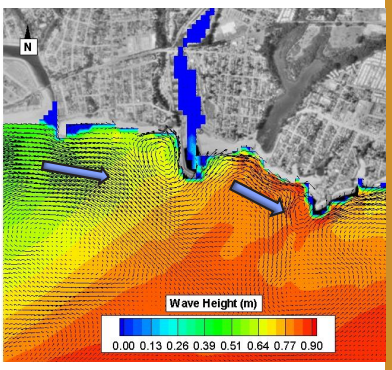
integral consulting inc.

Marine Science and Engineering Services



Service Areas

- Sediment and contaminant transport studies and water quality analyses
- Geophysical surveys
- Oceanographic studies
- Field and laboratory support
- Coastal studies
- Marine renewable energy studies

Integral Consulting Inc. provides environmental, oceanographic, and coastal engineering solutions for clients worldwide, in environments ranging from alpine lakes to the deep ocean.

With services spanning water quality assessment, geophysical surveying, and oceanography, Integral offers clients an array of innovative tools and approaches to support projects in marine and coastal areas. Recent projects include sediment and contaminant transport measurement and modeling, deep water oceanographic monitoring, coastal process investigations, design for shoreline protection and erosion control, planning and design for harbors and port facilities, and studies of water quality and wastewater outfalls.

Sediment and Contaminant Transport Studies and Water Quality Analyses

Our staff have extensive experience in the design and implementation of end-to-end field analyses and modeling studies to solve sediment and contaminant transport problems. We deploy state-of-the-science instrumentation to characterize system-wide transport and conduct analyses and modeling in any aquatic environment.

Geophysical Surveys

Integral provides a full range of geophysical survey services, from planning and conducting surveys to analyzing data. Our primary areas of expertise include bathymetric and topographic surveying using tools such as side-scan sonar, magnetometers, and subbottom profilers.

Oceanographic Studies

We deploy oceanographic and meteorological instrumentation—from the surf zone to the deep ocean—to obtain accurate measurements of physical and biogeochemical properties. Our staff also offer advanced data analysis along with analytical and numerical modeling.

Field and Laboratory Support

Integral's field capabilities include instrumentation for measuring currents, waves, sediment, optical properties, and chemical constituents in the water column and at the sediment bed. We conduct shallow sediment coring and coordinate deep geophysical coring. Through our mobile and fixed laboratories, we perform unique erosion testing to accurately characterize sediment transport.

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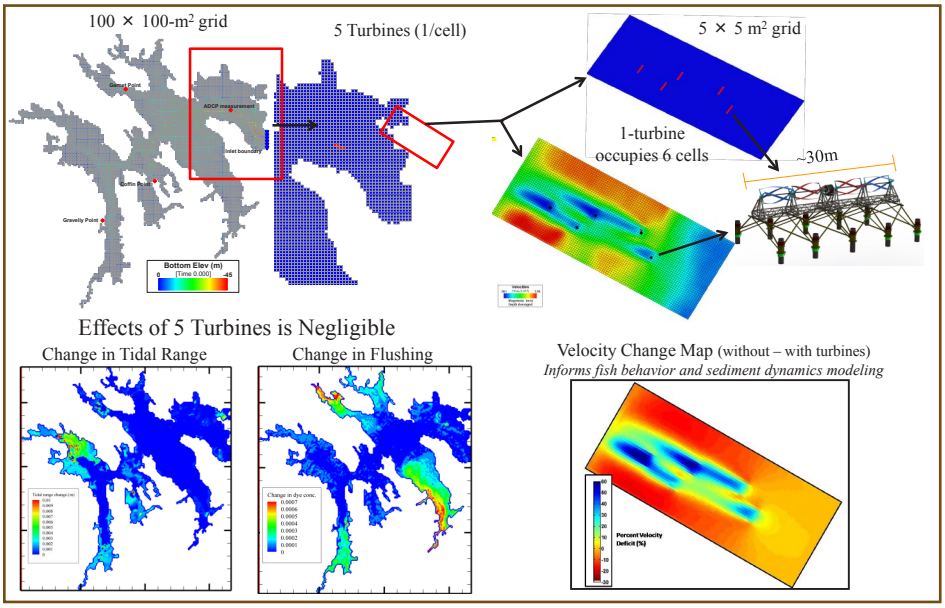
Coastal Studies

Shoreline characterization is an important part of any coastal project. Integral provides technical and environmental studies, engineering evaluation, and permitting to support coastal zone projects. Our multidisciplinary expertise also includes assessment of biological and ecological impacts on wetlands/ sensitive habitats, marine species, and wildlife.

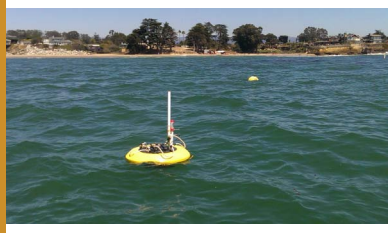
Marine Renewable Energy Studies

As renewable technologies such as marine hydrokinetic energy and offshore wind farms evolve from pilot- to commercial-scale, an accurate assessment of site-specific resources and environmental impacts is essential. Integral has led projects assessing the marine physical environment (e.g., currents, waves, sediments, and water quality) in regions of existing or potential future device installation. Our state-of-the-art modeling and measurement tools quantify the relationships between the environment and device arrays, which helps maximize energy production while minimizing environmental effects. Integral's services also reduce installation and maintenance costs by supporting informed design and operations.



Scientists now at Integral supported research on the deployment of energy converters to help generate clean, tidal energy in Cobscook Bay, Maine, which boasts some of the world's most powerful tides. Our staff modeled changes in tidal range, flushing, and velocity (bottom figures) to support environmental assessments, design of efficient array layouts, and studies of fish behavior.

SEDflume is a powerful tool that directly measures sediment erosion properties, providing critical information on site-specific sediment transport.



Integral is developing and validating low-cost monitoring instrumentation for waves, currents, and water quality to provide clients with effective site characterization and monitoring.

Marine Science and Engineering Services

Integral In-House Resources and Capabilities

- Mobile and fixed SEDflume laboratory for erosion testing, including laser diffraction particle sizing, density measurement, and organic content measurement capabilities and associated coring equipment
- A full suite of instrumentation to measure currents, waves, and suspended solids
- Instrumentation for optical and chemical characterization of the water column
- Custom, commercial, and public domain software for 3-dimensional sediment and contaminant transport modeling, water quality assessment, and oceanographic modeling
- High-speed computing for data analysis and numerical simulations
- Surveying (single- and multibeam), side-scan sonar, magnetometer, and subbottom profiling.

Ocean monitoring systems obtain meteorological and oceanographic (metocean) data for routine monitoring and scientific studies on topics such as ocean acidification.

Selected Project Locations

Sediment Site Investigations

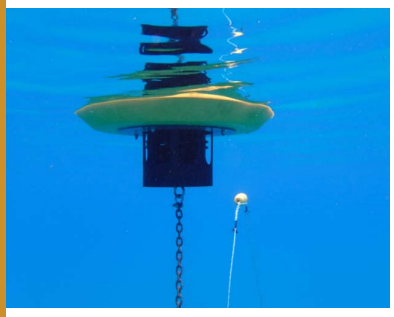
- San Francisco Bay, California
- Kalamazoo River, Michigan
- Berry's Creek, New Jersey
- Passaic River, New Jersey
- Newtown Creek, New York
- Ashtabula River, Ohio
- Lower Willamette River, Oregon
- Lake Hartwell, South Carolina
- Bremerton Shipyard, Washington
- Lower Duwamish River, Washington
- Port Angeles, Washington
- Anacostia River, Washington, DC
- Lower Fox River, Wisconsin

Coastal Studies

- Moss Landing Harbor, California
- Santa Cruz Harbor, California
- Waimanalo, Hawaii
- Duck, North Carolina

Marine Renewable Energy

- Department of Energy Wave Buoy Research and Development
- Hawaii and Oregon Wave Test Facilities
- Sandia National Laboratories



Integral has developed and patented low-cost wave measurement devices for characterization and operations at wave energy sites.

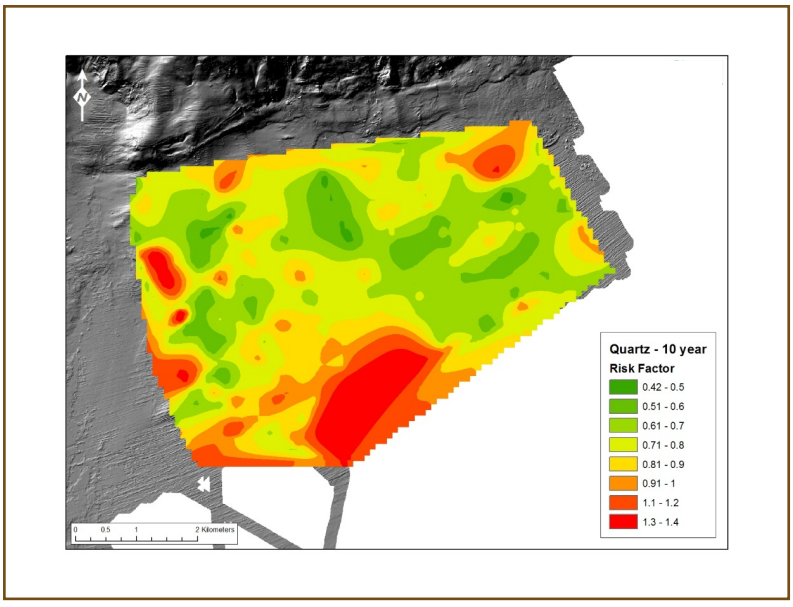
Marine Science and Engineering Services

Oceanographic Studies

- Australia
- Bermuda
- California
- Gulf of Mexico
- Hawaii
- Mediterranean

Geophysical Surveys

- Loch Lomond, California
- Morris Reservoir, California
- Moss Landing, California
- Santa Cruz, California
- South San Francisco Bay, California
- Ashtabula River, Ohio
- Augusta Bay, Italy
- Pallanza Bay, Italy
- Campeche, Mexico



On a project in the Gulf of Mexico, scientists now at Integral used existing seafloor bathymetry to identify potential risk factors for pipeline risk assessment. The above figure illustrates the potential pipeline risk throughout a varying bathymetric region, where the red areas indicate areas of increased risk. Potential pipeline free span distances were identified during the pipeline route selection phase. The potential induced scour and resultant increase in free span width were estimated to determine the ultimate risk of pipeline structural vulnerability.

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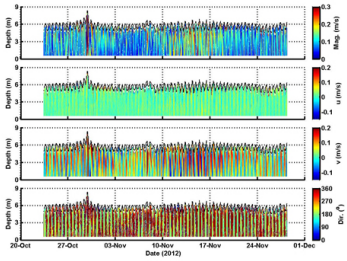

Long-term acoustic Doppler current profilers provide important data on transport in tidal estuaries.

- Health
- Environment
- Technology
- Sustainability

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