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Technology

Crawling robots will survey ageing US nuclear missile silos

David Hambling

ROBOTS will be employed to automate the maintenance of nuclear missile silos in the US.

There are some 400 steel and concrete silos housing Minuteman III intercontinental missiles in the US. Constructed in the early 1960s, each silo is 30 metres deep and 5 metres across, with a missile inside.

The missiles and silos are years beyond their planned service lives, but the US Air Force's Minuteman IIIs act as a nuclear deterrent, and they will continue in this role until they are replaced by Sentinel missiles, which is planned in the next decade.

To check whether the facilities are still fit for purpose, silos have previously been inspected by subjective, manual methods, says a spokesperson for Gecko Robotics, which has won a $1.5 million contract to use robots for the task. Yet it can be hard for a person to check the sheer, curved internal wall of a silo when much of the space is occupied by a missile, and dropping a tool could conceivably lead to damage or explosions.

Gecko Robotics has pioneered robots to inspect storage tanks and ship's hulls. Its TOKA series robots can climb walls, crawl at up to 20 metres a minute and are loaded with sensors and cameras.

The readings the robots take enable the creation of a high-resolution 3D model of the area. "We're able to provide the Air Force with a digital twin of the facilities to help them identify problem areas," says the spokesperson.

Gecko Robotics will equip the robots with echo impact sounders to assess reinforced concrete. These are essentially an automated version of a surveyor tapping with a hammer and listening for a change in note, says Phil Purnell at the University of Leeds, UK.

The surveys should reveal whether the silos need repairs or should be taken out of service. ▮

Space

Gravitational wave detectors could spot alien warp drives

Leah Crane

WE MAY be able to spot enormous alien spacecraft by the gravitational waves they would create. Gravitational waves are ripples in space-time formed when a massive object moves around, so if there are any extraterrestrials driving gigantic spacecraft around our galaxy, the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the US could potentially detect them.

Gianni Martire at Applied Physics, a research institute in New York, and his colleagues calculated how large such a craft would have to be, and how fast it would have to move, to create a gravitational wave big enough for LIGO to spot. They found that the craft would have to be about the mass of Jupiter, travelling at about one-tenth the speed of light – that is nearly 30,000 kilometres per second, faster than any star astronomers have discovered.

They found that LIGO could spot such a craft if it travelled within about 326,000 light years of Earth, and more sensitive planned gravitational wave detectors could extend that distance even further (arXiv, doi.org/jp3n).

"With trillions of stars out there, you're telling me that one doesn't have aliens that haven't done this? Just one? I think the odds are in our favour," says Martire. "I wouldn't want to be on the team figuring out how to build a Jupiter-sized spacecraft, but the odds aren't zero."

30,000

Speed in km/s an alien craft would have to travel to spot it

This could also work for crafts using warp drives, theoretical engines that move by creating their own wrinkles in space-time. "There's no way in hell we could detect a craft so far away in other ways, even if it's as big as Jupiter," says Martire. "The LIGO folks and the SETI [Search for Extraterrestrial Intelligence] folks should be best friends."

But even though it is clear that extraordinarily massive spacecraft and warp drives should create gravitational waves, other researchers are sceptical that we will ever be able to actually detect them.

"This is well and fine in principle, it's just that I am surprised they find the result to be in the sensitivity range of LIGO," says Sabine Hossenfelder at the Munich Center for Mathematical Philosophy in Germany. "If the spacecraft was actually Jupiter, which is pretty close, maybe we'd actually be able to measure it, but if it was much further away, probably not."

Even if we were to detect gravitational waves from a huge, fast-moving object, it would be hard to discern whether it was an alien spacecraft or a natural phenomenon. It could be easier for warp drives because of the unique way they are expected to affect the gravitational field around them. "How do you know the difference between a comet and the starship Enterprise? You can tell between a rock and a warp drive the same way you can tell whether a jet ski went past or a boat," says Martire. "They both create waves, but they have a particular signature in their wake."

There is no downside in checking for an outlandishly enormous spacecraft in LIGO data, says Hossenfelder. "It's there, it's collected already and freely available, I don't see why not," she says. "I'm just not that excited about the idea that they'll actually find anything."

If they do, even if it isn't an alien spacecraft but simply a huge object moving far faster than we expect anything that big to go, it would be an important find. "Even if it's not aliens, it'd be something new," says Martire. "It would be exciting no matter what it is." ▮

For more aliens, see page 64

***Star Trek*'s Enterprise uses a warp drive**

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