# Alaska Field Testing of a BladeRunner Energy Hydrokinetic Turbine

PAMEC 2024, Barranquilla, Colombia
January 24, 2024


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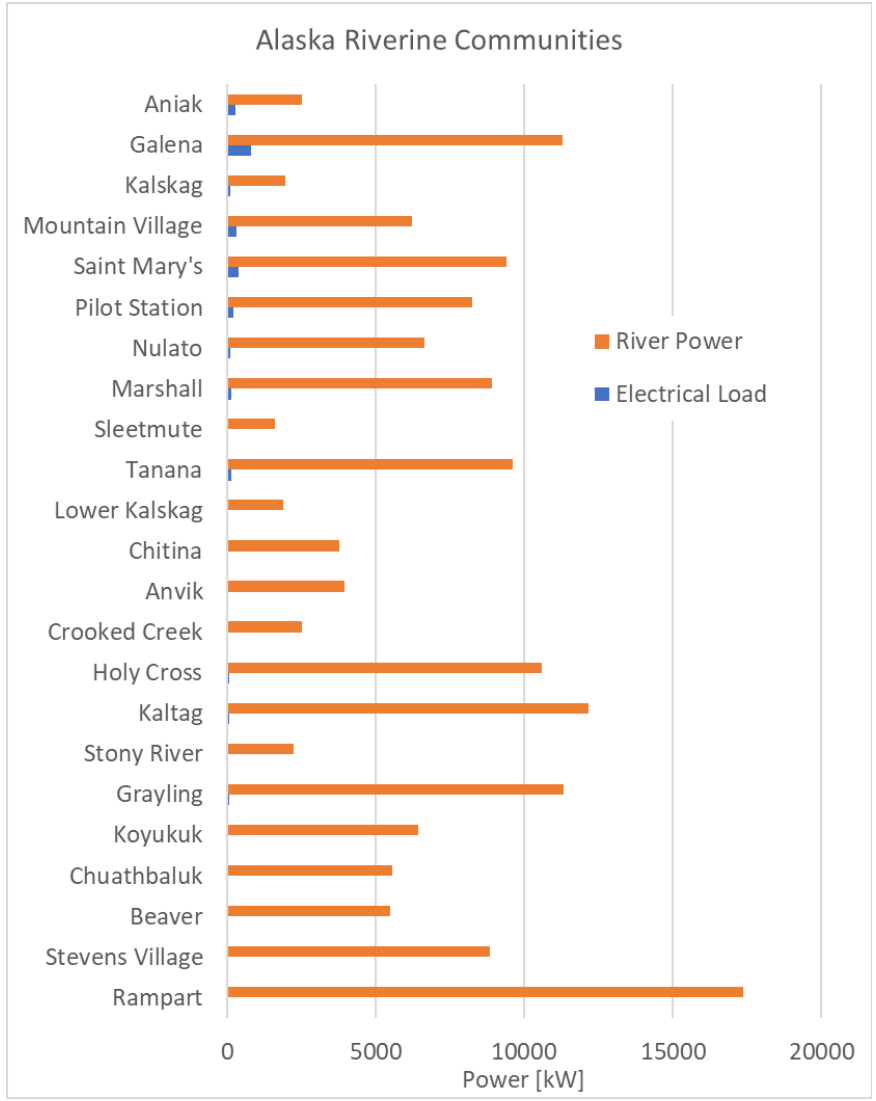
# Outline

- Project Background and Significance
- BladeRunner Energy Hydrokinetic Solution
- Tanana River Test Site
- Methodology
- BladeRunner Prototype Test Piece
- Performance Results

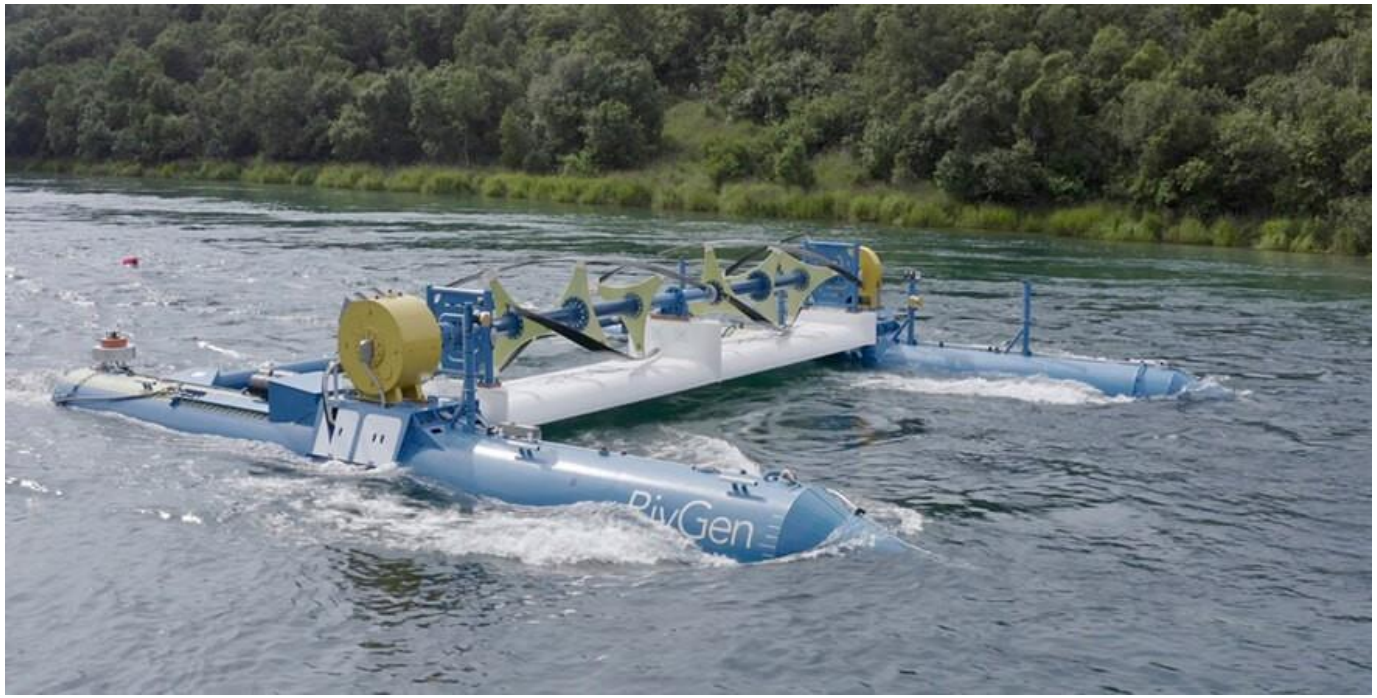
# Project Background and Significance

- Alaska is home to over 200 remote communities
  - 90+ located on a river
  - 20 MW total average electrical load
  - Predominantly utilizing diesel



# (Brief) Alaska Riverine HK History

Debris accumulation on surface turbine.  Ruby, AK 2013



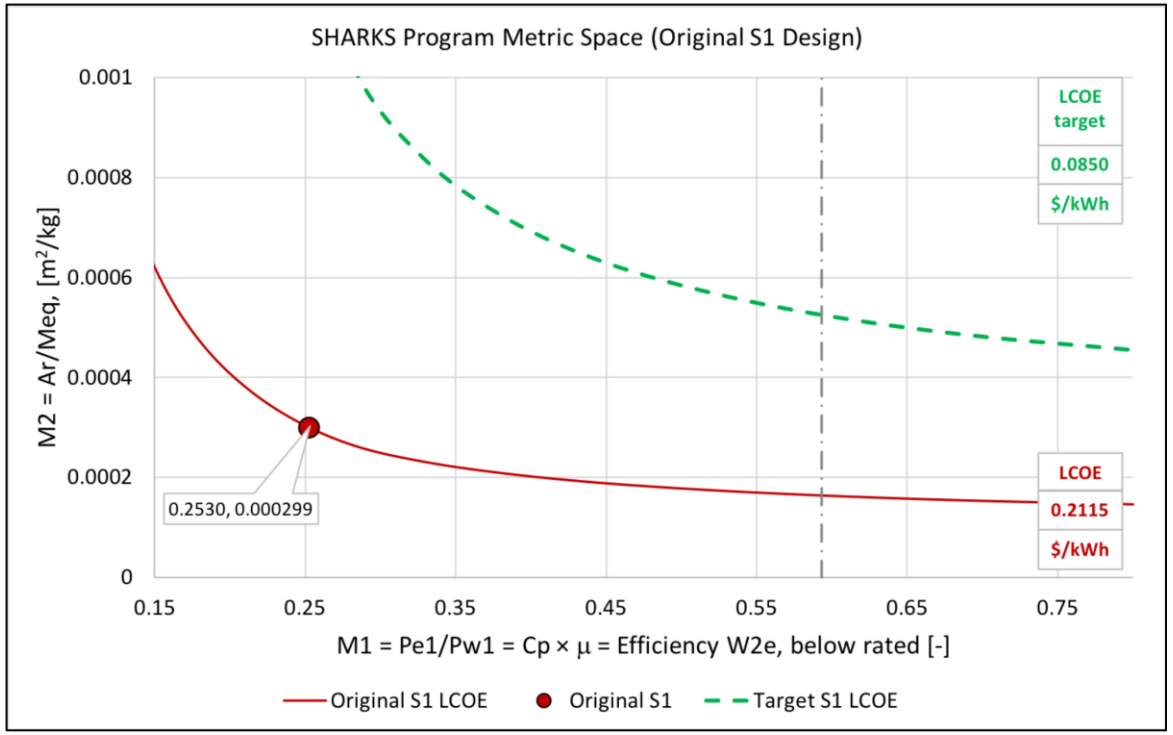

ORPC RivGen, prior to submersion.  Igiugig, AK 2020

# Funding Acknowledgement

“The information, data, or work presented herein was funded in part by the Advanced Research Projects Agency-Energy (ARPA-E), U.S. Department of Energy, under Award Number DE-AR0001444. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.”

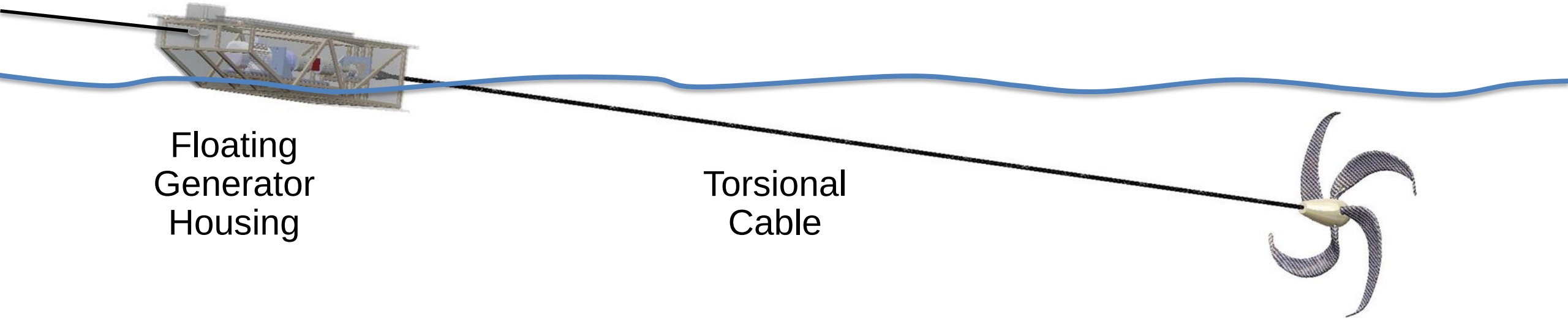
# ARPA-e SHARKS Program

- “Submarine Hydrokinetic And Riverine Kilo-megawatt Systems”
- Focus on co-design and controls co-design
- Use of “metric space” to improve LCOE




Source: Funding Opportunity No. DE-FOA-0002334
CFDA Number 81.135

# BladeRunner Energy Hydrokinetic Solution



Floating Generator Housing

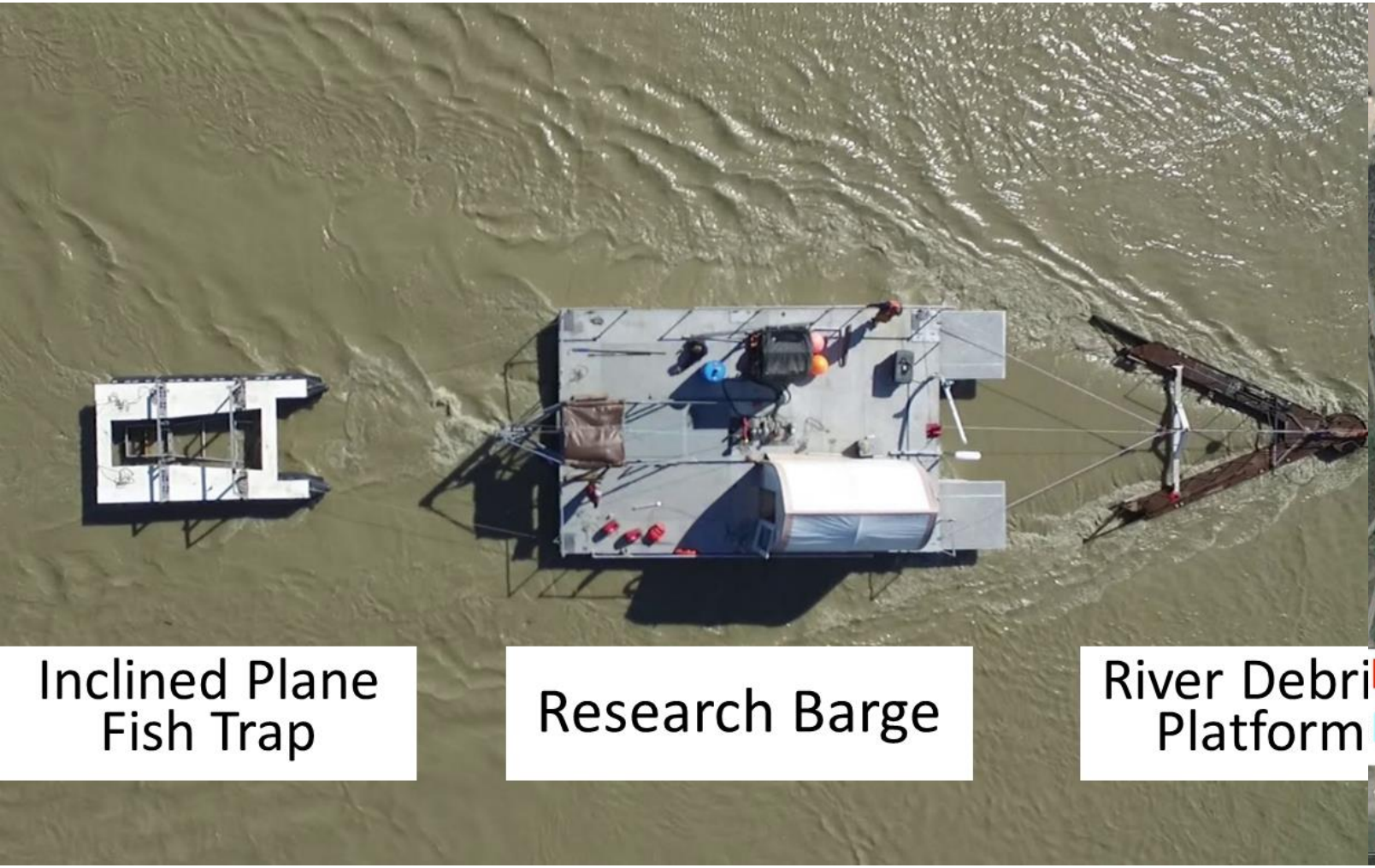
Torsional Cable

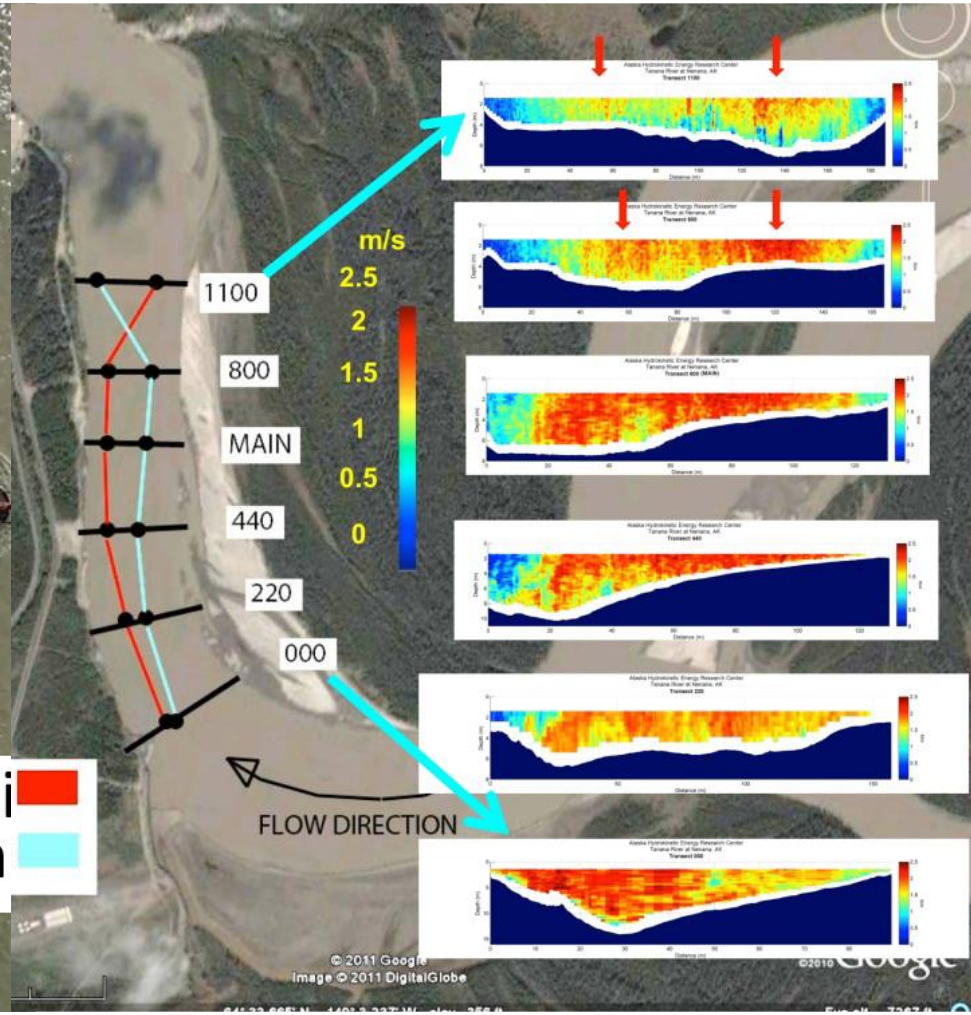
Debris-Resilient Rotor

**Design Attributes/Objectives**

- Increased system flexibility to address debris interaction
- Lightweight composite-driven design
- Minimal equipment required for assembly, deployment, retrieval

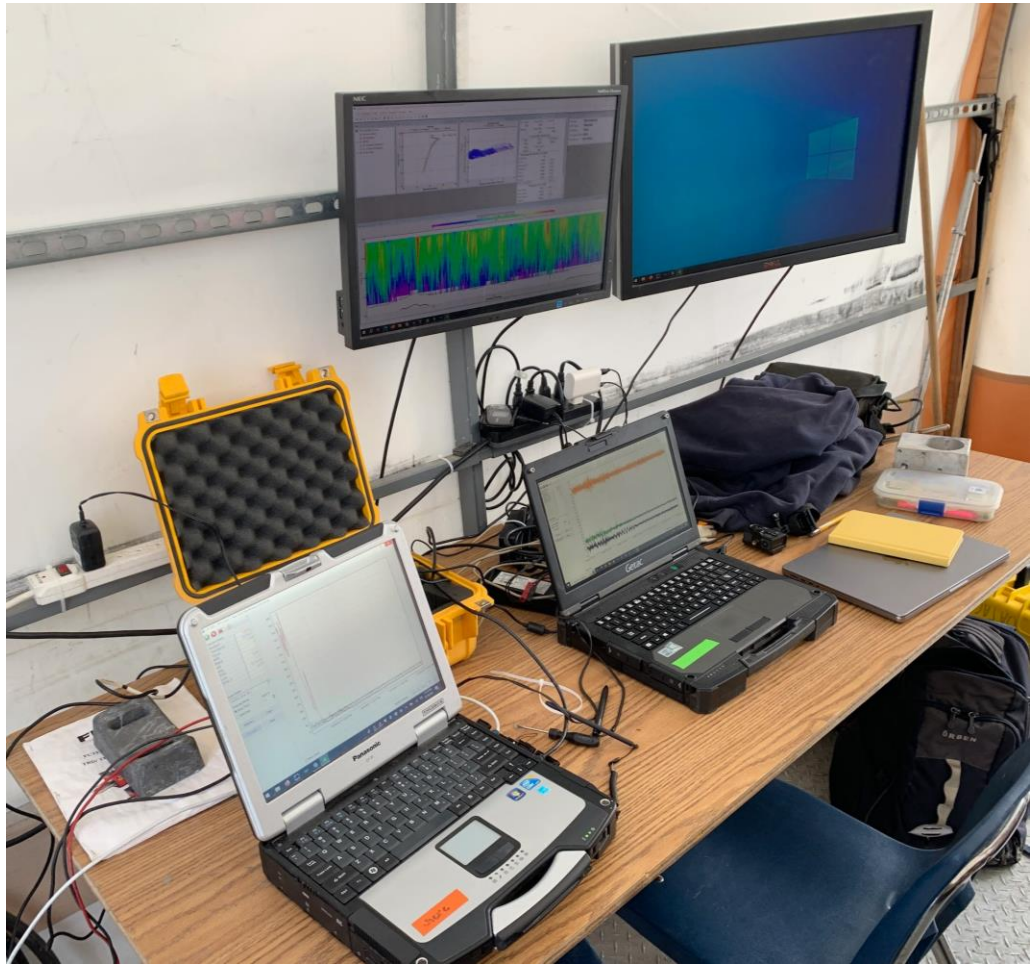
# Tanana River Test Site



# Data Collection

- ADCP
  - RiverPro 600 kHz
  - Nortek Sig 1000kHz
- Campbell Scientific Dataloggers
  - CR1000
    - DC voltage and current transducers
    - Torque and speed
    - Load cell, thermocouple
  - CR6
    - 3-axis accelerometers
- Hobo Loggers (in rotor nacelle)
  - Static Pressure
  - 3-axis Accelerometer
- Fish Sampling



# Testing Methodology

- River Velocity
  - Swept Power – at mercy of nature
- Independent variables
  - Rotor configuration
  - Load bank impedance (TSR)
- Dependent variables
  - Rotor depth, pitch
  - Mechanical and Electrical Power
- Follow IEC 62600-300 methodology as much as practical

# BladeRunner Prototype Test Piece

**v3 Prototype**

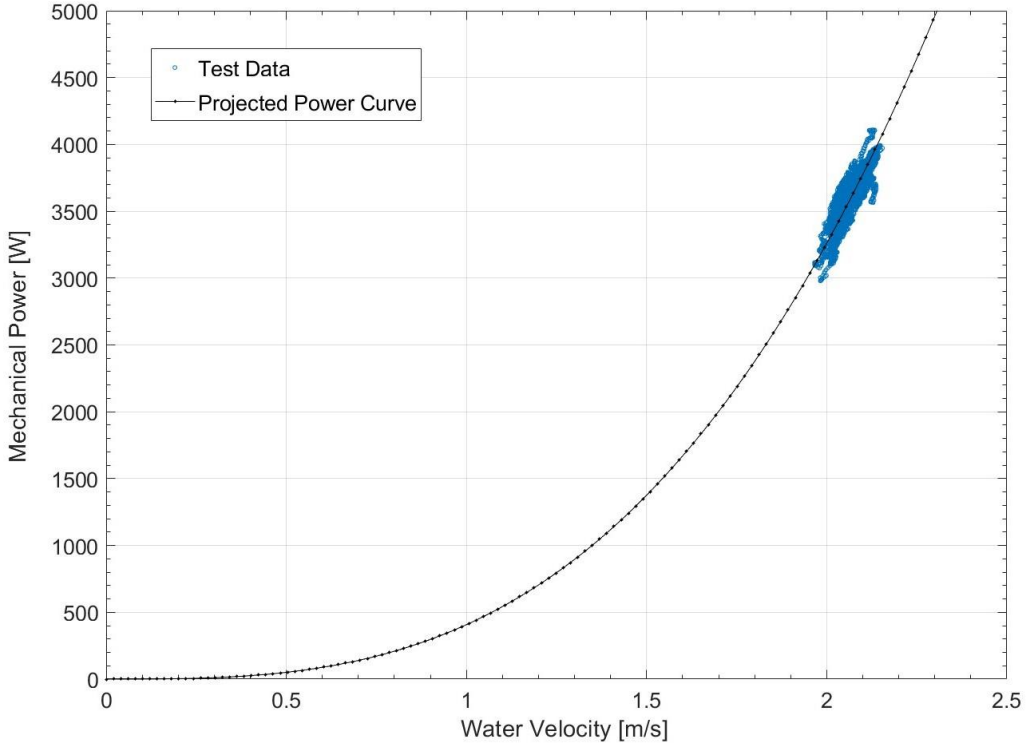
- Rotor diameter: 1.6m
- Torque rope length: 8m
- Generator: 7.5kW 3-phase 2,000 rpm rated servomotor
- Gearbox: 15:1 2-stage planetary
- Passive depth control

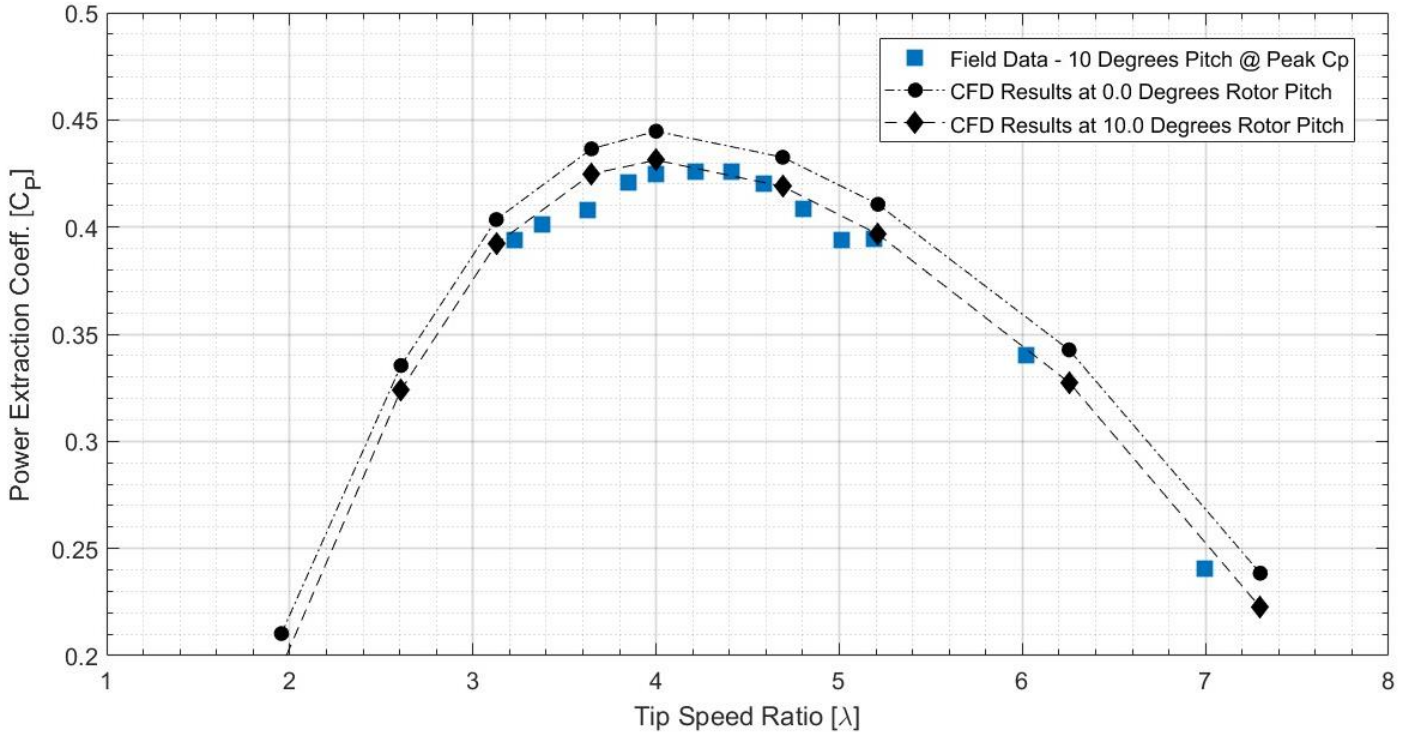
# Performance Results

## v3 Prototype

- >40 hours of instrumented operation, range of configurations
- Water Velocity: ~2.0 m/s
- Mech. Shaft Power: 3.3kW

- Rotor Peak Cp: 43%
- TSR @ Peak: 4.3
- Mech.-to-Elec. Conversion Eff.: 86%



# Questions

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