

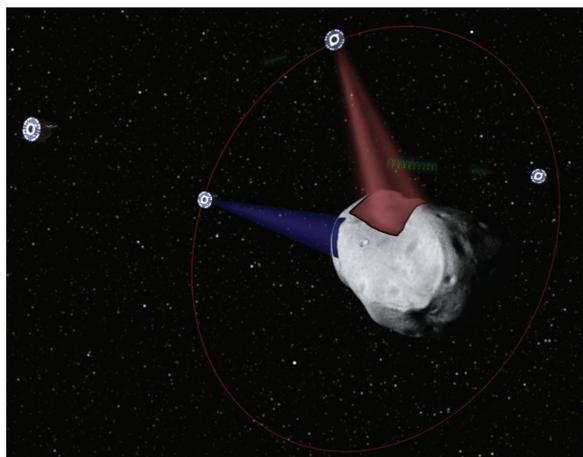
## Space

# US firm's asteroid-mining plans face challenges

Concerns have been raised over the legality of ambitious plans that were announced in late April by the private US company Planetary Resources to mine near-Earth asteroids for raw materials. Supporters of the firm claim that it heralds the start of a new era of commercial space operations and a potential solution to mineral shortages here on Earth. However, others warn that current laws governing space exploration may hinder these ambitions and that US and international law will need to be beefed up if it is to cope with the commercial exploitation of resources in space.

Planetary Resources was founded three years ago by aerospace engineer Eric Anderson and space entrepreneur Peter Diamandis. It has attracted a range of high-profile backers, notably film director James Cameron and Google co-founder Larry Page. Over the next decade, the company plans to identify, map and analyse asteroids using a suite of specially designed spacecraft, before extracting valuable materials such as metals, minerals and water.

The firm also hopes to use near-Earth asteroids as orbiting space “depots” for water and fuel, to serve



Planetary Resources

as stepping stones for deep-space exploration. Planetary Resources wants to launch its first spacecraft to search for resource-rich asteroid targets within the next 18 months, possibly hitching a ride on a commercial satellite bound for low Earth orbit.

However, some warn there are many issues that need to be overcome before the company can start surveying. “Neither the public interests – ranging from security, safety and the environment to protecting Neil Armstrong’s footsteps – nor the interests of the company in securing its investments are properly pro-

## Rich pickings

US firm Planetary Resources is developing the technologies to enable prospecting of near-Earth asteroids.

ected,” says space-law expert Frans von der Dunk from the University of Nebraska-Lincoln. “Consequently, there is no legal certainty that those activities would not become seriously challenged.”

Chris Lewicki, president and chief engineer of Planetary Resources and former NASA flight director for the Spirit and Opportunity Mars rovers, recognizes the challenges that the company will face in breaking new ground. “We have to be mindful of all the different variables, such as the nature of competition, regulation and perception. It’s something that we certainly don’t take lightly,” he told *Physics World*. “We are very mindful of the precedents we’re setting.”

While the company’s mission is primarily commercial, Lewicki is enthusiastic about the scientific benefits of working with near-Earth asteroids. “By getting out there, we learn more about our own planet,” he says. Indeed, Lewicki has been encouraged by the response that the company’s plans have received. “We expected a reaction of sorts, but we didn’t know what it would be,” he adds. “We were overwhelmed by the positive reaction that we received.”

**Simon Perks**

## Energy

# Norway takes the lead in carbon-capture technology

The world’s largest centre for testing and developing carbon capture and storage (CCS) technologies opened last month at Mongstad on Norway’s west coast. A joint venture between the Norwegian government and the energy firms Statoil, Shell and Sasol, the Technology Centre Mongstad aims to act as a test bed for the capture of carbon dioxide (CO<sub>2</sub>) and to demonstrate that the approach is commercially viable.

Construction of the facility began in 2006 and cost \$1bn – some 10 times more than initial government estimates. The facility hosts two carbon-capture plants that can “scrub” 80 000 tonnes of the gas a year from a nearby oil refinery and 20 000 tonnes from an on-site gas power plant. The centre uses two carbon-capture techniques, one using ammonia to trap CO<sub>2</sub> and the other using an

## Gas guzzler

The Technology Centre Mongstad will be able to “scrub” around 90% of the carbon dioxide emitted from a nearby oil refinery and an on-site gas power plant.



Technology Centre Mongstad

“amine” chemical. Both techniques are applied after the fuel has been burned and use the solvent to absorb around 85–95% of the CO<sub>2</sub> contained in the exhaust gases, which can then be transported and stored.

The International Energy Agency says that CCS will play a vital role in worldwide efforts to reduce carbon emissions and to limit the effects of climate change, possibly contribut-

ing around one-fifth of required emissions reductions by 2050. “There is no solution to the challenges presented by climate change that does not incorporate CCS,” says Ola Borten Moe, Norwegian minister for petroleum and energy. “Technological development is crucial if we are to progress in this important area.”

The opening comes as other CCS projects around the world have been put on hold or shelved because of government austerity initiatives. Plans for Canada’s \$4bn Project Pioneer carbon-capture facility were scrapped last month, while the UK cancelled a scheme at Longannet in Fife late last year. The difficulty in securing investment in CCS is compounded by the current low cost of carbon. The EU’s emissions trading scheme, the largest in the world, currently charges around \$9 per tonne of CO<sub>2</sub> emitted, contrasting with the likely \$70 per tonne cost of capturing the gas using CCS technologies.

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