



ELVHYS PROJECT

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on behalf of ELVHYS coordinator (Prof. F. Ustolin) and consortium
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ELVHYS project

Project title: Enhancing safety of liquid and vaporised hydrogen transfer technologies in public areas for mobile applications

Total project budget: €2.0M

Project duration: 2023-2025

Project coordinator: NTNU

Consortium: 8 partners from 6 countries

Website: www.elvhys.eu





Aim and objectives

Aim: develop inherently safer and efficient cryogenic hydrogen technologies and protocols in mobile applications by proposing innovative safety strategies and engineering solutions, including selection of effective safety barriers and hazard zoning strategies.

Objectives and expected outcomes

1. Detailed risk analysis for LH2 transferring operations for mobile applications (ships, trucks, stationary tanks) fillings.
2. Generic hazard distances for LH2 transferring operations in the different applications, also addressing SimOps.
3. Guidelines for design of LH2 transferring facilities.
4. Consensual loading procedures for LH2 transferring operations.
5. Provide inputs for developing Standards, Technical Specifications, or Technical Reports at the international level.



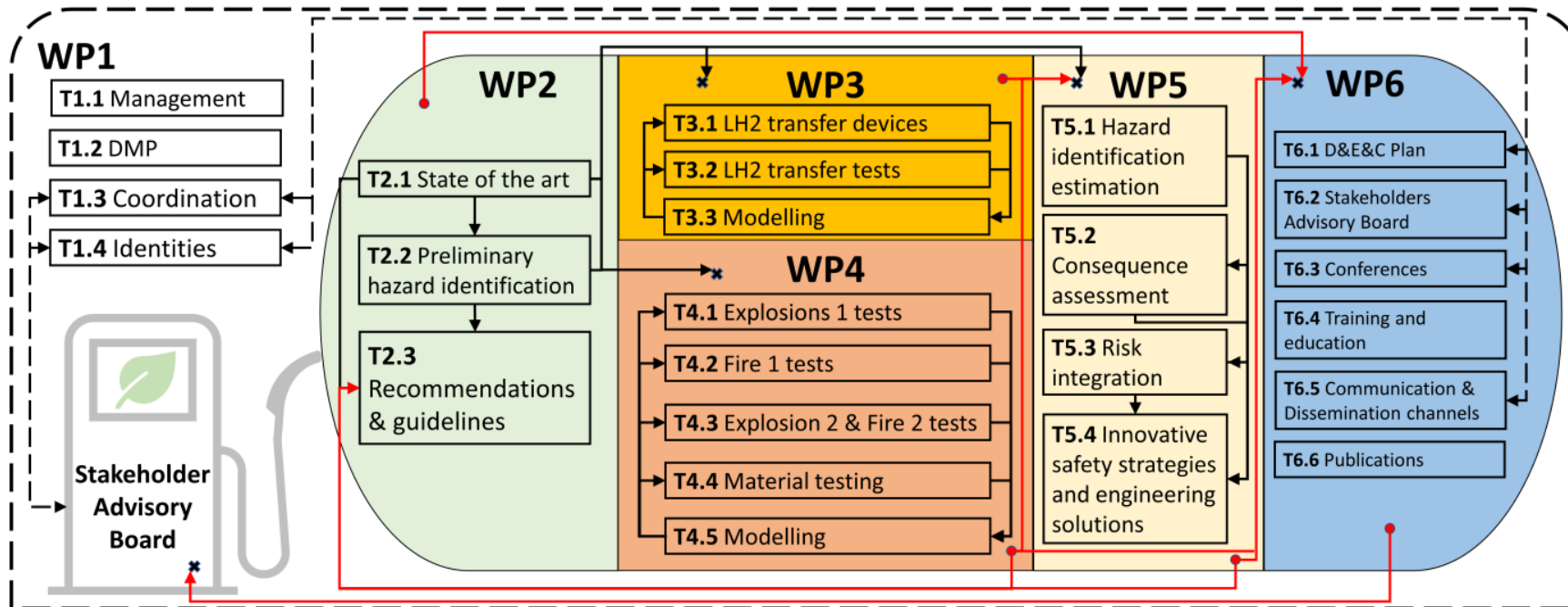
ELVHYS - Work plan

WP2 (AL) - From industrial background and strategy to findings application

WP3 (DLR) - Cryogenic hydrogen transfer facilities performance

WP6 (UU) - Dissemination, exploitation, communication

WP1 (NTNU) - Project Management & Coordination



SAB - 33 members

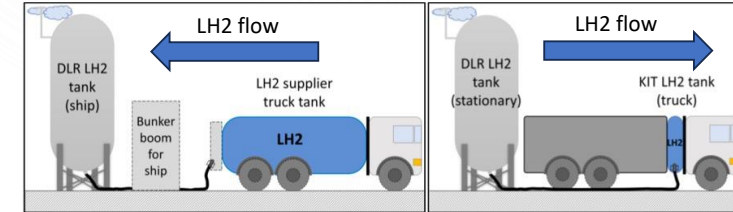
WP4 (HSE) - Fires & explosions from cryogenic hydrogen transfer facilities

WP5 (NCSR) - Risk Analysis for selected cryogenic hydrogen transferring operations



ELVHYS experimental activities (1/2)

Nr	Phenomenon investigated	WP	Location	Partner
1	LH2 transfer operations from a giving to a receiving tank	3	Lampoldshausen (Germany)	DLR
2	Oxygen enrichment and condensed phase explosions	4	Buxton (UK)	HSE
3	LH2 Leakage into cold room/tank connection space considering barriers and obstacles	4	Buxton (UK)	HSE
4	Boiling Liquid Expanding Vapour Explosion (BLEVE) tests with a shock tube	4	Karlsruhe (Germany)	KIT
5	Fire tests of short LH2 transfer line elements	4	Karlsruhe (Germany)	KIT
6	Material testing against unignited and ignited LH2 jets	4	Karlsruhe (Germany)	KIT



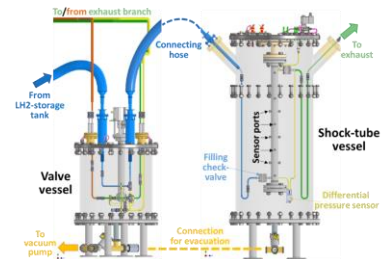
DLR test facility



KIT LH2 tank



KIT free field test site

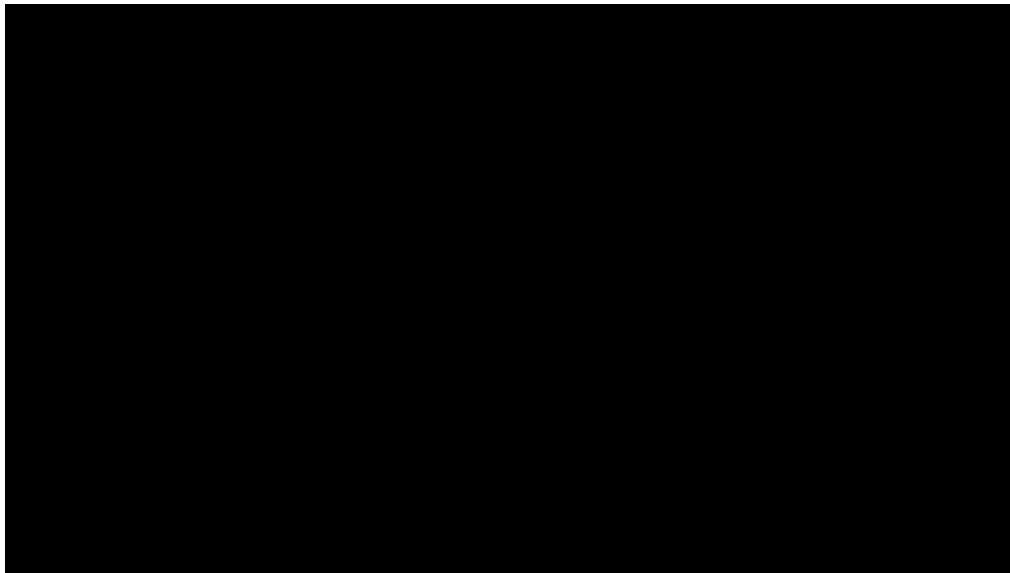


KIT shock tube



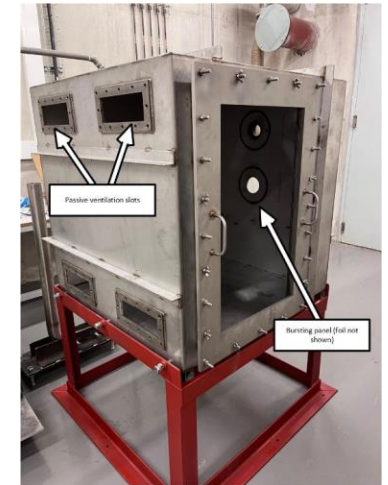
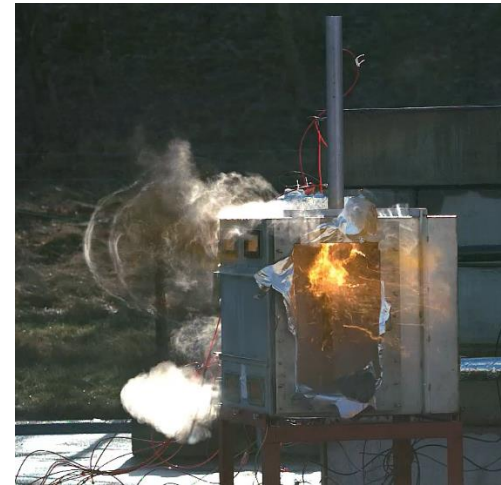
ELVHYS experimental activities (2/2)

2. Oxygen enrichment and condensed phase explosions (WP4, HSE)



HSE ELVHYS tests

3. LH2 leakage in confined spaces considering barriers & obstacles (WP4, HSE)



LH2 indoor testing at HSE



ELVHYS modelling activities

Cryogenic hydrogen transfer facilities performance (WP3, NCSRD, KIT, NTNU)

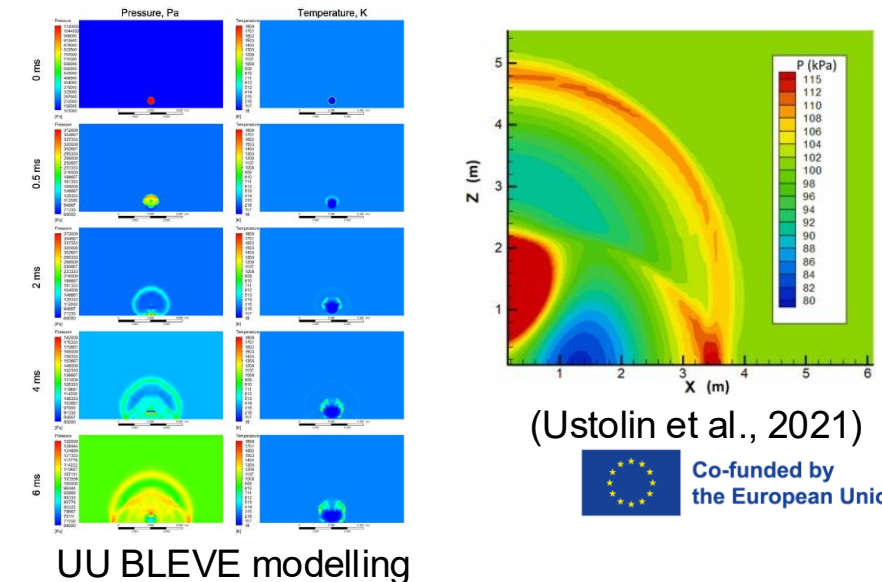
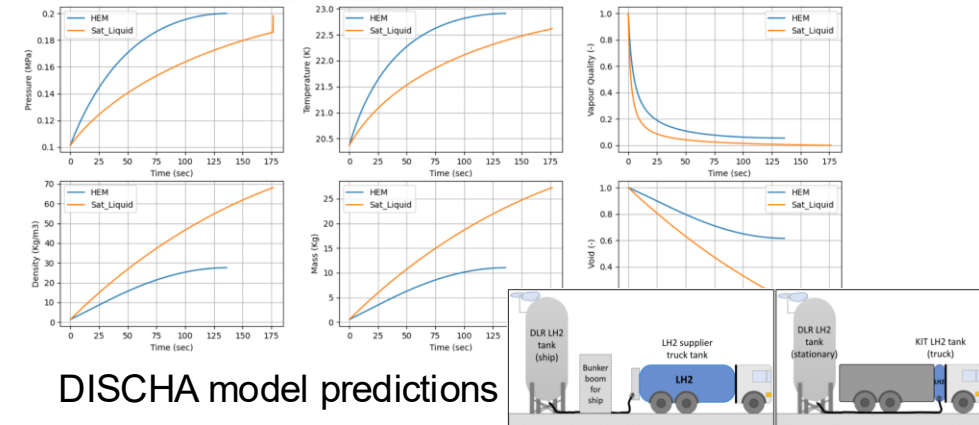
Modelling serves a dual purpose:

- Support the experiments design (NCSRD DISCHA tool)
- Validate the models against experimental data

Fires and explosions from cryogenic hydrogen transfer facilities (WP4, NCSRD, HSE, KIT, NTNU, UNIBO, UU)

Model relevant physical phenomena and incident scenarios:

- Unignited and ignited LH2 releases
- Fire resistance of LH2 components
- Pressure Peaking Phenomenon (PPP)
- BLEVE



(Ustolin et al., 2021)



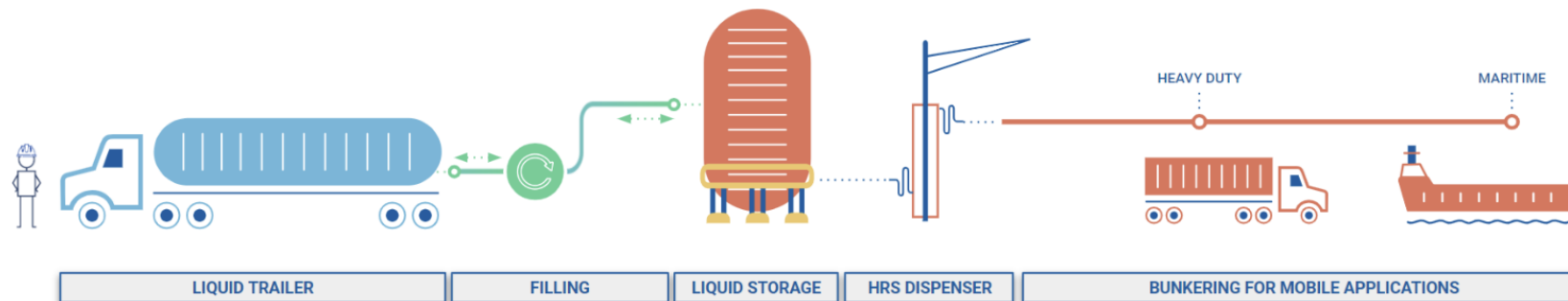


ELVHYS - Risk analysis

Risk analysis for selected cryogenic hydrogen transferring operations (WP5, NCSRD, AL, DLR, KIT, NTNU, UNIBO, UU)

The tasks of this risk analysis are:

- **Task 5.1** – Hazard identification and damage state estimation
- **Task 5.2** – Consequence assessment
- **Task 5.3** – Frequency assessment and risk integration
- **Task 5.4** – Innovative safety strategies and engineering solutions





ELVHYS impact pathways

- FAIR open access research data for stakeholders' use.
- Provision of validated contemporary models and engineering tools for LH2 transferring operations and assessment of associated incident scenarios.
- Guidelines for inherently safe design of LH2 transferring facilities.
- Consensual loading procedures for LH2 transferring operations.
- Recommendations for Regulations, Codes and Standards for LH2 transferring operations.
- Training materials on safety of cryogenic hydrogen transfer technologies.
- Scientific advancement in understanding and safety of LH2 transfer operations for mobile applications, supported by an intensive knowledge transfer and exchange of expertise.



Thank you for your attention

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Workshop registration



Join our workshop No. 6 to hear more about ELVHYS project!

Friday 5th December 2025, virtual event

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