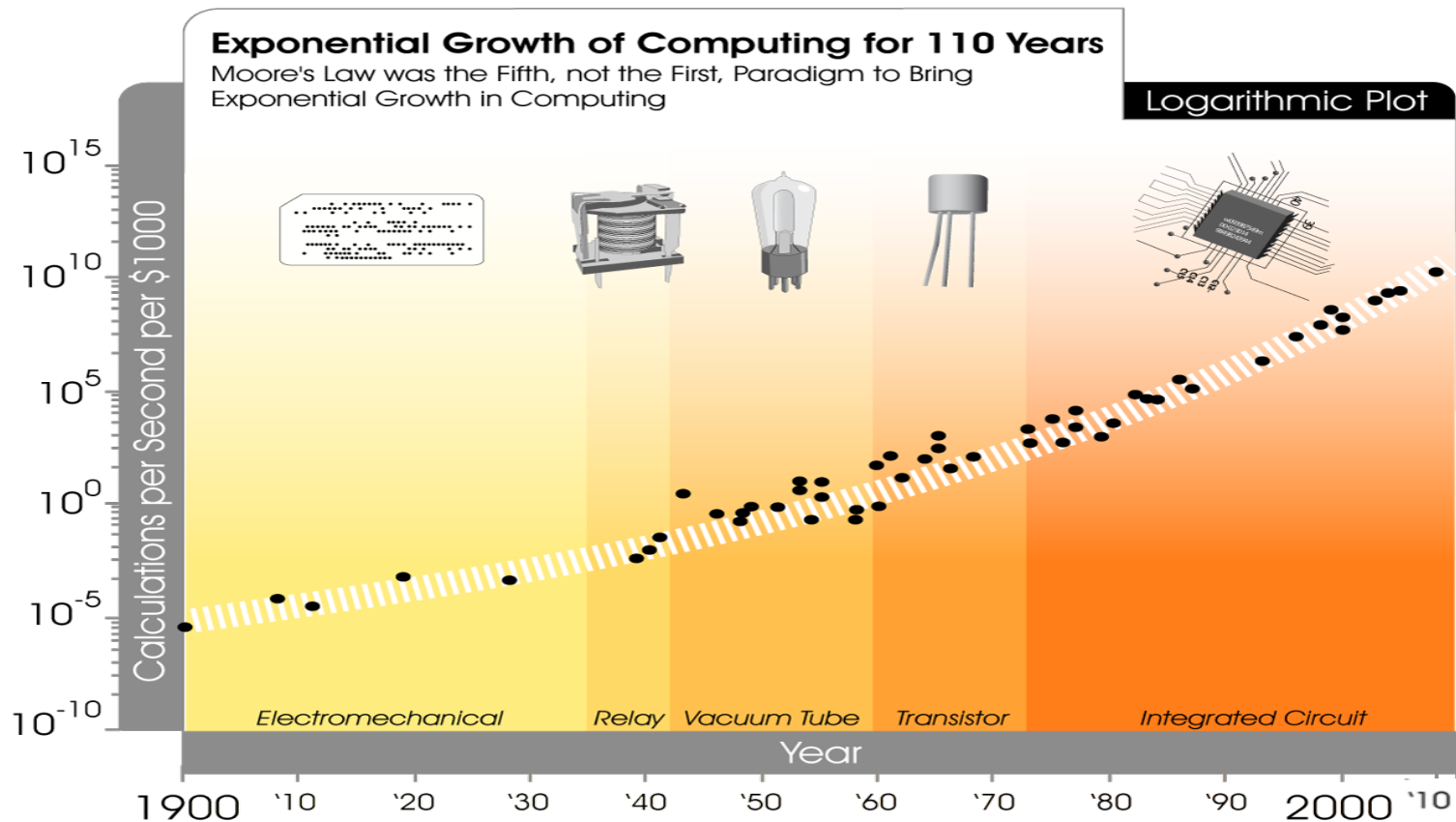


*Electronics, April 19, 1965*





# Compounding Capacity to Compute

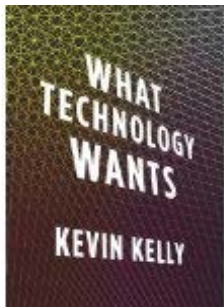


Source: Ray Kurzweil (each dot is a computing machine)

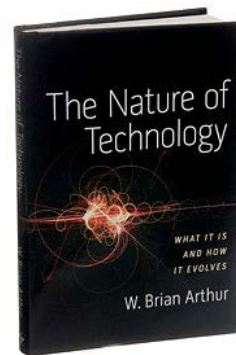
# Why does technology accelerate?

“All technologies are combinations of technologies that already exist.” —

- Combinatorial Explosion
- Creates Economy



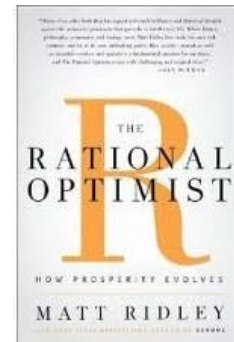
— “Science quickly became the greatest tool for making new things the world has ever seen. Science was in fact a superior method for a culture to learn.”



“Throughout history, the engine of human progress has been the meeting and mating of ideas to make new ideas. The human race will prosper mightily in the years ahead, because *ideas are having sex* with each other as never before.”

- Urbanization
- Interdisciplinary Disruption
- Globalization

—

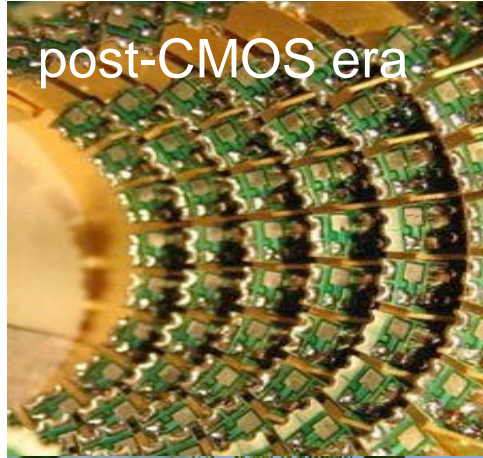




# Disrupting Many Industries



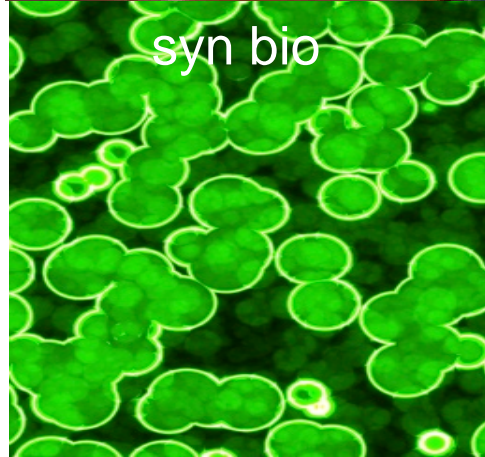
robots & AI



post-CMOS era



manufacturing



syn bio



agriculture



new space

# Summary

## Accelerating Technological Change

- Interdisciplinary Renaissance
- IT innervates \$T markets
- More Black Swans
- Perpetual driver of disruption
  - ⇒ Virtuous cycle for entrepreneurs
  - ⇒ a great time for the new





**THANK YOU**

**Steve@DFJ.com**

