



## SBIR/STTR Topics and Awards Search

**Pioneer Sea Glider**  
**Pioneer Astronautics**  
**Total Award: \$98,968.00**

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**Component:** DARPA**Solicitation:** 03.1**Topic Number:** SB031-021**Proposal Number:** D031-0354**Year:** 2003**Program Type:** SBIR Phase I**DUNS:** 120561456**CAGE code:** 1PDXS**Year Founded:** 1996**Website:** <http://www.pioneerastro.com>

**Benefit:** Potential near-term commercialization of the Pioneer Sea Glider centers on military applications including deployment of sensors, unmanned aerial vehicles, and personnel. Closely following are non-military oceanographic research applications for sample collection and scientific observations. A potential market for commercial SCUBA divers also offers great promise.

**Technical Abstract:** The proposed Pioneer Sea Glider is a new method for underwater transport of equipment and personnel over long distances in a quiet manner. A unique buoyancy control system is based on the conversion of liquid nitrous oxide to a mixture of gaseous nitrogen and oxygen. This nitrous-oxide-derived buoyancy gas also provides breathing air and heat for crews and is based on technology developed and patented by Pioneer Astronautics for long-duration space flight, SCUBA, and terrestrial rescue operations. Because one volume of nitrous oxide gas dissociates to 1.5 volumes of nitrogen plus oxygen, buoyancy gas mass requirements are reduced by one-third compared to those required for other gases. In contrast to successfully demonstrated sea gliders currently used for unmanned oceanographic research purposes, the Pioneer Sea Glider will provide much greater carrying capacity and speed. The Pioneer Sea Glider will be capable of operations between the surface and maximum depths of about 500 meters (1,640 feet) in seawater. The proposed buoyancy control system will accommodate the increased drag resulting from the higher desired velocity. Mission durations of several days or even longer are possible.

**Keywords:** glider, submarine, nitrous oxide, sea glider, buoyancy control

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**Topic Title:** Sea Glider Transport Vehicle

**Topic Objective:** Design and develop an underwater vehicle that uses buoyancy control and vehicle lift to drag as the primary means of propulsion for the transport of equipment, supplies, sensors, weapons, and personnel in a silent and efficient manner.

**Topic Description:** Soaring birds inspired man's first successful attempts at winged flight. It is well understood that gliding flight in the atmosphere can be achieved with the conversion of potential energy into work to offset vehicle drag. In addition, aircraft can gain energy from updrafts, currents, and winds that in turn can be used at work to offset drag. In a similar manner, sea mammals and fish are known to sometimes glide in water by trading potential energy into work against drag. In the case of an airplane, potential energy is in the form of altitude. A gliding airplane trades off altitude to propel itself forward. In the case of a sea mammal, the animal allows its buoyancy to decrease. This causes it to sink and glide forward. If we think of sea creatures as underwater flying vehicles they can inspire us to think of underwater gliding craft. Underwater gliders should be able to fly in the oceans just like airplanes fly in the atmosphere. In the same manner, sea gliders can convert potential energy by sinking into the deeps just like a gliding airplane gives up altitude to propel itself forward. A sea glider should be able to use the ocean's current, up flows and tides to gain energy for continued flight. But liquid flight has an advantage over atmospheric flight; a sea glider that has reached a great deep can reverse its buoyancy and glide upwards. A sea glider can glide both downwards and upwards to continue its glide indefinitely as long as it continues to cycle its buoyancy. The concept of sea gliders has been successfully demonstrated for long duration flight of oceanographic sensors. The project hopes to broaden the application of the mode of underwater propulsion to the transport of equipment, supplies, sensors, weapons, and personnel. Sea gliders hold the potential for efficient transport under water for long distances in a very quiet and passive manner. There are a number of both military and commercial applications that could benefit from this form of transportation.

**Topic Phase I:** Systems studies to identify requirements for potential applications and performance studies to size concepts and identify technology and design requirements. In this early phase a number of vehicle concepts will be described and at least one simple proof of concept model will be demonstrated.

**Topic Phase II:** A target application will be identified. A proof of concept model for this application will be designed and constructed for limited demonstration. This model need only be sized and constructed in a manner that provides a realistic demonstration that will justify future investment.

**Topic Phase III:** There are a number of military and commercial applications for this class of vehicle. In the military sector a sea glider transport would allow a submarine to deploy an unmanned aerial vehicle (UAV), a sensor platform, and personnel by launching a sea glider. A sea glide could travel a considerable distance from the submarine, silently, before it deploys its payload. By deploying a payload at great distances from the submarine, the unknown location or presence of the submarine's can be maintained. In the commercial sector, sea gliders can transport equipment and personnel to locations that have harsh surface conditions. The oceanographic community has already targeted sea gliders as an effective way to collect data over wide expanses of the oceans.

**Topic Keywords:** Submarine, Glider