ENGINEERING

Eng 1 Eng 2 Capstone Aerospace

NTI DAY 5

Please complete the attached assignment and turn in within 3 days of the NTI Day.

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THE WALL STREET JOURNAL.

Drones Become Mining's Flight to Safety

Fully autonomous devices use lasers to explore dangerous caves, reducing costs and human risks

By Mike Cherney
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JUNDEE, Australia -- Hundreds of feet underground here, scientists are experimenting with a technology that could transform how mining companies dig out rocks in dangerous, pitch-black caves: fully autonomous drones.

The drones would fly without any pilot assistance into areas too risky for human miners. Using a rotating laser similar to those on autonomous cars, they would create three-dimensional maps more detailed than what is available now, helping miners excavate more gold and other commodities that might otherwise be missed.

"It's very sci-fi," said Zachary McLeay, a production engineer for Australian gold producer Northern Star Resources Ltd., after seeing a drone fly into a dark cavern during a recent test.

The trial, at Northern Star's Jundee gold mine in Western Australia, is part of a broader effort by the global mining industry to embrace automation, which is driving down costs and improving safety.

It also might lead to fewer jobs. Companies from South Africa to Australia are already using technology such as driverless trucks, mechanized drilling and extra-long conveyor belts to improve productivity as they look to rebound from the recent downturn in commodity prices.

Automation can "save lives, and also save time and save money," said Mehmet Kizil, associate professor and mining-engineering program leader at the University of Queensland in Australia. "The industry's made a big jump in adopting this technology because the biggest cost in mining is labor."

Drones have become a popular cost-saving measure in sectors as diverse as retail and insurance, and mining companies regularly fly them to get aerial views of their facilities. But taking the machines underground represents a new frontier, and one fraught with risk.

Pitch-dark cavities can conceal dangers, such as falling rocks, with the potential to destroy drones that cost tens of thousand of dollars apiece. Adding to the challenge, a drone flying underground can't use satellite-navigation systems, such as GPS, like it could on the surface.

Scientists and mining engineers say drones could be deployed to investigate large underground caverns after they are blasted open by explosives. The rock blasted out of these caverns is trucked to the surface, where it is crushed and gold is extracted.

Currently, surveyors must use a laser-mapping device attached to a boom, and stick it as far into the cavern as possible. But a laser attached to a fixed point can't capture everything, and it is too dangerous for human surveyors to go inside for a closer look.

With a better map from a drone, miners could get a clearer picture of how much rock they have blasted out, modify their blasting technique if they aren't getting enough, and better plan the next cavern to blast. Drones could also collect maps of older sections of mines, making it easier to restart mining in those areas if commodity prices rise.

In general, mining companies assume they can get 95% of the ore from underground using current methods, said Brad Valiukas, technical-services manager at Northern Star. Jundee alone is expected to produce more than $300 million in gold this fiscal year, so even a small improvement in efficiency is "a massive amount of money," Mr. Valiukas said.

In September, a team of researchers from Data61, part of the Australian government-funded Commonwealth Scientific and Industrial Research Organisation, demonstrated at Jundee that a drone could fly by itself in an underground cavern where the pilot couldn't see it. But that means the pilot also couldn't intervene if something went wrong.

"It's a pretty big step for us and it shows that this is feasible," said Stefan Hrabar, the Brisbane, Australia-based scientist who led the team.

More work still needs to be done. Right now, researchers first must fly the drone with assistance from a pilot to build a preliminary map. Using the initial data, they can then program the drone to fly autonomously to certain locations.

But the ultimate goal is a fully autonomous drone that can simply be taken underground and turned on, and then fly away to map a tunnel or cavern. Such drones could be tested in the next few months.

One of the riskier test flights Mr. Hrabar and his colleagues attempted at Jundee was an autonomous flight in a roughly 180-foot-tall cavern, the largest that had been blasted at the mine.

"This is the moment of truth," said Farid Kendoul, another scientist on the team, just before the flight.

The drone, whizzing on its six rotors, disappeared into the cave. It returned a few minutes later, though a hardware glitch required the pilot to help land the machine.

Mr. Kendoul clapped his hands in the poorly lighted tunnel.

"It came back," he said.

Name: _____ **Date:** _____

1. What technology are scientists in Australia experimenting with to improve mining?

2. How could fully autonomous drones help improve mining? Give at least two details from the text to support your answer.

3. What is the main idea of this text?

4. Why is it risky to try and use drones underground? Support your answer with evidence from the text.

5. Is it worth the risk and cost of developing new drone technology to use underground for mining? Support your argument with evidence from the text.