Hydrogen Emergency Response Training Program for First Responders – HyResponse

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forward-looking energy

Content

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HyResponse overall presentation

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HyResponse at a glance

- **HyResponse aims at training FR to handle any**
- **Starting date: 12/06/2013**
- **Project duration: 3 years**
- **FCH JU contribution: 1 857 897 €**
- **Project coordinator: ENSOSP**
- **Consortium :**

International expert panel

- **European Fire members of the ACP**
  - **Germany, UK, France, Belgium, Denmark, Italy, Poland, USA**
- **FC car manufacturers**
  - **Toyota, Hyundai, BMW, etc.**
- **International Association of Fire and Rescue Services (CTIF)**
  - **36 countries represented**
  - **New commission created in 12/2013 “New Technologie and Extrication”**

HyResponse: key objectives

- **To develop a comprehensive training for First Responders dealing with all safety aspects of H_2 transport and stationary applications**
  - **An educational training including hazard and risks from H_2 applications**
  - **An operational-level training on mock-up real scale transport and stationary installations**
  - **A virtual reality training exercises reproducing entire accident scenarios**
- **Organize 3 pilot sessions to train 50 FR in a face to face mode**
- **Deliver an Emergency Response Guide**
- **Website**
  - **Free access to teaching materials, videos, European Emergency Response Guid, etc.**
  - **On-line interactive virtual reality platform**
  - **Links to European First Responders community**

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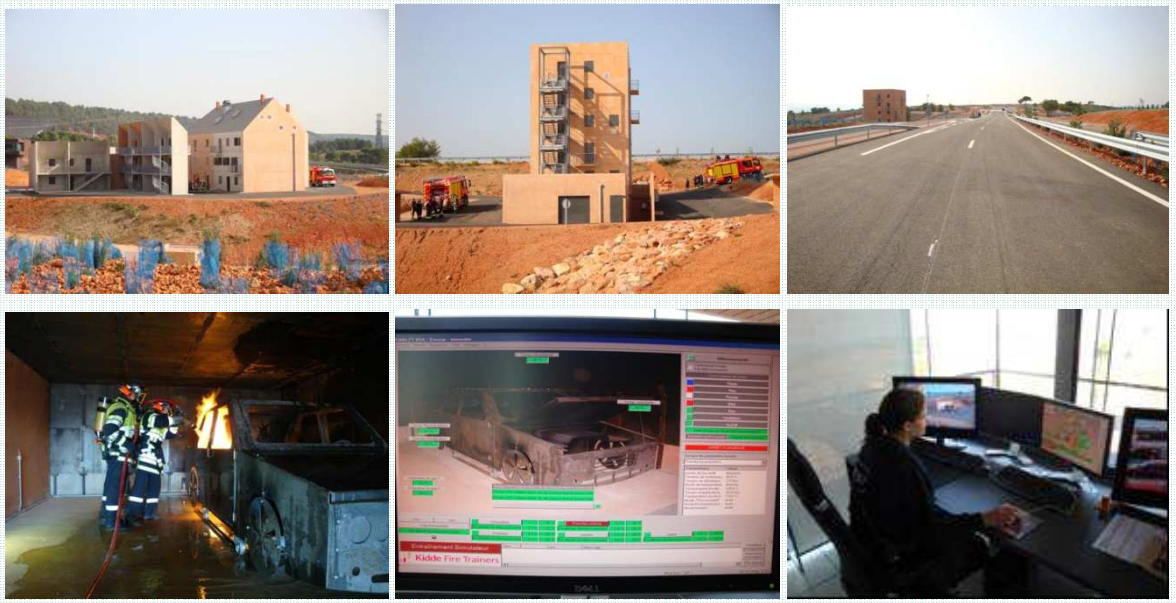
Operational training facility (1/3)

- On the existing ENSOSP emergency response training facility
  - 23 ha facility with four fire and rescue stations equipped by 64 fire engines
  - Several platforms including an urban area, a villa and a 5 level building, a portion of a main road and a motorway
  - More than 300 intervention scenarios piloted from the Control Room



H_2 operational training facility (2/3)

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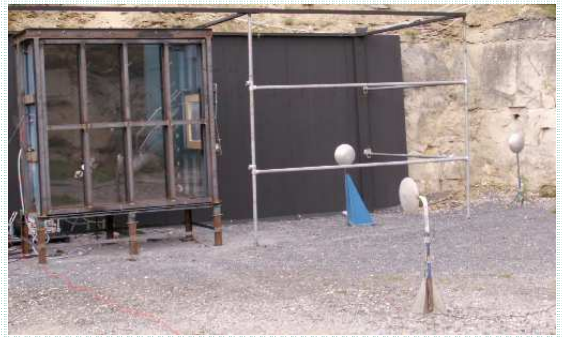
- Small FCH demonstrators
  - Didactic FC system
  - Hydrogen phenomena

Bonfire tests

Fire tests of pressurized bottles

H2 releases and jet fires

Vented explosion



H_2 operational training facility (3/3)

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- Full scale operational hydrogen training platforms
  - Mock up stationary indoor/outdoor applications e.g. back up systems, electrolyser, hydrogen energy storage systems coupled with RES, etc.
  - Mock FC vehicles and H_2 refuelling station
  - Forklift and refuelling station
  - H_2 storages
  - H_2 trailers

- Trainings will be performed in the garage facility

H2 firefighting video

Virtual Reality platform (1/3)

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- Hydrogen VR platform

Virtual Reality platform (2/3)

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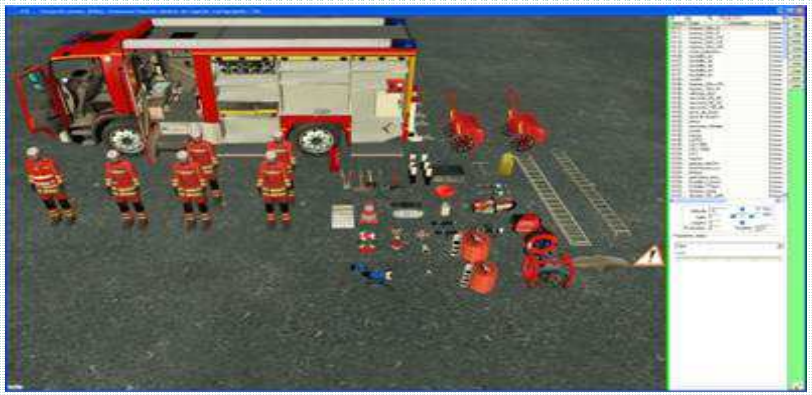
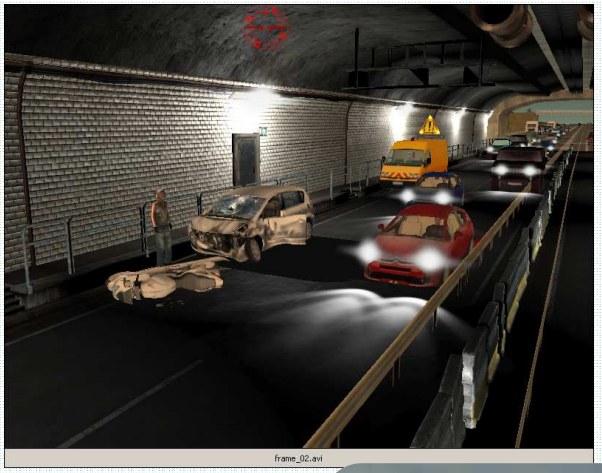
- 3D Virtual Reality Serious Game exercises reproducing entire command chain



Virtual Reality platform (3/3)

HyResponse

- VR exercises to test, check and improve intervention strategies for complex scenarios



Progress

First International Workshop on Hydrogen Safety Training for First Responders

- 3rd and 4th September 2014 in ENSOSP (Aix en Provence, France)
- 70 participants from 9 countries
- Virtual reality “exercises”
  - Multiple-car accident
  - Liquid H2 trailer in a commercial
- Burning vehicles
  - LPG
  - CNG
  - 350 and 700 bar H2 car

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Video

Perspectives

Video

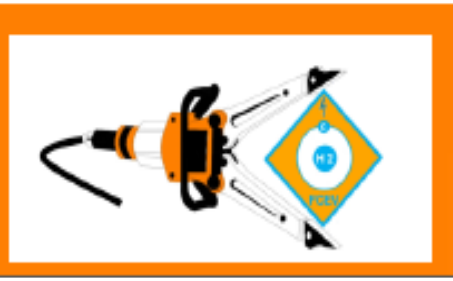
CTIF has send 3 New Working Item Proposals to ISO

TC 22 Road vehicles: Information for first and second responders:

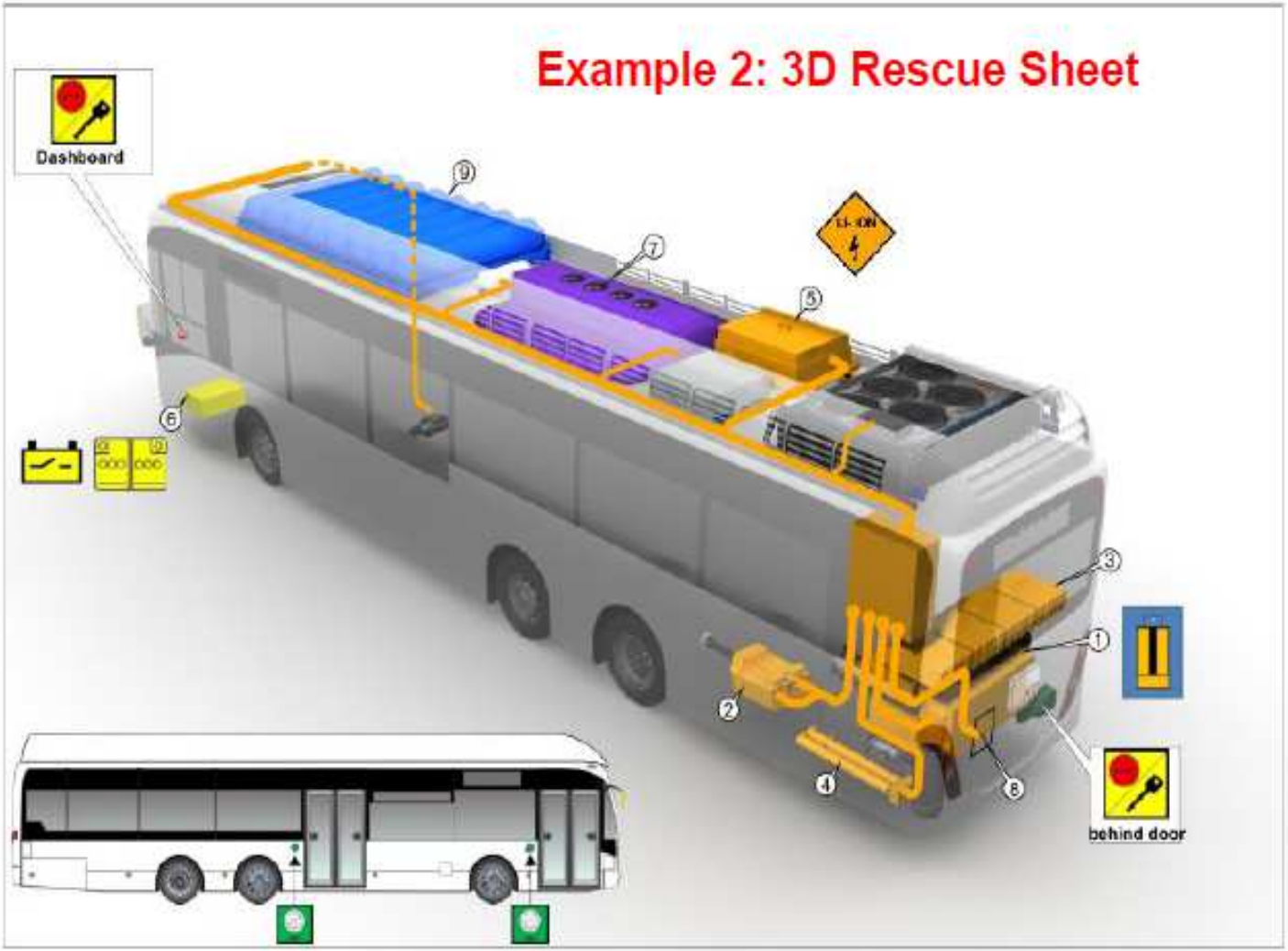
- Part 1: Rescue sheet: distribution soo
- **Part 2 :** Rescue sheet for busses, coaches and heavy commercial vehicles;
- **Part 3 :** Rescue and training manuals;
- **Part 4 :** Drive line signs.

First responders: fire fighters, police, medical personal…

Second responders: towing and maintenance personal…



Example 2: 3D Rescue Sheet



Safety Regulations/PPE		

In Case Of Fire		
Small fire		
Big Fire and High Voltage Battery Fire		

Hydrogen reservoir 8x205L ±350 bar	Lithium-ion battery Highvoltage 800V - 100A	Component High voltage
High voltage lines	Fuel Cell	Switch off motor/High voltage
Battery key	Low voltage battery	Emergency exit

1. Fuel Cell	4. Brake resistors	7.Airconditioning
2. Traction engines	5. Li Ion Battery	8. Night Charging
3. Inverters	6.Low voltage battery	9. Hydrogen reservoir

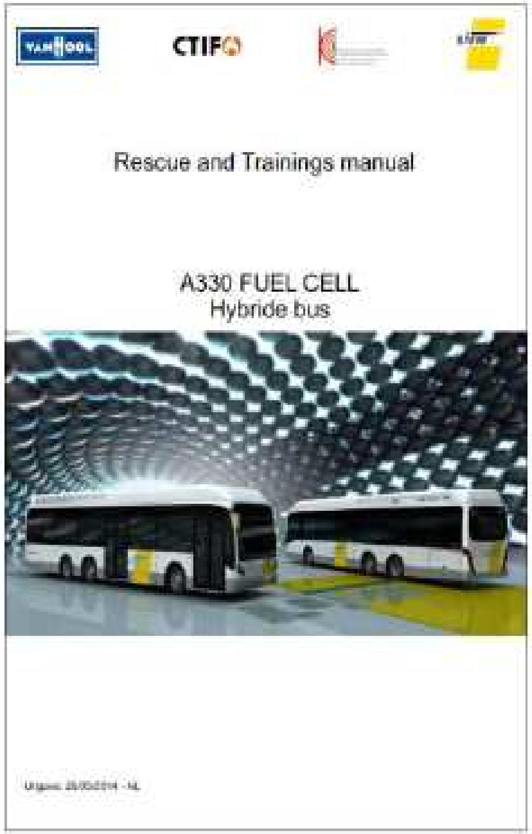
RESCUE SHEET
High Voltage lines

VANHOOL CTIF

A330 Fuel Cell bus

S7043

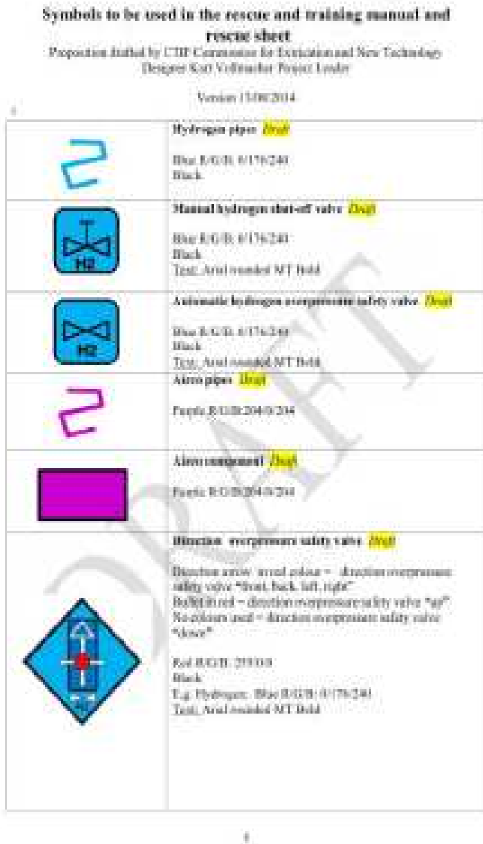
A) Rescue and training manual vehicle



3. Disable direct hazards/safety regulations/ PPE

Disable immediate hazards	Shutdown complete system (high voltage and hydrogen supply interruption) instrument panel. 1) press "Emergency button" 2) Open the cover and turn the switch upwards	A
	Shutdown complete system (high voltage and hydrogen supply interruption) behind rear hatch. 1) press "Emergency button"	B
Safety Precautions	After switching off the high voltage is the energy immediately disconnected. For the sake of the discharge capacity wait an additional 5 minutes! There is always high tension present in the lithium-ion Battery! This can never be discharged. In suspected damaged high voltage components and lines. Wear gloves with a breakdown voltage greater than 1000V. Never touch high voltage components!	

A Shutdown system on dashboard



Symbols to be used in the rescue and training manual and rescue sheet

Proposition drafted by CTIF Commission for Extrication and New Technology
Designer Karl Vollmacher Project Leader

Version 15/08/2014

	Hydrogen pipes Draft Blue R/G/B: 0/176/240 Black
	Manual hydrogen shut-off valve Draft Blue R/G/B: 0/176/240 Black Text: Arial rounded MT Bold
	Automatic hydrogen overpressure safety valve Draft Blue R/G/B: 0/176/240 Black Text: Arial rounded MT Bold
	Airco pipes Draft Purple R/G/B: 204/0/204
	Airco component Draft Purple R/G/B: 204/0/204
	Direction overpressure safety valve Draft

Part 4 :Drive line signs

Gasoline-powered vehicle.

Diesel-powered vehicle.

Bio diesel-powered vehicle.

Plug In Hybrid Electric Vehicle and Gasoline

Electric Vehicle

Fuel Cell Electric Vehicle

Bio diesel-powered vehicle with for example 85% ethanol.

Hybrid Electric Vehicle and Diesel

Plug In Hybrid Electric Vehicle And Diesel

Hydrogen powered vehicle (liquefied)

Hydrogen powered vehicle

LPG (liquified petroleum gas)

LNG (liquified natural gas)

CNG (compressed natural gas)

Super capacitor low-voltage

Diesel powered vehicle with super capacitor

Gasoline/LPG powered vehicle

Super capacitor high-voltage

Set-off distances

- **Example of set-off distances for Hamburg Fire Department**

AGBF „Hydrogen“)	Danger Zone bursting (Radius)
Single bottle H2-car, (Autogas/Erdgas)	100 m
Batterie of bottles with H2 H2-BUS , (LPG,…)	400 m
Fluid hydrogen transport	750 m

Perspectives

- **Reinforce the involvement of FC vehicle manufacturers (car, bus)**
  - **More robust, tested and shared procedures with FR and other stakeholders**
  - **Dissemination of knowledge at international level (USA, Asia, Europe)**
  - **Facilitate permitting process and public acceptance**
- **Strengthen international collaboration**
  - **USA, Japan, Korea, etc.**
  - **Opening talk / dedicated session at the ICHS in Japan ?**
  - **Participation at the training sessions in France (2015-2016) ?**
- **“Train the trainers”**

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HyResponse - Conclusions

- **HyResponse to develop a comprehensive training for FR**
  - **An educational training including hazard and risks from H_2 applications**
  - **An operational-level training on mock-up real scale transport and stationary installations**
  - **A virtual reality training exercises reproducing entire accident scenarios**
- **European Emergency Response Guide (operational and virtual training)**
- **Funding for training 50 European First Responders during 3 training sessions in a face to face mode of one week duration**
- **Website**
  - **Free access to teaching materials, videos, etc.**
  - **Online interactive virtual training**
- **Further international collaboration needed**

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Thank you for your attention