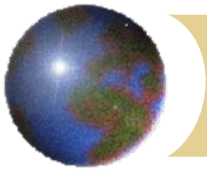


Hydrogen and Fuel Cell Technical Advisory Committee
Hydrogen Fueled Vehicle
Global Technical Regulation (GTR)

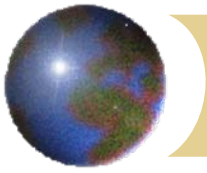
Nha Nguyen
US Department of Transportation
National Highway Traffic Safety Administration
October 2010





Overview

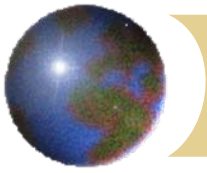
- UN/ECE 1998 Agreement
- Global Technical Regulation (GTR) goals and safety requirements
- GTR Details
- GTR Milestones and Timeline



Harmonization of Vehicle Regulations

1998 Agreement and GTR

- Under the framework of the United Nations, the World Forum for Harmonization of Vehicle Regulations (WP.29) is a permanent working party. The U.S., working with Japan and the European Commission, spearheaded efforts to develop the 1998 Global Agreement which allows the Global Technical Regulations (GTR) being developed:
 - The industry has become global and needed a predictable global regulatory framework
 - Consumers were demanding safety worldwide
 - DOT/ NHTSA wanted to establish a formalized instrument for cooperating with other governments on vehicle regulations to learn from their experiences and leverage its limited resources
- 31 contracting parties are under the 1998 Agreement, including: Canada, China, the EC, India, Japan, Korea and South Africa
- NHTSA is currently working under the 1998 Agreement on a global technical regulation (GTR) for Hydrogen fueled vehicles.
- This effort is being co-sponsored by Japan, Germany and US; US and Japan chair the meetings



Harmonization of Vehicle Regulations

1998 Agreement

● International development of Global Technical Regulations (GTRs) under the 1998 Agreement is guided by three governing principles:

■ **Data-driven & science-based**

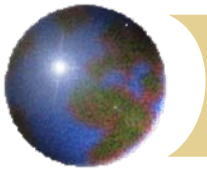
- Rigorous research on safety issues and countermeasures enables
 - development of objective compliance tests and methods
 - sound regulatory impact assessments (cost-benefit analyses)

■ **Performance-based**

- GTRs are performance based to the extent possible, which enables and encourages vehicle safety innovations

■ **Transparent**

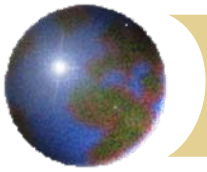
- Proposed regulations, drafts, and meeting reports are publically available
- Public comment sought throughout the GTR development process



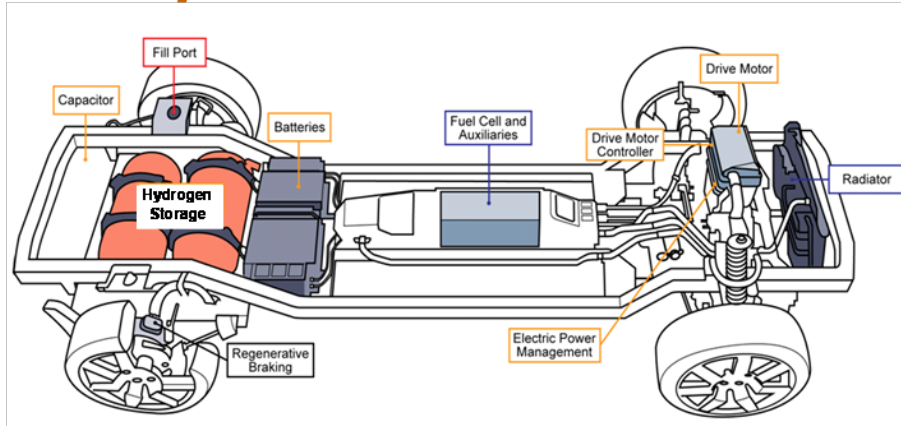
Hydrogen Fueled Vehicle

GTR Objectives

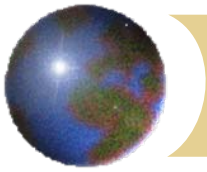
- Attains equivalent levels of safety as those for conventional gasoline powered vehicles
- Performance based (not design specific)
- Data driven and science-based
- Objectively measurable compliance



GTR Requirements



1. High pressure fuel container system
2. Fuel system at vehicle level: in-use and post-crash hydrogen leakage limits
3. Electrical integrity of high voltage system: in-use and post-crash
 - ▣ Type approval components



GTR - Requirements

⚙ High pressure fuel container system

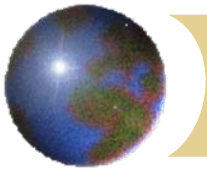
- ▣ Verification Test for Performance Durability: *sequential hydraulic cycling tests*
- ▣ Verification Test for Expected On-Road Performance: *sequential pneumatic/hydraulic cycling tests*
- ▣ Verification Test for Service Terminating Performance: *fire test*

⚙ Fuel system integrity

- ▣ In-use: fuel leakage mitigation
- ▣ post crash: maximum allowable leakage limit

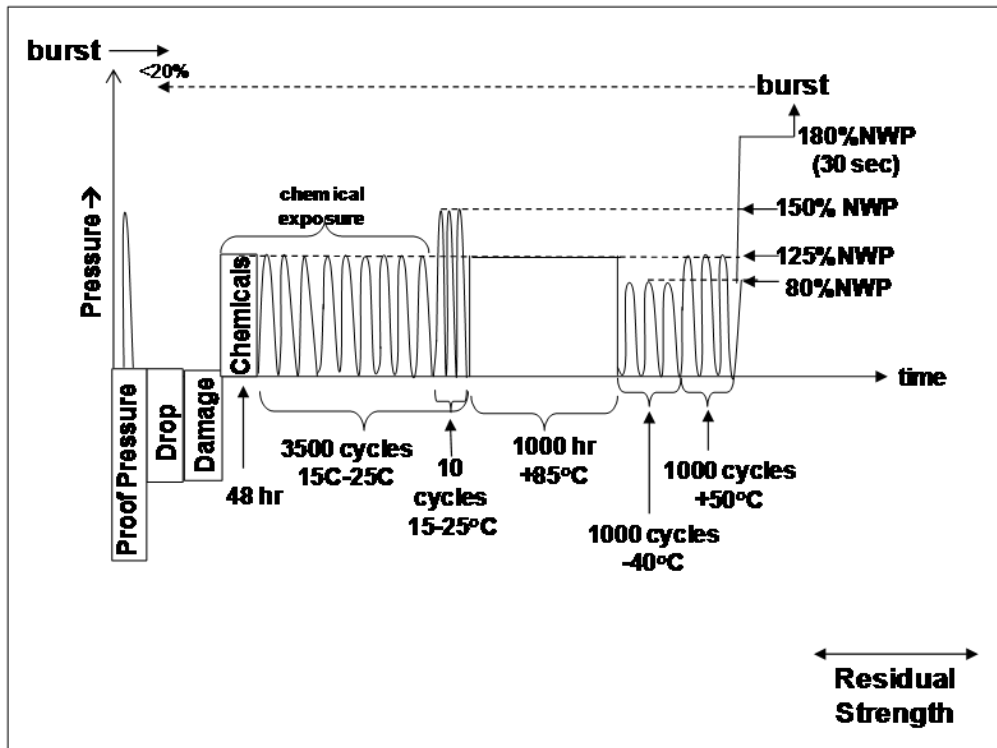
⚙ Electrical Safety

- ▣ High voltage safety for in-use and post crash



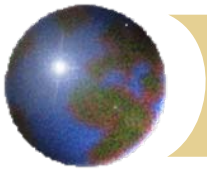
Verification Test for Performance Durability

Sequential hydraulic cycling tests



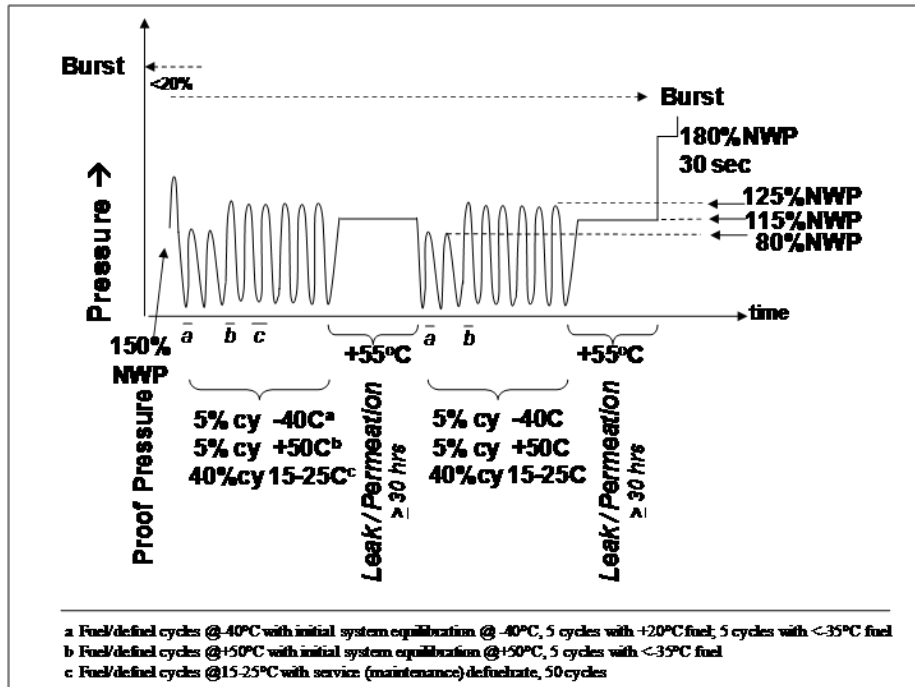
Based on the cycling tests in SAE J2579:

- ☐ Proof pressure test
- ☐ Drop (impact) test
- ☐ Surface damage
- ☐ Chemical exposure and ambient temperature pressure cycling tests
- ☐ High temperature static pressure test
- ☐ Extreme temperature pressure cycling
- ☐ Residual proof pressure test
- ☐ Residual strength burst test



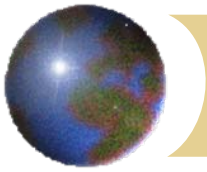
Verification Test for On-Road Performance

Sequential pneumatic/hydraulic cycling tests



Based on the cycling test in J2579:

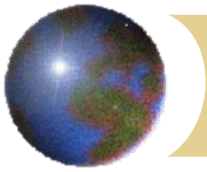
- ☐ Proof pressure test
- ☐ Ambient and extreme temperature gas pressure cycling test (pneumatic)
- ☐ Extreme temperature static gas pressure leak/permeation test (pneumatic)
- ☐ Residual proof test
- ☐ Residual strength burst test (hydraulic)



Fuel system integrity

- In-use: fuel leakage mitigation
 - Fuel system safety requirements
 - Provide warning to the driver and close the fuel containers in the event of fuel leakage into the enclosed spaces

- post crash: Contracting parties maintain their current crash test requirements and apply the following GTR requirements
 - Maximum allowable leakage limit
 - Controlled leakage into enclosed spaces



Electrical Safety

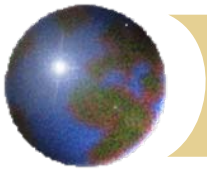
● High voltage safety for in-use and post crash

■ In-use:

- Maximum voltage
- Electric isolation
- Protection from indirect and direct contact

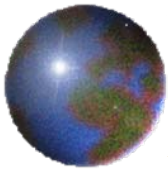
■ Post-crash:

- Maximum voltage
- Electric isolation
- [*Protection from indirect and direct contact*]



Milestones and Timeline

- WP.29 approved GTR – 6/2007
- GTR expert group conducted 10 formal meetings
- Formal GTR to GRSP – 5/2011
- Formal GTR to WP.29 for a vote – 11/2011
- Contracting Parties under the 1998 Agreement shall be obligated to start the adoption of the GTR into its own laws or regulations after favorable vote by WP.29



Thank you