University of Exeter

Testing the TfI SeaSpring, a potential route to lower cost moorings for marine energy devices

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The TIGER project

TIGER (Tidal Stream Industry Energiser) is the largest ever Interreg project

- The project brings together developers, academia and industry to drive the sector forward
- Through TIGER, we tested the TfI SeaSpring for Orbital Marine Power

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Mooring Systems

- Floating tidal stream turbines are installed in the highest flow areas
- Mooring systems are critical to the success of the deployment
- Moorings must be designed for peak load conditions
- Conventional designs are heavy and expensive

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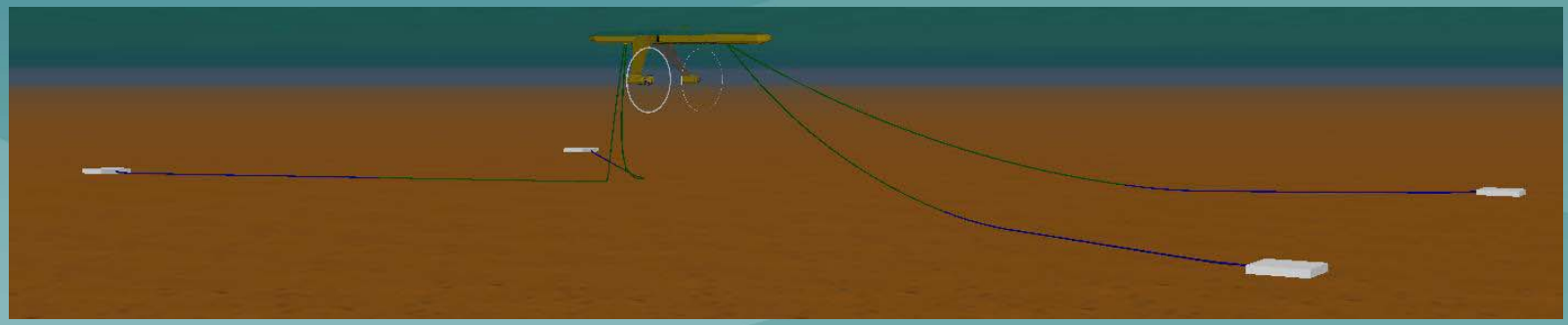
Mooring system example: Orbital O2

Each mooring line is composed of 225m of studlink chain (56.5 t)



Mooring dampers could reduce peak loading, allowing reduced chain mass, thus reducing:

- Cost (CapEx and OpEx)
- Device loads
- Carbon footprint

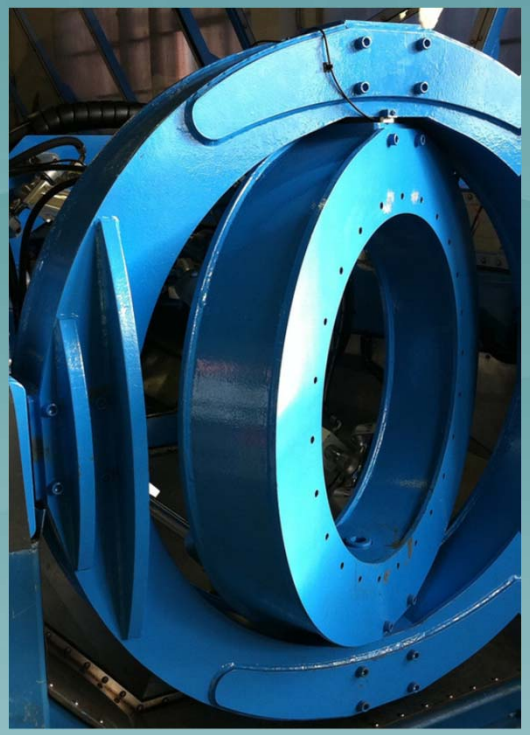
Technology from Ideas (TfI) SeaSpring

- SeaSpring comprises a series of compressive polymer springs linked by chain
- Polymer springs act in tension and provide a tailored, non-linear force response
- As the system is loaded, the polymer compresses by up to 50% of its length, dissipating mooring line forces and reducing fatigue and peak loading
- These load reductions allow for CAPEX and OPEX savings by reducing mooring line length and weight and reducing maintenance requirements

Dynamic Marine and Component test facility (DMaC)

Purpose-built test rig for offshore marine components:

- Tension/compression: 200kN
- Pitch / roll: 10kNm
- Bending: 10kN
- Wet and dry
- Data logging and CCTV
- Common testing:
  - Mooring systems
  - Power cables & Ancillaries
  - Sensors



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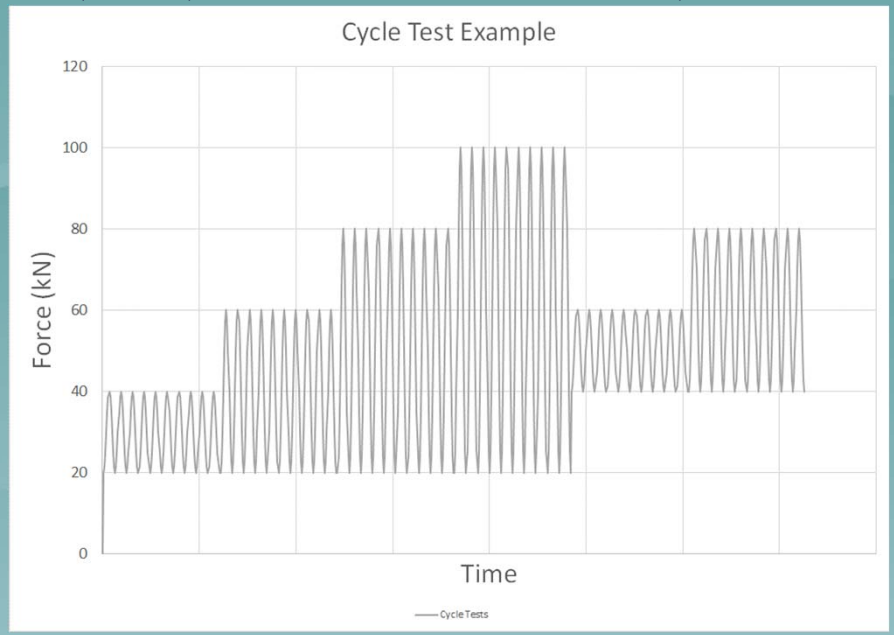
Test plan

- Force response tests: full cycle and sub-cycle regimes
- Standard operational and 50-year return period storm sea states
- Durability: thousand cycle load level (TCLL) tests at 6 load values (50% –



Installation

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Test runs

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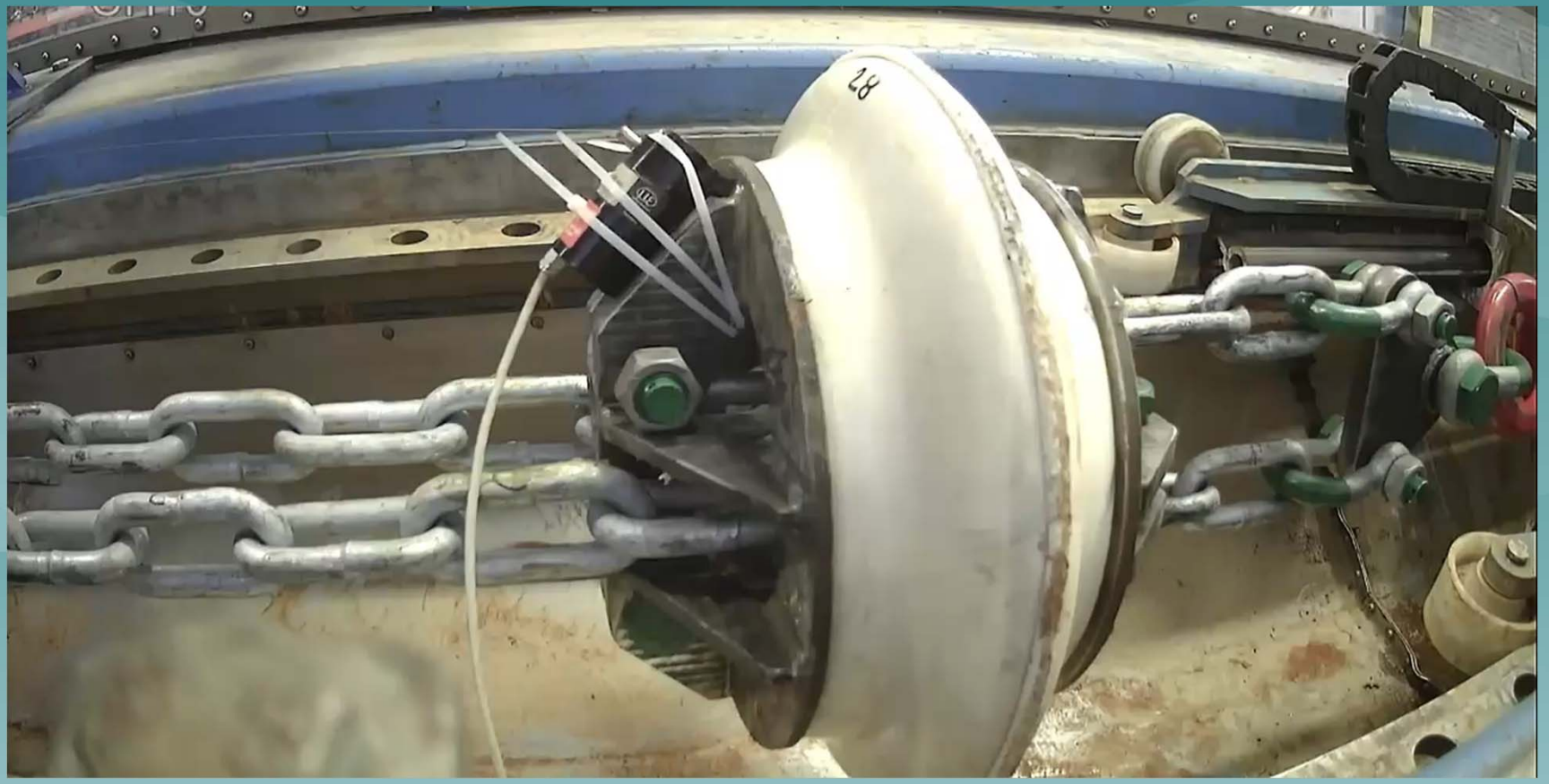
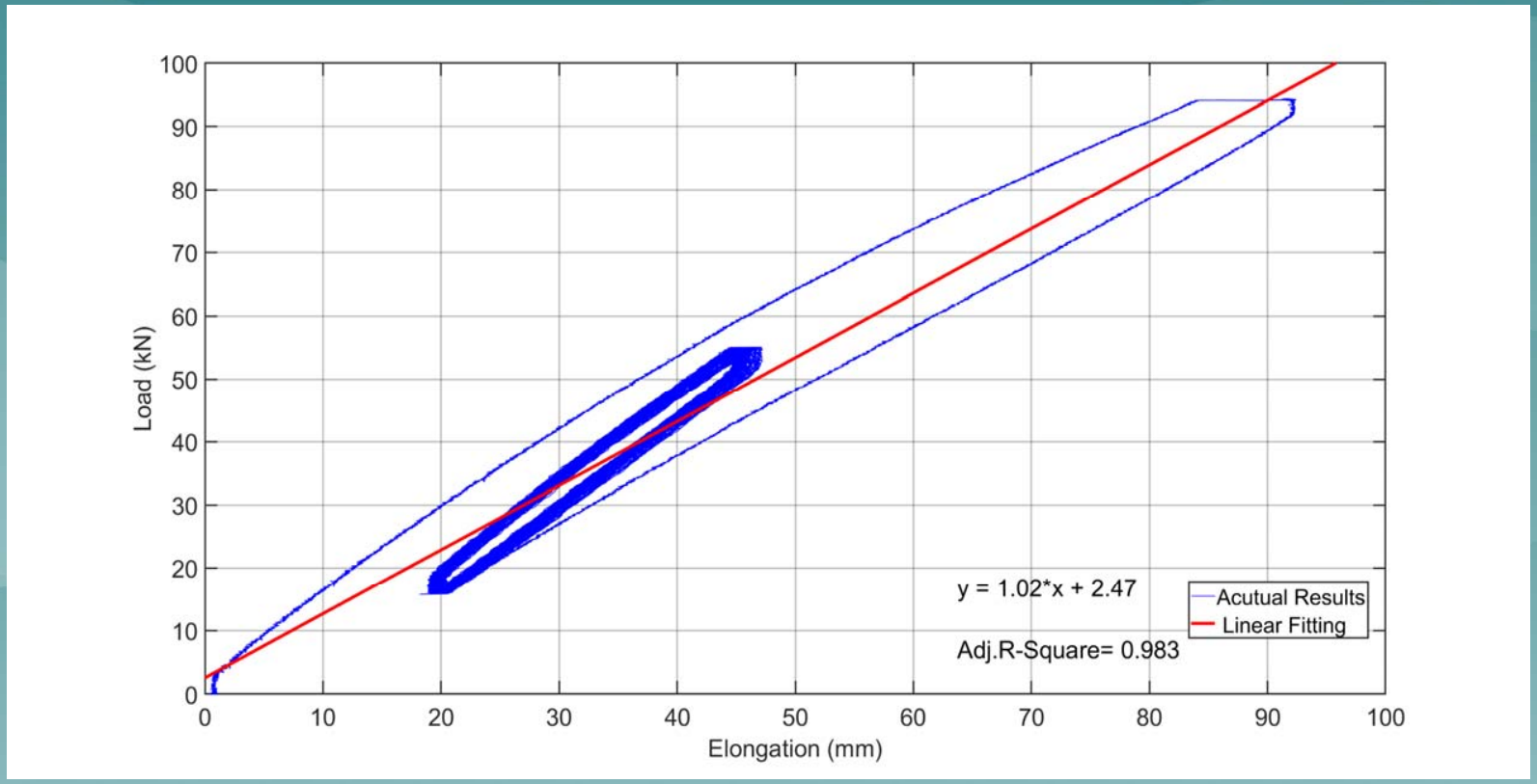
Test runs



Results


Load (kN)
Elongation (mm)
y = 1.02*x + 2.47
Adj.R-Square= 0.983
Acutual Results
Linear Fitting

Results

- Accurate replication of target loads and deflections to within 1%
- SeaSpring device met or exceeded all test targets
- Cyclic force response was measured, and the spring was subjected to aggressive storm sea states
- 5 years of accelerated fatigue was achieved over 2 days' durability testing

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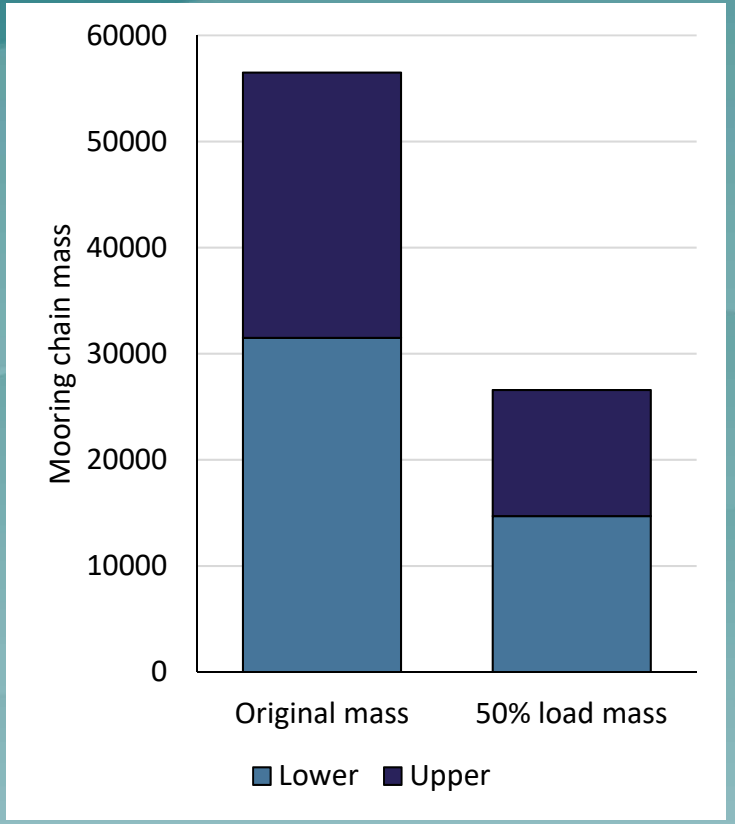
Conclusions: Cost-reduction potential

- Previous testing demonstrated 50% load reduction
- Component testing reduces risk of innovations / critical parts for developers such as Orbital Marine Power
- 50% load reduction allows a reduction in mooring system mass from 226 t to 106 t, driving reduction in cost



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Questions

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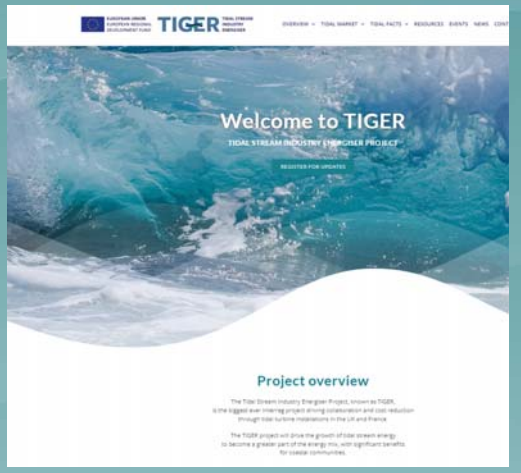
TIGER: Tidal Stream Industry Energiser project (interregtiger.com)

Or see as at our stand #24



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