VII.7 Global Technical Regulations

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Objectives

Support and facilitate development of global technical regulations (GTRs) for hydrogen vehicle systems under the United Nations Economic Commission for Europe, World Forum for Harmonization of Vehicle Regulations, and Working Party on Pollution and Energy Program (UNECE-WP29/GRPE) by working with the Department of Transportation/National Highway Traffic Safety Administration (DOT/NHTSA) and the Environmental Protection Agency (EPA) to coordinate the U.S. position on the development of international hydrogen/fuel cell codes, standards, and regulations that are performance-based.

Technical Barriers

The GTR project addresses the following technical barriers from the Hydrogen Codes and Standards section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

(F) Limited DOE Role in the Development of International Standards

(G) Inadequate Representation at International Forums

(H) International Competitiveness

(I) Conflicts between Domestic and International Standards

(J) Lack of National Consensus on Codes and Standards

(K) Lack of Sustained Domestic Industry Support at International Technical Committees

Contribution to Achievement of DOE Codes and Standards Milestones

This project will contribute to achievement of the following DOE Codes and Standards milestones from the Codes and Standards section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- **Milestone 25**: Draft regulation for comprehensive hydrogen fuel cell vehicle requirements as a GTR approved (UN Global Technical Regulation). (4Q, 2010)

Accomplishments

Approval to proceed on the effort to develop a GTR for hydrogen fuel cell vehicles.

Introduction

The goal of this international effort is to develop and establish a GTR for hydrogen fuel cell vehicles (HFCVs) that attains equivalent levels of safety as those for conventional gasoline powered vehicles, is performance-based and does not restrict future technologies. Given that hydrogen-powered vehicle technology is still emerging, it is widely agreed that input from researchers is a vital component of this effort. Based on a comparison of existing regulations and standards of HFCVs with conventional vehicles, it is important to investigate and consider the main differences in safety and environmental aspects and what items need to be regulated based on justification.

Approach

In June 2005, a proposal from Germany, Japan and the U.S. was accepted regarding how best to manage the development process for a GTR on hydrogen-powered vehicles. Under the agreed process, two subgroups were formed to address the safety and the environment aspects of the GTR (see 2006 Annual Progress Report for discussion of the structure). With the approval to proceed, the effort is now underway to develop a GTR that will cover fuel cell (FC) and internal combustion engine (ICE), compressed gaseous hydrogen (CGH_2) and liquid hydrogen (LH_2).

Results

Most countries have adopted vehicle crashworthiness standards that rely on dynamic crash test procedures simulating real world crashes, to evaluate the ability of a vehicle to protect its occupants from trauma and fuel-fed (gasoline and diesel) fires. These tests procedures include full frontal, offset frontal, side, rear and, to some extent, rollover crash modes. These standards and test procedures are not harmonized worldwide and/or not required in all jurisdictions. Tables 1 and 2 [1] highlight the different safety and fuel integrity test requirements, respectively, and their application for conventional gasoline and diesel, compressed natural gas, and hydrogen vehicles within the European Union (EU), Japan, and the U.S. While Japan and the U.S. specify at least some crash tests to evaluate the fuel system integrity of conventional and electric/hybrid vehicles, apparently only the U.S. does so for compressed natural gas (CNG) vehicles, and, currently, only Japan does so for hydrogen-powered vehicles. The EU regulatory approach is more based on testing of components and subsystems, and requirements for the installation of fuel systems.

Only Japan has adopted a regulation to evaluate the performance of a hydrogen vehicle (April 2006). The regulation has component, subsystems, and full system crash performance test requirements. The latter is evaluated using full frontal, side and rear crash tests.

TABLE 1. Vehicle Fuel Integrity [1]

		Conventional Gasoline and Electrical / Hybrid			CNG/LPG			Hydrogen- / Fuel Cell- Vehicle		
		Japan	EU	US	Japan	EU	US	Japan	EU***	US
Fuel Integrity Crash test	Full frontal	50	N	48	N	N	48	50	N	N
	Offset frontal	N	N	N	N	N		N	N	N
	Side	50	N	53	N	N	48	50	N	N
	Rear	50	N	80	N	N	48	50	N	N
	Rollover	N	N	Static rollover	N	N	N	N	N	N
Integrate system safety and system requirements	Fuel tank and underride protection		Y	N		Y	Y (Tank)		Y	N
	Fuel lines		Y	N		Y		Y	Y	N
	Detection of leakage	N	N	N	N*****	N	N	Y	N	N
	Purge gas							Y	N	N
	Blow off	N/A	N/A	N/A	N	N	N	N	Y	N
	Container Assembly	N/A	N/A	N/A	N	Y	Y	Y	Y	N
	Fault Strategy / Safety management system	N	N	N	N	N	N	N	Y	N
	Prevention of misfueling	N/A	N/A	N/A		Y			Y	
	Installation and mounting requirements		Y		Y	Y		Y	Y	
Component requirements	Container	N/A	N/A	N/A	Y	Y	Y	Y	Y	N
	Container Attachments	N/A	N/A	N/A	Y	Y	N	Y	Y	N
	Other components of the fuel system	N/A	N/A	N/A	Y	Y	N	Y	Y	N
	Fuel Cell	N/A	N/A	N/A	N/A	N/A	N/A	N	N	N
Electrical Isolation and electric safety *	In-use	N	Y****	N	N/A	N/A	N/A	Y	N****	N
	During and post crash	N	N	Y	N/A	N/A	N/A	N	N****	Y
	Total electric safety		N****					Y	N****	

Y Mandatory Requirement
N No requirement
N/A Not applicable
* For Electric, Hybrid or Fuel Cell Vehicles
** N1 vehicles with side fuel container
*** Draft European H2 Regulation (already appliccable in Germany)
**** Draft proposal to amend ECE-R 100 is under discussion
***** Odorant in CNG fuel
No's in table : Impact speed [km/h]

TABLE 2. Vehicle Occupant Protection [1]

	Japan	EU	US
Full frontal	50 km/h	Y	48 km/h
Offset frontal	N	56 km/h	N
Side deformable barrier	50 km/h	50 km/h	53 km/h
Side pole	N	N	53 km/h
Rear	N	N	N
Rollover	N	N	Y
Roof crush	N	N	Y

The Japanese regulation will be evaluated as a potential starting point for the development of a GTR, although it is noted that the Japanese requirements for fuel system integrity of other vehicles (as highlighted in the tables) are not harmonized with those in the U.S. and EU (nor are the U.S. and EU requirements harmonized). Harmonizing crash performance requirements has proven to be a difficult task in the past, and may take a long time to complete because of the need for extensive and expensive research and thorough evaluation of the results.

Therefore, for the first phase of this effort, it has been decided to avoid attempting to harmonize current national crash tests for the GTR and instead include language in the GTR specifying that countries apply their existing crash tests and check for compliance with an agreed set of requirements and limit values. There will be a decision made regarding a plan for Phase 2 on how to harmonize crash test requirements for HFCVs, after the establishment of a comprehensive GTR in Phase 1.

Conclusions and Future Directions

In order to develop the GTR in the context of an evolving hydrogen technology, the trilateral group proposes to develop the GTR in two phases:

- Phase 1 (GTR for hydrogen-powered vehicles): Establish a GTR by 2010 for hydrogen-powered vehicles based on a component level, subsystems, and whole vehicle crash test approach. For the crash testing, the GTR would specify that each contracting party will use its existing national crash tests but develop and agree on maximum allowable level of hydrogen leakage. The new Japanese regulation, and any available research and test data will be used as a basis for the development of this first phase of the GTR.
- Phase 2 (Assess future technologies and harmonize crash tests): Amend the GTR to maintain its relevance with new findings based on new research and the state of the technology beyond 2010. Discuss how to harmonize crash test requirements for HFCVs regarding whole vehicle crash testing for fuel system integrity.

References

1. "Proposal to develop a global technical regulation concerning hydrogen/fuel cell vehicles," ECE/TRANS/WP.29/2007/4, 10 April 2007.