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MARS MISSION POSSIBLE

LONDON, March 27, Graphic News: NASA's missions to explore the surface of Mars revolve around one crucial problem: how to trade off the weight of the spacecraft with the cost of the fuel needed to travel the 80-odd million kilometres to the Red Planet.

In 1952 rocketman Wernher von Braun proposed launching space vehicles weighing over 37,000 tonnes into low Earth orbit. Almost all of this weight was for the huge supply of rocket fuel needed for the journey to Mars. The cost – hundreds of billions of dollars.

By 1989 NASA had reduced the the mission-mass to 980 tonnes with a $400 billion price tag, and now, 11 years later, NASA's ambitions have been refined to the bone; down to 437 tonnes of fuel and hardware and a price tag of $50 billion spread over a decade.

Today's launch vehicles, the Space Shuttle and the Titan 4B, can lift payloads of just 23 tonnes into low Earth orbit. With each fully-fueled Mars craft weighing over 130 tonnes, they will have to be launched in sections and assembled in orbit.

To cut costs NASA's Marshall Space Flight Centre in Huntsville, Alabama, has designed a rocket using off-the-shelf, Russian-designed, RD-120 engines and the same solid-fuel boosters as the Space Shuttle. The two-stage "Magnum" is capable of hauling an 80-tonne payload over 200 kilometres (125 miles) into space and can lift-off from existing launchpads.

In NASA's "Design Reference Mission", two unmanned spacecraft – a cargo lander and a habitat lander – are first assembled in orbit before being blasted on an elliptical path towards Mars.

The path, known as the "Hohmann transfer", takes advantage of the Earth's orbital motion and reduces the fuel required for the voyage.

On arrival the habitat lander remains in orbit while the cargo lander drops a power plant and ascent vehicle onto the planet's surface.

A third spacecraft – the crew transfer vehicle, with a crew of six – is launched 26 months later on its six-month journey.

Once in orbit around Mars the crew moves to the habitat lander and descends to the surface, touching down next to the cargo lander.

After 500 days of exploration the astronauts blast off in the ascent vehicle, rendezvous with the crew transfer vehicle and return to Earth. Repeated missions build up a permanent settlement.

The NASA mission draws heavily from a plan known as "Mars Direct", put forward by Robert Zubrin and David A. Baker in 1990.

The power plant uses a small, 100-kilowatt, nuclear reactor which powers a chemical-processing unit.

Inside the unit, hydrogen brought from Earth reacts with the Martian carbon dioxide atmosphere to produce water and methane. Through electrolysis the water molecules are broken down into hydrogen and oxygen. The methane and oxygen is stored for use as rocket fuel for the return journey and the hydrogen is recycled through the unit to generate more water and methane. Additional water and oxygen can be used for crew life-support.

"Some day millions of people will live on Mars," says Mr. Zubrin, now president of the privately funded Mars Society which is encouraging public interest in Mars exploration.

The society's first project, a $1 million Mars Arctic Research Station at the Houghton meteorite impact crater on Devon Island in the Canadian Arctic, will be operational by summer 2000.

"Today we have the opportunity to be the parents, the founders, the shapers of a new branch of the human family," says Mr. Zubrin. "The cost is a small price to pay for a new world."

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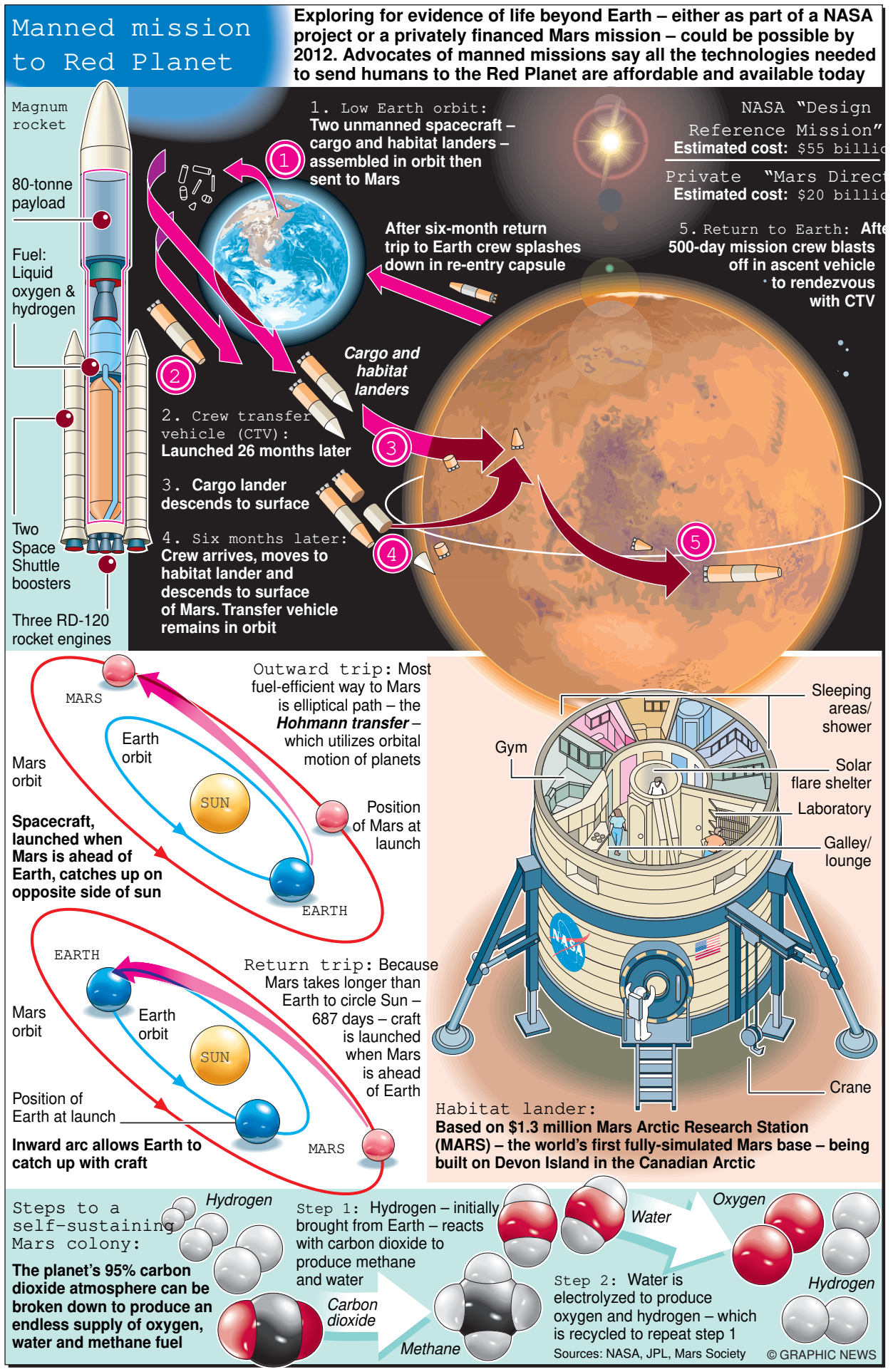
Sources: NASA, JPL, Mars Society, Reuters, Associated Press



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