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Use of Multi-Spectral High Repetition Rate LED Systems for High Bandwidth Underwater Optical Communications, and Communications to Surface and Aerial Systems

Abstract—A variety of both existing and developing sensors would benefit from near real time communication of high bandwidth data. To cite just one example, sensors that could more accurately report real-time positions of marine mammals would be useful in reducing whale-ship collisions. Similar considerations are relevant for maritime port and harbor security, including detection and alerts for divers or autonomous underwater vehicles (AUVs) that could pose a risk to ships. Especially in ports and harbors, field experiments have confirmed that acoustic communication in these cluttered and noisy shallow water environments, compounded with vertical reflecting surfaces formed by piers and pilings, can limit the reliability and utility of underwater acoustic communications. Moreover, many sensors have greater bandwidth requirements than acoustic communications are able to provide. We here discuss the development of high repetition rate multispectral LED optical systems initially developed for imaging, but also capable of simultaneous data transmission at rates of ~100 kbps. Results are discussed for the multispectral images from coral reefs in Guam, and data transmission experiments from underwater to surface vessels. Subsequent field efforts will extend data transmission from AUVs to unmanned aircraft systems (UAS).

Key Words: Multi-Spectral, Underwater, Optical, Communications