Supergen Marine (UKCMER) highlights
An efficient, experimentally validated, open source turbine array CFD model

Ian Masters, Alison J Williams
Swansea University

Funded by:
EPSRC (2015-2019)
EU Interreg (2019-2022) Project Selkie
RANS finite volume CFD model
Rotor disk source term.

OpenFOAM implementation
GitHub open source distribution
The FloWave Facility
Simulation of the Facility

- Model type.
- Model equations.
- Boundary conditions.
- Initial conditions.
- Initial results.
• Measurement Locations shown
• Hub height 1 metre
• Flow direction
• Cross section at rotor location and wake
Simulation of the Facility

One turbine results

Rotor results

- Upstream velocity good fit.
- Downstream excessive deficit.
- Wake section shows same result.

- Rotational speed 7.4 rad/s.
- Thrust curve trend OK.
- Thrust too high? 240N vs. 300N.
- Pitch angle not set correctly.
• Existing tank model
• 3 identical turbines
• Generalised Actuator Disk for each rotor
• CL, CD curves chosen for Reynolds number
• Downwash for tip loss correction
• Results:
  – Acceleration between rotors
  – Wake follows tank streamlines
Velocity and Turbulence

Open Source CFD tool

SELKIE

- Thanks to EPSRC for funding so far
- 2019-2022 Project Selkie
- TWO RESEARCH JOBS AVAILABLE
- Turbine CFD
  - OpenFOAM Array modelling
- Software support
  - Github, Docs, training, benchmarks