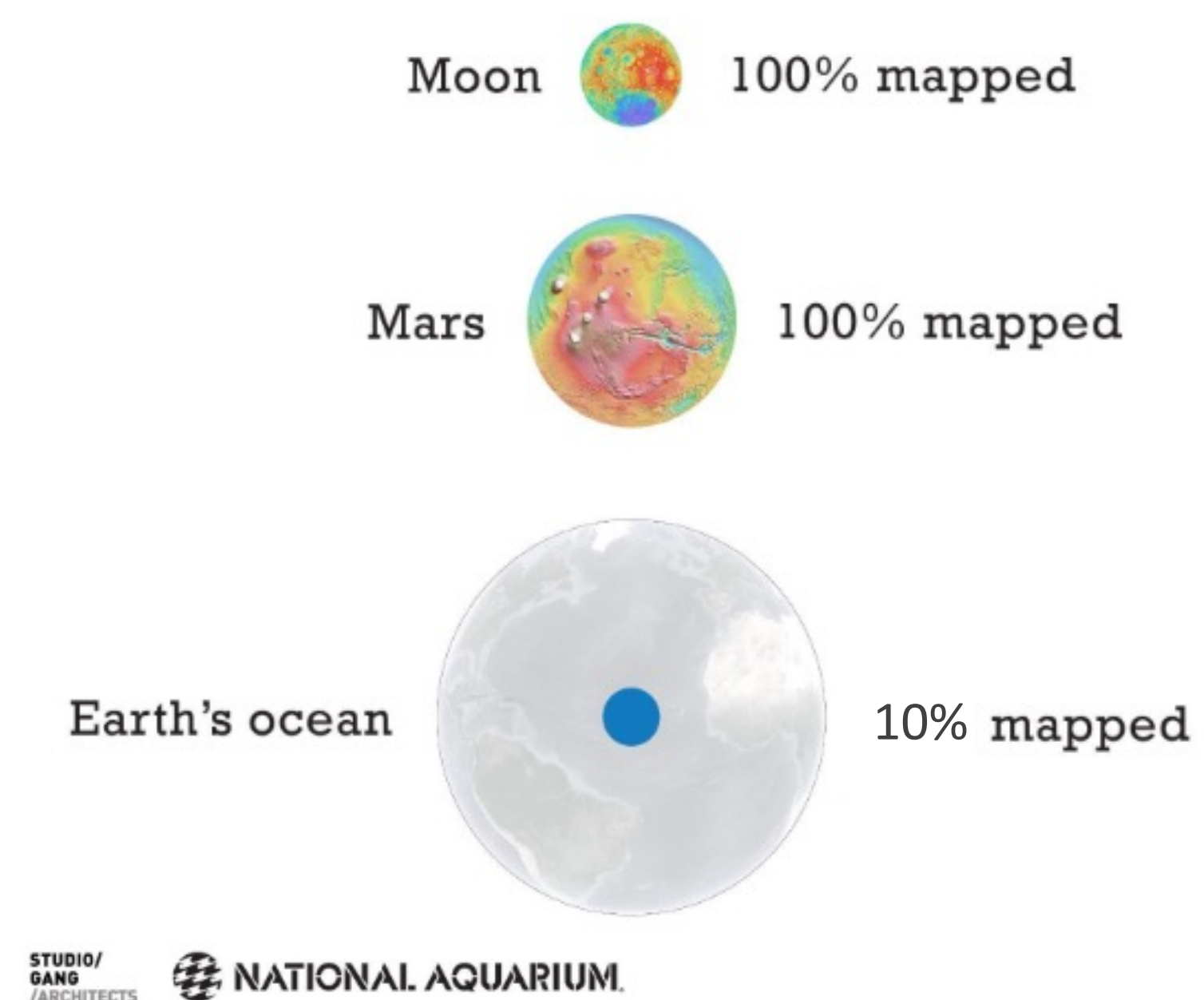


Data-driven Re-configurable Swarm of Autonomous Underwater Vehicles for Underwater Wireless Communication

M.-Reza Alam, Masayoshi Tomizuka
University of California, Berkeley

Lack of high-bandwidth wireless communication has been a major obstacle in ocean's exploration

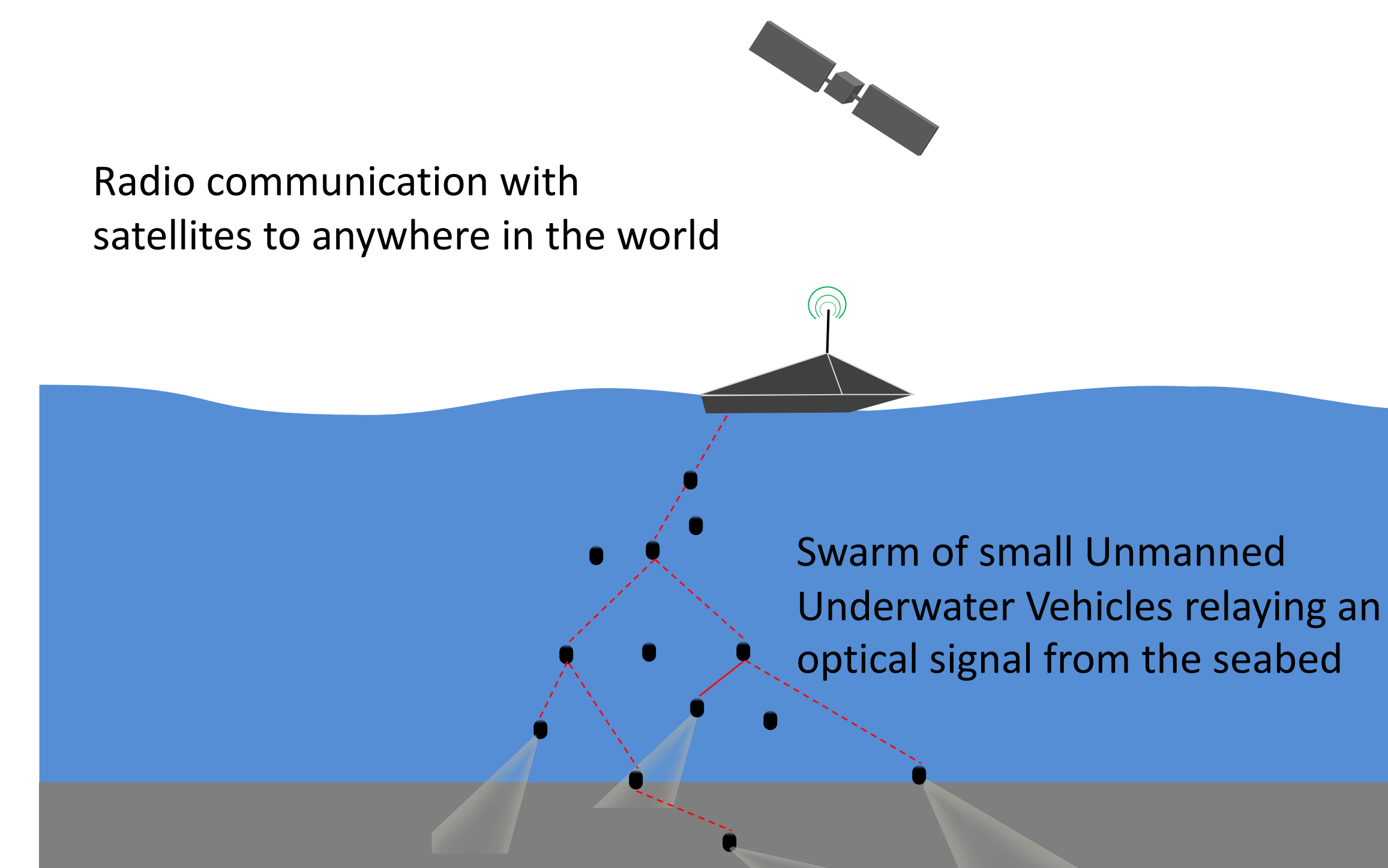


GPS or cellphones do not work underwater because Radio Frequencies are absorbed by sea water

Underwater data communication properties

	Acoustic	Optical	RF
Bandwidth	Kbps	Gbps	Mbps
Range	Kms	100m	10m
Speed	1500m/s	2.2×10^8 m/s	2.2×10^8 m/s

Real-time observatory of oceans and of the benthos for researchers and interested parties



Acoustic communication

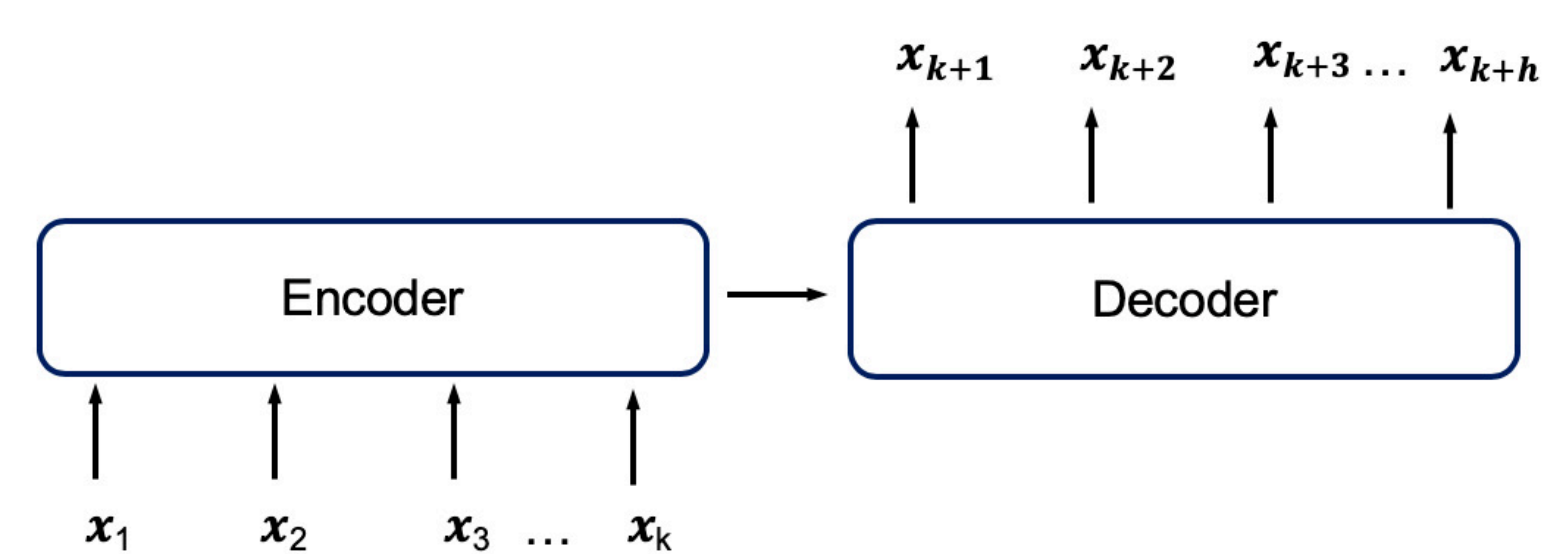


Fig. 4. An image from the original video sequence. Frame size is 144 x 176 pixels, resolution 8 bits/pixel.

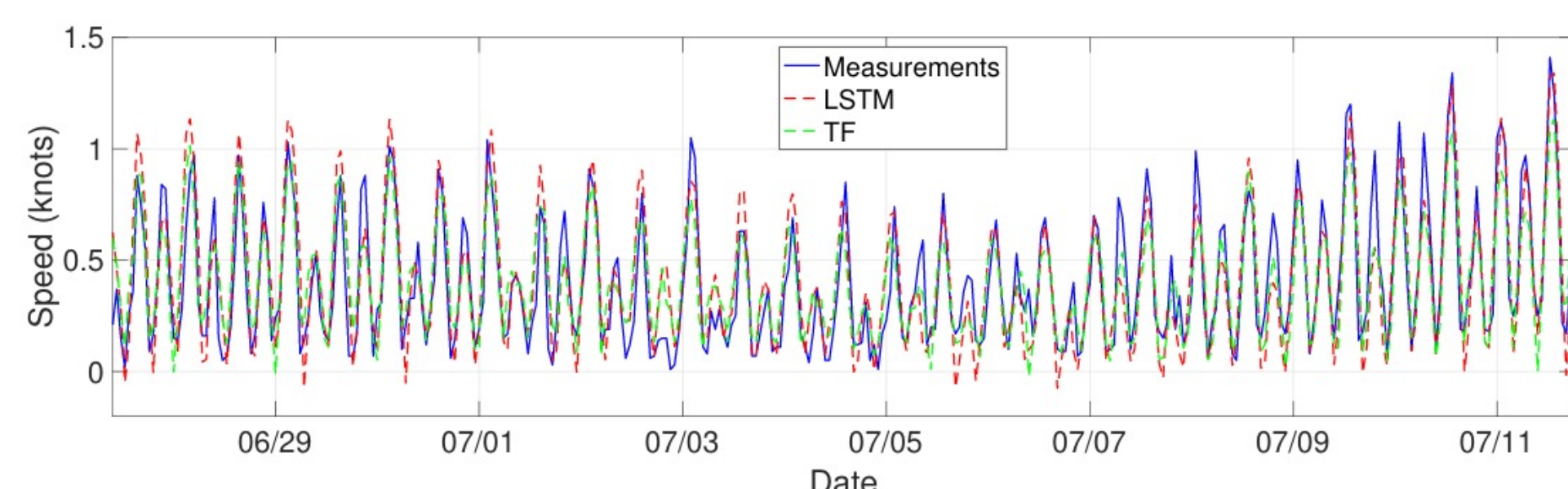
Maximum bandwidth with acoustic waves: 150 kbps¹
Bandwidth for 720p HD video BluRay H.264: 5Mbps

1. Pelekanakis, C. et. al. "High rate acoustic link for underwater video transmission." *Oceans 2003. Celebrating the Past. Teaming Toward the Future (IEEE Cat. No. 03CH37492)*. Vol. 2. IEEE, 2003.

Real-time in situ prediction of ocean currents with deep autoregressive networks for UUV navigation

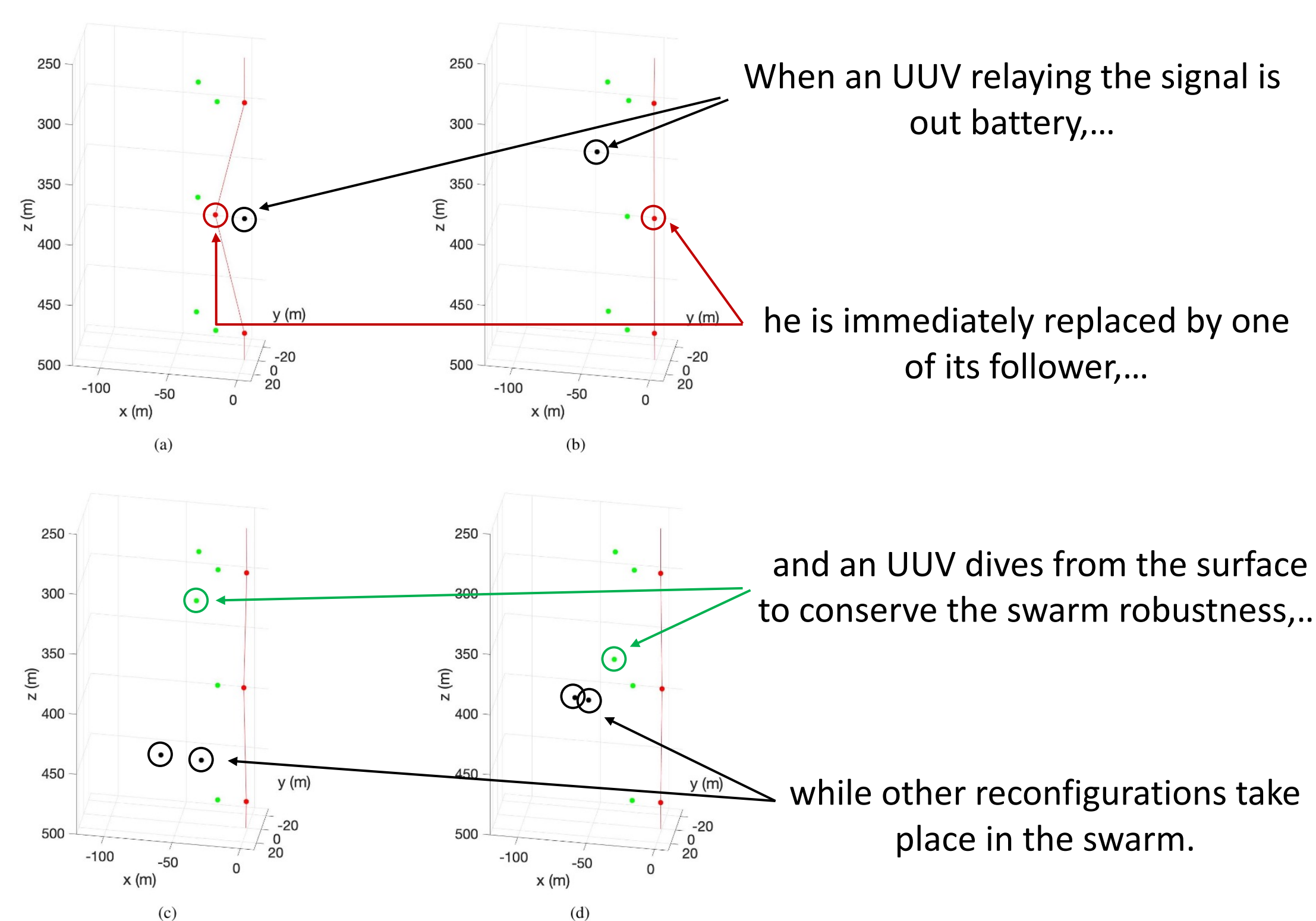


Deep autoregressive networks (LSTM and Transformer)

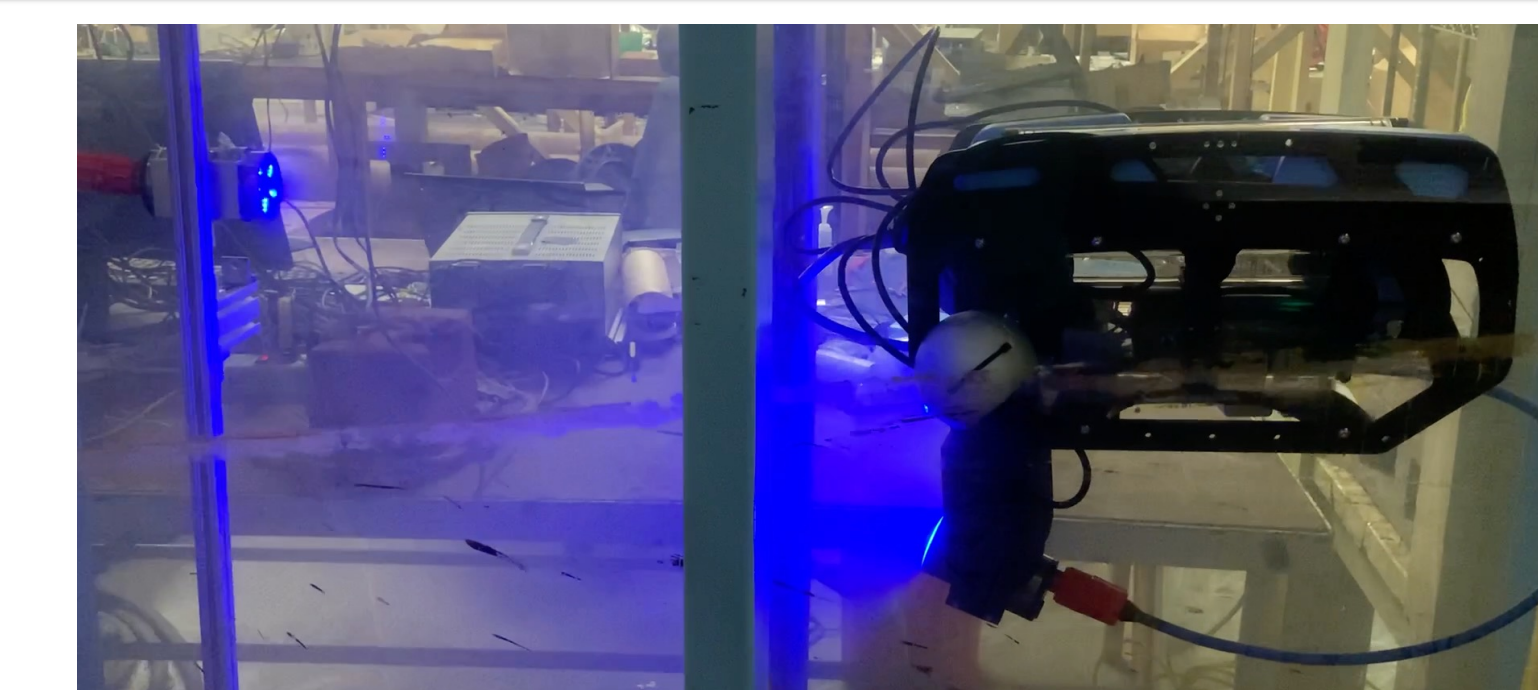


Comparison of LSTM and Transformer (TF) predictions with experimental measurements at Portland Harbor Entrance

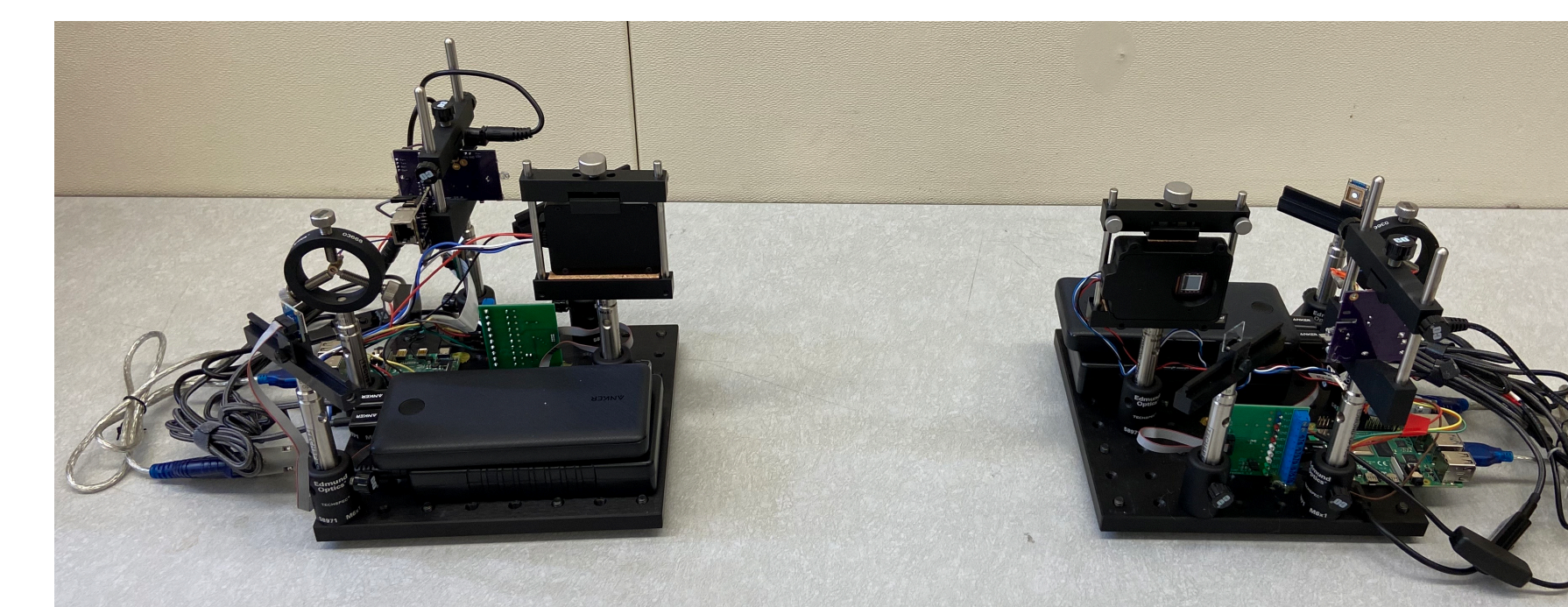
Guidance, Navigation and Control of UUVs for permanent underwater optical networks



Towards hybrid UUV with optical modem that can operate as wireless ROV and AUV with live control and feedback



UUV with LED modem



First prototypes of laser modems