Consequences of high-pressure cylinder in fire scenario

Vojtěch Jankůj

Introduction

Fire and Industrial Safety

Explosion Prevention and protection

Hydrogen safety research

REFRESH

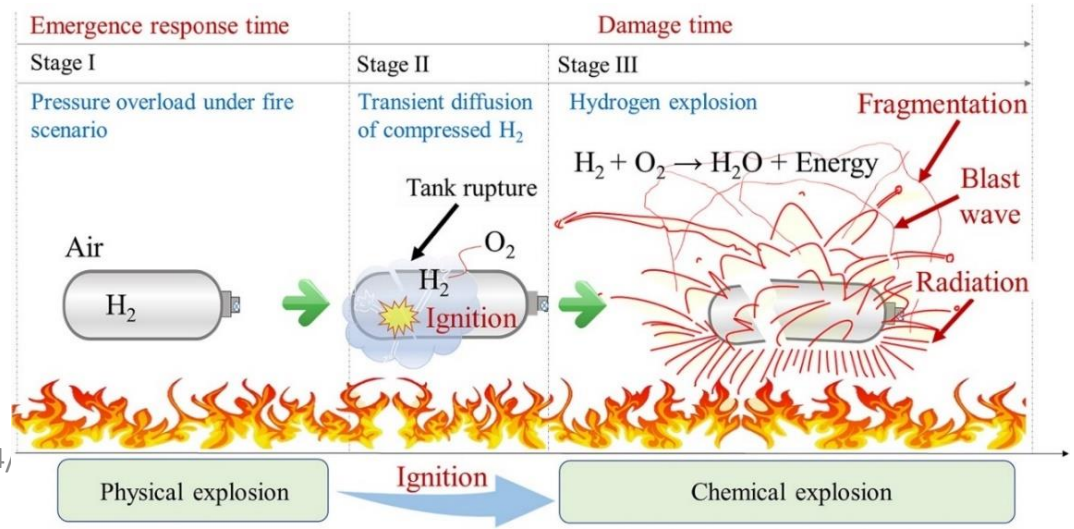
HYSACO

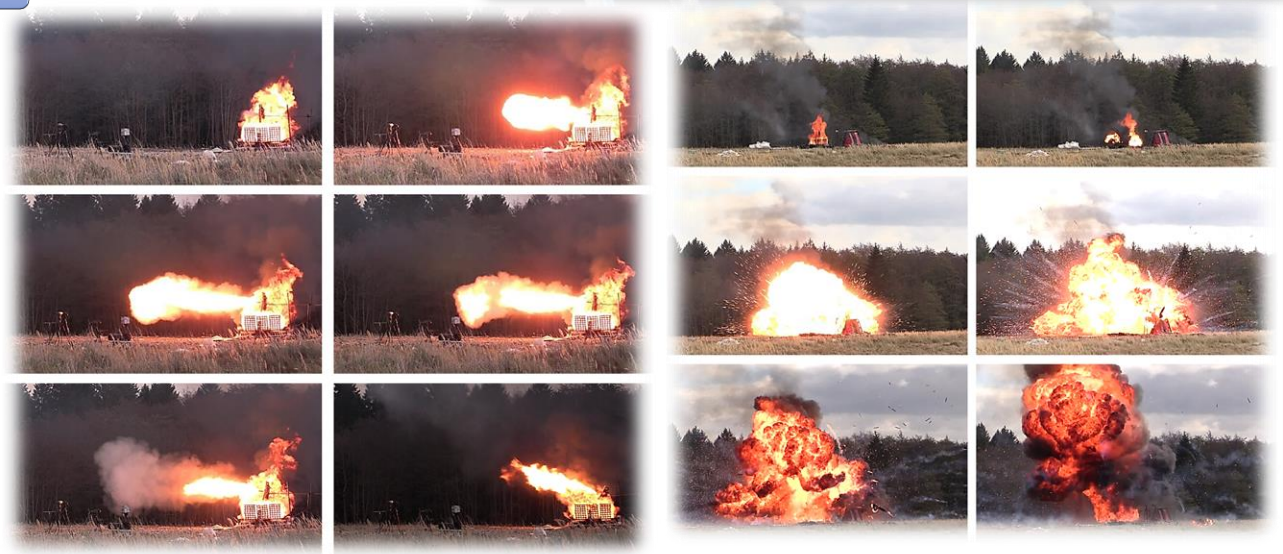
CESAR
Centre of Excellence for Safety Research

- Why?
- Experimental test
- Results
- Future overlook…
- CESAR
- Conclusion

Why is this important?

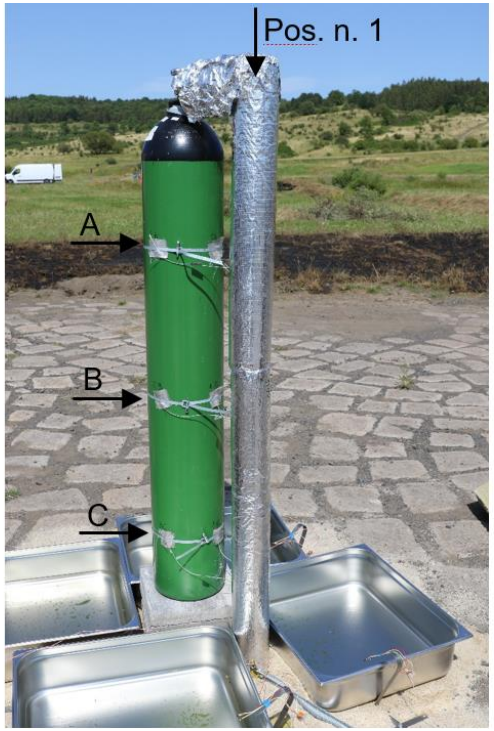
- Still widely used in industry and households
- In the case of fire present severe risks, including catastrophic failure
- Hydrogen safety is increasingly crucial as adoption grows
- Understanding high-pressure cylinder behavior (Hydrogen & Nitrogen) under fire conditions.
- Assessing fragmentation and fireball formation.
- Previous incidents involving cylinder failures.
- Application in hydrogen-powered transportation and energy storage.



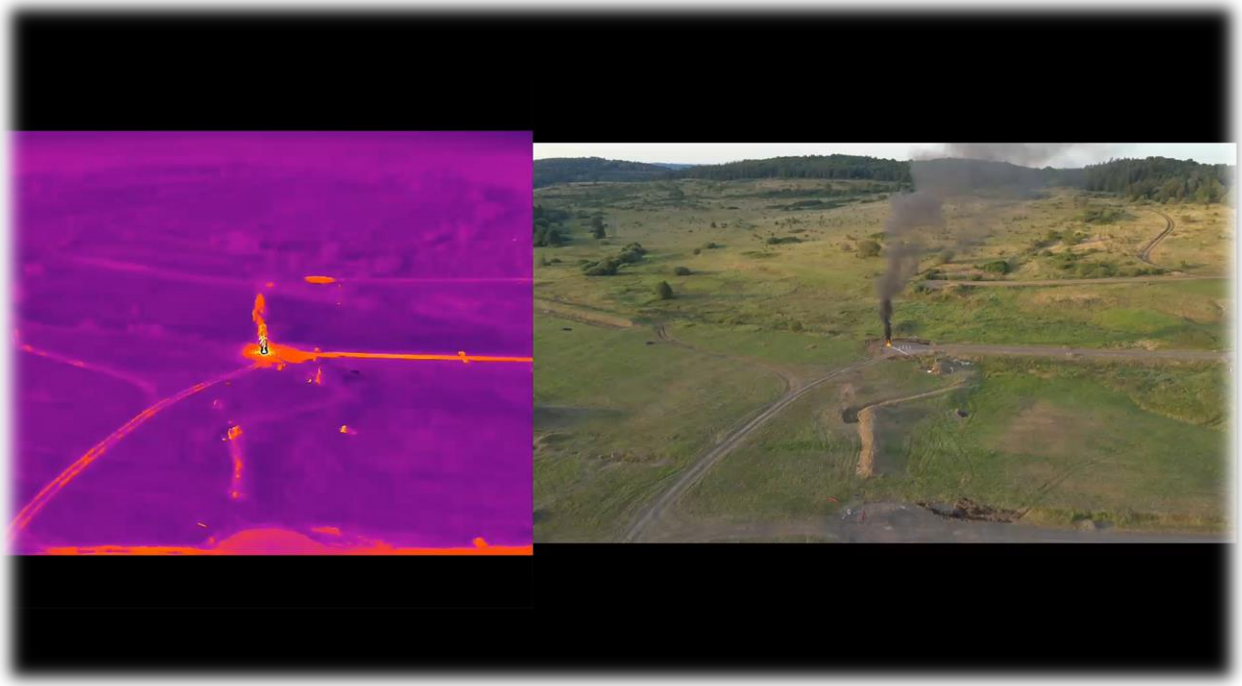


Experimental study

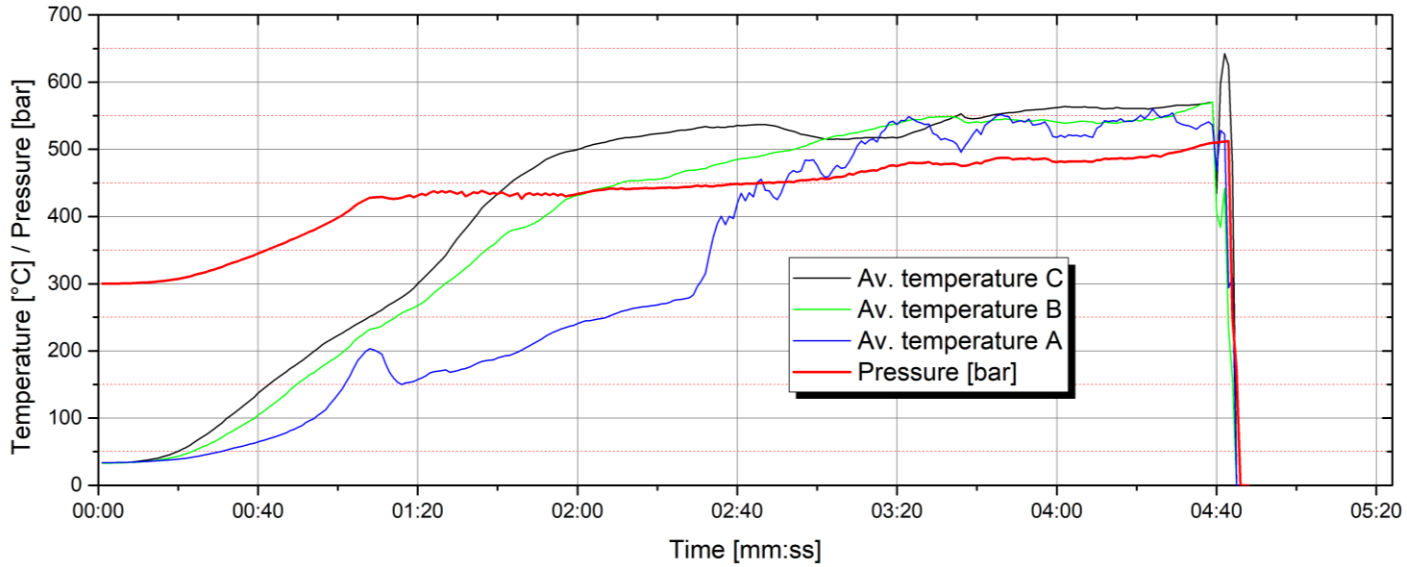
Hydrogen pressure cylinder	• 50 litres • 300 bar
Nitrogen pressure cylinder	• 50 litres • 300 bar
Fire	• 80 litre of diesel fuel • 4 tubes • Pyrotechnical ignition
Recording	• Shell's temperature • Internal pressure • Cameras, drones, thermovision …



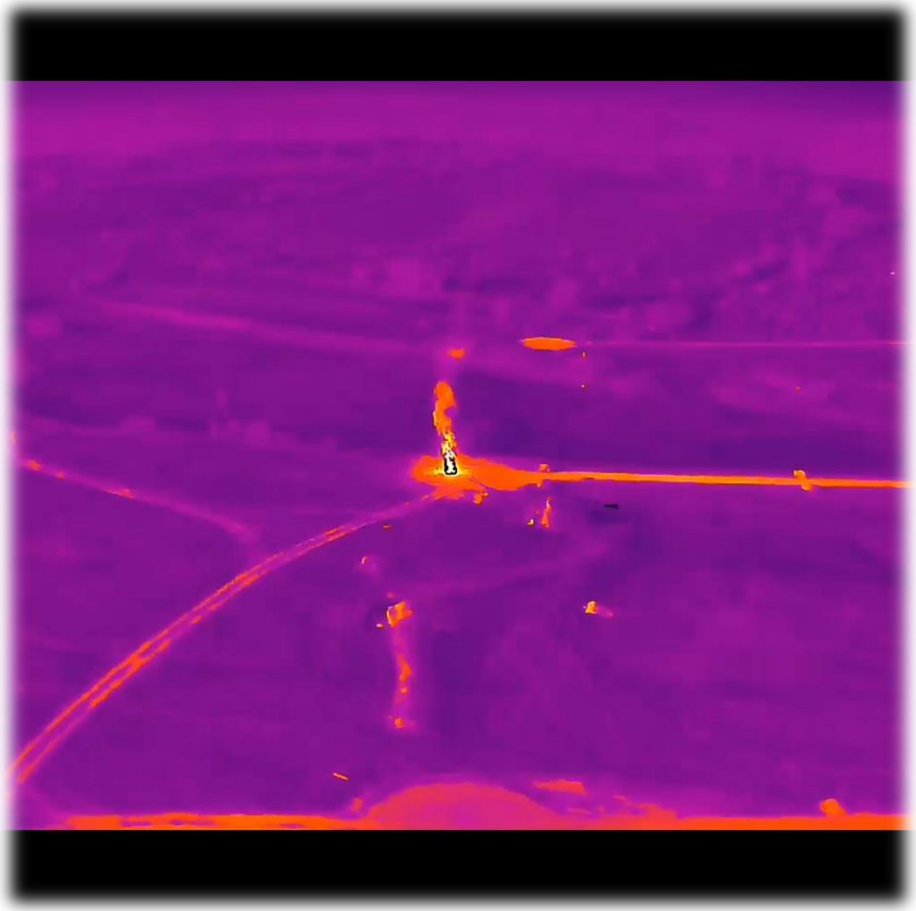
Results



Hydrogen – temperatures and pressure



Pressure cylinder fragmentation



Safety and future

Safety and future

CESAR
Centre of Excellence for Safety Research

ERA Chair: Prof. Ernesto Salzano

Full Professor of Chemical Plant Design at the University of Bologna, Italy.
Director of Studies for Chemical and Process Engineering

- enhancing safety related to hydrogen technologies and alternative energy sources
- addresses safety challenges arising from the increasing global adoption of hydrogen as a clean energy source

- **Vision**: To establish a leading research centre dedicated to understanding and managing the safety of emerging energy technologies.

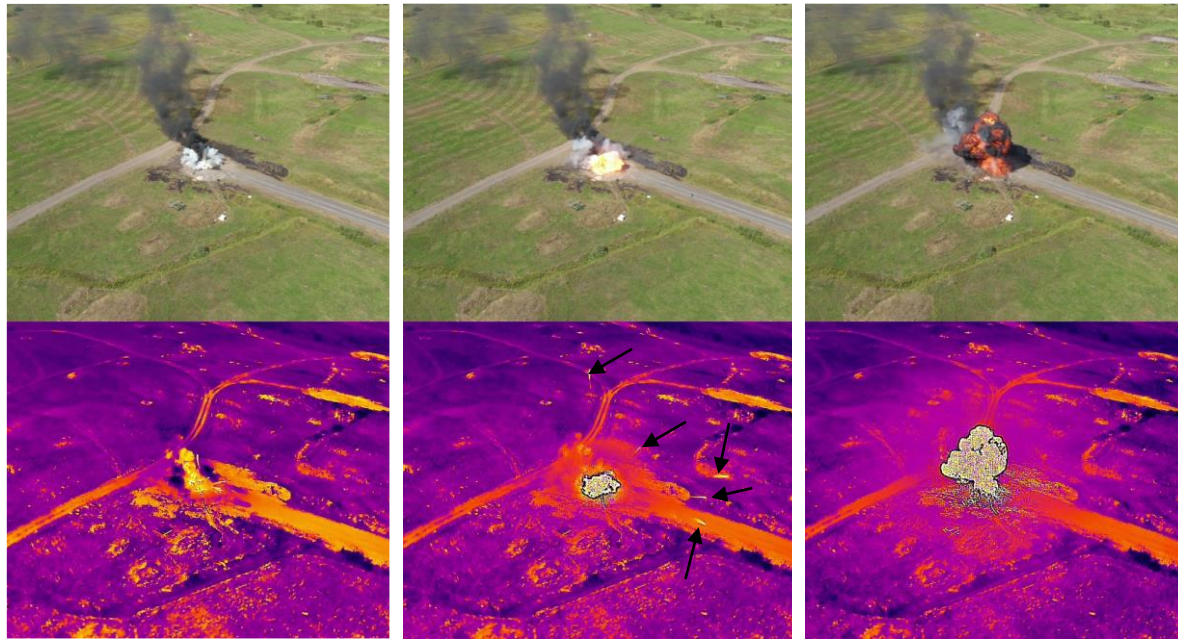
The multidisciplinary team will include international experts covering explosion protection, fire safety, risk analysis and crisis management and other expertises.

Young Researchers - Postdocs and PhD students will play a key role, receiving mentorship and career development opportunities through the CESAR initiative

Cooperation with a strong network of partnerships within academia and industry worldwide.

Project coordinator and VSB group leader – Dr. Vojtěch Jankůj

Conclusion



- High-pressure cylinders pose a major explosion risk in fires.
- Hydrogen cylinders result in extensive fragmentation and large fireballs.
- Thermal imaging and high-speed cameras provide crucial insights.
- Safety recommendations for industry and emergency responders.

Thank you for your attention

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