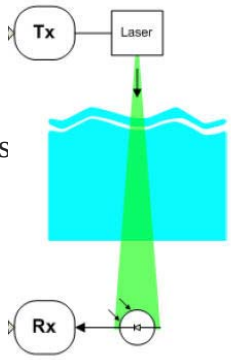
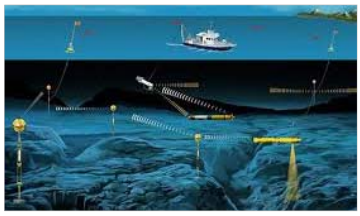
Transfer and correlation functions between underwater hydrographical and optical parameters

Naval Postgraduate School

Topic Description

- Optical communication/detection systems have great potential to get around the obvious limitations of current acoustic communications and detection systems in SSTP/S3P especially increased fleet and port security in noisy littoral waters. The ocean optical properties are highly variable on small spatial and temporal scales. Scattering by seawater and particles including chlorophyll-a causes light attenuation.





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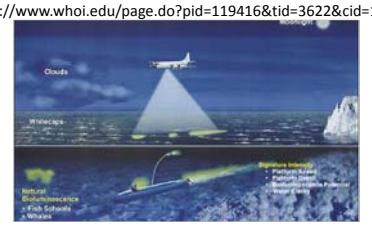
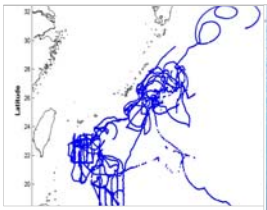
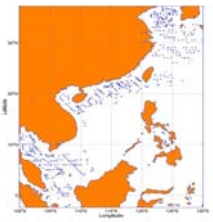
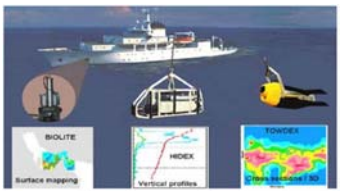


Courtesy of Jeffrey Smart. (http://www.aticourses.com)

Underwater optical communication and detection







From Naval Oceanographic Office

Glider and shipboard data collection

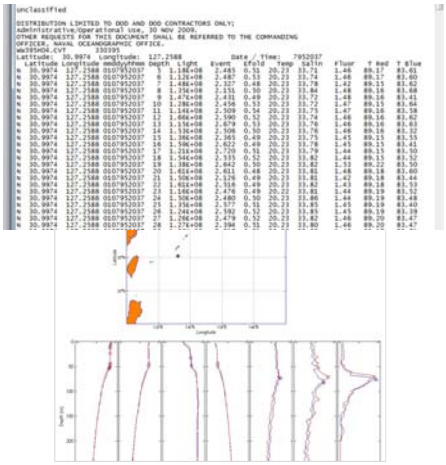
Underwater Optical Transfer

- Sensor characteristics and response functions
- Laser image quality brought about by absorption and scattering of the media (i.e. seawater) and background illumination,
- Bottom reflectivity and clutter effects
- Target characteristics

$$\left[\frac{1}{v}\frac{\partial}{\partial t}+\mathbf{s}\cdot\nabla+c(z)\right]L(t,r,\mathbf{s})=b(z)\int_{2\pi}\beta(\mathbf{s},\mathbf{s}')L(t,r,\mathbf{s}')d\Omega'$$

Potential Research Focus/Questions

- What are the effects of optical characteristics on the underwater communication and detection?
- What are the effects of (T, S) characteristics on the underwater optical transmission?
- How can the transfer and correlation functions between underwater hydrographical and optical parameters be effectively applied to SSTP/S3P?



Example of NAVO Underwater (T,S) and Optical Data

Students Involvement and Collaboration

- NPS USN student officers will be recruited to work on this proposed research topic for their thesis studies.
- This project will be conducted in collaboration closely among NPS (Dr. Peter C. Chu), NAVO (Mr. Ronald Betsch, ASW/MIW program manager, Mr. Mel Wagstaff, ASW Technical Leader), and NRL (Dr. Charles Barron)

Researcher Name (Distinguished Professor Peter Chu)
NPS School (GSEAS)

Topic Sponsor Organization (OPNAV – N97)