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Modeling SIGINT

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SIGINT: Detection Probability Reporting Toolset for ASW Airborne Platforms

NRP Funded FY21: Modeling the Operational Value of SIGINT in Anti-Submarine Warfare

Naval Postgraduate School

Background

- The project's goal is to more accurately model and evaluate the tactical capabilities of airborne sensors for detecting and locating ASW signals of interest.
- We developed a modeling toolset that outputs an airborne collector platform's received signal-to-noise ratio (SNR) and corresponding probability of detection via lookup tables (LUTs). Fig. 1 shows an example collection platform: P-8A.
- Our research increases the fidelity of predictive modeling for a wide variety of mission conditions that may be operationally encountered.

Fig.1: Boeing P-8A Poseidon Collection Platform

Example received SNR plots

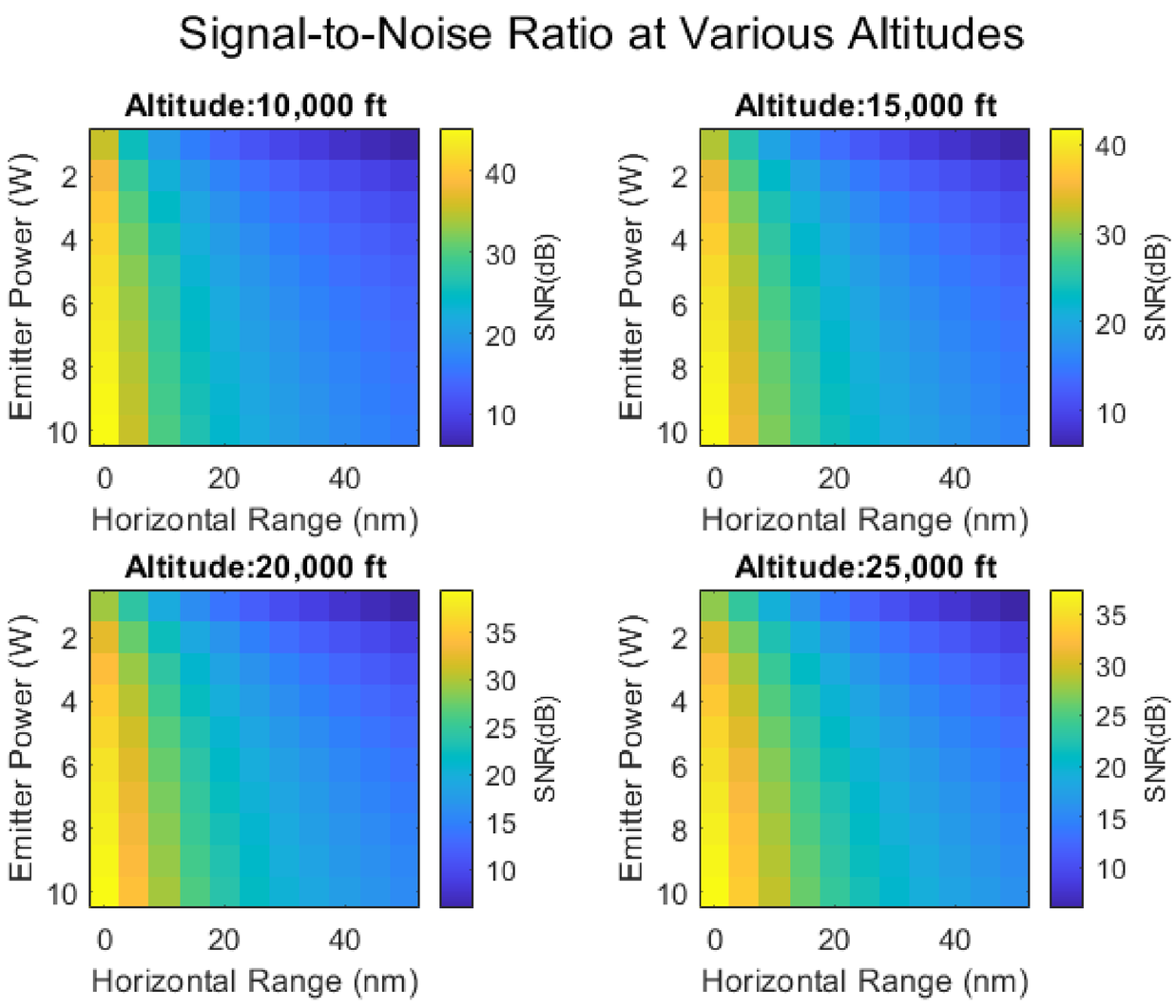

Fig. 2: Graphical received SNR plots as function emitter power and range for various standard aircraft altitudes.

- We developed a software toolset that calculates the received SNR from an emitter for various theoretical operational conditions and environments.
- These SNR calculations are useful in Monte Carlo simulations. Outputs include graphical depictions of sensor capabilities, such as those seen in Figure 2. A possible emitter is shown in Figure 3.

Fig.3: Submarine: an emitter of interest

Probability and SNR Look up tables

- We developed various software capabilities. For example, the toolset can generate detection probability and SNR LUTs for use in SIGINT sensor capability predictions (example LUT detection table in Fig 4).
- LUTs and graphical outputs (see Fig. 2) provide detection probability and SNR changes based on threat characteristics, ASW sensor suite characteristics, environmental conditions, and other parameters of interest.
- Various factors can be parameterized. Thus, the software toolset can accommodate a variety of missions.
- These LUTs can augment mission and operational level modeling toolsets and simulations. Our toolset may be utilized to model both current and future threat signals.

Pd Table for 10,000 ft Altitude

	0nm	5nm	10nm	15nm	20nm	25nm	30nm	35nm	40nm	45nm	50nm
pt:1	1	1	1	0.99975	0.96783	0.80698	0.58301	0.3972	0.26973	0.18716	0.13386
pt:2	1	1	1	1	0.99995	0.99389	0.94254	0.81897	0.6599	0.50942	0.38691
pt:3	1	1	1	1	1	0.99992	0.99567	0.96491	0.8848	0.76529	0.63402
pt:4	1	1	1	1	1	1	0.99978	0.9949	0.96877	0.90548	0.80883
pt:5	1	1	1	1	1	1	0.99999	0.9994	0.99281	0.96661	0.91011
pt:6	1	1	1	1	1	1	1	0.99994	0.99854	0.98936	0.96117
pt:7	1	1	1	1	1	1	1	0.99999	0.99973	0.99688	0.98436
pt:8	1	1	1	1	1	1	1	1	0.99995	0.99915	0.99406
pt:9	1	1	1	1	1	1	1	1	0.99999	0.99978	0.99785
pt:10	1	1	1	1	1	1	1	1	1	0.99995	0.99926

Pd Table for 20,000 ft Altitude

	0nm	5nm	10nm	15nm	20nm	25nm	30nm	35nm	40nm	45nm	50nm
pt:1	1	1	1	0.99961	0.96393	0.7996	0.57695	0.39342	0.26756	0.18592	0.13313
pt:2	1	1	1	1	0.99993	0.99321	0.93997	0.8153	0.65649	0.50681	0.38508
pt:3	1	1	1	1	1	0.9999	0.99532	0.96358	0.88258	0.76283	0.63182
pt:4	1	1	1	1	1	1	0.99975	0.9946	0.96783	0.90391	0.80698
pt:5	1	1	1	1	1	1	0.99999	0.99935	0.99251	0.96584	0.90888
pt:6	1	1	1	1	1	1	1	0.99993	0.99846	0.98904	0.96047
pt:7	1	1	1	1	1	1	1	0.99999	0.99971	0.99677	0.984
pt:8	1	1	1	1	1	1	1	1	0.99995	0.99911	0.99389
pt:9	1	1	1	1	1	1	1	1	0.99999	0.99977	0.99778
pt:10	1	1	1	1	1	1	1	1	1	0.99994	0.99923

Pd Table for 30,000 ft Altitude

	0nm	5nm	10nm	15nm	20nm	25nm	30nm	35nm	40nm	45nm	50nm
pt:1	1	1	1	0.99925	0.9569	0.78726	0.56701	0.38725	0.264	0.18388	0.13194
pt:2	1	1	1	1	0.99989	0.99196	0.93558	0.80917	0.65083	0.5025	0.38206
pt:3	1	1	1	1	1	0.99987	0.99468	0.9613	0.87884	0.75872	0.62817
pt:4	1	1	1	1	1	1	0.9997	0.99409	0.96623	0.90128	0.80391
pt:5	1	1	1	1	1	1	0.99999	0.99926	0.99199	0.96452	0.90682
pt:6	1	1	1	1	1	1	1	0.99992	0.99832	0.98849	0.95929
pt:7	1	1	1	1	1	1	1	0.99999	0.99968	0.99656	0.9834
pt:8	1	1	1	1	1	1	1	1	0.99994	0.99904	0.99361
pt:9	1	1	1	1	1	1	1	1	0.99999	0.99975	0.99766
pt:10	1	1	1	1	1	1	1	1	1	0.99994	0.99918

Fig.4: Detection probability tables as function emitter power from and range for various standard aircraft altitudes.

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