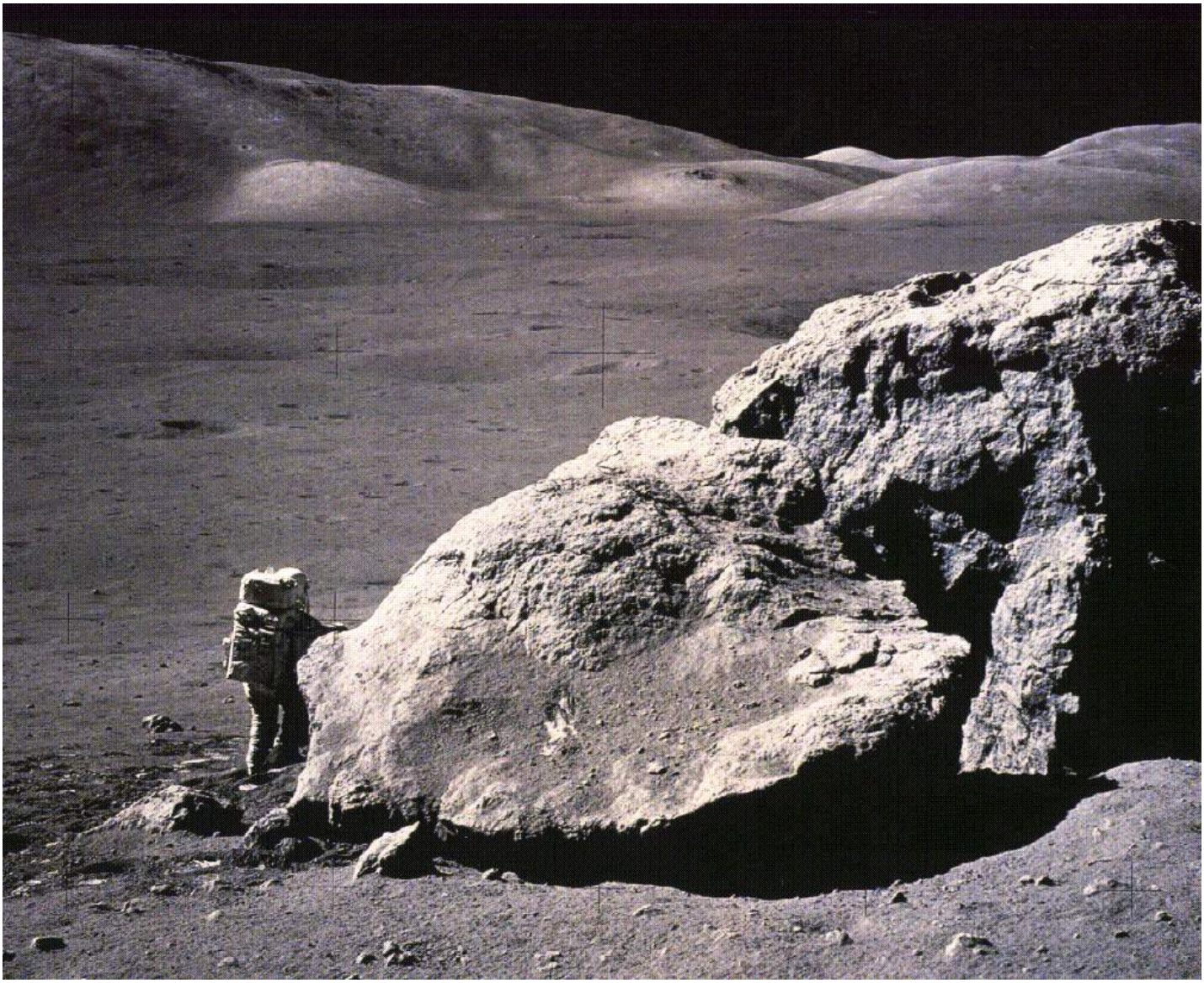
- **Human space exploration:**
- **Early steps: Mercury, Vostok 1961-1963**
- **The race to the moon: Apollo/Saturn and N-1 1966-1974**
- **Early space stations: Almaz, Skylab, DOS: 1971-2000**
- **Shuttle, 1981-present**
- **Station, 1998-present**

Back to the Moon

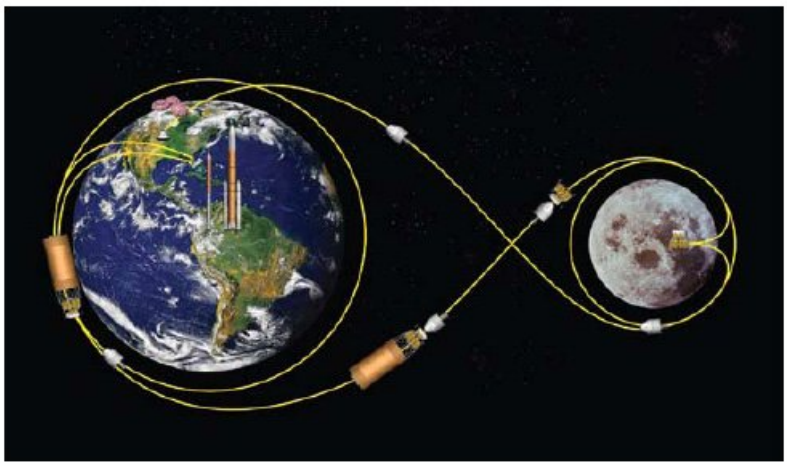


- Back to the Moon?
- Exploration and science -1
- Exploration and science -2
- A short history of space travel
- The Vision
- CEV
- CLV
- CALV
- LSAM
- LSAM
- CEV docked with LSAM
- LSAM AS
- The Vision
- Lunar Outpost
- Mars mission
- Questions

- **NASA's new mission - the "Vision for Space Exploration"**
- **Goal: human settlement of space: "Moon, Mars and Beyond"**
- **The new mantra: Exploration**
- **Exploration is NOT science - science is to understand how the world works, exploration (in this sense) is to promote a future in which our species is not tied to one planet.**
- **Just because it's not science doesn't mean it's not worth doing**
- **But it's a problem if it takes money away from science!**

- **Griffin promised science money would be protected**
- **He was wrong. Big cuts to science in 2006-7, worse to come in 2009?**
- **Congress supports science; NASA is much less interested**
- **Should we try and do science piggyback on human spaceflight (astronomy on the Moon) or do our best to defend our current programs?**
- **Upside: a clear distinction between exploration and science may help the public understand that the money spent on astronauts is NOT "science", and show how cheap science is in comparison.**

- **The new plan: "Apollo on steroids"**
- **4 people to the Moon, weeks at a time, by 2018**
- **Eventually, a lunar base (2028?) and Mars missions (2030s?)**
- **Step 1: a new spaceship and rocket:**
- **"CEV", Crew Exploration Vehicle, with command and service modules - a super Apollo CSM**
- **"CLV", the Crew Launch Vehicle or "the Stick"**
- **Replaces the Shuttle in 2012 with crew visits to Station**
- **Earth orbit vehicle first, but can go to Moon**
- **For that we need Step 2: CaLV and LSAM**
- **CaLV, the Cargo Launch Vehicle, is the biggest rocket ever**
- **LSAM is the Lunar Surface Module, carrying astronauts to the surface.**



- **Some differences from Apollo:**
- **- Two launches, one CLV and one CaLV.**
- **- The CLV carries the astronauts and CEV to orbit**
- **- The CaLV carries the empty LSAM and an upper stage, EDS.**
- **- CEV docks with LSAM/EDS**
- **- EDS fires its engine towards the Moon**
- **- CEV/LSAM arrive in lunar orbit using LSAM engine**
- **- LSAM then down to surface, back up, jettisoned**
- **- CEV back towards Earth**
- **- Lands at air base in western US**

- **Other questions:**
- **Will there be international cooperation in the VSE? Is the overhead worth it?**
- **What about the Chinese?**
- **Would the Democrats do anything different?**
- **What do you think of space tourism? Soyuz, Virgin Galactic..**
- **Is JWST worth 4 billion? What should the balance be between small and large missions?**