depth seen from height

airborne remote sensing for littoral applications

Narrator: From the air, the naked eye can't tell much about what lies below the water's surface — the speed and direction of currents, the depth and shape of the bottom.

APL-UW scientists and engineers are working on a way to measure the water's surface from the air, and from that data form models of coastal processes and physical parameters — the dynamic wave fields, currents, turbulence, and bathymetry — mapping the underwater depths.

Jim Thomson: Bathymetry is a key variable to understand how to safely navigate in an area and how to make predictions for the conditions: for the currents and the waves in an area. It's really the controlling parameter.

Narrator: The U.S. Navy needs bathymetry data when navigating unfamiliar coastlines or river mouths.

Gordon Farquharson: They need to know how fast the water is moving, for instance, if they want to deploy ships on a beach or drive a ship up into an inlet. And so being able to measure these sorts of things remotely from something like a UAV or a plane is important to them and gives them better situational awareness.

Narrator: That awareness could result from APL-UW's development of a light and inexpensive airborne synthetic aperture radar with one transmitting and two receiving antennas.

Farquharson: This radar is mounted to the bottom of this airplane.

Narrator: This remote sensing system exploits the Doppler shift in the returned signal, caused by the motion of the aircraft.

Farquharson: We want to measure the Doppler shift induced by any motion on the surface. So this is much like a car going past you, and the sound of the car, how it changes as it goes past you.

Narrator: Return signals from the water surface are received in sequence by two antennas.

Farquharson: And you know the time between the two measurements because you know the speed of the aircraft, you know the distance between those two antennas. And so you're basically calcualting change in distance of the surface that you measure from the two measurements divided by the change in time and that gives you an estimate of the surface velocity.

Narrator: At the New River Inlet in North Carolina, APL-UW SAR and infrared sytems discerned two navigable channels.

depth seen from height

airborne remote sensing for littoral applications

Narrator: At the mouth of the Columbia River between Washington and Oregon, strong river currents meet Pacific Ocean swells and wind driven waves, generating the navigation hazards of the Columbia bar, which hinder ship-based measurements.

Here, APL-UW SWIFT drifters measure waves, wind, and turbulence from wave breaking.

Seth Zipple: This new version that we're using actually emails us data as it's collecting, which is great. So we know it's working and we have the data if we don't get the SWIFT back.

Narrator: The SWIFT data are used to calibrate and validate measurements by the airborne remote sensing platforms. Together, the two methods cover large areas and provide detailed pictures of structure and process, which add input to model simulations.

Thomson: A big product of of our research is to begin to develop the tools and the algorithims to infer the depth from simply an aerial survey above — from NOT being there in the water. And to take the spareseness of that aerial survey and some drifter measurements and add into that a dynamic model and then make an even better inference of what the depth is.

And to be able to do that without having a ship present, without spending hours and hours making a survey and to still end up with a good estimate of what the depth is.

this is apl — the applied physics laboratory at the university of washington in seattle