

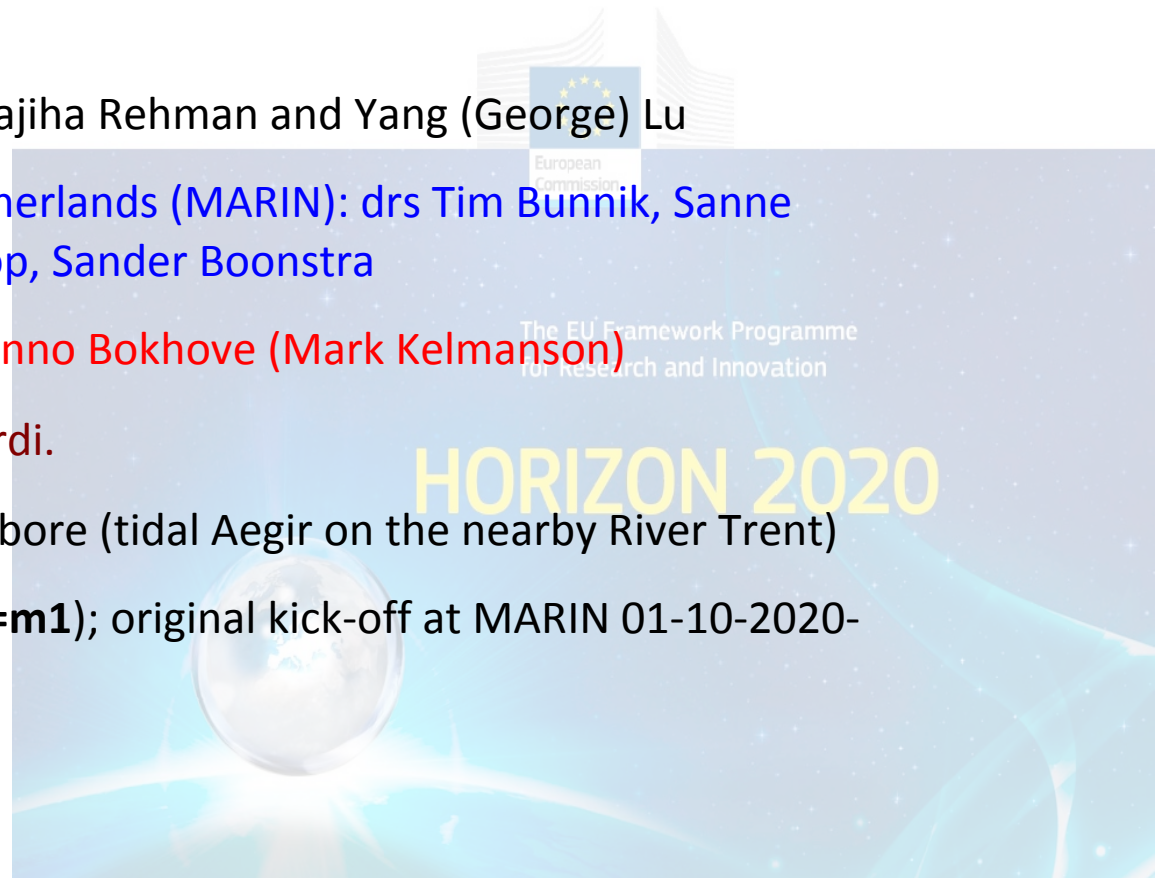
Eagre/Aegir: High-seas wave-impact modelling

(EU Marie Curie European Industry Doctorate 2020-2023)

Mid-term project meeting 26-03-2021

Coordinator's report by Onno Bokhove

1. Early Stage Researchers ESRs: Wajiha Rehman and Yang (George) Lu
 2. Maritime Research Institute Netherlands (MARIN): drs Tim Bunnik, Sanne van Essen; Bulent Duz, Arjen Koop, Sander Boonstra
 3. School of Mathematics, Leeds: Onno Bokhove (Mark Kelmanson)
 4. EU project officer: Filippo Gagliardi.
- Eagre/Aegir: a high tidal wave or bore (tidal Aegir on the nearby River Trent)
 - Start date: 01-01-2020 (**month 1=m1**); original kick-off at MARIN 01-10-2020->18-01-2021.



EID objectives



Eagre aims:

1. The overall objective is to create computational and mathematical modelling tools, for solving problems in maritime engineering, based on advanced mathematical and numerical analysis and the efficient implementation and testing of this analysis in a general finite-element simulation environment.
2. Our key task is to *offer training and research* such that this *numerical wavetank* can be established by the ESRs for maritime-engineering wave basins, such as those currently operational for consultation at MARIN Academy BV.
3. To create a numerical wavetank, developed by ESRs, on the modelling of *extreme or rogue waves* in wave basins (WP1-George) and on *wave-structure interactions*, especially wave-impact, on a dynamic wind-turbine mast (WP2-Wajiha).



4a Recruitment report

Recruitment report (D3.1 deliverable –completed but with delay):

- 1) First advertisement in 01-2020; due to pandemic repeated in spring. On Euraxess, UK site and ResearchGate (paid site, good experience). Stats available.
- 2) Interviews in July 2020, delayed due to pandemic.
- 3) Longlisting and then shortlist of 6 candidates for 2 ESR positions
- 4) Interview committee with HR (Maths-UoL), Tim Bunnik (MARIN), Onno Bokhove (PI), Steve Tobias (Maths UoL, also supervisory board) and Sepideh Khodaparast (Mechanical Engineering, UoL)
- 5) Wajiha Rehman and Yang Lu (George) are the two ESRs; intended start date of 01-09/10-2020 surpassed. Start dates ~01-11-2020 plus/minus two weeks self-isolation due to the pandemic. Wajiha arrived 20-10-2020 and George arrived 08-11-2020 in Leeds.

4b Deliverables

Deliverables (some deadlines set after but near mid-term date –as indicated):

- **D5.1:** WP5 D46 Establish data management plan 30 June 2020. **Ongoing.** See minutes kick-off meeting on GitHub page <https://github.com/obokhove/EagreEUEID20202023>
- **D3.2a -done:** Kick-off meeting 29-02-2020; took place on 02-03-2020 see minutes on <https://github.com/obokhove/EagreEUEID20202023>
- **D3.7 -done:** Supervisor board established (Henk Prins and Steve Tobias; emailed confirmation and contacts) 29-02-2020; done in 03-2020: see minutes on <https://github.com/obokhove/EagreEUEID20202023>
- **D3.2b -done:** Kick-of meeting September 2020 held at 18-01-2020; minutes on GitHub
- **WP4 D4.1 D41 old DD1;** Launch public media pages; WP4; UoL; Media; Media online; 30-09-2020 moved to 18-01-2021/26-03-2021. Commenced.
- **D3.9:** Mid-term progress report: **submitted, slight update made.**



4b Deliverables training Wajiha WP1

Deliverables (training –training plans formally established at SoM-UoL GRAD system):

- ***D1.14 M13 (Jan 2021)***: Training: MSc courses 1&2 (WP1)
 - Fluid Dynamics course completed except for Numerics Exercises 3 (relevant to EU-project); ***N3 pending.***
 - Fluid-Structure interaction course ongoing; 1st assignment submitted (relevant to EU-project); ***completed submissions 30-04-2021 plus marking.***
- ***D1.15 M13 (March 2021)***: Training: MSc courses 3 (WP1) optional (not needed)
- *Pre-transfer meeting at SoM-UoL deferred till after mid-term project meeting to lower work intensity during pandemic (PI decision), PhD transfer meeting at 12 months.*
- ***D1.16 M26 (~Jan 2022)***: Training: Skill workshops (WP1); outreach workshop done
- ***D1.17, D1.18 due at MARIN (2nd part of projects)***: two week-long professional courses, SoM-UoL has approved these as valid training courses
- ***D1.19 Training: Professional development log (WP1, WP); to do.***
- D1.20: Training Burgers courses in NL (during secondment phase)



4b Deliverables training George WP2

Deliverables (training –training plans formally established at SoM-UoL GRAD system):

- **D2.10 M13 (Jan 2021)**: Training: MSc courses 1&2 (WP1)
 - Fluid Dynamics course completed except for Numerics Exercises 3 (very relevant to EU-project)
 - Fluid-Structure interaction course ongoing; first assignment submitted (very relevant to EU-project)
- **D2.11 M13 (March 2021)**: Training: MSc courses 3 (WP1) optional (not needed)
- **Transfer meeting at SoM-UoL deferred till after mid-term project meeting to lower work intensity during pandemic (PI decision).**
- **D2.12 M26 (~Jan 2022)**: Training: Skill workshops (WP1); outreach workshop done
- **MISSING? due at MARIN (2nd part of projects)**: two week-long professional courses, SoM-UoL has approved these as valid training courses
- **MISSING?: Training: Professional development log (WP1, WP2); to do**
- **MISSING?: Training Burgers courses in NL (during secondment phase)**

4b Deliverables continued

Deliverables (continued deadlines set after but near mid-term date –as indicated):

- **WP1 WP1.1 D1.1 D1:**
Scientific: Reformulation/reproducing & HPC; interim report I;
30-04-2021 -> 30-06-2021
- **WP1 WP1.2 D1.2 D2:** Scientific benchmarking; update interim report I;
30-06-2021 -> 30-08-2021 (*People need summer holidays/family visits ...?*)
- **WP1 WP1.2 3-soliton:** update interim report I;
30-08-2021 -> 30-10-2021
- **WP2 D2.1 D12:** "D12; Mathematics; WP2.1; UoL (ESR2); Maths; Report I/draft2028note A;
30-04-2021 -> 30-06-2021
- **WP2 D13:** Numerics/ Mathematics WP2.2 Interim report II;
31-07-2021 -> 30-09-2021

4c Milestones update 26-03-2021

Milestones:

- **MS1 m8**: recruitment finalised –done.
- **MS2 m9 & m10**: kick-off meeting completed –done but 2nd meeting was delayed.
- **MS3 6-month**: SoM-UoL assessment complete; not yet 6 months; **to do May 2021** (incorrect date setting by SoM).
- **MSS8 m15**: mid-term check **–in progress**.
- **MS4 m16**: team workshop (pending will be delayed due to hiring delays).
- **MS19 m12**: enrolment in PhD program completed –done.

4d Ethical issues

Ethical issues:

- Not applicable it seems.

4e Management meetings

Management meetings:

- To date folded in kick-off meetings and various emails between Bunnik (MARIN) and Bokhove (SoM).
- Supervisory board has been established; email confirmation was sent (see deliverables and minutes first kick-off meeting).

4f Financial aspects

Financial aspects:

- Less is spent due to meeting planned to take place at MARIN have not taken place.
- Extra spending expected but less than travel money saved under bullet point above: ipads/ notepads, bigger screens, some online communication tools.
- IT support is somewhat insufficient so we may have to try to alleviate this. Not sure whether this leads to some extra spending (within the limits)? *Involve Firedrake at imperial College more formally.*
- *Should plan participation in scientific meetings (Firedrake, BAMC, OMAE).*
- Nothing else to report.

A wide-angle photograph of an offshore oil rig in the middle of the ocean. The sky is a mix of orange, yellow, and blue, suggesting a sunset or sunrise. The rig is a complex of metal structures with a tall derrick. In the foreground, the dark, calm water of the sea is visible. The text '4g Critical implementation risks and mitigation actions' is overlaid in a large, black, sans-serif font.

4g Critical implementation risks and mitigation actions

Critical implementation risks and mitigation actions:

- Under discussion with MARIN but completion of training has had and has now priority.
- To be discussed with project officer under agenda item 7.



4h) proposed reorientations ...

Proposed reorientations of the network's activities:

- Nothing in particular and under discussion (agenda item 7).
- See later slide/remark on WP2.7 (as planned).
- *People need summer holidays/family visits ...?*



4i) Document management and Open Research data

Document management and open research data:

- As planned, see deliverables and GitHub pages; open gold standard for pending publications, including programs at zenodo, etc.

George –“ExtremeWaves”

Extreme water-wave computational modeling using advanced geometric methods with wave generation, breaking, and currents.

WP1.1 Create a *complete numerical finite-element wavetank for high-amplitude potential-flow water waves* with a breaking-wave parameterization, optimized for parallel computing, wave generation and wave damping at beaches, in both two and three dimensions (2D and 3D). Explore coordinate transformations as well as dynamic mesh motion.

WP1.2 Develop and deliver a (new) series of *benchmark cases* (soliton splashes, Stokes, Rienecker-Fenton, (ir)regular, short-crested waves, random waves, etc.) for the wavetank of WP1.1.

Wajiha –“WaveTurbineImpact”

Water-wave impact on dynamic and flexible (wind-turbine) structures.

WP2.1. Formulate the *nonlinear mathematical theory* of potential-flow water waves coupled to a nonlinear hyperelastic beam (wind-turbine mast) in 2D and 3D, also using the applicants' new asymptotic analysis of the two-way feedback mechanism (cf. Salwa *et al.* 2017; Kelmanson 2018/2019).

WP2.2 Derive a *compatible numerical discretization* of potential-flow water-wave motion and a prescribed beam (or waveflap) motion in 2D.

--with MK.

Wajiha –“WaveTurbineImpact” cont.

WP2.7 *Provide and explore the variational formulation of a mixture-theory water-wave model in the Eulerian framework, using Euler-Poincaré theory and its Euler-Boussinesq-equation limit. Couple the resulting water-wave model variationally to the nonlinear beam (wind-turbine mast). Consider and explore numerical water-wave motion in a compressible Van-der-Waals-fluid model, in its potential-flow limit, and compare this computational model with a classic finite-volume formulation using a continuous equation of state. Explore the imposition of incompressibility (optional explorations).*

The proposal is to consider replacing WP2.7 at the mid-term review by a particular applied and end-user topic of interest to MARIN Academy BV, to be defined by the MARIN Academy BV supervisors depending on the progress at the time in discussion with ESR2 and the academic advisors.

Extra, Deliverables first ~6 months

Completed:

- Kick-off meeting 29-02-2020; took place on 02-03-2020.
- Supervisor board established 29-02-2020; done in 03-2020.
- WP5 D46 Establish data management plan 30 June 2020.
- See minutes: [GitHubEagre](https://github.com/obokhove/EagreEUEID20202023)
<https://github.com/obokhove/EagreEUEID20202023>

Delayed:

- Kick-off meeting 01-10-2020 now 18-01-2021; minutes placed on GitHub.
- **Fluid dynamics course** (exam done, 2 numerical tasks to go) & ~~self-study course~~ in semester 1 moved to semester 2: **FSI course**,

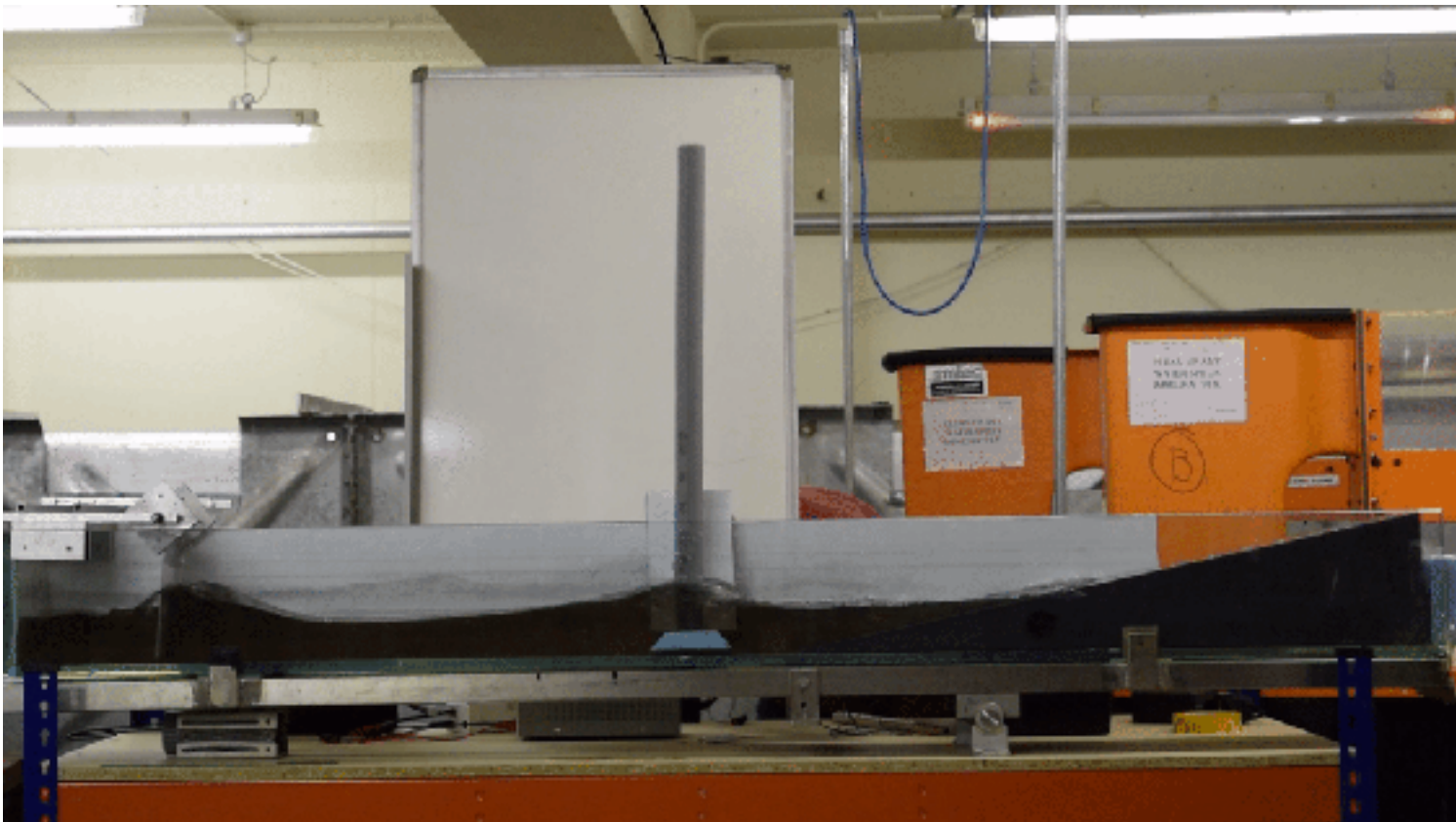
Note that:

- Month 1 is 01-2020
- Month 9 is 09-2020; ESRs were supposed to be starting 09/10-2020.
- ESRs started 01-11 to 21-11-2020 due to Covid-19 (hiring UoL delayed, hiring-freeze, and self-isolation).
- Teaching *out-of-sinc*: OB had to teach numerics twice (1x CDT, 1x ESRs).

Extra, Deliverables first ~6 months outreach

Delayed:

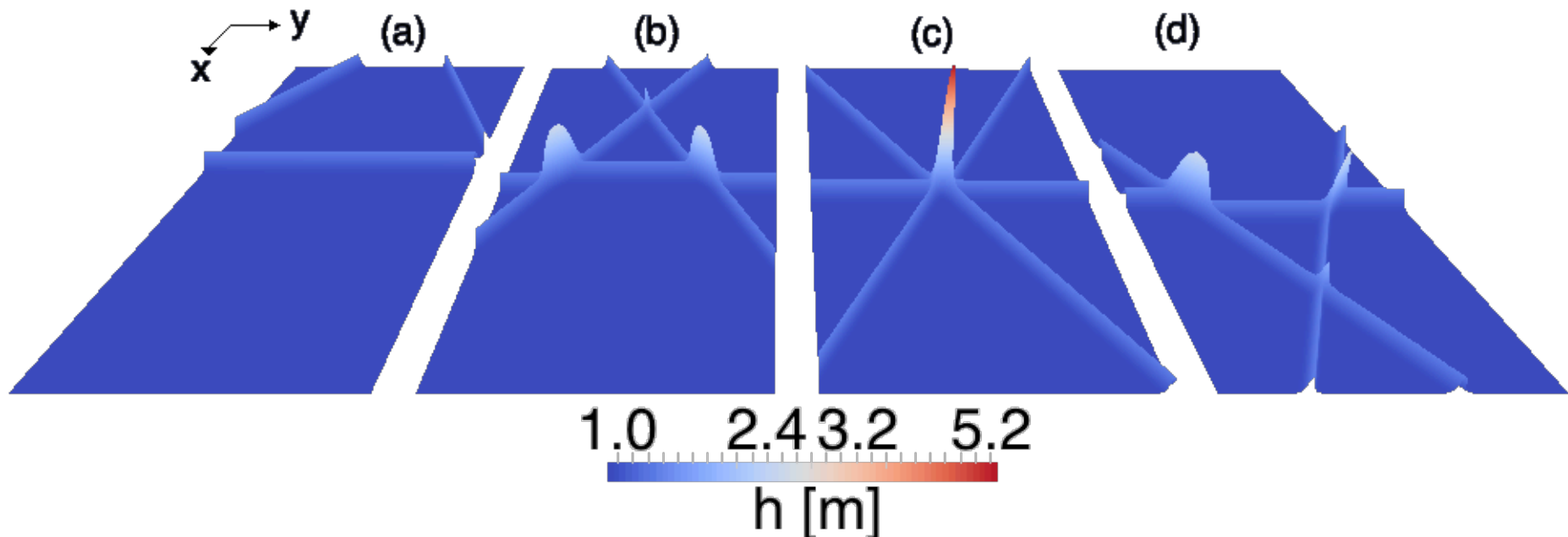
- **WP4 D4.1** D41 old DD1; **Launch public media pages**; WP4; UoL; Media online; 01-09-2020 -> 18-01-2021; *completed*.
- E.g., wavetank in Maths Lab: <https://github.com/obokhove/MathslaboratoryUoL>
<https://blogsurfsup.wordpress.com/>



Extra, Deliverables first ~6 months George

Delayed George:

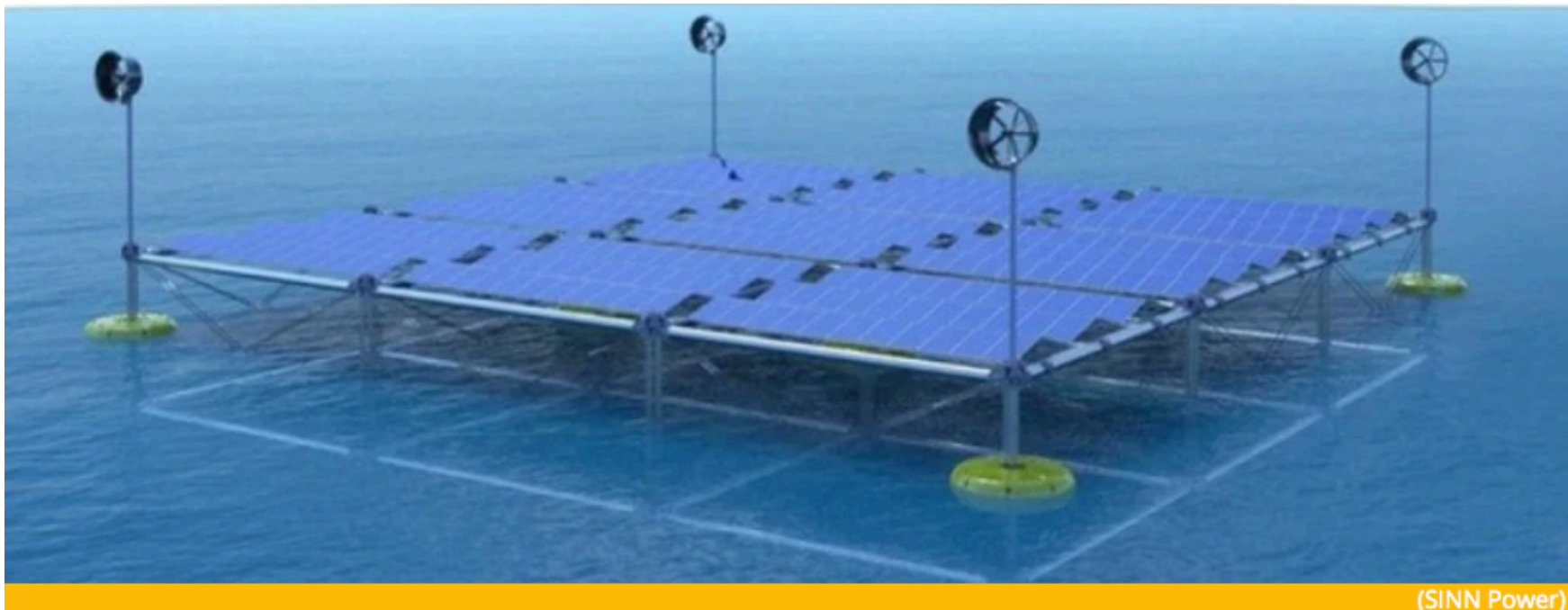
- **WP1 WP1.1 D1.1 D1:** **Scientific: Reformulation/reproducing** & HPC; interim report I; 30-04-2021 -> 30-06-2021
- **WP1 WP1.2 D1.2 D2;** **Scientific benchmarking**; update interim report I; 30-06-2021 -> 30-08-2021
- **WP1 WP1.2 3-soliton**; update interim report I; 30-08-2021 -> 30-10-2021
3 papers (Overleaf)



Extra, Deliverables first ~6 months Wajiha

Delayed ESR2:

- **WP2 D2.1** D12 "D12; [Mathematics](#); WP2.1; UoL (ESR2); Maths; Report I/ draftnote A; 30-04-2021 -> 30-06-2021
- **WP2 D13** Numerics/ Mathematics WP2.2 Interim report II; 31-07-2021 -> 30-09-2021
- Photovoltaic power plants at sea?



(SINN Power)

Get in touch!

<http://www1.maths.leeds.ac.uk/eagreEUEID/index.html>

github.com/obokhoveEagreEUEID20202023



Important Dates: Next progress report M26 (2022)