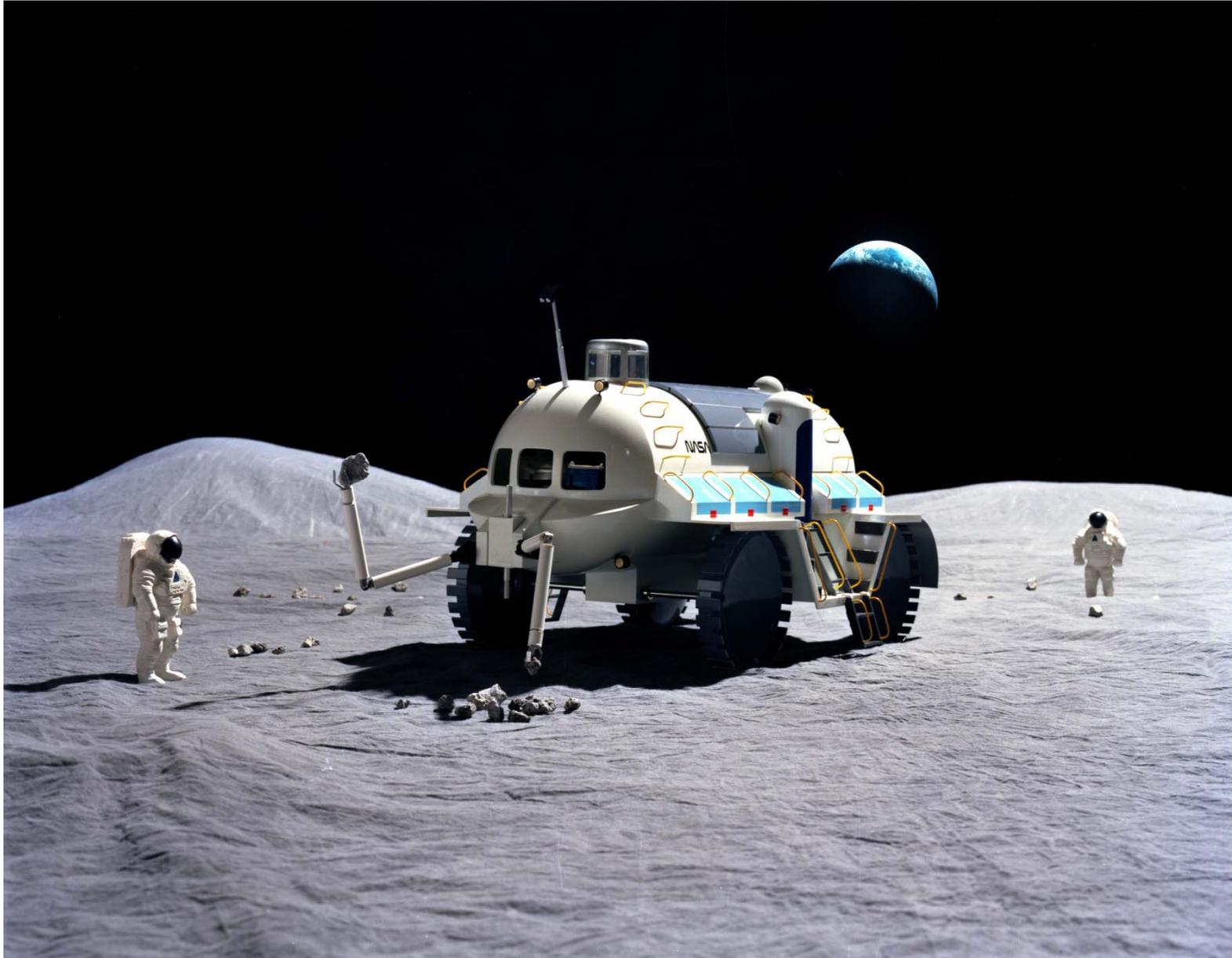


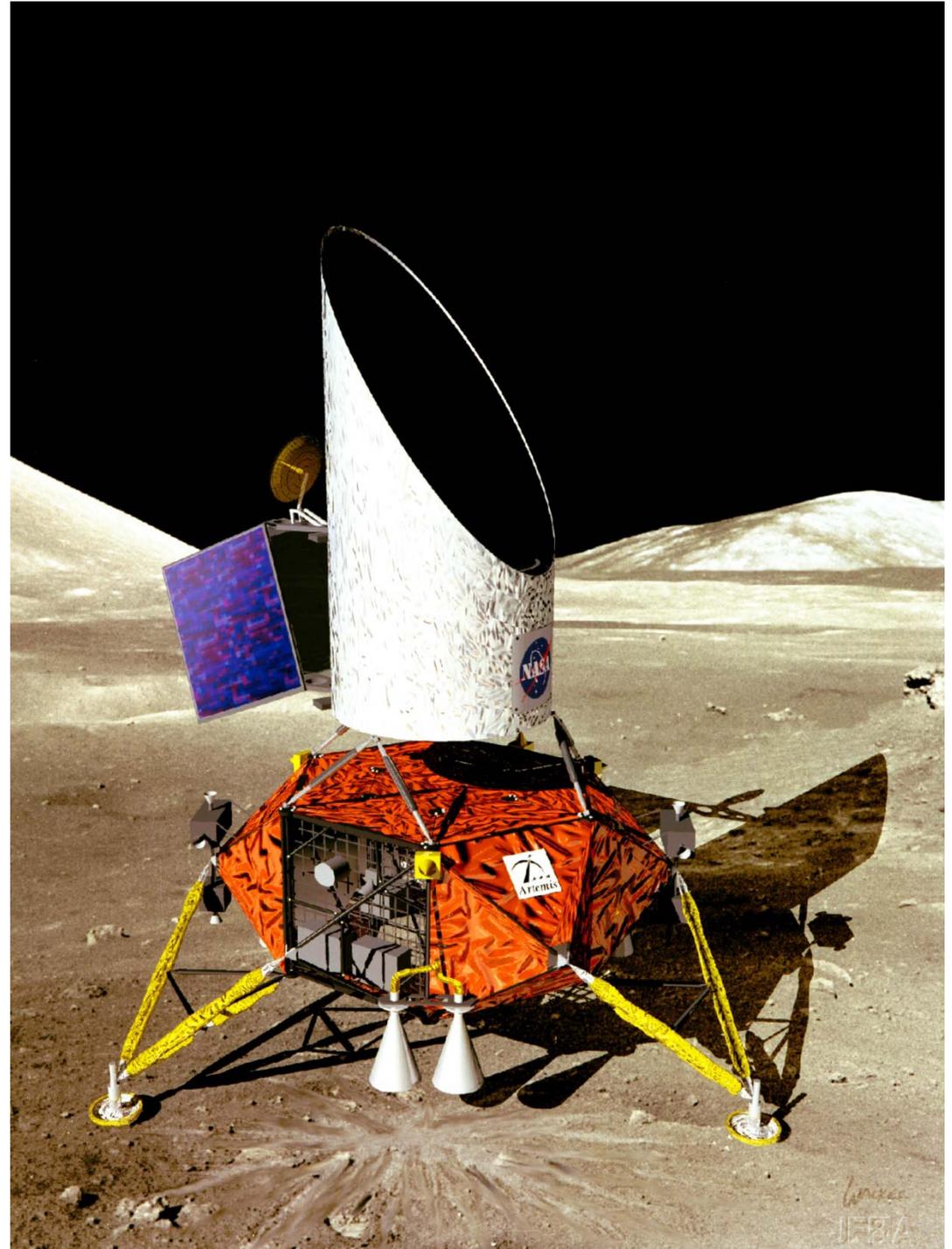
LunarRover

S90-29612 (22 February 1990) --- A model of a baseline lunar surface roving vehicle and accompanying astronauts on Extravehicular Activity (EVA). Part of the scene utilizes actual imagery. This view, as part of a study by the Johnson Space Center's Lunar and Mars Exploration Office does not depict existing or currently budgeted hardware.



MoonTelescope

S92-49394 (1992) --- (Artist's concept of possible exploration programs.) A one-meter transit telescope is shown mounted to a robotic lunar lander on the surface of the Moon. The Moon is a uniquely suitable platform for astronomy, which could include extreme ultraviolet images of Earth's magnetosphere (permitting study of solar wind interaction), the first far ultraviolet sky survey, and first-generation optical interferometers and very long wavelength radio telescopes. The instrument illustrated is a Lunar Ultraviolet Telescope Experiment (LUTE), which takes advantage of the stable and atmosphere-free lunar surface, and uses the Moon's rotation to survey the ultraviolet sky. The lander is an "Artemis" - class lander capable of delivering up to 200 kilograms to the lunar surface. The "Artemis" robotic lunar lander is designed for cost-effective delivery of payloads to the Moon to study lunar geology, astronomy, and as a precursor to human lunar expeditions. This image was produced for NASA by John Frassanito and Associates. Technical concepts from NASA's Planetary Projects Office (PPO), Johnson Space Center (JSC).



CraterExpedition

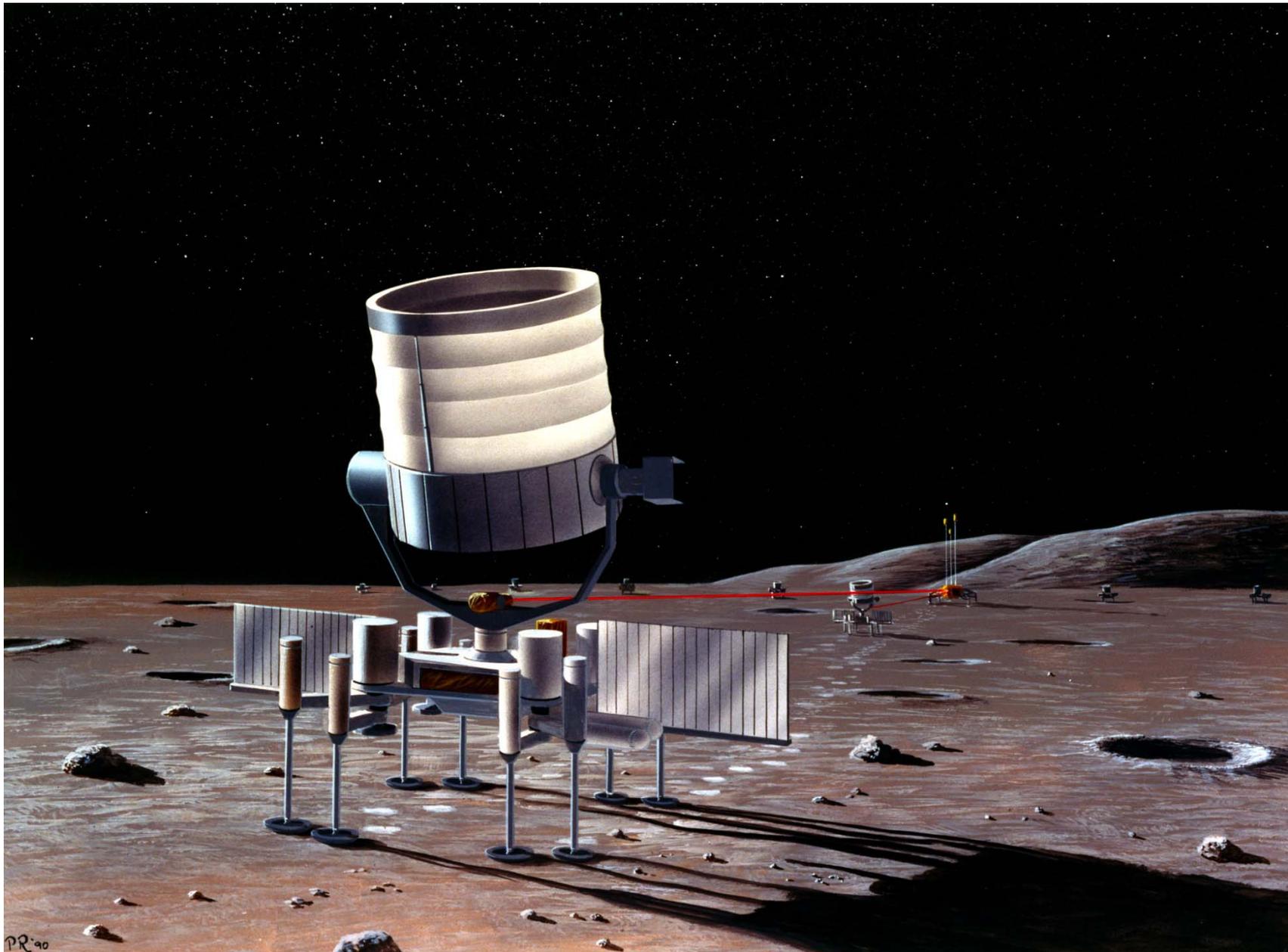
S88-33646 (April 1988)--- This painting was used as a visual at an April 1988 Houston-hosted conference titled "Lunar Bases and Space Strategies of the 21st Century." Here, a surface exploration crew begins its investigation of a typical, small lava tunnel, to determine if it could serve as a natural shelter for the habitation modules of a Lunar Base. One member of the expedition is standing on the lip of the rille near the point where the original tunnel disgorged its lava into an open channel. The two crew members in the foreground are standing in the lava channel. As indicated by the lack of meteorite erosion and debris burial, a section of the original tunnel's roof collapses sometime in the relatively recent past, perhaps due to the impact which formed the 15-meter diameter crater behind the crew member at the rille's edge. The collapse of this section of the tunnel roof exposed the layering in the volcanic rocks and displaced the mouth of the tunnel some 50 meters

upstream of its original position. The painting is by John Lowery of Eagle Engineering and was done on subcontract to, and under the technical and scientific direction of Lockheed Engineering and Management Services Company. The work was sponsored by the National Aeronautics and Space Administration's Johnson Space Center.



MoonTelescope2

S95-01425 (February 1995) --- (Artist's concept of possible exploration programs.) Space telescope on lunar surface uses an advanced walking mobility platform. Artwork done for NASA by Pat Rawlings, of SAIC.

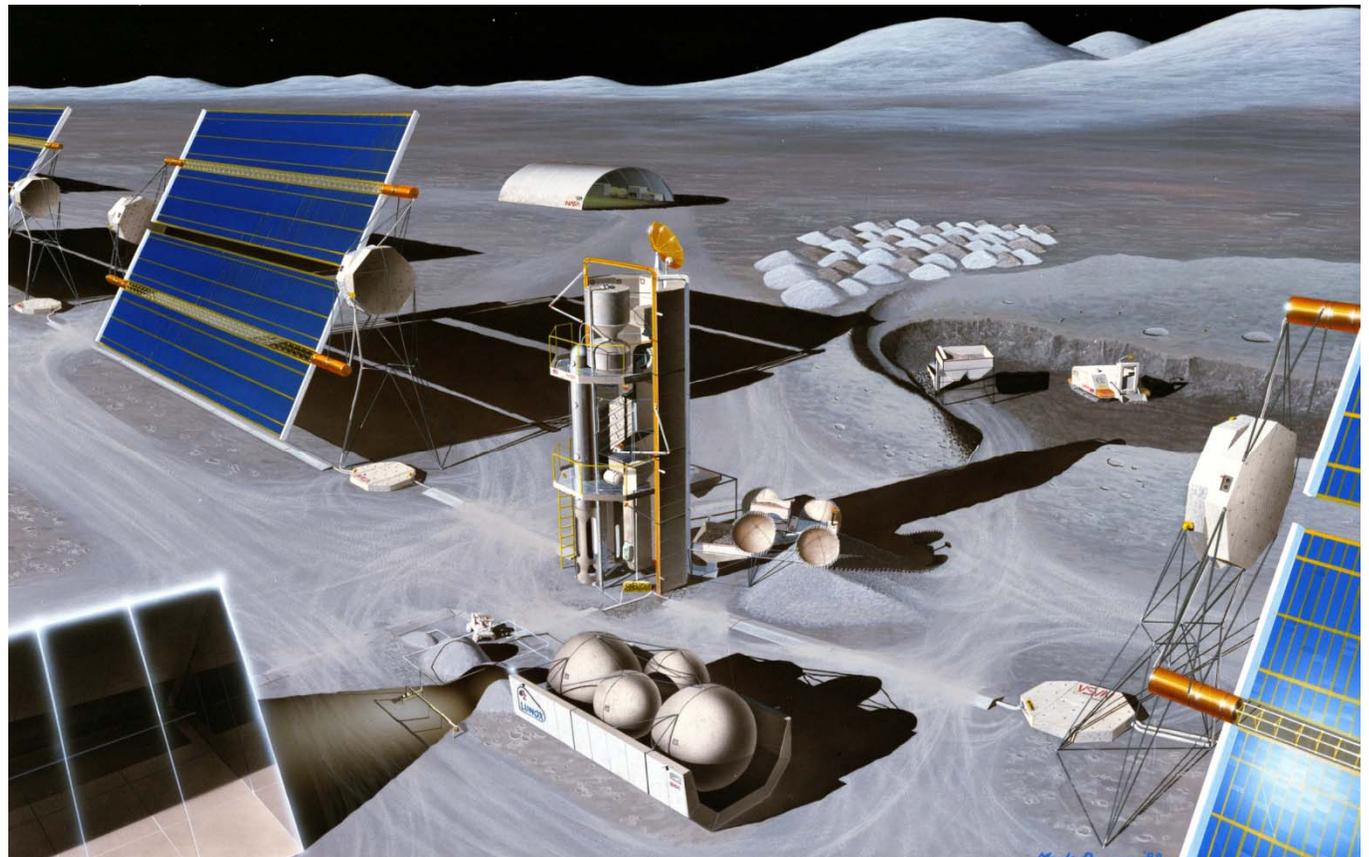


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Oxygen Production

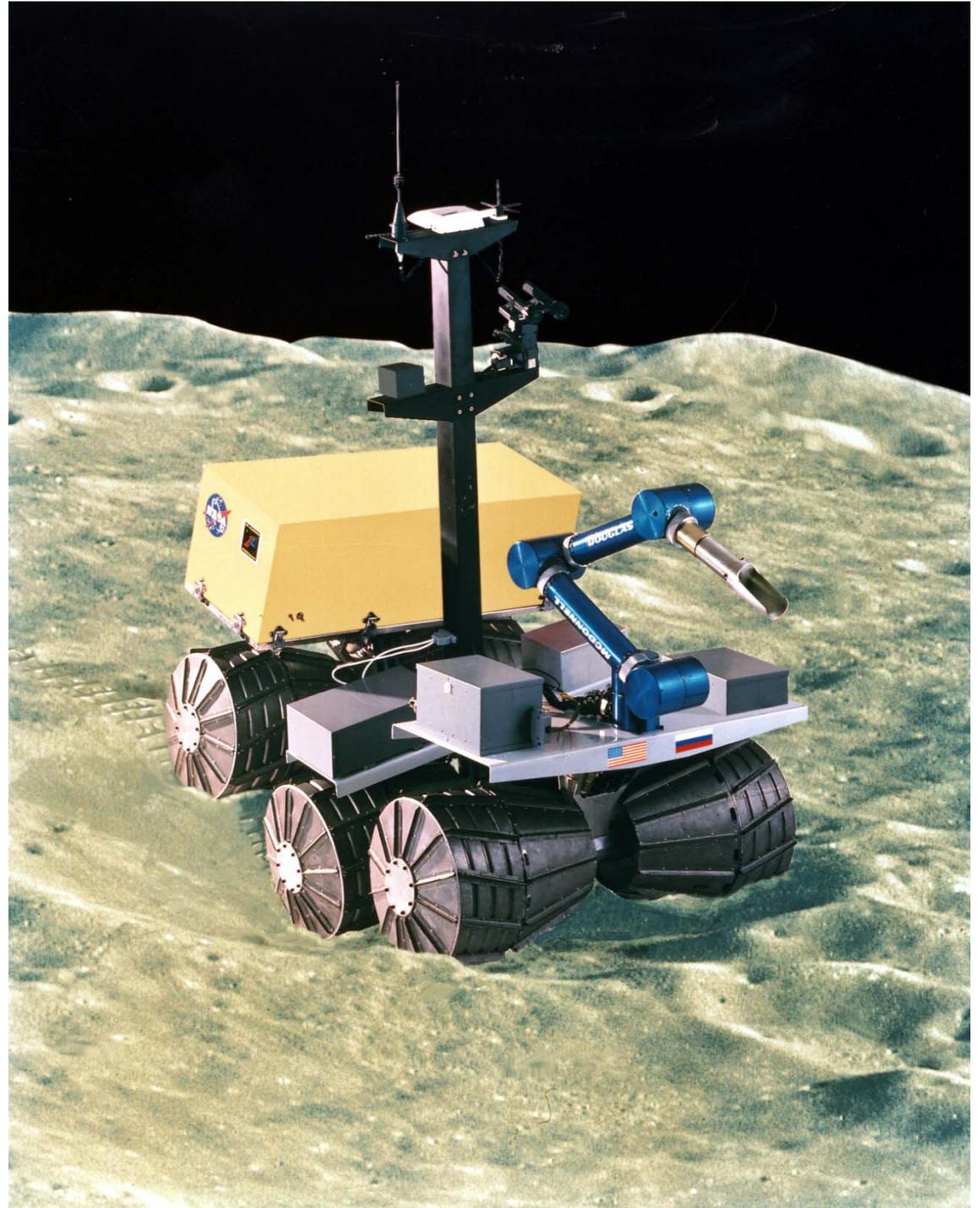
S88-33648 (April 1988)--- This painting was done by Eagle Engineering artists who are working with Eagle and NASA engineers on concepts born from a NASA sponsored project called the Lunar Base Systems Study. The art was also used as a visual at an April 1988 Houston-hosted conference titled Lunar Bases and Space Activities of the 21st Century. The NASA study revealed that oxygen propellant derived from lunar raw materials could play a key role in reducing the amount of mass launched into low earth orbit to support a lunar base program and thus cut costs. A program to manufacture lunar oxygen would involve a series of development stages on Earth and on the Moon to demonstrate process feasibility and to generate engineering data to support optimum one sixth g design of a full-scale production plant. The illustration shows a pilot plant sized to produce 2 mt per month of liquid oxygen. The plant reacts hydrogen gas with ilmenite to produce water and residual solids. The water is subsequently electrolytically separate into hydrogen and oxygen. The hydrogen is recycled to react with more ilmenite while the oxygen product is liquefied and stored. The feed stock for the depicted conceptual design is basalt rock mined from the bottom of a nearby crater. Oversized and undersized rocks are rejected at the pit site. The transported rock is loaded into a hopper and conveyed into a three-stage crushing, grinding circuit that reduces the rock size. Fine particles are separated by screens and discarded to a return conveyor. Ilmenite in the sized solid stream is concentrated prior to the reactor unit in a multi-roll high intensity magnetic separator. The reactor is a three-stage fluidized bed reactor. Reactor auxiliaries include low and high pressure feed hoppers, gas, solid cyclone separators, solid residual hopper, gas electric

heater, blowers and hydrogen makeup system. A high-temperature, solid ceramic electrolysis cell is used to split reaction water to oxygen and hydrogen. The oxygen is liquefied and stored. After product certification, possible uses for the pilot plant oxygen include LOX reactant for fuel cells and to supplement oxygen requirements for life support systems. This production scheme is based on the carbotex process. Telerobotic application is extensive in this conceptual design to allow long-term operation of the plant without on-site human involvement. The painting was done for NASA by Eagle Engineering artist Mark Dowman. The concept's principal investigator was Eric Christianson.



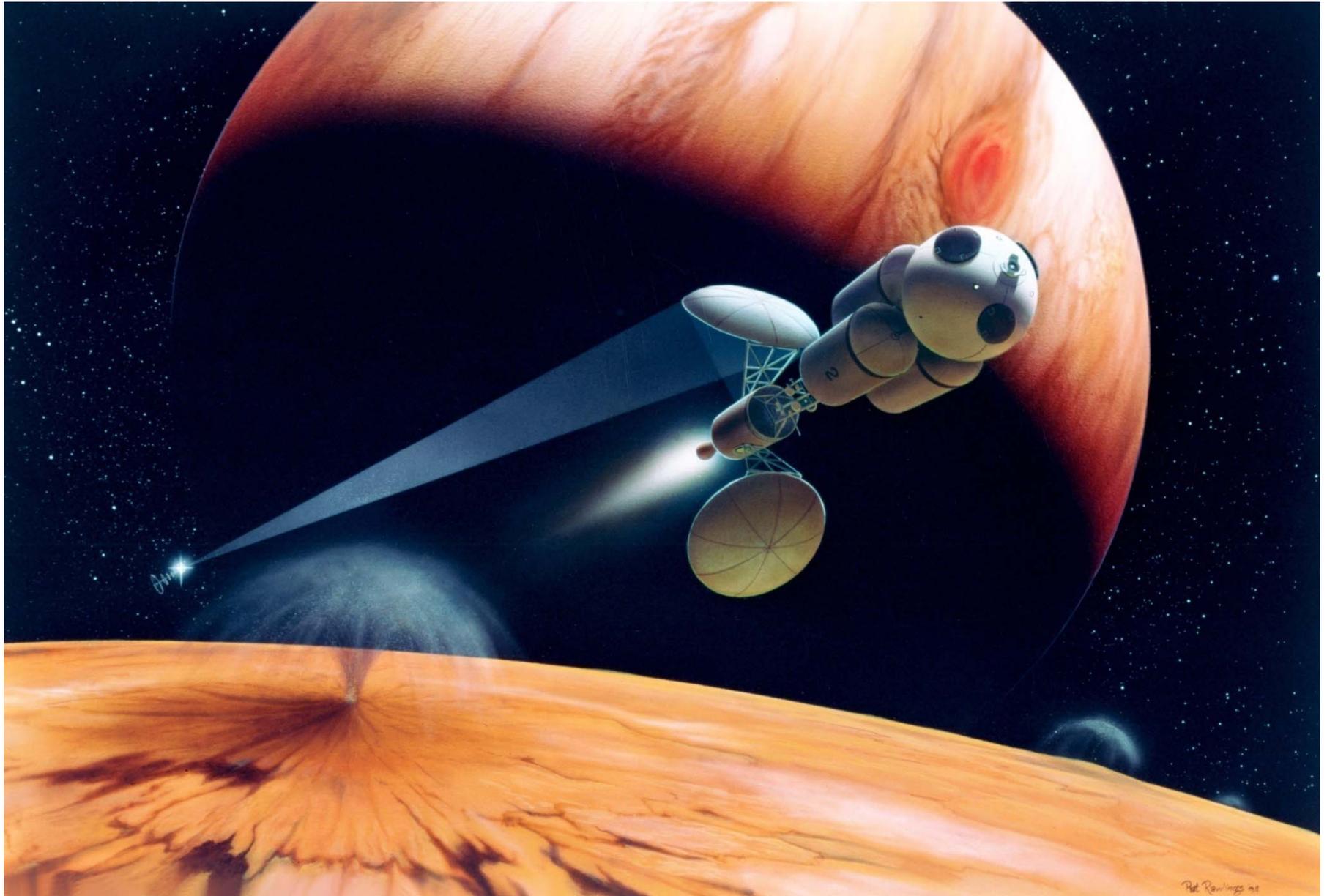
UnmannedRover

S95-03988 (February 1995) --- Unmanned exploration of the planets may some day be undertaken by tele-operated rover vehicles. A prototype rover will conduct field tests February 13 - 18, 1995, at Hawaii Volcanoes National Park, Hawaii. From a control center at NASA Ames Research Center (ARC) in northern California scientists will drive a Russian planetary rover inside an active volcano over terrain similar to that on Mars and the Moon. The six-wheeled rover is a descendant of the Russian Lunakhod vehicles that explored the Moon. Integration of the rover chassis with western avionics and development of a manipulator arm was accomplished by McDonnell Douglas. Participants in the field tests include NASA, McDonnell Douglas and The Planetary Society. Tests will also be conducted in conjunction with the JASON Foundation which has pioneered interactive student involvement in scientific field investigations in a marine environment.



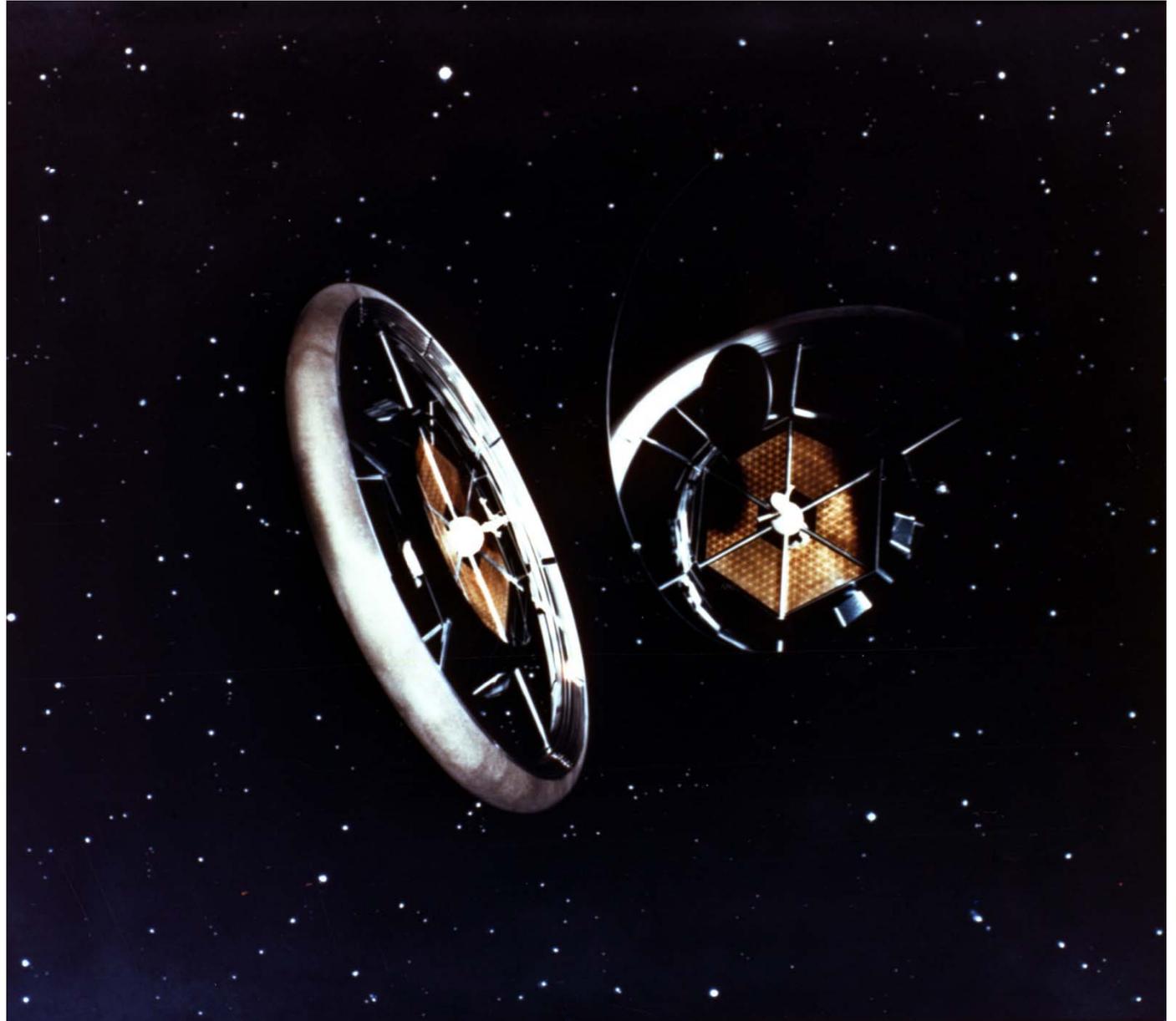
LaserSpacecraft

S99-04188 (1994) --- Laser power stations, perhaps drawing energy from the local environment, might one day propel spacecraft throughout the solar system. NASA studies of advanced planetary missions have ranged from small robotic probes to multiple-spacecraft human exploration missions. This image produced for NASA by Pat Rawlings, (SAIC).



Space Colony

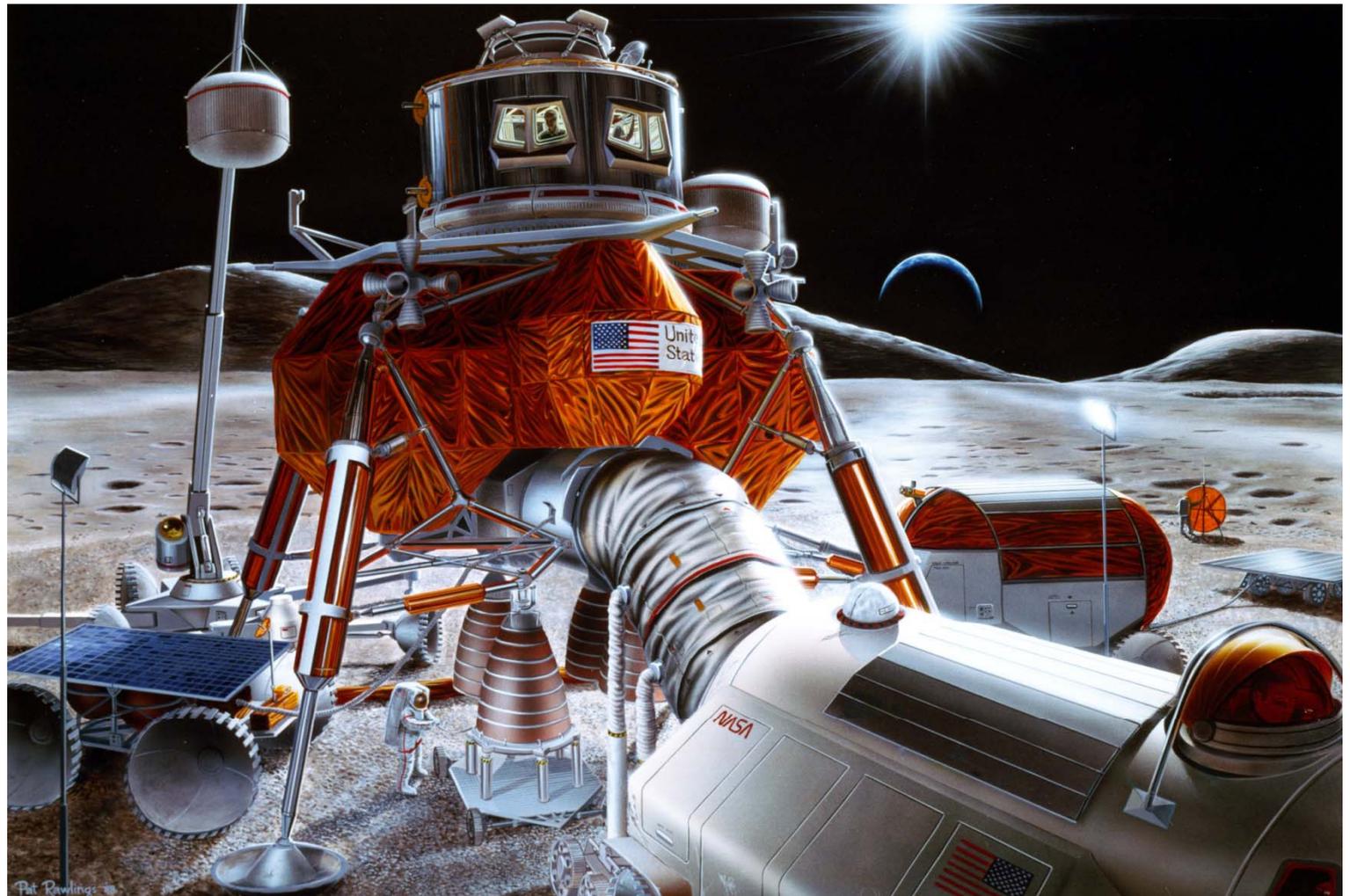
S76-28046 (16 July 1976)--- An artist's concept depicting a Space Colony in orbit. NASA scientists and engineers have designed a system for colonizing a permanent community in space. The colony looks like a giant wheel in space. The outer "tire" is a radiation shield built of compressed cinder-block-like lunar material. The central hub contains the docking station and communications antenna; six spokes connect the hub with the ring-shaped outer wheel and provide entry and exit to living and agricultural areas. To simulate Earth's normal gravity the entire habitat rotates at one revolution per minute about the central hub. The burnished disc that hangs suspended above the wheel is a floating mirror panel which reflects sunlight down onto the slanted panels and into the chevron shields that screen out cosmic rays.



LandingFacilities

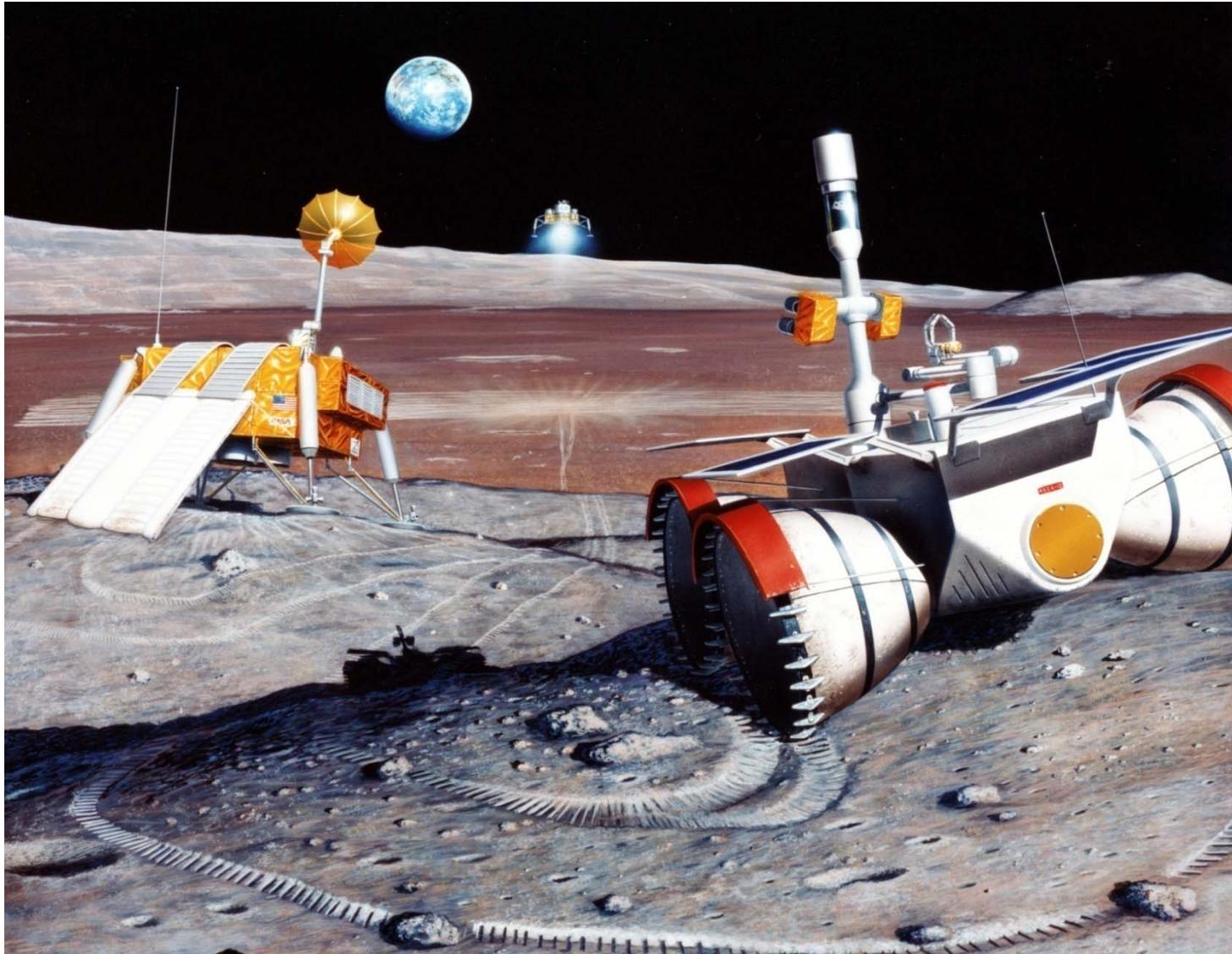
S88-33651 --- This painting was done by Eagle Engineering artists who are working with Eagle and NASA engineers on concepts born from a NASA sponsored project called the Lunar Base Systems Study. The art was also used as a visual at an April 1988 Houston-hosted conference titled Lunar Bases and Space Activities of the 21st Century. It was created to illustrate some of the landing facilities as they might appear near the end of a Phase II Lunar Base, the possibilities of which are being considered in the NASA-sponsored study. In this artist's concept the landing has occurred just after dawn. Earth appears over the Rook Mountains in the east across the dry lakebed of Lacus Veris. The lander sits in the middle of 100-meter diameter gravel landing pad where it is being readied for its stay on the lunar surface. Inside, crewmembers are shutting down the flight systems and configuring the lander for its layover. The pressurized vehicle in the foreground is connected to the lander, waiting to take the crew back to the base. The transfer tunnel has been connected the lander and the vehicle to allow the crew easy access. Beneath the lander an

astronaut begins the process of changing an engine by removing and relocating an old engine with a mounting rig. Changing modular line replaceable units is the first form of flight vehicle servicing to take place at the lunar base. To the right of the lander, a Propellant Refill Vehicle is being used to salvage hydrogen remaining in the tanks, a task requiring fast action before the Sun heats the tanks and evaporates the fuel. A crane removes a small canister containing the personal items of the arriving crew along with some small experiments and incidental supplies. The artwork was done by Pat Rawlings of Eagle. The principal investigator on this concept is Paul Philips.



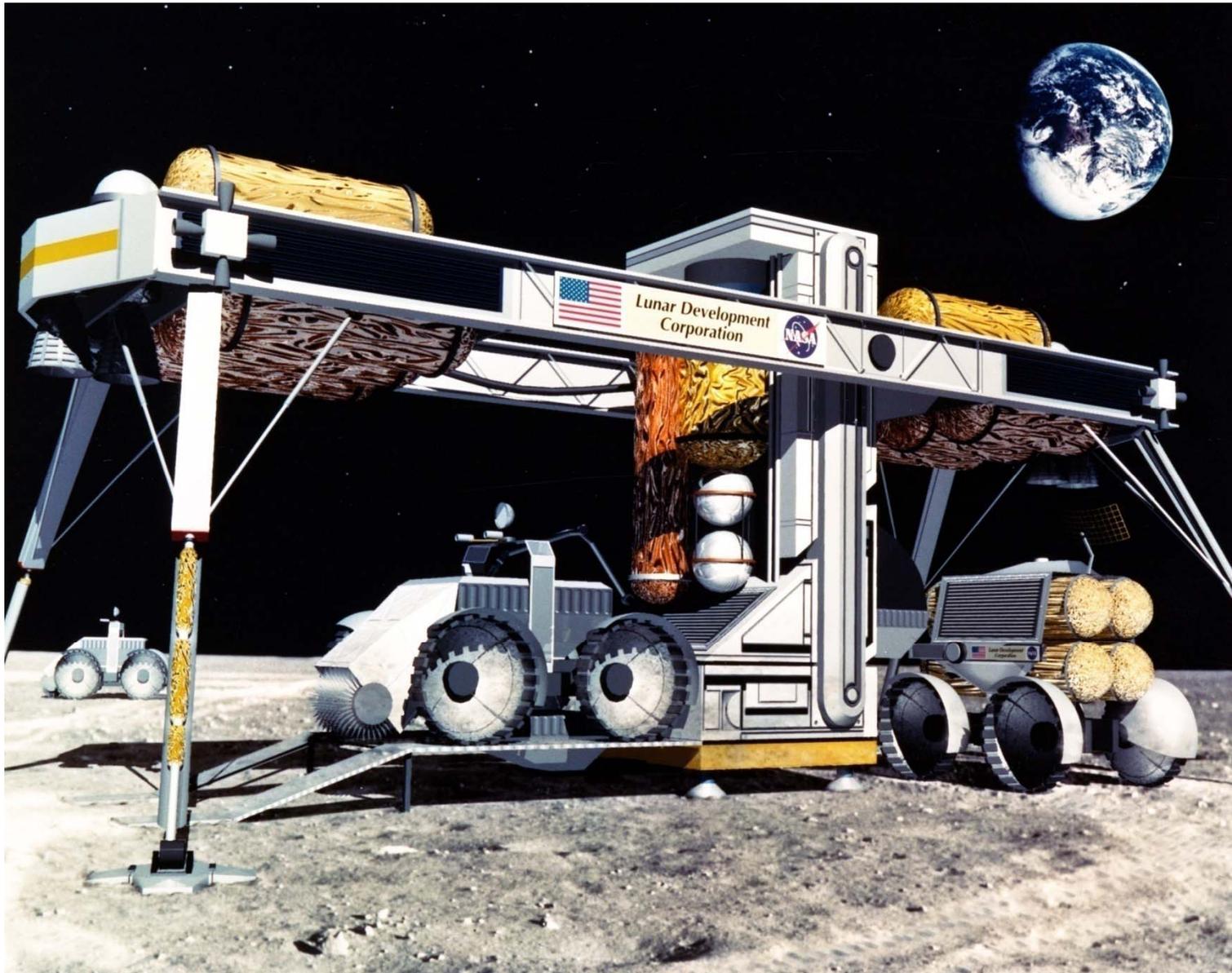
RoboticExploration

S91-52338 (1991) --- (Artist's concept of possible exploration programs.) An "Artemis" - class lander, capable of delivering up to 200 kilograms to the lunar surface, has delivered a teleoperated rover to the lunar surface. The rover has surveyed the landing site for an eventual human landing. The piloted vehicle is shown in the background during the final stage of its descent. The "Artemis" robotic lunar lander is designed for cost-effective delivery of payloads to the Moon to study lunar geology, astronomy, and as a precursor to human lunar expeditions. This image was produced for NASA by Pat Rawlings. Technical concepts from NASA's Planetary Projects Office (PPO), Johnson Space Center (JSC).



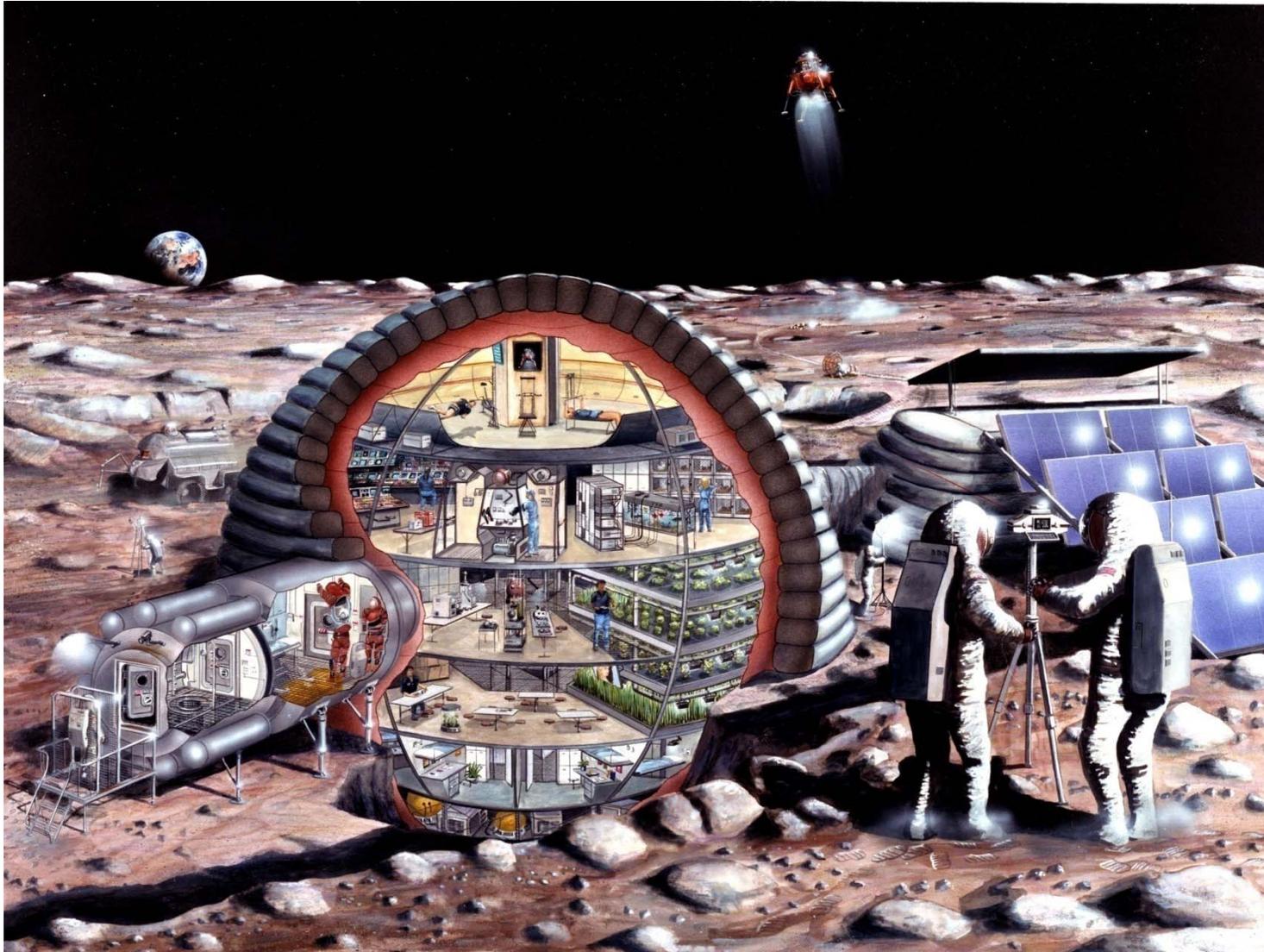
OxygenProduction2

S93-45590 (1993) --- (Artist's concept of possible exploration programs.) A teleoperated lunar oxygen plant begins production. Remotely driven surface vehicles mine and transport lunar soil to the plant, where the oxygen is extracted, liquefied, and pumped into waiting storage tanks. This image was produced for NASA by John Frassanito and Associates. Technical concepts from NASA's Planetary Projects Office (PPO), Johnson Space Center (JSC).



MoonBase

S89-20084 (July 1989)--- With a number of studies ongoing for possible lunar expeditions, many concepts for living and working on Earth's natural satellite have been examined. This art concept reflects the evaluation and study at JSC by the Man Systems Division and Johnson Engineering personnel. A sixteen-meter diameter inflatable habitat such as the one depicted here could accommodate the needs of a dozen astronauts living and working on the surface of the Moon. Depicted are astronauts exercising, a base operations center, a pressurized lunar rover, a small clean room, a fully equipped life sciences lab, a lunar lander, selenological work, hydroponic gardens, a wardroom, private crew quarters, dust-removing devices for lunar surface work and an airlock.



LargerRocket

S99-11038 (August 1999) --- A computer generated concept of a Magnum booster with fly-back boosters. Art work for NASA by John Frassanito and Associates, Houston.



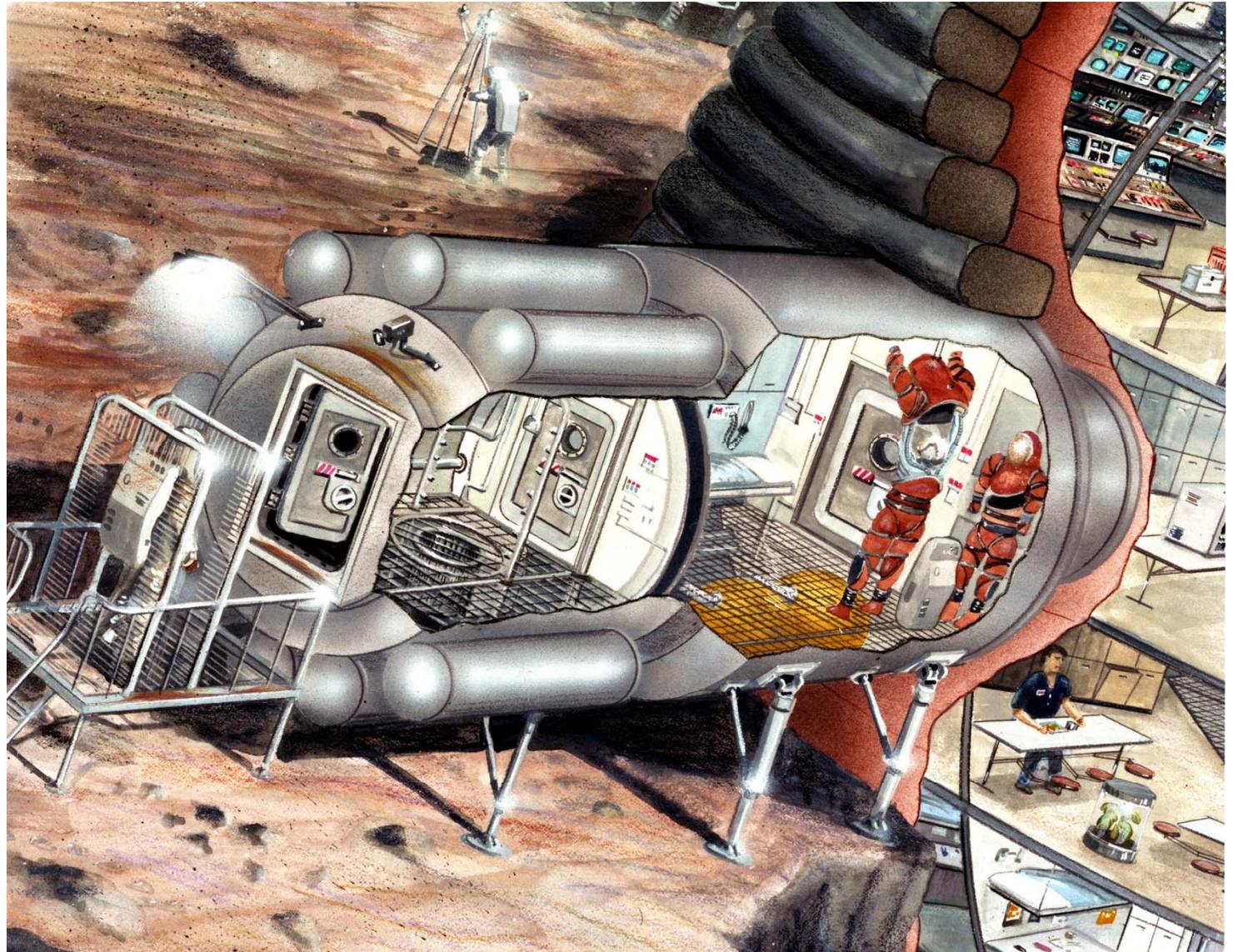
LunarCommercialism

S89-25055 --- An evolutionary approach to settling the inner solar system would begin with an outpost on the Moon. Here, just three days away from Earth, we could become experienced in living and working on another planetary body. The explorer in the foreground, wearing a constant-volume, hard space suit with rotating joints, is a representative of a commercial enterprise that intends to develop and exploit extraterrestrial resources. A lunar oxygen production plant, set between the two large solar panels, is generating a supply of rocket fuel that will be used for later journeys to Mars. The lunar base can be seen in the distance. Artwork by Mark Dowman and Mike Stovall of Eagle Engineering, Incorporated.



DustfreeAirlock

S89-20088 (July 1989) --- With a number of studies ongoing for possible lunar explorations, many concepts for living and working on Earth's natural satellite have been examined. This art concept reflects the evaluation and study at JSC by the Man Systems Division and Johnson Engineering personnel. A major concern of planners is the fine dust which covers the lunar surface and collects easily on astronauts garments, as evidenced by six crews of Apollo moon explorers. This special annex to the 16-meter diameter inflatable habitat (depicted in S89-20084,85) provides possible solutions to the dust problems, according to teams studying possible lunar expeditions. As much dust as possible must be removed, they say, before re-entering the habitat. The astronauts might pass through wickets (far left) which remove much of the dust. A perforated metal porch would allow dust to fall through. Once inside the dust lock (center) the astronauts would remove their white coveralls. This outer garment would provide an extra layer of dust control and protection for the precision moving joints of the space suit from gritty dust. An air shower could remove remaining dust with strong jets of air. An astronaut at right, after having removed as much dust as possible, would be able then to move into the airlock to doff his suit. The airlock could accommodate up to four astronauts at one time. Suits could be stored there when not in use.



ModuleTransfer

S99-04186 (1996) --- Routine 24-hour flights to the Moon could employ detachable crew modules atop nuclear thermal transfer vehicles. By transferring the module from one propulsion element to the next, the passengers could complete their trip to the lunar surface without ever leaving the module. This image produced for NASA by Pat Rawlings and Bill Gleason, (SAIC). Technical concepts for NASA's Exploration Office, Johnson Space Center (JSC).



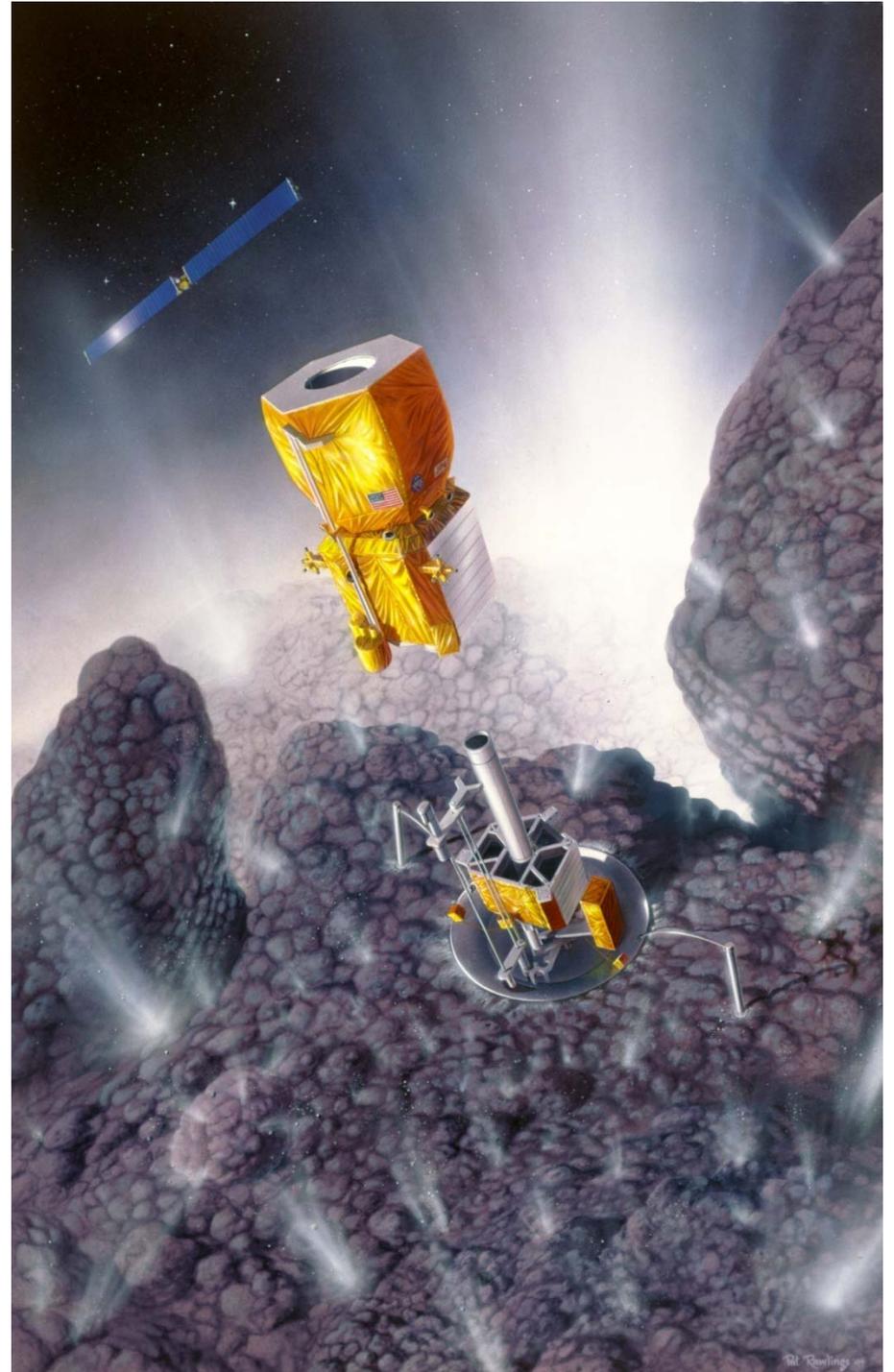
SpaceAccident

S99-04197 (1992) --- (Artist's concept of possible exploration programs.) Lunar pioneers will encounter hazards and crises requiring new emergency procedures. Here, an antenna installer fell over a 90-foot escarpment and fractured his right femur. Responding to this situation on a "medivac" hopper, two other lunar base crew members employ a portable CAT-scan device, a holographic display, and helmet-mounted heads-up displays to determine the severity of the injury. After an inflatable Thompson splint is placed on his leg, the semiconscious technician is transported back to the base strapped onto the side of the hopper. This image produced for NASA by Pat Rawlings, (SAIC). Technical concepts for NASA's Exploration Office, Johnson Space Center (JSC).



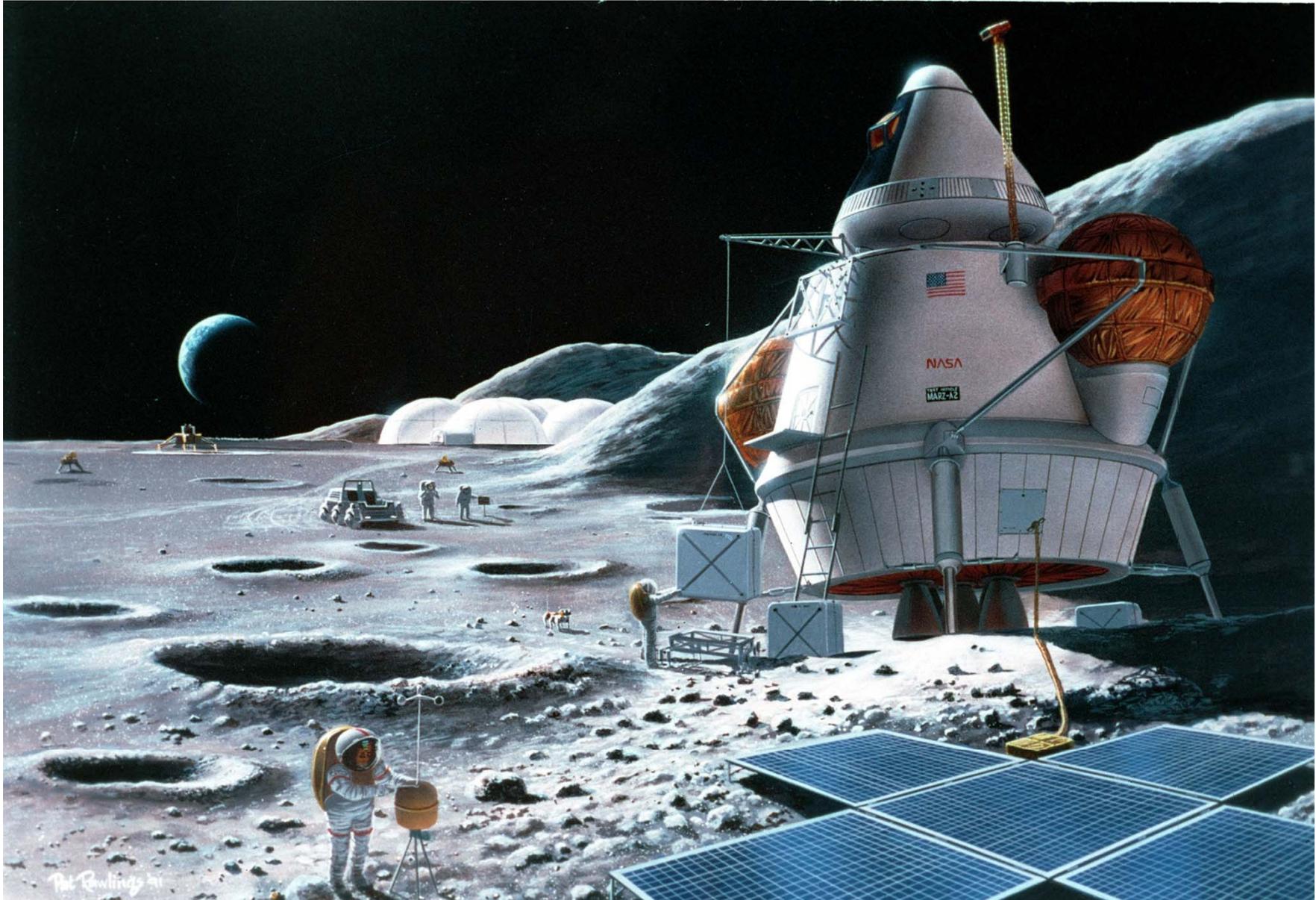
CometLanding

S99-04190 (1997) --- A massive, dirty snowball the size of a mountain plows through the Solar System, venting water vapor as it begins its inbound loop around the Sun. The proposed Champollion spacecraft lander anchors to the irregular surface and collects both surface and core samples. After transferring the samples and collecting other data, the ascent stage departs to rendezvous with the orbiting Earth return stage. This image produced for NASA by Pat Rawlings, (SAIC). Technical concepts for NASA's Exploration Office, Johnson Space Center (JSC).



MarsSimulation

S95-01563 (February 1995)---(Artist's concept of possible exploration programs.) Earth's Moon, just 3 days away, is a good place to test hardware and operations for a human mission to Mars. A simulated mission, including the landing of an adapted Mars excursion vehicle, could test many relevant Mars systems and technologies. Artwork done for NASA by Pat Rawlings, of SAIC.



LunarHabitat

S93-45585 (1993) --- (Artist's concept of possible exploration programs.) A lunar habitat has been assembled out of components delivered by automated cargo flights. Pressurized rovers, logistics modules, and a space suit maintenance and storage module combine to provide the living and working quarters for the crew. This image was produced for NASA by John Frassanito and Associates. Technical concepts from NASA's Planetary Projects Office (PPO), Johnson Space Center (JSC).

