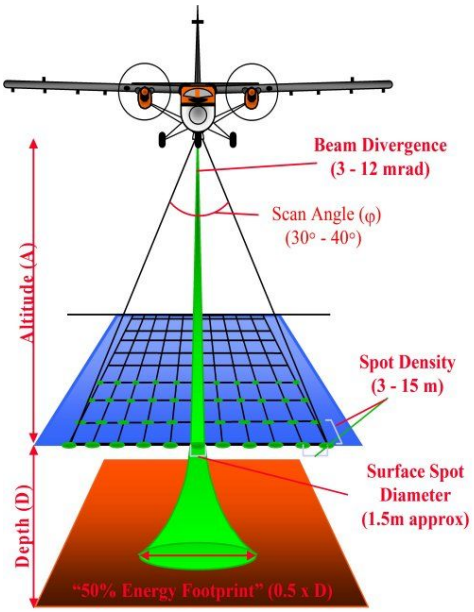
Airborne Laser Survey "Measuring the Sea with Light"

1. What is an Airborne Laser Survey?

A method was invented to measure depth by radiating a laser beams from an aircraft to the bottom of the sea and measuring the time it takes for the lights to come back. This made it possible to obtain depth data 1000 times more efficiently than the conventional method using survey vessels. In this method called airborne laser survey, an aircraft flies at an altitude of 400 meters and the airborne laser sounder (Japan holds Scanning Hydrographic Operational Airborne Laser Survey (SHOALS). Hereafter, it is described as SHOALS) radiates laser pulses downward 1000 pulses per second to a space about 200 meters wide. Among the two types of laser beams radiated, a near infrared ray (IR) reflects at the sea surface while green light (G pulse) reflects at the sea bottom, so the depth can be measured based on the difference between the times it takes for these two lights to come back (6 nanoseconds per 1 meter depth). By radiating the laser pulse at a very high speed, data for depth can be obtained with a grid of 5 meters. To avoid the influence of waves, laser beams are extended to a certain level (having a diameter of approximately 1 meter at the sea surface and half the length of depth at the sea bottom). On the other hand, the distance that the laser beam can reach, which means the measurable depth, changes according to the clarity of undersea. It is said that up to about 100 meters in depth is measurable for areas with very clear undersea, but in reality, it can be measured for a maximum depth of about twice the transparency (the depth where the transparency disc becomes invisible).



In the airborne laser survey conducted by the Hydrographic and Oceanographic Department of Japan (JHOD), it is now possible to measure up to 38 meters in depth for the Pacific side of Shikoku. It can also measure more than 10 meters in depth for Bisan Seto in the Seto Inland Sea, where the clarity of undersea is less.

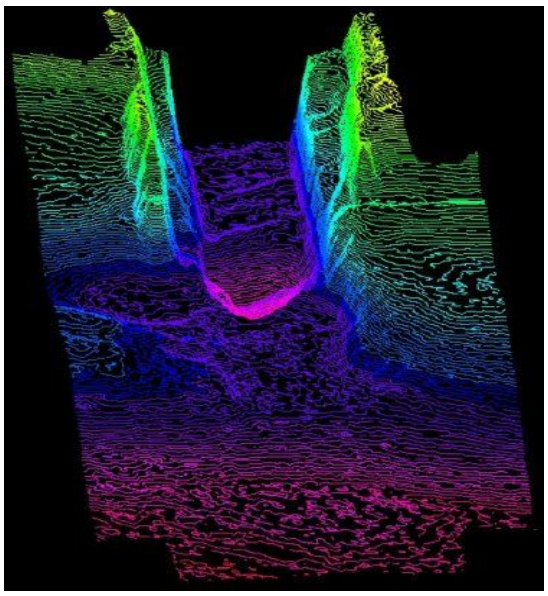
SHOALS-1000 (Equipment in Aircraft)

Laser Bay in Aircraft

2. Data obtainable through Airborne Laser Survey

Because the survey data obtained through the airborne laser survey are of high density with intervals of 5 meters, it can be displayed in a three-dimensional image. In addition, by using GPS to accurately measure the altitude of the aircraft, it is also possible to measure the depth and land's altitude above sea level.

Thus, the data of height sequential from land to sea will be available. Using this data, it is possible to describe submarine topography as can be seen in following the three-dimensional image. Therefore, using an airborne laser survey, it is now possible to obtain the data of height sequentially from land to sea.



3D image (channel)

3. Endeavors for Airborne Laser Survey

SHOALS is equipped and being operated on a medium aircraft (Beech 350) at Hiroshima Air Station. Survey for very shallow waters near coasts of Japan, especially in Seto Inland Sea, will be conducted by staff members at Hiroshima Air Station and those in charge of airborne laser survey who are assigned to the Hydrographic and Oceanographic Department at the 6th Regional Coast Guard (Hiroshima).

Beech 350 at Hiroshima Air Station, 6th RCG

By using the data of depth obtained from the airborne laser survey, we are going to further improve the safety of vessels navigating through coastal waters, as well as to provide information on topography near the coastal area, sequential from land and sea, to those who need them for marine leisure and ocean development. Furthermore, the airborne laser survey is expected to contribute to providing information to prevent disasters such as tsunami, as well as to be utilized for the geographic information system (GIS).