# Modeling of the Aqua-Quad Solar Power Generation System

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The Aqua-Quad: Solar-powered hybrid autonomous vehicle that combines a multi-rotor aerial vehicle with a buoy for surface and underwater surveillance.

Objective: Develop a realistic model of the Aqua-Quad's solar power generation system to predict electrical energy generated given its geographic location and charging duration.
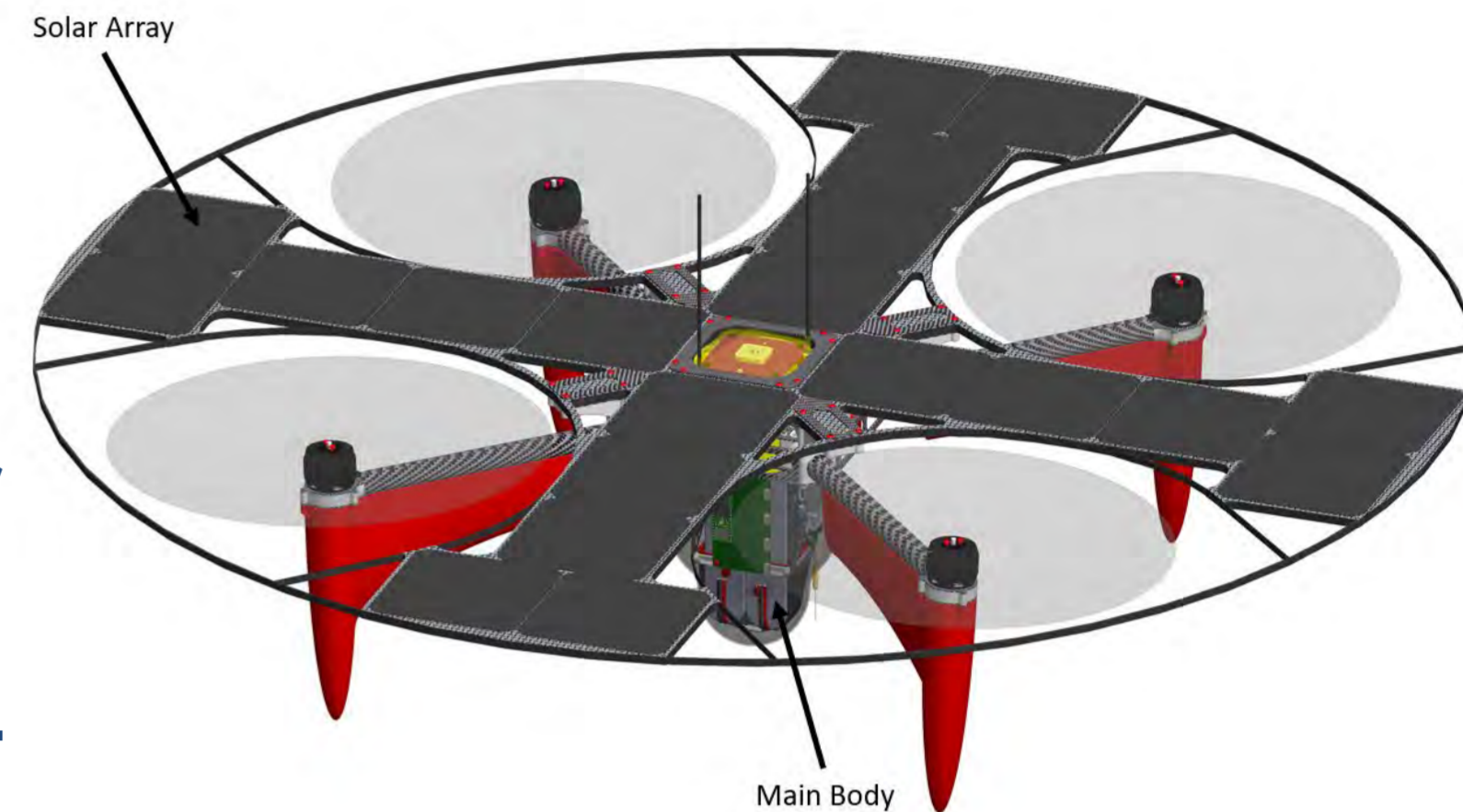
Modeling Approach: Account for geographic location, time of day and year, solar array tilt due to sea state, and degradation of solar array efficiency. Determine actual field performance and efficiencies of solar power generation system and its electrical components.
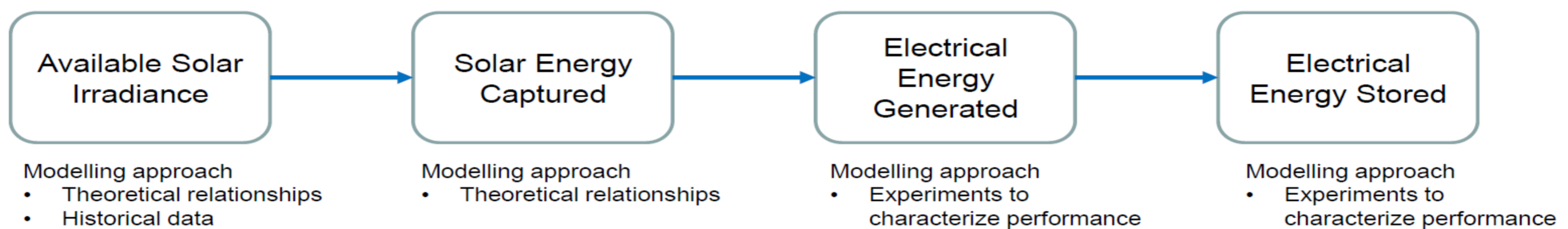

Results: Model prediction with mean absolute percentage error (MAPE) of 7% to 29% across four verification tests. Overall 14.5% ± 1.3% MAPE at 95% confidence interval.

Benefits of Model:
1. Optimize systematic development of the Aqua-Quad
2. Cost function of mission planning algorithm can be determined
3. Feasible mission envelope can be realistically evaluated
4. More energy optimal Aqua-Quad mission execution

Proposed Future Work:
- Artificial intelligence for more accurate model prediction
- Model the effects of the Aqua-Quad's operating environment
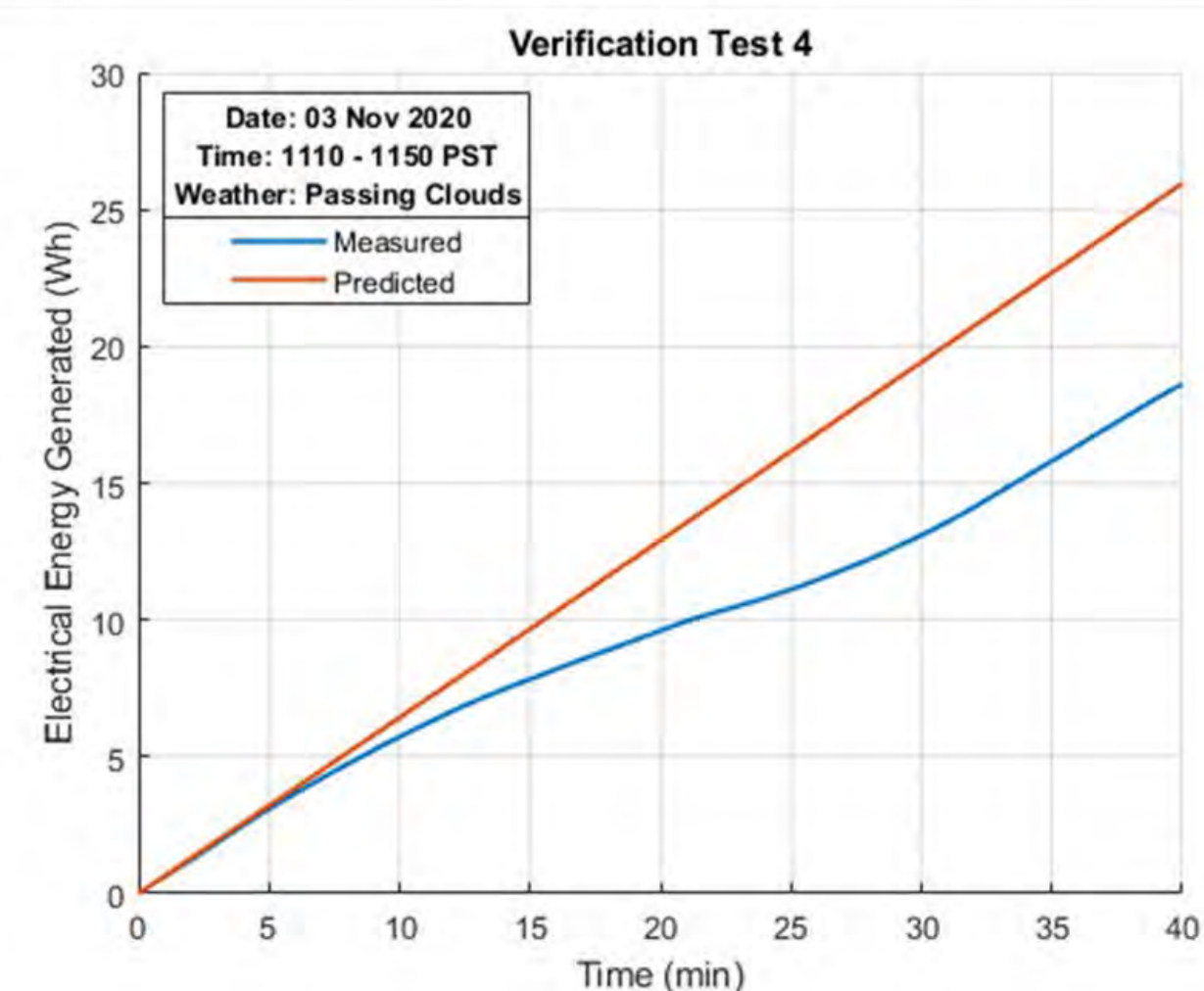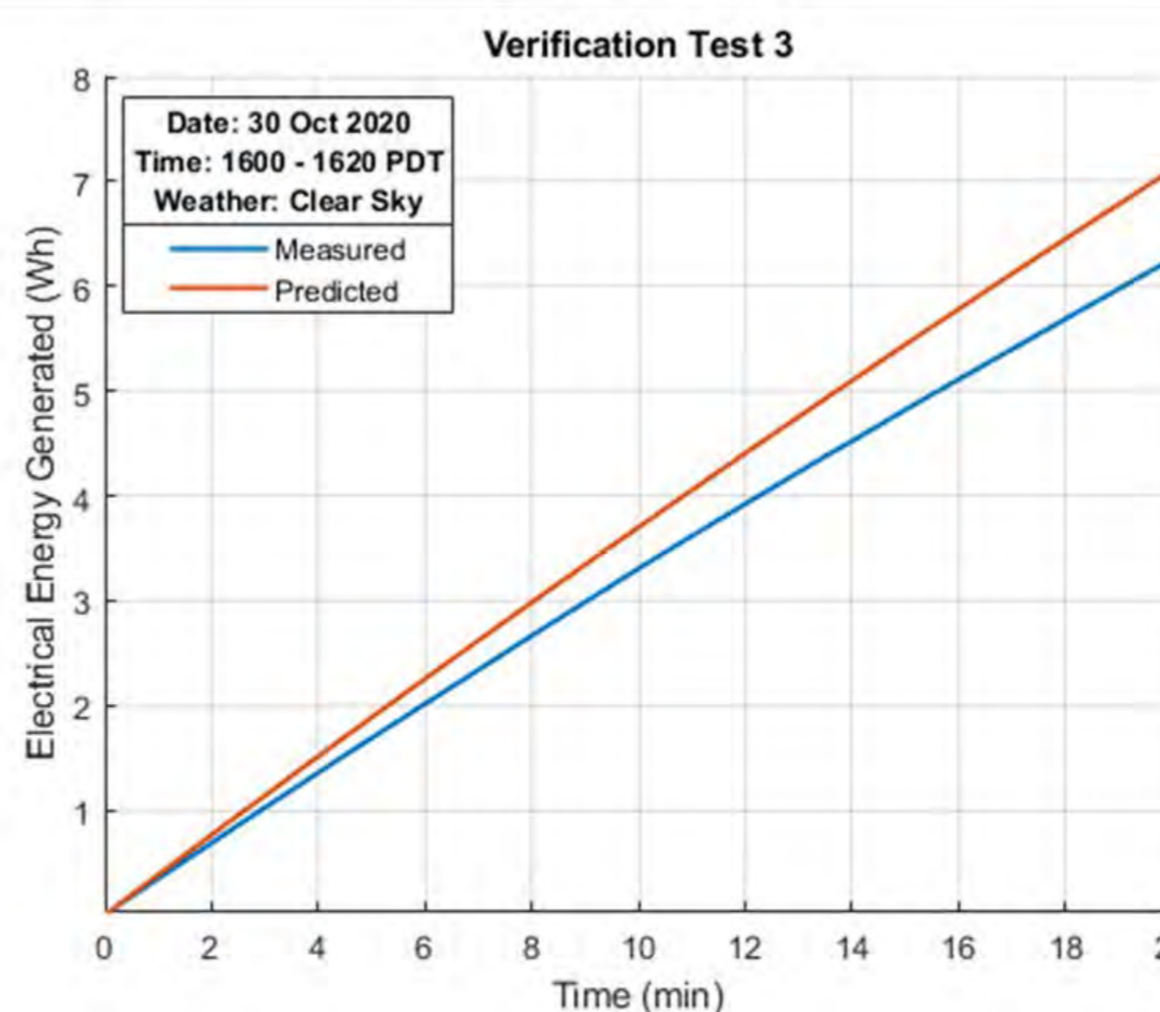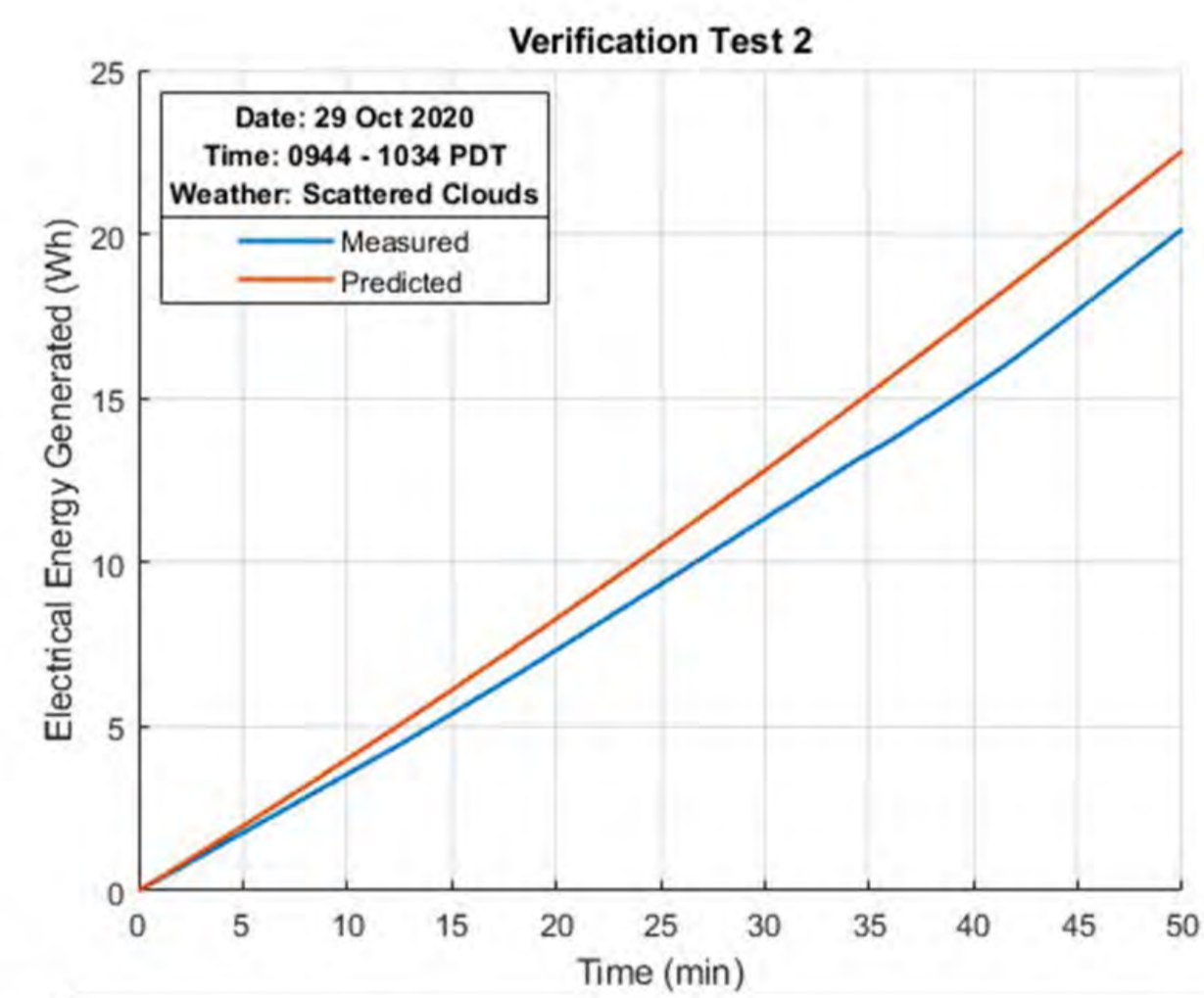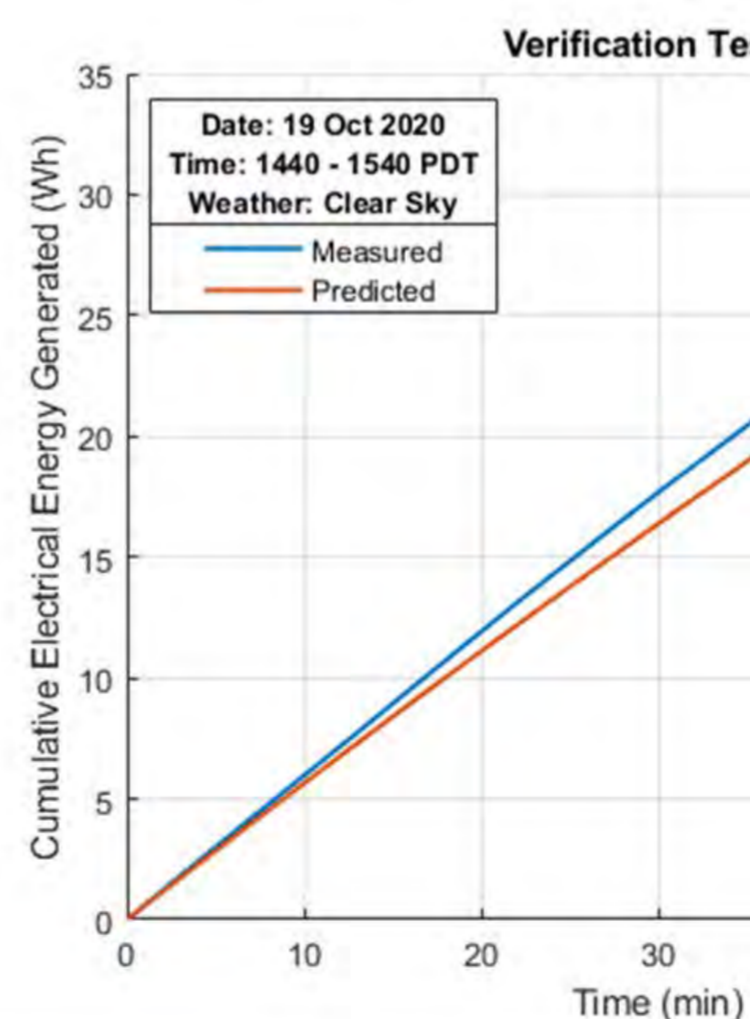
Reference: Lim, G., 2020, "Modeling of the Aqua-Quad Solar Power Generation System", Master's thesis, Naval Postgraduate School, Monterey, California, United States of America

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