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The Aquanaut Transformer

The 2018 Paramount movie *Bumblebee* tells the story of a transforming robot that shape-shifts into a 1957 yellow Volkswagen Beetle. It was a movie I truly enjoyed as much as my grandchildren and it was the first thing that popped into my mind when I selected the Aquanaut Transformer as this month's topic. If you never saw the movie, it is already listed on Netflix.

The Aquanaut Transformer is real, and it shape-shifts between a submarine and an Aquanaut robot (Photos 1 and 2). Its submarine shape allows it to quickly move through the water to get where it needs to be. Once there, it shape-shifts into a very powerful humanoid robot which can perform all kinds of underwater construction tasks.

Prior to the development of the Aquanaut, two types of underwater robotic systems have already been at work under the sea. Autonomous Underwater Vehicles (AUVs) are used to photographically inspect the hulls of ships, visually map ocean floor features, and find ship wrecks that lie beneath the sea. They operate autonomously and when they surface the operators of these AUVs download the information they gathered for analysis.

So, an AUV might be used to find a problem and then a Remotely Operated Vehicle (ROV) might be sent

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down to physically do the repairs. ROVs are robotic systems that can perform physical tasks in deep water.



Photo 1—In its submarine form the Aquanaut Transformer has an aerodynamic shape which allows it to easily move through water.

These robots are tethered by a line to a ship or drilling platform which supplies them with the electricity they need to power their robotic arms and systems.

The tether to the ROV also allows the robot's operator to have total control over the robot's systems even though they are in a control room on the ocean surface. Because of the tether, the people in control of an ROV need to be almost directly above the robot that they are observing on a video feed. They control its movements in the same way that you control the movements of your avatar in a video game.

The Aquanaut Transformer is very different from these other underwater robotic systems, beyond its ability to transform its shape between a submarine and the working Aquanaut. As a submarine it can travel 108 nautical miles from the point it is released in the ocean to the location where it is going to perform its assigned tasks. Its aerodynamic shape allows it to easily move through the water. In this configuration it is a

mini submarine with all the vertical and horizontal thruster controls and hull features necessary to travel and maneuver underwater. See Photo 1 again.

The Aquanaut Transformer travels under its own power without a tether; its power is supplied by its own internal batteries. Most of the Houston Mechatronics engineers who designed and built this transformer are former NASA employees; they designed the control system so that it is under human control for parts of its mission and under AI autonomous control for other parts of the mission.

Its ability to travel to the worksite becomes critical when the body of water where a robot is needed to do physical work has no safe place to park an ROV support ship. Physically it is

about as big as Bumblebee after it shape-shifted out of its Volkswagen Beetle form (Photo 3). This YouTube video <https://www.youtube.com/watch?v=DZPjsB-qas> can give you more insight into this Aquanaut



Photos courtesy Houston Mechatronics

Photo 2—When the Aquanaut Transformer shape-shifts, it becomes a very powerful humanoid robot that can perform all kinds of underwater construction tasks.



Photo 3—A scuba diver swimming next to the Aquanaut helps you visualize the physical size of the robot.

Transformer’s capabilities. It is not surprising that NASA is now very involved with Aquanaut’s continued development.

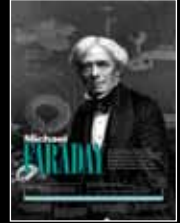
The Aquanaut Transformer does underwater what NASA eventually needs robotic systems to do in space. To physically send astronauts to Mars, NASA is going to need to build similar transforming systems that can travel great distances in

outer space and then transform into robots that can build the infrastructure that people will need to survive in an alien environment when they arrive as explorers.

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