

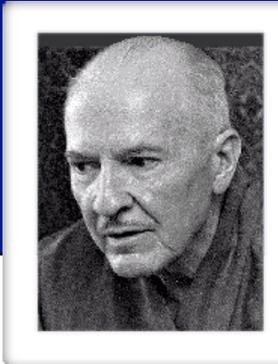
# **Heinlein was Wrong:** Why we don't need D.D. Harriman

Stephen Fleming

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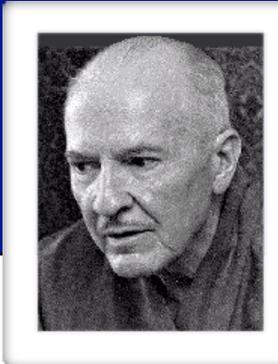
# Stephen Fleming



- 12+ years venture capital investment experience.
- BS, Physics, Ga. Tech (*Highest Honors*).
- 15 years operational experience at AT&T Bell Labs, Nortel, LICOM (*venture-backed startup*).
- Now supervising Georgia Tech's commercialization and intellectual property efforts.
- Initial investor and board member, XCOR Aerospace.
- Investor and advisor at multiple other aerospace startups.
- Space community gadfly.

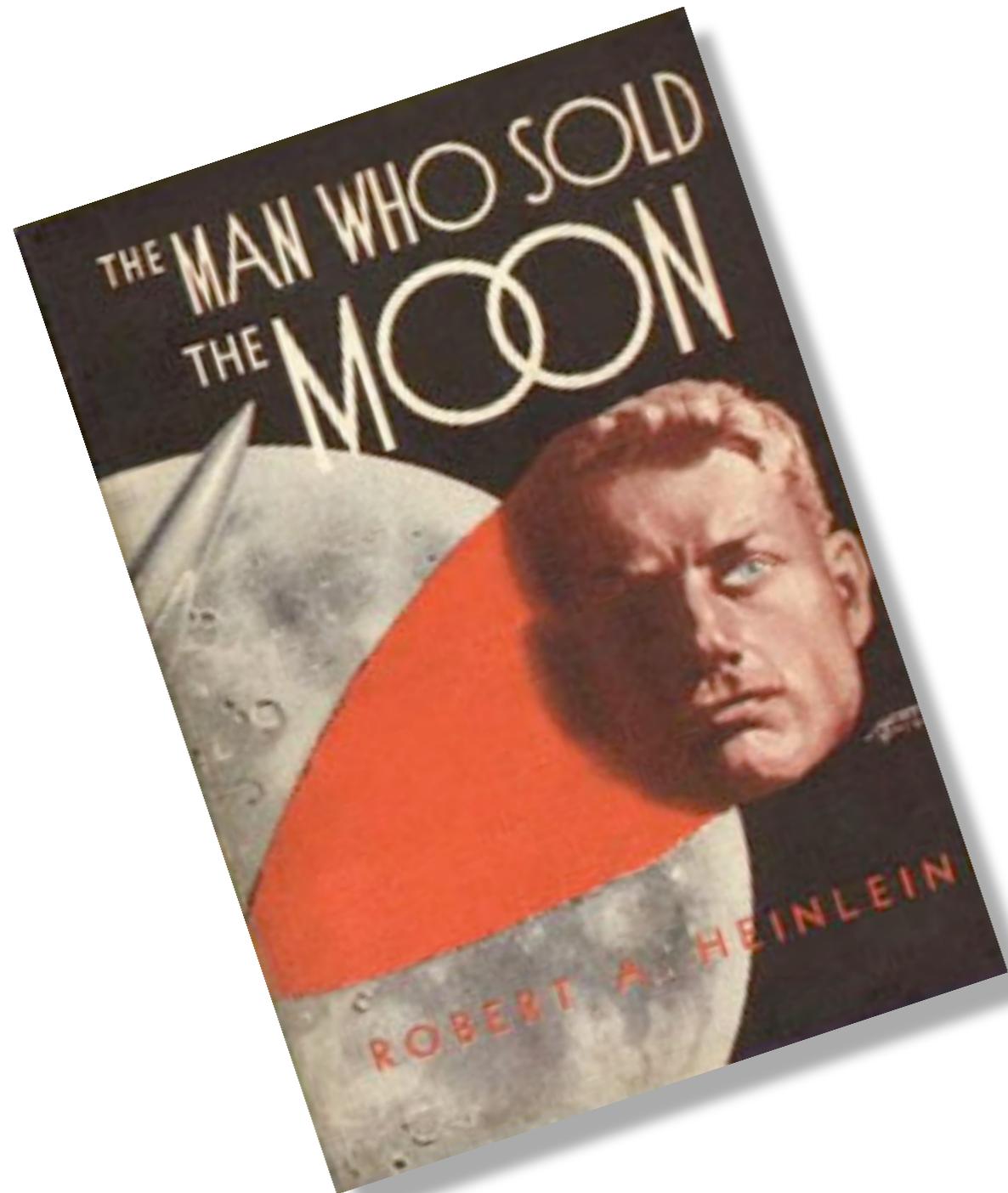
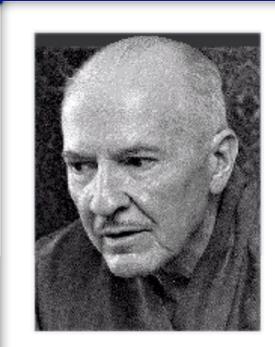


# Disclaimer



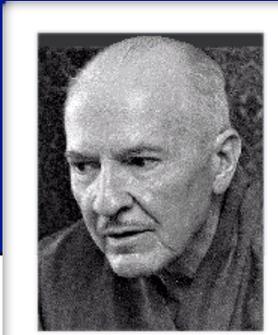
- All material in this presentation reflects the personal opinion of Stephen Fleming, and does not necessarily represent the position of Georgia Tech, the University System of Georgia, or the State of Georgia. And that's a damned shame.
- PS — it doesn't necessarily represent the position of XCOR, either, but the odds are a lot better...

# The Man Who Sold the Moon



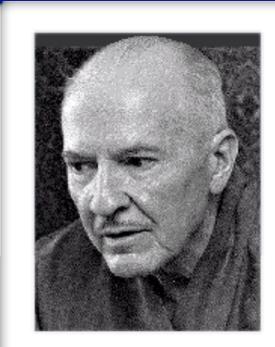
- “You’ve got to be a believer!”
- Written in 1949
- First (and for a long time, the *only*) space travel story based on making money
- Delos D. Harriman first appeared in *Requiem* in 1940!

# D.D. Harriman



- One of the world's richest men
- Cajoled, browbeat, and tricked more of the world's richest men into financing his rocket
- No government involvement (other than random obstructionism)
- Larry Niven:
  - “A. E. Van Vogt never worried about what a spacecraft cost. I don't think Isaac Asimov did either. Nobody ever did until, in the 1950s, Robert Heinlein published ‘The Man Who Sold the Moon.’ And nobody did again for a long time.”

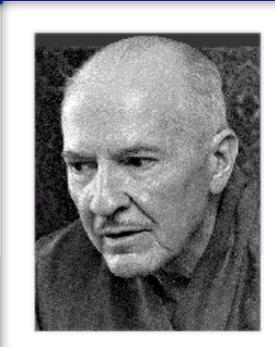
# Harriman's Moon Mission



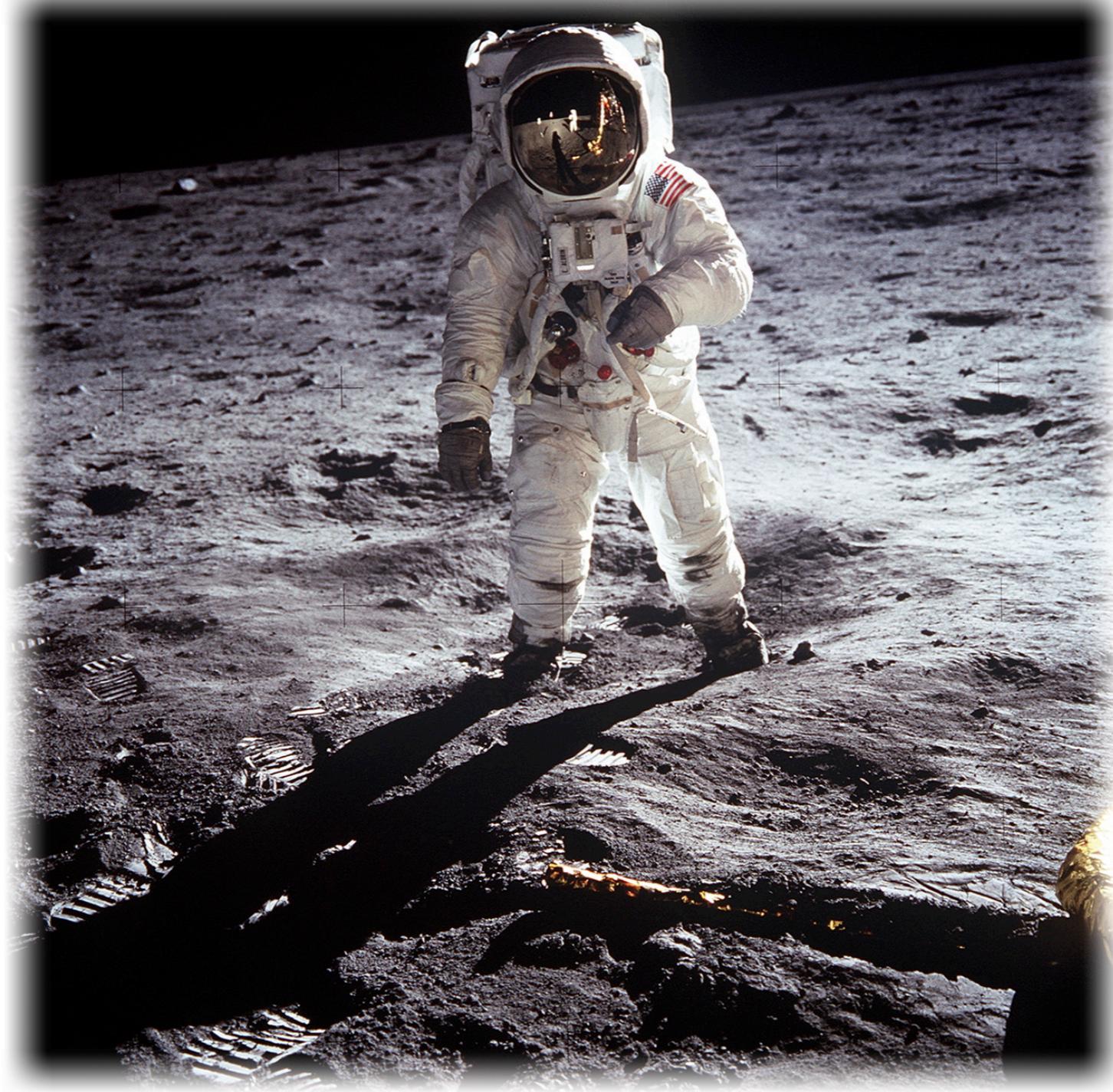
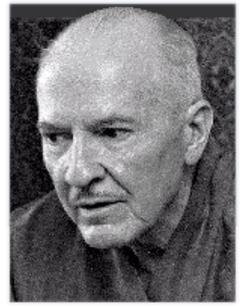
- No one knew if it was technically feasible
- Turned out to be at the edge of practical technology
- Had to use a midget as the sole astronaut to save weight
- Second mission (and follow-ons) wound up using a catapult up the side of Pike's Peak



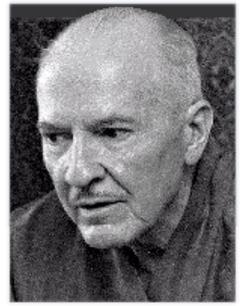
# What We Got



# What We Got



# What We Got



# Aviation After 46 Years (1949)



- Number of airports in operation: 6,484
- Number of civil aircraft: 92,622
- Number of licensed pilots: 510,000
- Number of revenue passengers carried: 16,600,771

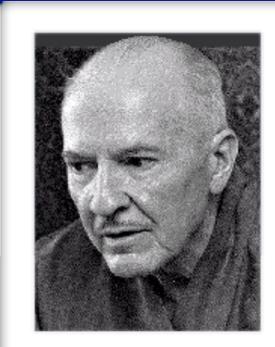


# Human Space Flight After 46 Years (2007)



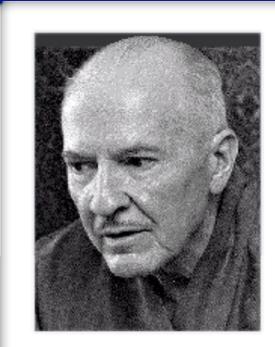
- Number of launches: 257
- Number of people who have been to space: 450





Why?

# Transcontinental Railroads

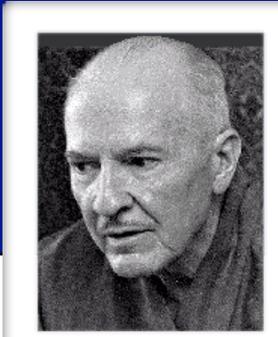


- Government did not build the railroads.
- Government (U.S. Army) contracted to be the largest customer.
- Also regulated, subsidized, guaranteed property rights.

A “National Railroad Program” in the 1870s would have been doomed to failure.

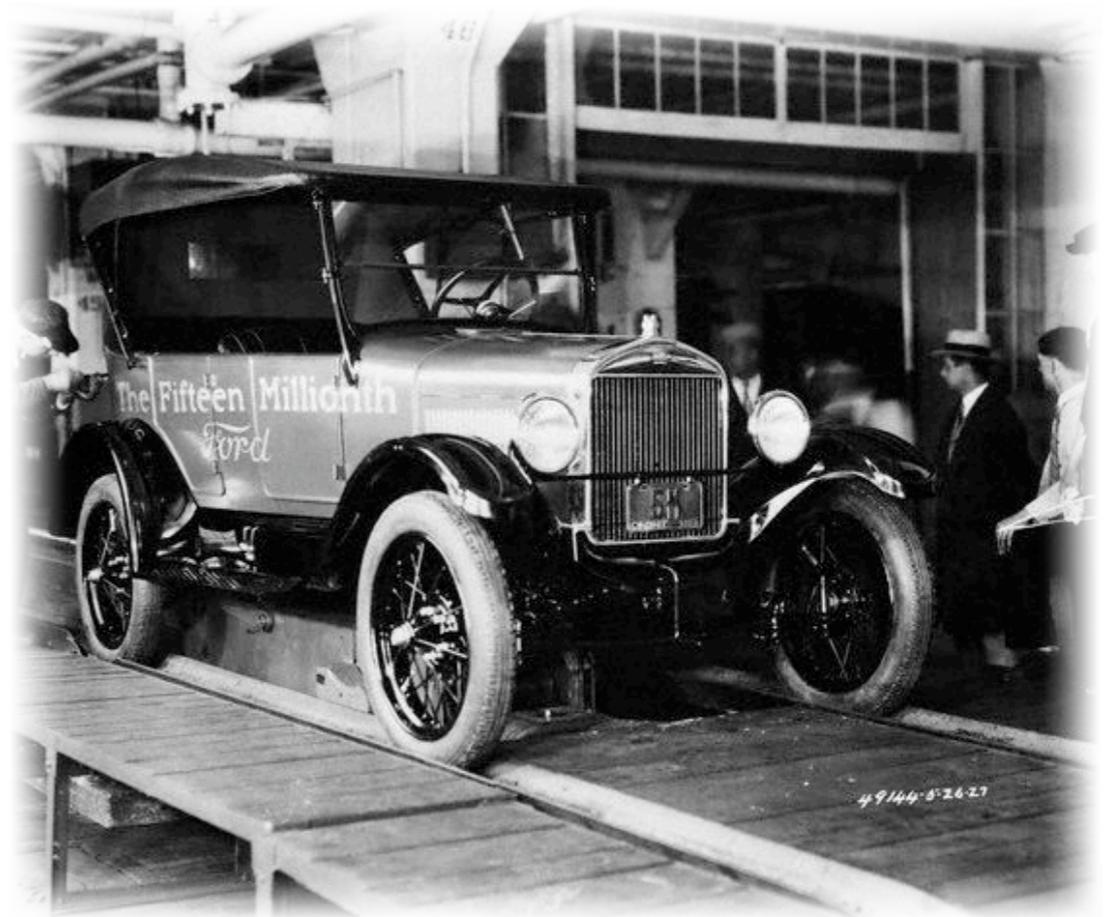


# Automobile Industry

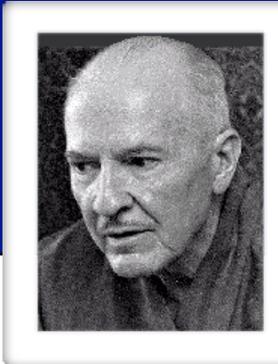


- Government did not build the auto factories.
- Focused on infrastructure (highways) and regulating the new industry.
- Government became a large and stable customer.

A “National Automobile Program” in the 1910s would have been doomed to failure.



# Airline Industry

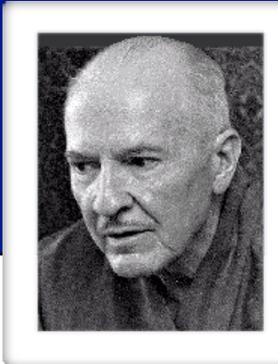


- Government did not build the airplanes.
  - NACA did research, not development or ops.
- Government contracted to be the largest customer.
  - Military contracts to expand performance.
  - Civilian contracts (air mail) to expand routes.
- Focused on infrastructure, regulation, safety.

A “National Airplane Program” in the 1930s would have been doomed to failure.



# Space Travel Industry

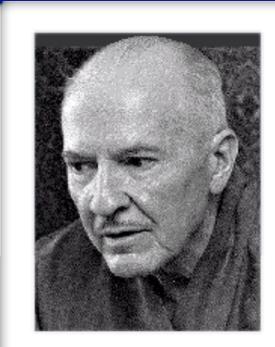


- After Heinlein, it was assumed that space would follow the same pattern...
  - Government as customer, regulator, military presence.
  - Pan Am would run spacelines, Hilton would build hotels.
- We can see echoes of D.D. Harriman here...

So... why did we wind up with a National Space Program in the 1960s?



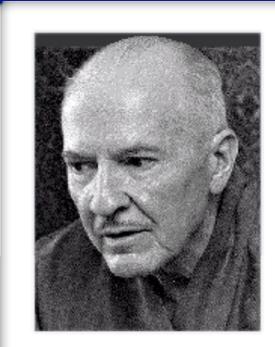
# Where Did We Go Wrong?



The four most dangerous words in the English language:

“It’s different this time.”

# Where Did We Go Wrong?

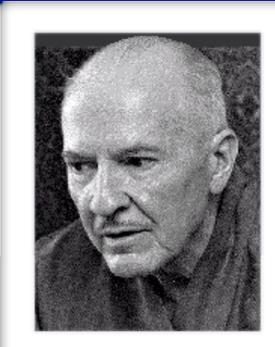


“First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish.”

—Pres. Kennedy, May 1961



# Where Did We Go Wrong?



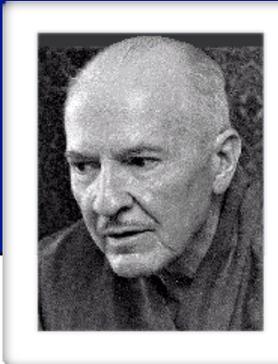
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Where did we go wrong?



# The Legacy of Apollo

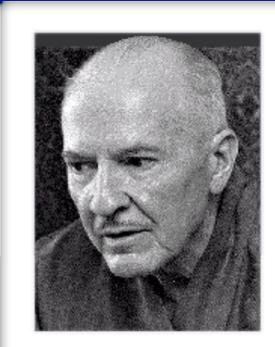


- Extraordinary expense.
- Justified by national prestige and Cold War rivalry.
- Spinoffs were nice, but no core economic legacy.
- Infrastructure was abandoned.

“Flags and footprints” make a lousy business plan.



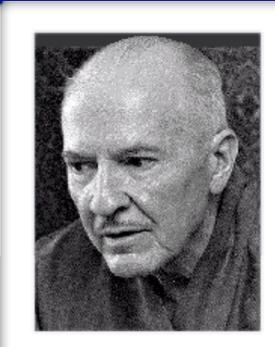
# The Legacy of Apollo



- Nearly forty years later, what remains of the moon missions?
  - Zero presence.
  - Zero industry.
  - Zero infrastructure.
  - Zero economic value.
- Not a model which will get traction on Wall Street!

We went too early, and we never went back.

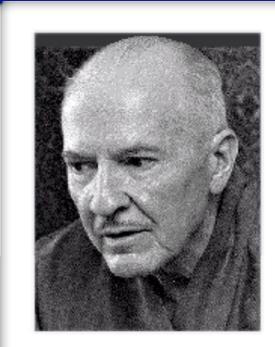




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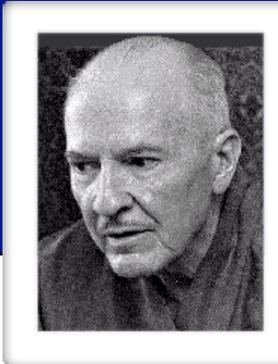
“It’s different this time.”

# What's Different This Time?



- Unlike D.D. Harriman, we *know* it's possible.
  - “What man has done, man can aspire to.”
- Unlike in Heinlein's *Future History*, we *know* that we don't need absurd amounts of money to do it.
  - SpaceX has nearly reached orbit for \$100M.
- Unlike the shortsighted executives in “The Man Who Sold the Moon,” we *know* there is money to be made in space.
  - Comsats are just the beginning...

# Regulatory Environment



- Unlike D.D. Harriman, today's space entrepreneurs are engaging the Federal regulatory apparatus up front.
- FAA-Office of Commercial Space Transportation mission statement:
  - To ensure the protection of the public, property, and the national security and foreign policy interests of the United States during commercial launch and reentry activities, and to encourage, facilitate, and promote U.S. commercial space transportation.
- Think about that! *They're not the bad guys!*

# Commercial Space Launch Amendments Act

- Put Congress and the Administration on the record as supporting the development of commercial human space flight.
- Established an “informed consent” regime for carrying space flight participants.
- Created a new experimental launch permit for testing reusable suborbital launch vehicles.
- Called for proposed regulations to be issued on an accelerated schedule.

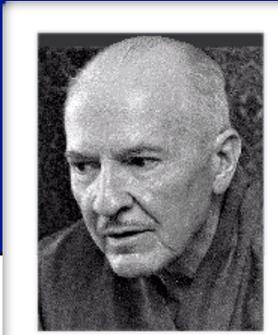


# U.S. Spaceports

## Commercial and Government Active and Proposed Launch and Landing Sites



# Focus on Economic Feasibility

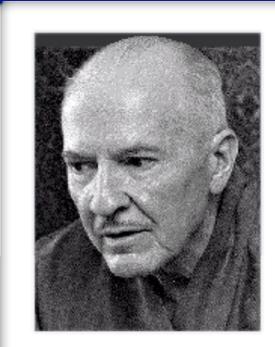


- At current launch prices, an on-orbit process to turn lead into gold would lose money!
- \$10,000/pound must come down by 10× to 100×.
- Single greatest barrier to space exploration.

Today, putting anything in orbit costs nearly twice its weight in gold.



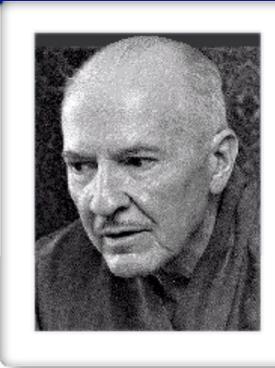
# Impact of Space Access Costs



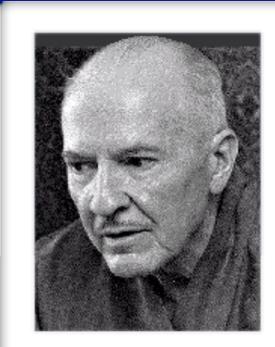
- It's hard to build a factory using \$10,000 wrenches.
- Even harder when getting someone to the work site costs \$3 million!
- High launch costs will doom us to repeating “flags and footprints” missions on the Moon and Mars.



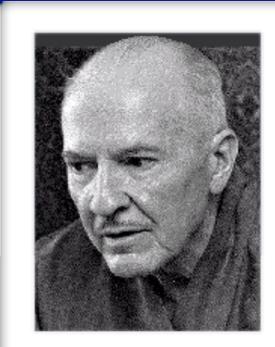
# SpaceShip One



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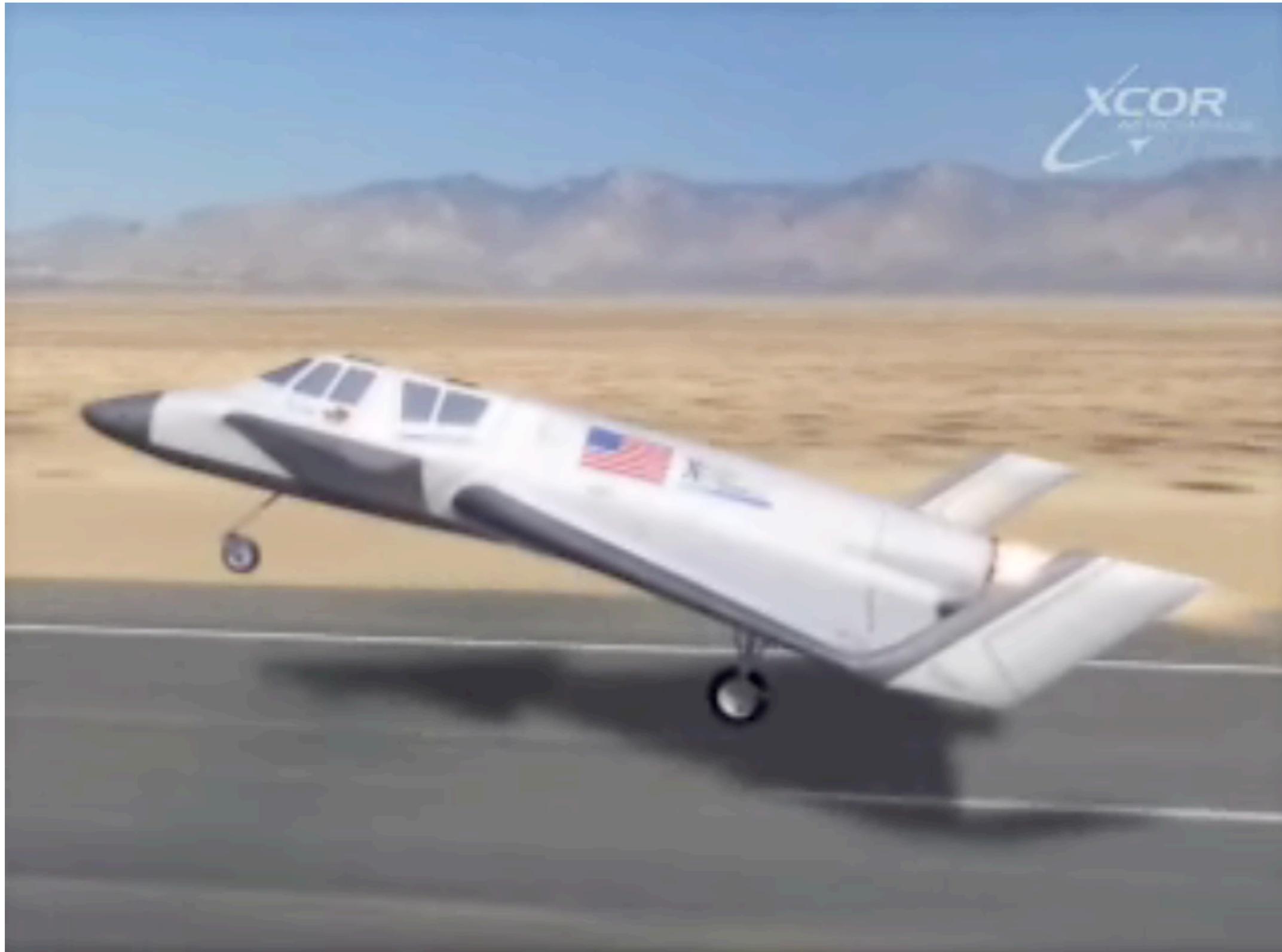
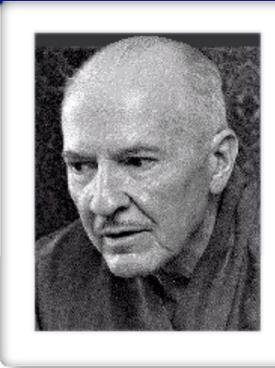


# The SpaceShip Company

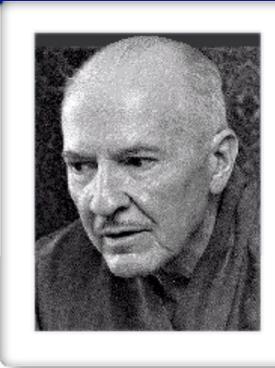


- Formed by Richard Branson (Virgin Group) and Burt Rutan (Scaled Composites)
- Scaled will design, build, and test 5 spaceships and 2 launch aircraft
- Virgin Galactic will be the operator
- Each vehicle will carry up to 6 passengers and 2 crew
- Initial ticket price is \$200,000
- Operations expected to start in 2009

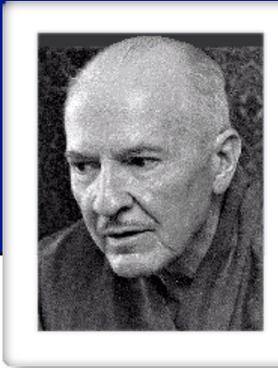
# XCOR Aerospace



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**POPULAR SCIENCE**

**THE FUTURE NOW**

**GADGET OF THE MONTH**  
The first palm-size HD camcorder p.30

**NASCAR WITH ROCKETS!**  
Introducing The Next High-Thrills Spectator Sport

**HOW WE'LL FIND LIFE ON MARS**  
Ride along on a desert test drive with NASA's next-generation rover p.66

**5 FLOOD FIXES**  
Our blueprint for a safer New Orleans p.56

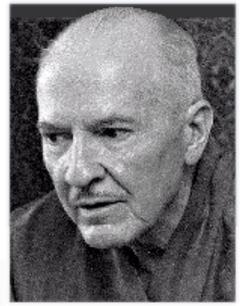
**SPY FISH!**  
Meet the U.K.'s underwater detective p.14

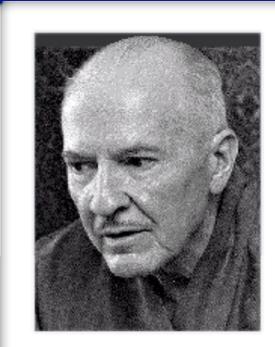
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FEBRUARY 2006 US \$2.99 CAN \$4.99

The magazine cover features a large, detailed image of a white and orange XCOR Aerospace aircraft in flight against a sunset sky. The aircraft has a sleek, aerodynamic design with a cockpit and a large, curved nose. The text is arranged in a clean, modern layout with various font sizes and weights. A barcode is located at the bottom right of the cover.

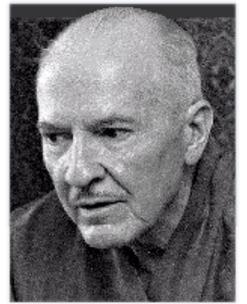
# Armadillo Aerospace



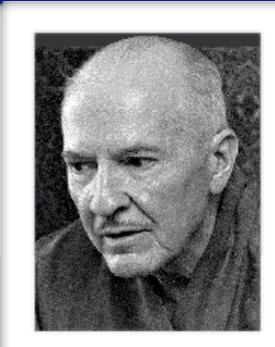


- Founded by Elon Musk (one of the founders of PayPal... and Tesla Motors)
- Building “disintegrating totem poles” but using modern design and production techniques.
- Closest match to D.D. Harriman that we have!

# A Dangerous Business...



# Halfway to Anywhere

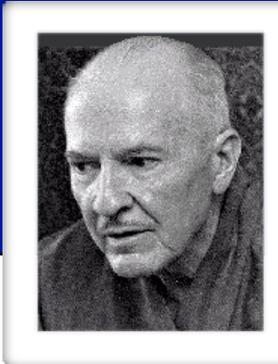


- Profitable industries are sustainable; government programs are *not*.
- With a private launch industry in place, missions to the Moon and Mars will become 10× to 100× cheaper.

“Reach low orbit, and you’re halfway to anywhere in the Solar System.” —*R.A. Heinlein*



# Heinlein Was Right!

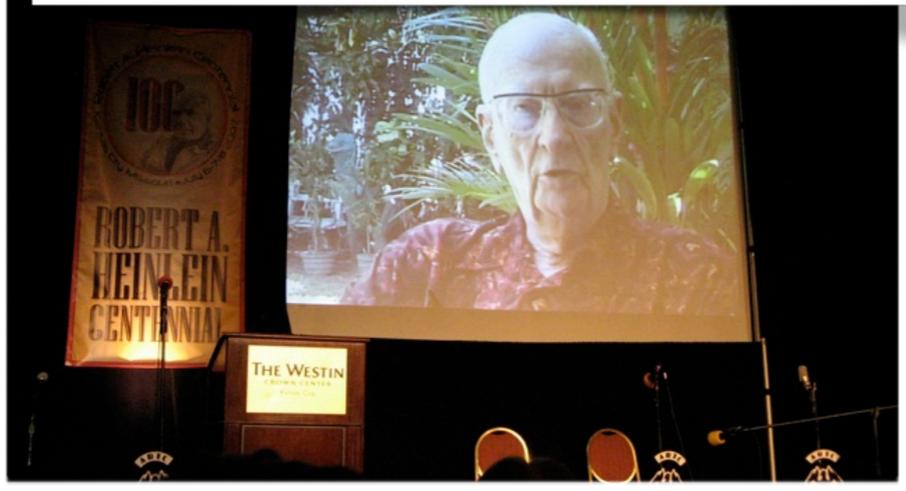
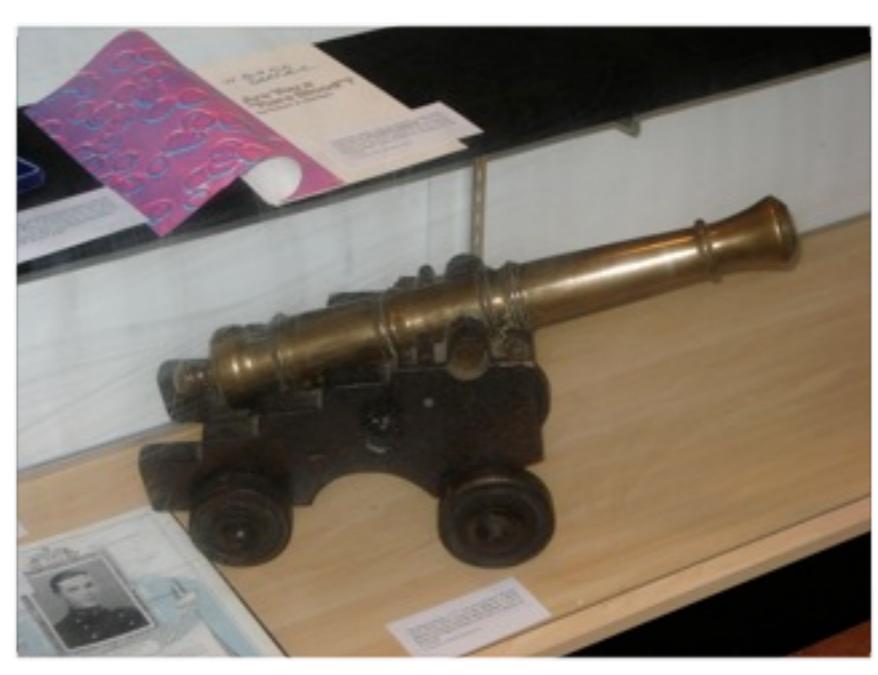


*Space: We're Finally Doing It  
the Right Way.*

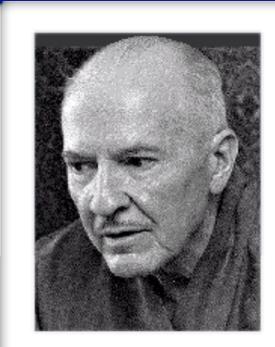
[www.HeinleinCentennial.com](http://www.HeinleinCentennial.com)



# Heinlein Centennial



# For Further Information



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