How Visionary Entrepreneurs Are Privatizing Space

The Next big Thing

Colorado Space Grant Consortium Seminar

Dr. James R. Stuart
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Brief History of Commercial Space Privatization

- Brief History of Space
- Government Space Achievements
- Government and Big Corporate Commercial Space Achievements
- Beginnings of Entrepreneurial Space Privatization
- Visionary Space Entrepreneurs’ Projects
1813 William Moore

1903 Konstantin Tsiolovsky

1915 NACA formed

1926 Robert Goddard - first liquid rocket

1938 Werner von Baun - V2 rocket prototype

1945 Arthur C. Clarke - “Extra-Terrestrial Relays”

1957 USSR Sputnik

1958 NASA formed
Brief History of Space (cont’d)

- 1957 Vanguard
- 1958 NASA/JPL’s Explorer-1
- 1960 von Braun - Director of NASA MSFC
- 1961 Yuri Gregarin - 1st tourist orbits Earth
- 1961 Alan Shepard - 1st USA suborbital
- 1962 John Glenn - orbits Earth
Brief History of Space (cont’d)

- 1962 AT&T Telstar satellite
- 1963 Joe Walker - X-15 to 67 miles
- 1964 Intelsat formed - 120 countries
- 1969 Moon Landing
October 16, 2009

Brief History of Space (cont’d)

- 1981 First Shuttle Launch

Dr. Joe Allen 1984

FOR SALE

1984

1986

2003
Brief History of Space (cont’d)

- 1986-2001 USSR/Russian MIR Space Station
Brief History of Space (cont’d)

- 1998-Present International Space Station
Brief History of Space (cont’d)

- 1997 Mars Rover - Pathfinder
- 2004 Mars Rovers - Spirit and Opportunity
Brief History of Space (cont’d)

- 2005 Saturn’s Titan Lander - ESA Huygens

- 2006 Saturn’s Enceladus

Cassini Flew ‘through’ Water Geysers
Brief History of Space (cont’d)

- **2008 Titan 2nd Underground Ocean Discovered**
  - Underground Water Ocean
  - Ice Volcanoes, Weather, Rivers, Lakes

- **2008 Mars Lander Phoenix**
  - Surface Methane Lakes
  - Water Ice and Ice Crystal Snowfall

- **2009 Lunar Ice**
  - In South Pole Craters
  - + global thin $\mathrm{H}_2\mathrm{O}$ film layer
  - LCROSS
  - Cabeus Crater
GPS

DirecTV, Liberty, EchoStar, etc.

- Dr. John Malone
  1973 CEO of TCI
  1998 sold for 48B$

- Charlie Ergen
  Professional Gambler
  1980: sold Big dishes
  EchoStar is >6B$
Rene Anselmo - Maverick Privatized Sat Com Industry

“Truth and Technology will Triumph Over Bullshit and Bureaucracy”

- 1963 Founded Spanish International Network
- 1984 Founded PANAMSAT
- 1987 Sold SIN (UNIVISION) for $80M
- 1988 Launched PAS-1
  - Refurbished Satellite, 1st Ariane 4 Launch
  - Broke INTELSAT Monopoly
  - 1991 NYT Cartoon Ad - ‘My Dog Spot’
    Urinating on legs of problem politicians
- 1995 Died at 69 (2 days before IPO)
- 2004 PANAMSAT sold for $2.6B
Rene Anselmo - Maverick Privatized Sat Com Industry
Entrepreneurial Space Privatization

Beginnings (cont’d)

- Drs. Joe Allen, Max Faget - First Private Space Station effort
  - 1982 and 1984 Shuttle Astronaut
  - 1985 Joined Space Industries Inc.
    - Founded 1982
    - INDUSTIAL SPACE FACILITY
    - Private/Government Partnership
  - 1988 Reagan requested $700M
    - No Congress Approval
Entrepreneurial Space Privatization
Beginnings (cont’d)

- **Orbital Sciences Corp**
  - 1982 Founding
  - 1984 $50M LP Raise
  - 1986 $160M in TOS Sales
  - 1990 Pegasus 1st Launch
  - 1990 IPO (NYSE: ORB)
Entrepreneurial Space Privatization Beginnings (cont’d)

- **Low Earth Orbit Constellations Bubble**
  - **Big Corporations** - Spent $ Billions
  - **Bubble Burst** - No Market Uptake - Lost $ Billions

- **1991 Iridium** - Motorola
  - 1998 Service Start 1999 Bankruptcy

- **1991 Globalstar** - Loral and Qualcomm
  - 2000 Service Start 2002 Bankruptcy

- **1991 Orbcomm** - Orbital Sciences
  - 1996 Service Start 2000 Bankruptcy
Entrepreneurial Space Privatization Beginnings (cont’d)

- **Teledesic** - $10B Mega Constellation
  - 1990 Founded
  - 1997 Licensed Granted
  - 1998 IPO scheduled
  - 2003 Liquidated

- **Bill Gates** and **Craig McCaw**
Entrepreneurial Space Privatization Beginnings (cont’d)

- **1993** Leo ONE PANAMERICA
  - Jose Manuel Villalvazo Baz (was 38)
  - Mexico License granted 1995 Closed 2002

- **1994** Leo ONE USA
  - David A. Bayer (was 51)
  - USA License granted 1998 Closed 2002

- **1995** KiTcomm
  - H. James Kennett (was 36)
  - Australian License granted 1997 Closed 2004
Entrepreneurial Space Privatization Beginnings (cont’d)

- Innovative Launchers Caught in Bubble
  - Rotary Rocket Corp.

- Gary Hudson (was 45)
- Tom Clancy
Entrepreneurial Space Privatization Beginnings (cont’d)

- Innovative Launchers Caught in Bubble (cont’d)

  - American Rocket Company
    - 1985: George A. Koopman (1944-89)
      - Founder: Insgroup Inc.
      - Produced: Movies, Books, Albums
      - Founder: AmRoc
    - $20M invested: 300 rocket tests
    - 1998 IP Sold to SpaceDev
Entrepreneurial Space Privatization Beginnings (cont’d)

- Innovative Launchers Caught in Bubble
  - Kelly Space & Technology Astroliner

Mike Kelly (was 39)
Entrepreneurial Space Privatization Beginnings (cont’d)

- Innovative Launchers (cont’d)
  - VentureStar X-33
    - Dave Urie, Proj Mgr
Entrepreneurial Space Privatization Beginnings (cont’d)

- Innovative Launchers (cont’d)
  - DARPA’s DC-X Delta Clipper
    - Basis of Bezos’ ‘Blue Origin’
Entrepreneurs' Space Visions

- Space Tourism Businesses
  - Zero-G Flights
  - Space Prizes
  - Space Tourism Suborbital Flights
    - Spaceports, ‘Astronaut Dude Ranches’
  - Space Tourism Orbital Flights
  - Orbital Space Hotels

Space For Hire
- Space Station: $20 million
- Suborbital Space Flight: $98,000
- MiG-25: $12, 595
- Zero Gravity: $5,400
- Shuttle Launch: $1,150
- Renting Apollo 13: $3,50
- 1990’s Russians sold 5-10 trips to MIR
  - Foreign Astronauts, Japanese Reporter, UK Contest Winner
- Space Adventures - Eric Anderson
  - Co-Founder Space Adventures 1997 (at 23)
  - Co-Founder Cosmopolis XXI 2007
Space Tourists (cont’d)

- 2001 Dennis Tito (67)
  - Ex-JPL, Orbit Analysis Software
  - Founder Wilshire Associates
Space Tourists (cont’d)

- **2002 Mark Shuttleworth (34)**
  - UK, born South Africa
  - Founder Thawte
    - Sold to VeriSign for $575M

- **2005 Greg Olsen (63)**
  - Founder Sensors Unlimited
    - Sold for $750M, Bought Back for $7M
    - Resold to Goodrich during launch
Space Tourists (cont’d)

- **2006** Anousheh Ansari (41)
  - Founder Prodea Systems, telecon technologies
  - Sold for $550M to Sonus Networks
  - Ansari X-Prize

- **2007, 2009** Dr. Charles Simonyi (60)
  - Microsoft since 1981 (WORD, EXCEL)
Space Tourists (cont’d)

- **2008 Richard Garriott (46)**
  - Founder ORIGIN, ULTIMA
  - Sold to Electronic Arts

- **~2009/10 Vladimir Gruzdev (41)**
  - Founder Largest Retailer in Russia
  - Explorer, Parliament

- **~2011 Sergey Brin (34)**
  - Co-Founder Google
  - Space Adventures Investor
  - Cosmopolis XXI
Space Prizes

- **100 Aviation Prizes offered 1905-1935**
  - $25k Orteig Prize: 1927 Charles Lindbergh to Paris

- **Space Prizes**
  - SFF Cheap Access to Space (CATS) Prize
  - Heinlein Prize
  - Planetary Society Asteroid Tagging Prize
  - Northrop Grumman Lunar Lander Prize
  - NASA Centennial Challenges
  - Florida $40M RLV Prize

- **$10M Ansari X-Prize**
  - 3 people to 100 km (62 miles), Repeat within 2 weeks

- **$30M Google Lunar X-Prize**
  - Land on Moon, Traverse, Snap Photos, Transmit

- **$50M Space America Prize**
  - 5 people to 400km, 2 orbits, Repeat within 60 days

John Cusack’s Armadillo Aerospace Lunar Lander Entry
John Cusack (39)
- Co-founder id Software (at 21)
  - Games: Doom 1-4, Rage, Quake 1-4, etc.
  - Doom RPG for iPhone
  - Engines: Half-Life, Call of Duty, Medal of Honor, etc.
  - 4th person inducted into AIAS Hall of Fame
    (Academy of Interactive Arts and Sciences)

- Founder Armadillo Aerospace (2001)
  - Lunar Lander Challenge:
    - Won 350k$ prize 10/08
    - Qualified for 1M$ prize 9/09
Peter Diamandis (48)
- Co-Founder of SEDS (at 19)
- Founder of International Space University (at 26)
- Founder Zero-G (at 32)
- Co-Founder of Angel Technologies (at 35)
- Founder of X-Prize Foundation (at 35)
- Co-Founder of Space Adventures (at 37)
- Founder X-Cup (at 44)
- Founder Rocket Racing League (at 45)
X-Cup Rocket Racing League

Leading EDGE

Rocket Racing League

MAXIMUM KINETIC POTENTIAL

Rocket Racing League

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2004 $10M won by Paul Allen and Burt Rutan
Ansari X-Prize (cont’d)

- Paul Allen (56)
  - Co-Founder Microsoft
  - Experience Music Project
  - Sci Fi Museum
  - Co-Founder Space Ship Company
  - Owns Trailblazers, Seahawks and Sounders
Ansari X-Prize (cont’d)

- **Burt Rutan** (66)
  - Founder **Scaled Composites**
  - Co-Founder **Space Ship Company**
- Bob Bigelow (56)
  - Founder Budget Suites of America
  - Founder Bigelow Aerospace
  - Founder National Institute for Discovery Science
Virgin Galactic

Sir Richard Branson (59)
George French
- Founder Space Explorers
- Rocketplane
- Kistler
BSC DreamChaser - Jim Benson
- Founder CompuSearch (at 38)
- Founder ImageFast (at 44)
- Founder Space Development Corp (at 52)
- Founder Benson Space Company (at 61)
Blue Origin - Jeff Bezos
- Founder Amazon
- Founder Blue Origin
Private Spaceports

- New Mexico - Spaceport America
- Oklahoma
- Texas
- California
- Florida
- Hawaii
SpaceX - Elon Musk (38)
- Co-Founder Zip2 (at 24)
- Co-Founder PayPal (at 27)
- Founder Space Exploration Technologies (at 31)
- Co-Founder Tesla Motors (at 32)
- Co-Founder Solar City (at 35)

9/28/08
First private liquid rocket into orbit

9/28/08
4th Falcon 1
Launch of RazakSat

October 16, 2009 JRS 48
Bigelow Aerospace Corp. - Bob Bigelow (56)
Dr. James R. Stuart is an independent, internationally recognized consultant specializing in the development of new technologies, advanced systems and commercial businesses, and is a serial entrepreneur. He has consulted to over 100 companies in the past 30 years. He is currently a Board Director of 8 entrepreneurial, high-technology companies involved with wireless telecommunications, digital rights management, RFID’s, satellite communications, launchers and tourist launchers. He has been a Board Director of 35 companies and an Advisory Board member of 18 companies. He has been a professional expert witness in 4 major space industry litigations.

Dr. Stuart has held positions as the President of IOSTAR Corp. (developing a commercial nuclear-powered space tug) in Salt Lake City, UT, the CEO of SkyVault Secure Digital Distribution, Inc. in Carmel, CA, the CEO and President of Kitcomm Satellite Communications Ltd. in Hamilton, Bermuda, the Vice President and Chief Architect of Teledesic Corp. in Bellevue, WA, and as the Chief Scientist and the Chief Engineer at Ball Aerospace in Boulder, CO. He was previously the founding Chief Engineer of Orbital Sciences Corporation (ORB: NYSE), the Assistant Laboratory Director of the Laboratory for Atmospheric and Space Physics (LASP), and the Development and Flight Program Manager at NASA Jet Propulsion Laboratory (JPL) of both the Solar Mesosphere Explorer Mission (launched 1981) and the Mars Observer Mission (launched 1992).

Dr. Stuart was a member of three graduate engineering faculties of the University of Colorado at Boulder for 19 years, in the Electrical Engineering, the Telecommunications and the Aerospace Engineering Sciences Departments. He has been a regular lecturer at various universities, including the Stanford University Graduate School of Business and the Naval Postgraduate School. He received his Ph.D. in Systems Engineering (1979), M.S. in Operations Research (1977), and M.S. in Electrical Engineering (1974) from the University of Southern California, and his B.S. in Physics (1968) from the University of Washington.

Dr. Stuart has received numerous professional awards, including NASA's Exceptional Service Medal for his project management of JPL’s Solar Mesosphere Explorer Project. He has been listed in Via Satellite's "Top 100 Executives in the Satellite Communications Industry". Dr. Stuart holds 17 patents in satellite, wireless communications and network designs (another 10 are pending). He was the author of a graduate engineering, two-volume text entitled Satellite Communications Systems, co-author of Telecommunications: An Interdisciplinary Text, and has published over 165 professional papers.