

The Mode Decision

HONR 269i

To the Moon and Back: The Apollo Program

[Lunar Orbit Rendezvous](#)

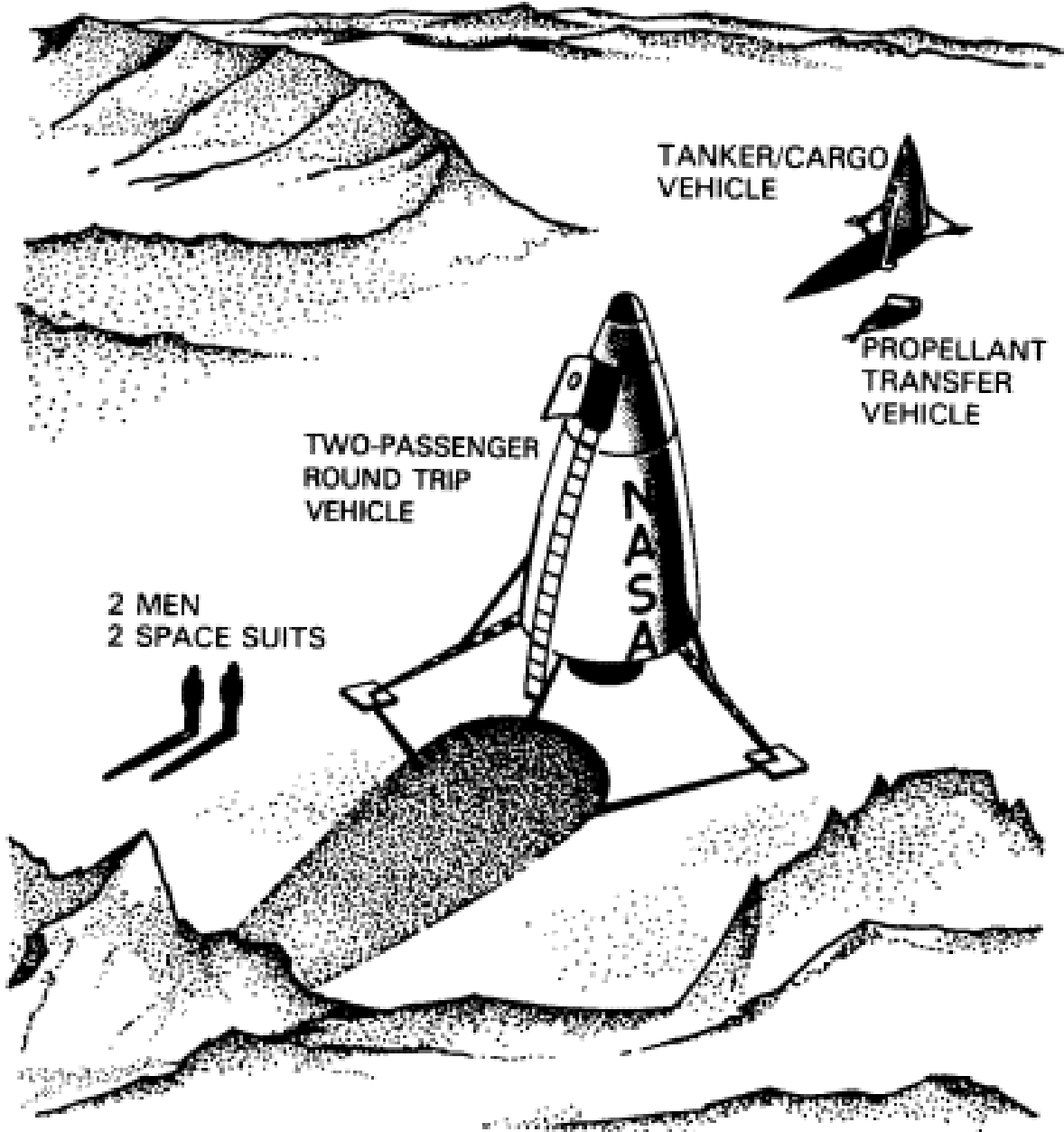
Four Bad Ideas

- Direct Ascent
 - Required an enormous rocket and made the landing much more difficult
- Earth Orbit Rendezvous, then Direct Ascent
 - Required salvo launches and made the landing much more difficult
- Lunar Orbit Rendezvous
 - Rendezvous failure at the moon would be fatal
- Lunar Surface Rendezvous
 - Navigation errors on landing would be fatal

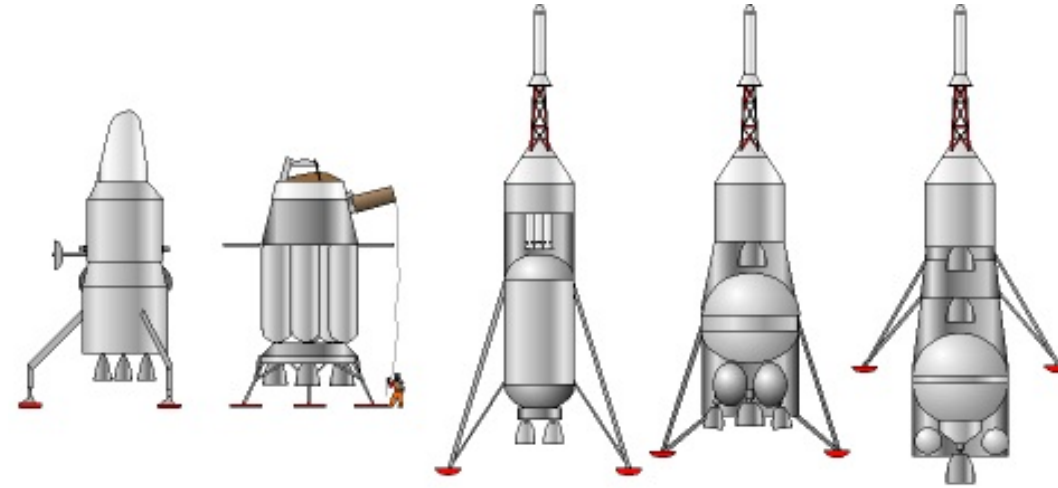
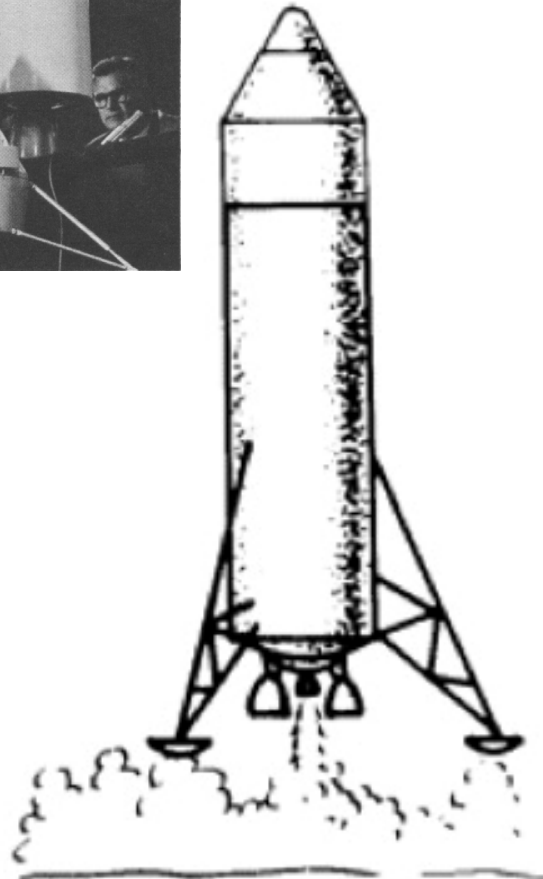
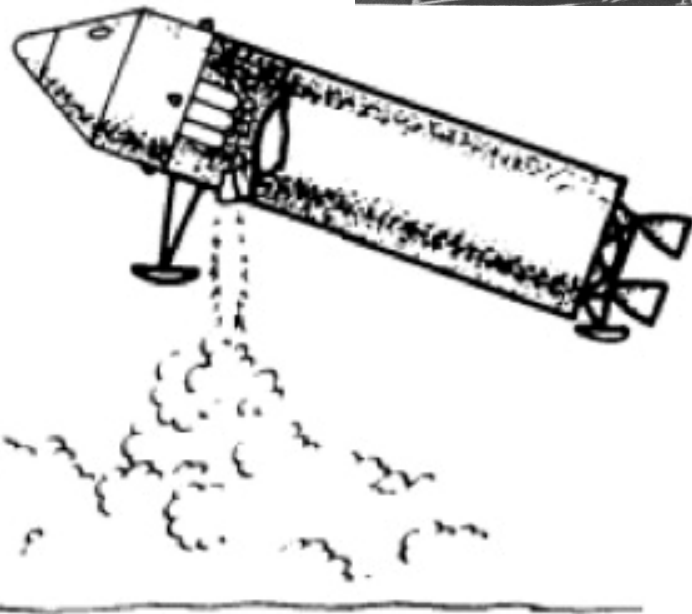
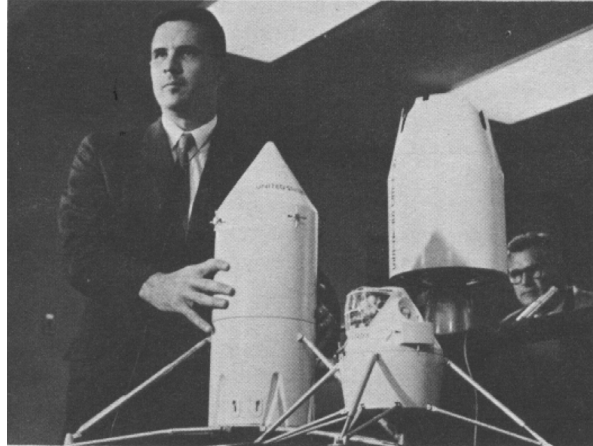
The Michoud Assembly Facility



Lunar Surface Rendezvous



EOR/Direct Ascent vs. Lunar Orbit Rendezvous



Martin Model 410
May 1961

Convair M-1
June 1961

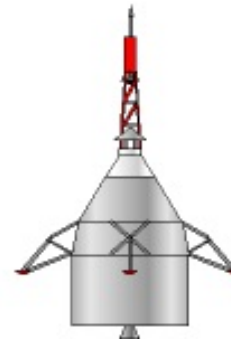
NASA Direct
July 1961

North American
CSM
December 1961

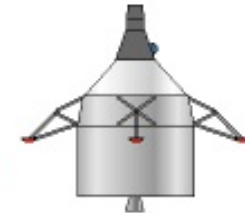
Final Direct
Configuration
April 1962



LOR Decision
July 1962



2-Man Apollo Direct
October 1962



Gemini Direct
October 1962



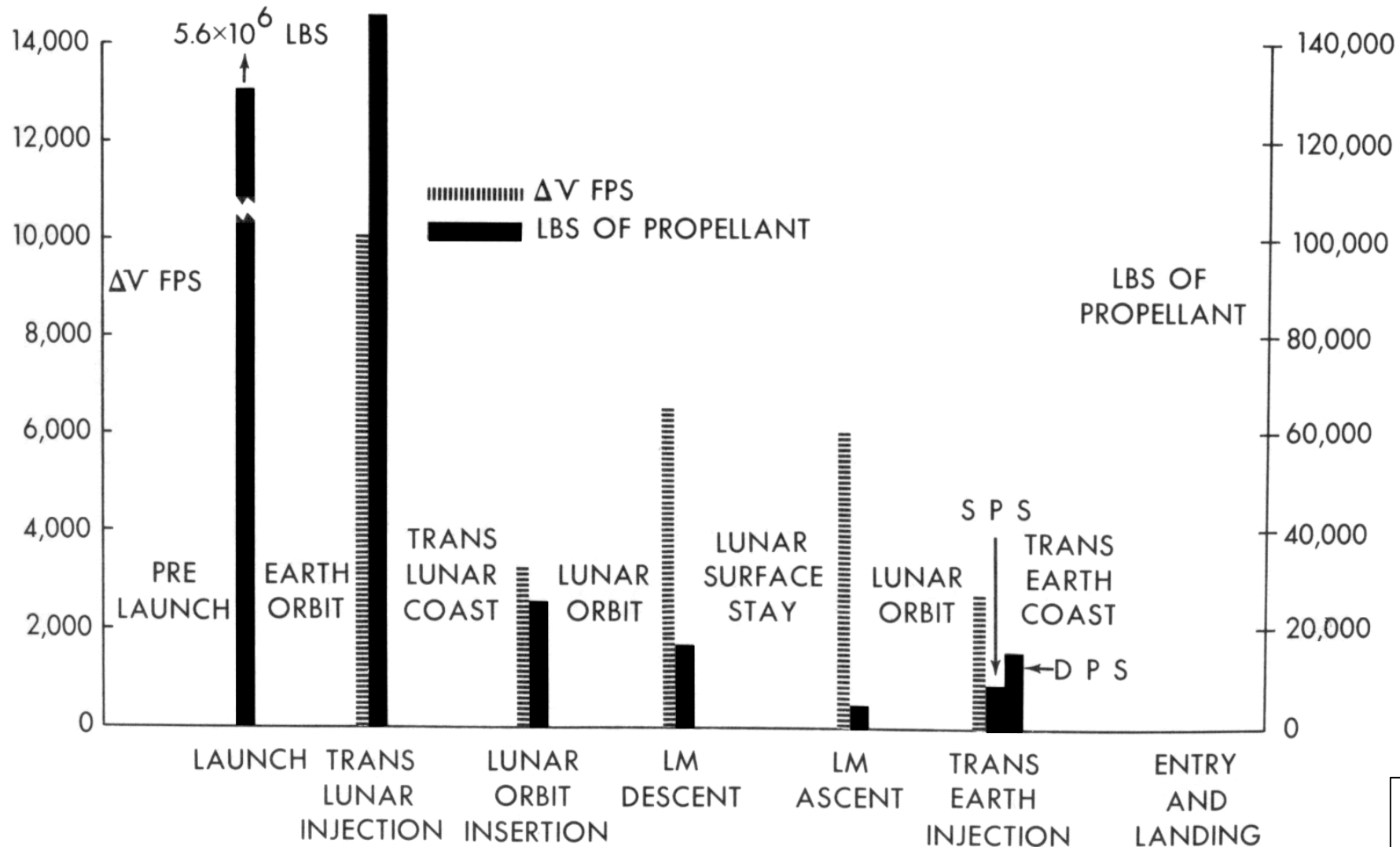
Grumman LEM
November 1962



As Flown 1969

“Halfway to Anywhere”

ENERGY REQUIREMENTS FOR LUNAR LANDING MISSION



Advantages and Disadvantages of LOR

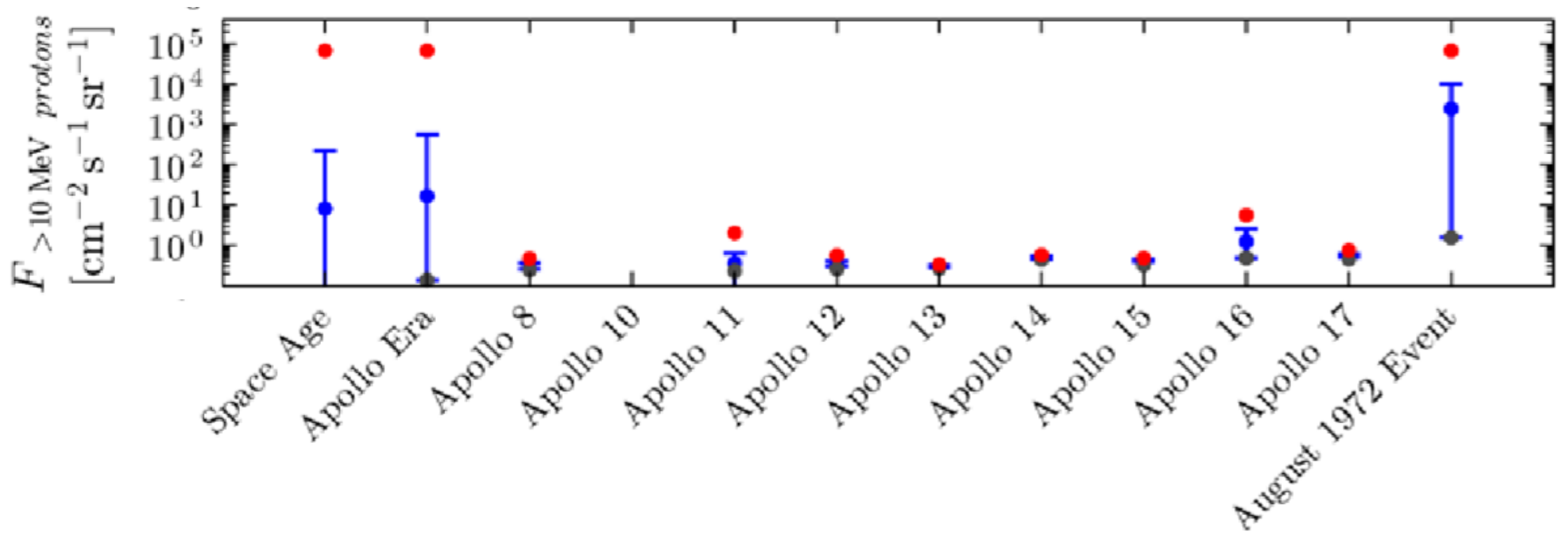
- Pro

- Specialized lander can be optimized for that purpose
- Separate vehicles can be developed and tested in parallel
- Use of fewer launch vehicles reduces cost and risk

- Con

- Rendezvous had never been tested
- Lander would not provide adequate shielding from a solar flare
- Increased development cost for second crewed vehicle

Radiation Hazard



Dramatis Personae

- Robert C. (“Bob”) Seamans
- D. Brainerd Holmes
- Joseph F. (“Joe”) Shea
- John C. Houbolt
- Thomas E. (“Tom”) Dolan
- Werner Von Braun
- Charles W. Frick
- Maxime A. (“Max”) Faget
- Jerome B. (“Jerry”) Wiesner
- Nicholas E. Golovin

Timeline

- Dolan's company-funded MALLAR studies begin at Vought (1958)
- RCA and STL awarded DARPA study contracts for SAINT (late 1958)
- Dolan briefing at Langley (early 1960)
- Seamans leaves RCA to join NASA (September 1960)
- Lundin committee recommends EOR as the mission mode (June 1961)
- Houbolt minority report to the Golovin Committee (October 1961)
- Shea leaves STL to join NASA (December 1961)
- Decision to build the Saturn V (January 1962)
- First American manned orbital flight (February 1962)
- NASA selects Lunar Orbit Rendezvous for Apollo (July 1962)
- Lunar Module contract awarded to Grumman (November 1962)

Optimizing for the Short Term

- Saturn V is to Mars as Saturn 1B is to the Moon
 - By not pursuing Nova, NASA failed to invest in human solar system exploration
- Growth potential of the “Apollo system” was severely limited
 - Lunar Module science payload was initially a few hundred points
- Incentives for Marshall Space Flight Center to agree to LOR
 - Workload balancing for payloads (later realized as Skylab and Lunar Rover)
 - Promise to consider autonomous resupply (never funded)
 - Offer to continue work on Nova launch vehicle after Apollo funding peak (not done)

Discussion Groups

- Annis Podcast (“Apollo: The Mode Decision”)
 - A detailed recounting of many aspects of the mode decision
- Alesi Article (“Do We Want to Go To the Moon or Not?”)
 - The mode decision from the perspective of Lunar Orbit Rendezvous advocates
- Houbolt Report (“Manned Lunar Landing Through the Use of LOR”)
 - The minority report the Golovin Committee that Houbolt sent directly to Seamans
- Cox Chapter 9 (“What Sonofabitch Thinks It Isn’t the Right Thing to Do?”)
 - A vivid description of the end game for the mode decision debate

Activity: Case Studies

- James Webb
- Werner Von Braun
- Boris Chertok
- Max Faget
- Margaret Hamilton
- Katherine Johnson
- Gene Kranz
- Gunter Wendt
- Valentina Tereshkova
- Alan Sheppard
- Jim Lovell