NO ASSEMBLY REQUIRED

A new plan for exploring the Moon foregoes rebuilding the Saturn V

By John R. Williams

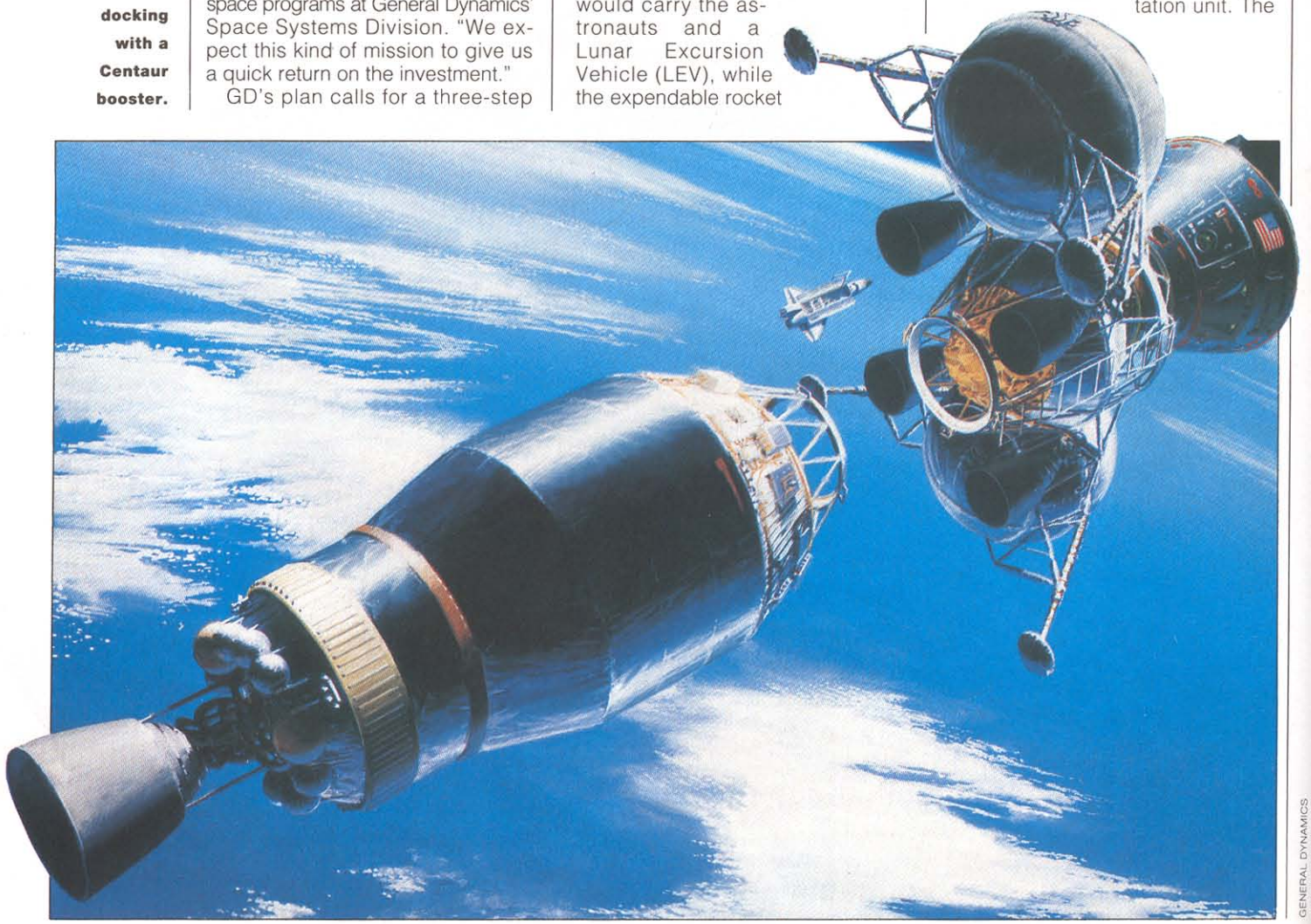
By all accounts, the return to the Moon will be more than a flags and footprints enterprise. But such a mission might not require a new heavy booster or exotic technology.

General Dynamics is pitching a relatively low-cost return to the Moon—a mission that could occur before the end of the decade using existing hardware. "The mission would be an excellent, high-profile and highly productive endeavor," says Paul Bialla, manager of civil space programs at General Dynamics' Space Systems Division. "We expect this kind of mission to give us a quick return on the investment."

GD's plan calls for a three-step return to Earth's nearest neighbor. The plan's strength lies in using existing, off-the-shelf technology developed for the space shuttle and Space Station Freedom, Bialla says. In that respect, it differs from NASA's current First Lunar Outpost study (*see FF, Nov/Dec 1992)* since it doesn't require the development of a Saturn V-type heavy booster. GD's mission envisions using both the space shuttle and existing expendable boosters to loft the components into orbit. The shuttle would carry the astronauts and a Lunar Excursion Vehicle (LEV), while the expendable rocket would carry a heavier and more volatile booster into low-Earth orbit. Candidates for the expendable rocket include a modified Titan IV and France's Ariane V.

The first mission, scheduled for 1999, would be unmanned. GD plans to land 9.7 metric tons of scientific equipment and support hardware on the lunar surface. The second mission would also be unmanned, but would set the stage for human exploration by deploying a crew habitation unit. The

Below: Off-the-shelf technology—a Lunar Excursion Vehicle docking with a Centaur booster.



GENERAL DYNAMICS

proposed module would probably be derived from the mini-pressurized logistics module developed by Italy's Alenia for use on Space Station Freedom, says Bialla. The unit would contain a life support system, fuel cell power systems and environmental control hardware.

With equipment in place on the Moon, the third mission would be crewed. As Bialla envisions it, the space shuttle would ferry the LEV—composed of the lander and crew capsule—and the astronauts into low-Earth orbit. Shuttle astronauts would then attach the crew capsule to the four-legged lander base and check out the systems. Next, a Titan IV would lift a modified Centaur booster, also developed by General Dynamics, into orbit. Astronauts will then perform an extra-vehicular activity (EVA) to enter the capsule and dock with the booster, which will propel them to the Moon.

Currently, the Centaur booster can remain in orbit for only a few hours. To boost that time to several days, Bialla says that engineers will add insulation to the cryogenic tanks, batteries to provide power for subsystems and more fuel for attitude control jets. Other upgrades are needed to man-rate the booster, and the propellant capacity must be increased by 10 to 15 percent. Because the upgrades will increase the weight of the Centaur booster, both the Titan IV and Ariane V would have to be upgraded.

The two-person lunar capsule itself would look very much like a scaled-down Apollo command module, and would weigh about 7,200 pounds. The aerospace company's engineers decided to take advantage of the proven aerodynamic properties of the three-person Apollo capsule while upgrading the materials. The lander, slightly larger than the Apollo lunar module, will use four engines fueled by 35,000 pounds of liquid hydrogen-oxygen propellant to brake the descent to the Moon and to return the astronauts back to Earth. Bialla says that the astronauts could live on the Moon for up to three weeks, conducting various scientific experiments and surveys.

With international cooperation, Bialla says that General Dynamics' plan could cost as little as $6 billion. Yet NASA, which has praised the "ingenuity and creativity" of the plan, has nevertheless expressed concern that the first proposal falls short of some key performance and safety margins. The LEV, which would be launched aboard the space shuttle, exceeds NASA's weight requirements for a safe landing during an abort. Also, NASA says that the extent of the modifications to the Titan IV/Centaur configuration takes aspects of the program out of the "off-the-shelf" category.

Bialla, however, responds that General Dynamics has already taken safety concerns into account. In the event of an emergency, Bialla argues, the propellant carried by the LEV could be jettisoned, making the shuttle light enough to land safely.

And, as for the technological upgrades, Bialla contends that "there are fewer modificatons to something we already have and it will be less expensive. The idea of getting people to the Moon in the near future requires an innovative approach short of building something brand new." ■

Contributing editor John R. Williams wrote about NASA's ACTS program in our March/April issue.