SGS-9-04

Draft Minutes for the
8th Meeting of the Subgroup on Safety (SGS)
on Hydrogen-/Hydrogen Fuel Cell Vehicles

20-22 January 2010
Geneva

Place: Meeting Room: VIII
Palais des Nationes
Geneva, Switzerland

Schedule:

Wednesday, 20 January	09:30 – 18:00
Thursday, 21 January	09:00 – 18:00
Friday, 22 January	09:00 – 12:30

Video equipment and wireless internet connection available

1. Welcome and Introductions

Chair Narusawa welcomed the delegates.

Representatives from USDOT/NHTSA, Ministry of Land, Infrastructure, Transport and Tourism of Japan, JAMA, JASIC, OICA (BMW, GM/Opel, Honda, PSA,Toyota, , USDOE, ISO TC197, Korea Automobile Testing and Research Institute, Transport Canada, Tsinghua University, China Automotive Technology and Research Center, LANL, German Ministry of Transport, Building and Urban Development, BAST, BAM,

2. Logistical Arrangements

2.1 Meeting arrangements

The meeting will be 2 ½ days. Due to renovation, the meeting will stop 1 p.m. and resume at 2:30 p.m. SGS Dinner (no-host) will be Wednesday evening at an Italian restaurant near the UN. Documents are available on the website.

3. Approvals

3.1 Minutes/decisions of the 7th Meeting

No comments.

3.2 Action Items from the 7th Meeting

1. China will provide summary of standards as soon as possible. email received. Three have been translated into English. Information has not been posted. English versions will be sent and posted.

2. Japan to provide draft document (pdf) to USDOT for translation. open

3. OICA and SAE will develop new Figures 1 and 2, so that they are more generic or general. completed

4. Secretary to make sure SI units are used throughout. completed

5. Germany to consult with BMW so that LH2 is properly addressed and handled open

6. Co-chair (US) will suggest structural changes to the document completed

7. Japan will provide rationale for the 15-year limit (this is in their regulation) submitted as SGS 8-04

8. Secretary will rewrite Part A section 5.2.1 as a rationale for what remains in Part B completed

9. Co-Chairs will work to address Germany's concerns regarding the telltale section (description of the telltale is not appropriate for Part A - only the rationale for such a warning is appropriate for this section) received comments - will be discussed

10. Contracting parties to provide justification for position on upper pressure limits open

11. GS will provide definition of the typical components within the pressure boundaries incorporated in the document

12. Secretary will update numbering system in the GTR draft completed (may change)

13. All participants are to submit proposed text, written comments and other documents prior to the next meeting, no later than November 30th completed and all documents have been posted on SGS-8 webpage

14. Secretary will post the Powertech test report completed (document was emailed)

15. EC will investigate if the reduction of cycles from 11,000 to 5,500 effectively covers taxis in extremely high use. open, will be discussed

16. Germany will present proposal on tank sample size. open

17. ISO will present proposal on pneumatic versus/plus hydraulic testing (the Powertech report may provide the needed validation). completed (comments provided)

18. Paul Adams will provide recent paper on permeation rates. open

19. SAE and HySAFE will cooperate to develop a proposal for a new paragraph on the leak permeation rate. open

20. GS will develop in collaboration with other interested parties, specific language regarding the special case of the PRD durability and performance, for inclusion in Part A completed

21. Parties are asked to submit proposals for markings completed

22. OICA will provide a new proposal on leak detection for the section on single failure of the hydrogen fuel system completed

23. Obtain telltale-related terminology from UNECE-R121 open

24. GS to provide calculation of the 3-sec average for inclusion in Part A completed

25. Contracting parties to provide proposals for marking of the fuel receptacle completed

4. Reports of UN Activities

4.1 149th Session of WP.29 in November 2009

Project Manager Albus submitted status report: work is progressing according to plan, with several open issues. Japan and EC regulations exist already; how to incorporate these existing regulations. ELSA (electrical safety) is behind schedule. A one-year extension was requested for the GTR and was granted (AC.3). A new timeline has been developed (see agenda item 8) by the co-sponsors (Germany, Japan, US).

5. Reports of other activities

5.1 National/Regional

Canada:
No update on regulations.
Q: will hydrogen vehicles be used during the Winter Olympic Games this February?
A: 20 hydrogen buses will be in service; there will also be some passenger vehicles at the Olympics (GM Equinox)
C: A large number of electric vehicles will be introduced in the near future.
C: please share any feedback on the hydrogen bus performance at the next meeting
C: standards used for these buses: SAE J2579 and J2578

China:
In 2009, three standards were released. Expect another 3 standards to be approved in 2010.
- fueling connections
- on-board hydrogen systems certification
- dynamic performance test methods (maximum speed)

Distributed flyers for upcoming conference EVS-25 on electric vehicles (November 2010 in Shenzhen)

EC and Germany:
Regulation 79 in 2009; implementing measures have been translated into EU languages and will be published in a few months.

Japan:
Revision of hydrogen container regulation - incorporation of 70MPa pressure. Comment period is complete, supposed to be in force in March 2010, but some delay is expected.
Q: why is there a delay?
A: incorporation of public comments will take some time.
Q: will the discussions occurring in the development of the GTR be incorporated into this revision?
A: once the GTR is established, the content will be considered and incorporated as appropriate.

Korea:
No update

US:
Localized fire test report review is nearly complete. As soon as the report is finalized, it will be posted on the website. Working with Transport Canada to develop a test procedure (also working with SAE) for localized fire. Hydrogen research and harmonization efforts continue to be funded, as the US Congress restored funding for hydrogen-related activities.

5.2 ISO/SAE

ISO:
Comments were provided in preparation for this meeting. Focus is to harmonize this GTR and ISO TC197 documents - hope this is a two-way street.

SAE:
Safety working group is active with international members (Japan, Germany). Focus is on streamlining protocols for verification/validation, shortening time required for testing (the validity of these changes has been verified); localized fire will be added to the standard J2579 (rough draft has been developed and is being fine-tuned).
Interface working group - fueling protocol (fueling rate to prevent over pressurization and over temperature) for 70MPa is being finalized.
CSA/UL - interest in forklifts is increasing - many refuelings have now been conducted, and data are being collected.

6. Discussion of Key Items for HFCV GTR/Report on the decisions of the Drafting Task Force – Revised Draft GTR

Review of documents that have been posted on the website.

6.1 Revised Draft GTR - using SGS 8-13 rev 1 plus some additional information developed during the task force meeting (1/18-19)

Part A *- renumbered (sections denoted with 'A' to provide additional clarity).*

Note that most of the suggested changes and corrections are highlighted in yellow throughout this section in the draft GTR. Pertinent discussion is recorded below.

Figure 1 needs larger text to be more readable.

Section A.2.2 GTR Action Plan:
Need to add information on ELSA

ACTION: Secretary will update section A.2.2 to include reference to ELSA

Section A.3.3.1.2 (upper limit on pressure)
JASIC comment 4 (SGS 8-04): on page 10, upper limit of NWP should be set at 70MPa to address uncertainty in hydrogen embrittlement data at higher pressures.
Germany: regulation currently has limit of 70MPa, so the limit should remain.
GS: this is going to be very difficult to change if it is specified as the limit in the GTR. The upper limit should not be set.
CS: further increase in upper limit may not be likely, since additional increases in pressure may not be useful. Pressure increases above 70MPa may not be economical, as the additional hydrogen storage capacity is very small at increasingly high pressures - the pressure/volume curve is not linear at high pressure (equation of state is very non-ideal). It may not be necessary to go higher from a practical standpoint.
OICA: we do not have the experience at very high pressures for hydrogen. Nevertheless, extrapolation from known pressure levels has been conducted. Care was taken to develop testing procedures that cover other pressures, so we should not limit the upper pressure.
Germany: set the maximum at 70MPa and individual contracting parties can extend this value upon adoption of GTR.
US: this would not be consistent with the ideals of the GTR process.
GS: this is really a philosophical issue - putting in upper limits based on current understanding is counterproductive.

Proposed: develop language that states that the containers are qualified up to 70MPa, but that it does not preclude the use of higher pressures, as long as the containers are qualified at the higher pressure.
C: is this in line with the principles of the GTR process?
C: concern with extrapolation to higher pressures - what is the form of the equation (linear, non-linear?)
C: care should be taken in the drafting, because upper limit of 70MPa could be interpreted as not allowing the pressure to ever exceed 70MPa anywhere.

ACTION: draft language will be proposed and inserted in Part B to address the issue of maximum NWP of 70MPa.

ACTION: Germany and Japan will provide sample language on pressure limits from existing regulations.

C: note that the EC regulation is constrained by the fueling receptacle; the upper pressure limit is not specified directly.

A.3.3.2 Liquefied hydrogen section

BMW: Figure 4 is not correct; also need to fix text in A.3.4.1 to include the hydrogen internal combustion engine.
GS: the check valve was left in - some sort of backflow prevention is required

ACTION: BMW and GS will work to develop a more correct (generic) Figure 4.

A.5.1.1.5 Rationale for B.5.1.2
Germany: with a limited number of refueling stations and the limited tank capacity, the number of refueling needs to be based on the actual driving range.
CS: fuel cell demonstrations are at 200 miles per fill (minimum acceptable, at this point). Full fills are much more stressful that "topping" off (as would be expected if the driver keeps the tank mostly filled). Tests use full fill cycles, which is the most stressful situation.
OICA: the EU regulation has three alternatives to determine the number of cycles

Page 19: specification of tests for specific tank type
Germany is concerned that there is no distinction between tank types, and cylinders of different types behave very differently. Tests should be adapted to the cylinder type so that the appropriate parameter is tested.
ISO: this is also the ISO position.
CS: a performance-based vehicle standard requires that the same level of safety must be proven for any system, regardless of its constituents. No assumptions are made and no exceptions to testing are allowed.
Japan: no differentiation in their regulation
Korea: no differentiation should be included
US: the goal of this GTR is to be performance based. If the requirement is not stringent enough, that can be discussed. However, the preference is not to have differentiation based on cylinder type.
Japan: This issue is in the section on taxis, and since they are under severe conditions, there may be different requirements. Need to ensure that the current tests measure this requirement.

A.5.1.1.8 Rationale for B.5.1.3
ISO comment 2: Powertech report does not provide evidence in support of the statements in this section.
CS: the report can be modified, since the cylinders were qualified to these standards and a statement can be added.
ISO: request the removal of reference to the standards to which components were qualified, since this is not in the Powertech report.
CS: these facts were presented in the course of the Powertech project. These things can be added to the final report. The text of the GTR can remove the reference to Powertech, or the Powertech report can be modified.
GS: it is important to note in the report that the tanks were approved. The tanks failed, and this had to be investigated so that the tests could be modified to improve safety.
C: Powertech report should be modified, or the language in the GTR should be made to be consistent with the report.

ACTION: Secretary will work to correct the reference to current Powertech report, or to revise

the text of the Powertech report to include more information on this issue.

A.5.1.2 Supplemental requirements for type approval of compressed hydrogen storage
Germany: requirements do not belong in Part A, and we cannot distinguish between type approval and self certification. This should be moved or removed.
US: this has been discussed in the last four meetings. As a compromise, for type approval, we recommended supplemental tests included in Part A. No further discussion is required.

ACTION: Mr. Albus will obtain a legal opinion on the inclusion of the supplemental requirements for type approval in Part A. (this was discussed in the Task Force meeting)

A.5.1.2.3i: Material test requirements
Germany: evaluation of tests during service should be done, since the current tests are only an approximation of the wear and tear that a tank will actually experience. Propose taking cylinders out of service and doing destructive tests on them to determine what is actually happening to the cylinders (i.e., measurement of residual life)
GS: this sounds like a research project, not a regulation.
Germany: some discussion should be included in Part A to note that the data base of degradation mechanisms is limited at this point, and that the manufacturers should consider doing this test and collecting the data.

ACTION: Contracting parties will draft text for Part A to address the recommendation for monitoring/measuring residual life of cylinders

A.5.1.1.8 Expiration date of the tank
Japan: graphical representation of cylinder lifetime. 15 years is a reasonable lifetime.
CS: is it more the time or the number of miles? Seems the data presented in the figure were related to the level of usage, not the time (drive a lot or drive only a little over a long period of time). Logic may need to be clarified.
US: the manufacturer recommends the expiration date (the “do not use after” date). The life is not mandated.
Canada: some cylinders could see a lot of mileage/km usage (taxi example) in a shorter period of time (say, in 5 years). Suggest collecting more information and addressing this later. Age could also be influenced by environmental conditions (temp, humidity, etc). Likely would require reinspection. Suggest that the contracting parties decide how they want to handle.
GS: Reinspection versus taken out of service date - need to be careful about putting the “death“ date.
US: would like the “born on” date. Harmonization of when and how to inspect will be difficult - should be left to the contracting parties.
Canada: should separate the issue of inspection versus end-of-life.
GS: keep in mind that the tank may not be very easy to see on some of these vehicles.

A.5.1.2.5 Markings
US: Want a harmonized set of markings (have several different sets). This will be revisited once the Secretary puts together a side-by-side list of the information to be included. Once there is an agreement, this will be a requirement for Part B.

A.5.3: Vehicle fuel system requirements and safety concerns
OICA: please explain this title.
US: section was added under the advisement of the DOT attorney, and is related to how a requirement addresses a safety concern.
CS: we need to ensure that the content is correct, and let Mr. Albus work with the lawyers to determine if this and similar sections belong in Part A or Part B.

A.5.3.1.3: Telltale
Topic will be discussed in Part B

A.5.3.1.4: LFL
ISO: to be consistent with stationary installations, triggers should be at 1% hydrogen, not at 4% which is the LFL.
GS: have to apply the criteria correctly for the situation; for example, the exhaust calculation uses the 4% limit, but buildings applications general use 1% - is the passenger compartment a room? Probably. Need to discuss in Part B.

A.5.3.3.3 Markings
Not likely to be able to harmonize the markings (information, language(s), etc). In Part A, it is a recommended practice and would be up to each contracting party to decide what would be needed. Consensus of the contracting parties has been reached

ACTION: Contracting parties and other participants should provide the Secretary with the information that should be recommended for inclusion on the refueling port.

PART B - Text of Regulation

BEGIN use of numbering system from the TOC of the draft GTR (SGS 8-13 rev 1)

1. Purpose
Two additions proposed: 'safety-related' and addition of the word burst.
C: reminder that we should focus on safety-related issues is important. It is not really necessary to have a complete list, but we could expand it (may be additional terms to be added).

ACTION: Secretary and co-sponsors will work to improve the Purpose paragraph in Part B.

2. Application/Scope
Project Manager suggested that we specify compressed hydrogen and liquid hydrogen.
C: do not want to have to keep repeating this information throughout the document.
C: hydrogen-fueled vehicle should also be added
C: move the specification of storage system type into the definitions.
C: might be confusing - put everything into the scope as well as the purpose.
Note: this issue was not resolved. Suggestion was made that grammar and clarity edits be made by a small group.

3. Definitions

Enclosed or semi-enclosed spaces: should the space under the vehicle be included in the definition?

C: the issue is the use of the term, related to venting. Under the vehicle would be allowed in this situation. This was the rationale for the removal of this phrase from this definition. To harmonize with the Japanese requirement that the space under the vehicle should not have a flammable mix. Recommendation is to add this phrase to the text where it is needed to address the flammability issue, and to leave it out of the definition.

Germany: current definition is acceptable

4. General Requirements

5. Performance Requirements

5.1 Compressed Hydrogen Storage System

Inclusion of text on container components

Task Force discussion resulted in acceptance of the Japanese proposal that each container has TPRD, check valve, and shutoff valve directly mounted on or within the container.

NOTE: OICA regards this decision to be design-restrictive. The specific inclusion of the text (proposed by Japan) for the TPRD, check valve, and shutoff valve to be directly mounted on or within the container, is design-restrictive and should not be in the GTR.

Inclusion of specific tank types that are covered by the GTR.

ISO and Germany want the types to be included

US and OICA do not want specificity, as this limits innovation and makes assumptions about one type of tanks being assumed to be impervious to a particular failure mode. All technologies need to be tested for all potential failure modes.

Germany: without type 4 tanks, there would not have to be a permeation test. In the future, a tank type that has a new failure mode would not be covered (we might have to develop a new test). Listing the current tank types would ensure that the tests cover the known tank types and the known/potential failure modes.

GS: actually, the existing standards do address permeation of other tank *systems* - permeation from all components of the constituents is measured.

US: all containers qualified for use on the vehicle have to pass the same series of tests.

Japan: to keep the GTR open to new technologies and for innovation, the tank types do not need to be included here.

Canada: need more testing to have a higher level of confidence in the specifications that we are putting into the GTR. Is the level of safety sufficient? Not enough data. There seem to be too many minimally-compliant requirements that could cascade and cause an issue/failure.

China: prefers GTR to be performance-based; no inclusion of list of allowed tank types

Korea: does not want the tank types specified

Canada: how do we know if we have an adequate level of safety? As confidence is gained, the initial (high) level of safety could be lowered. We are starting with too low of a factor of safety

US Chair: we are chartered with developing performance-based regulation to the extent possible. Propose that, with five contracting parties in agreement, we will move forward without specifying allowed tank types. US, Japan, Korea, China agree. Germany disagrees, Canada

abstains (has remaining abjections to the safety level). EC not present. ISO recommendation is therefore rejected.
ISO: this is not consistent with the discussion in the task force regarding 70MPa as the upper limit.
Germany: there is not sufficient agreement to remove the suggested text (inclusion of the tank type list).
US: the basic philosophy for the GTR is to set the *minimum* safety requirement for the vehicle (and, therefore, the storage system).

ACTION: Each contracting party will draft a rationale for or against limiting the GTR to current tank types.

5.1.1 Verification Tests for Baseline Metrics

Use of container only or complete storage system for hydraulic tests

The SGS agrees with the use of container for all tests except for the bonfire test, which requires testing of the storage system (this will require consistent and appropriate use of container or storage system throughout the document).

Validity of the revised test sequence

ISO: do not think we have the data to change the numbers. Only a small number of tanks were tested by Powertech, and there is no 15-year database.
CS: the test procedure is based on published data on material testing. There is a published reference that supports the validity of the test procedure for Performance Durability (hydraulic) on fiber-wrapped tanks.

Leak-before-break test

LBB is incorporated into the test sequence. Question is the change from 150% to 125%
CS: use of 125% is reflective of a reasonable exposure scenario. Justification for using 150% should be presented.
Germany: EU regulation has 15,000 cycles - 3 times the normal use (5,000 cycles)
CS: this is representative of a very high number of miles (11,000 is a factor of 2, assuming 5,500 cycles)
ISO: OICA should provide a rationale for the reduction to 125% from the previous proposal requirement of 150%
CS: this test is included to ensure conformity of production. It does not require the tank to actually leak before it breaks (misnomer in the name of the test)
Germany: the EU needs confirmation that this revised test gives the same level of safety

ACTION:OICA will provide justification for the changes to the LBB test to support the change from 150% to 125% and for the reduction in the number of cycles from 15,000 to 11,000.

5.1.2 Verification Tests for Performance Durability

Boss torque test

Task Force agreed tentatively to remove this test.
Japan: reserve this decision - need to check on validity of its removal with regulators

ACTION: OICA will provide rationale for the removal of the boss torque test requirement, text to be included in Part A.

Leakage upstream of the shutoff valve

Consideration of taxis (and need for increased number of cycles for the hydraulic test)
Japan: what is the rationale for the use of 5,500 cycles or for 11,000 cycles - need to have a discussion supported by data
CS: cannot have a distinction between passenger vehicles or taxis - manufacturer has no control over how the vehicle is to be used. The database is available (California report, reference is given in Part A), with no distinction between passenger vehicles and taxis (no way to be able to tell how the vehicles were used). If there are other data, it should be brought forward.

ACTION: Parties are asked to provide data to support higher number of cycles for Performance Durability tank testing (the taxi issue).

5.1.3 Verification Tests for Expected On-road Performance
Change in the number of cycles and the hold times during Expected On-Road Performance test sequence

ACTION: CS/OICA will provide documentation/rationale to support the modified Expected On-Road Performance test sequence is equivalent to previous sequence

Permeation rate needs to be properly specified (units)
Germany: in the EU directive, the value is similar for the whole vehicle. For type approval, we need it on a per-container basis.
Japan: permeation rate (5cc/liter/hour) but has a different temperature as EU (approximately the same when temperature is taken into account).
CS: The HySAFE values are on a per-vehicle basis, and this is appropriate for this GTR. If it is on a per-tank basis, this would be a problem because we would not necessarily know how many tanks would be used. The tank manufacturer would provide the per-tank permeation rate to the OEM, and the OEM would then decide how many tanks could be used, based on all of the other components on the vehicle.
ISO: in Ottawa, we agreed to have both numbers (per tank and per vehicle)

Permeation rate is too high to prevent explosion
US: the equation can be scaled up or down - a small car can fit in a small garage, but only needs a small amount of hydrogen (compared to a larger car, with commensurately larger garage). This is consistent with the HySAFE data. Need a small change in the text to address the smaller vehicle in a smaller garage.

ACTION: GS, CS, OICA, and Paul Adams (HySAFE) will draft text for Part A that explains how the equation of allowable permeation rate as a function of vehicle size and garage size.

ISO: the HySAFE permeation rate number keeps changing - is there other data sources that support the current permeation rate values? Does Japan have supporting test results that support

its value?

ACTION: Japan will check permeation test results to confirm that the value is consistent with HySAFE value.

5.1.4 Verification Tests for Service Terminating Conditions

Localized fire test

US: proposal will be made to incorporate the localized fire test

Engulfing fire test (bonfire)

Germany: the comment (#32) was added to make it consistent with the existing regulation.
CS: what is the data that support the testing at lower pressure?
Germany: from ECE-R110 (CNG); one cylinder at NWP, one cylinder filled to 25% NWP. TPRDs with special feature that the device opens only with sufficient pressure behind the melted TPRD. This may not be relevant, but would need to be checked.

Note: Proposal is made and accepted to discuss the new test procedure at the next meeting, once the procedure is made available and can be reviewed (localized fire followed by an engulfing fire, after some amount of time)

ACTION: US will provide a proposal for the combined localized + bonfire test procedure.

ACTION: Germany to provide rationale for the ECE-R110 two-tank requirement for bonfire test (one tank at reduced pressure) and relevance given current TPRDs

Penetration test

ISO: this is a test that is widely used
Japan: it is very difficult to penetrate a 70MPa tank with gunfire.
CS: it is a marksmanship test - really hard to get the bullet to pierce the tank. Not a useful test (has nothing to do with simulation of a crash).
Contracting parties agree that this test can be removed.

5.2 Liquefied Hydrogen Storage System

BMW drafted a version in EIHP. It will need to be revised to be consistent with the compressed gas GTR.

ACTION: BMW will provide a revised LH2 section, assuming the structure of the section on CH2 revised draft does not change (substantially).

5.3 Vehicle Fuel System

5.3.1 In-Use Requirements

Gas Fueling Port

ISO 17268 will be released for 35MPa soon, and the GTR should be compliant with the ISO document.

OICA: field tests are still being conducted. Inclusion of the specific receptacle design/dimensions should not be included in the regulation. There are other receptacles for other pressure levels that may be better and are being used. Should not repeat the errors of the EC regulation. There is no safety benefit.
Germany: Disagree. Safety issue with refueling with the wrong pressure nozzle.
ISO: this would be an international standard, widely accepted. It is a safety issue (high-pressure refueling of a low-pressure tank system).
OICA: no one uses the ISO LH2 refueling nozzle standard in the market, so we should not assume that the ISO CH2 will be used.
US: need some wording to make sure that safety issues are addressed by the vehicle manufacturers and the refueling companies, without being design-specific. Needs to be described as a performance requirement

ACTION: OICA will draft text for performance-based requirements for safe refueling.

ACTION: ISO will provide text of the DIS for refueling receptacle. SAE will provide similar.

Single Failure Conditions (air tightness)
Japan: justification is currently given in Part A (recommendation). Propose to move this to Part B (requirement)
OICA: discussion in the past of normally-operating vehicles. Unsafe conditions have to be covered by the detection system.
Japan: there is no design-specific requirement or a performance-based requirement. This is a philosophical approach. It is in the current regulation. Requesting comments and opinions on this requirement
US: identify the hazard that is to be mitigated (and that is not already covered). How would this test be performed?
Japan: test procedure was provided (see page 57); rationale is on page 40.
Germany: the EC regulation and the Japanese regulation both require an air tightness test. The question should be - why not require an air tightness test?
OICA: In type approval, this test would be performed on only one vehicle. Now, the end-of-line air tightness test is performed on each vehicle before it is put in service.
Korea: this should be in Part A
China: this requirement is necessary for safety and should be in Part B.
US: the fundamental issue here is that when a particular requirement and a test for it is proposed, we have to document the specific safety benefit.

Proposal: put a requirement into Part B that the fuel system shall not leak (or shall be airtight, or similar), and put the Japanese test procedure into Part A as a suggestion/example.

There is no agreement among contracting parties on how to handle
GS: it would be much more difficult for manufacturers to deal with many different test procedures, including some that might be much more stringent. Consistency is important. If we agree to a specific test procedure, we could put the procedure in Part B and remove/reduce confusion or non-uniformity.
US: we do not think this test is necessary. The current proposal is a compromise acceptable to

DOT.
Germany: leak tight is open to interpretation.
OICA: how does Japan do the test? Is it necessary to disassemble parts of the vehicle, or is it only necessary to test in the accessible areas?
Japan: only the connection points in the fuel lines are tested. Guards covering the fuel lines are removed if they are present.
US: in this GTR, there is an allowance for leakage as long as it does not exceed 4%. How do we reconcile this contradiction?
Japan: there is no contradiction. If leak occurs, the detection system must sense the leak. The goal is to have no leakage. This test is performed on one vehicle for the type approval process, and is also part of the periodic inspection process for each vehicle.

ACTION: OICA, in collaboration with JASIC and Japan delegation, will prepare alternate text and test procedure for air tightness.

Single Failure Conditions (leak detection)
GS: propose the removal of the phrase "downstream of the main shutoff valve"
OICA: this is not possible - when the vehicle is shut off and parked, the shutoff valve is closed and there should be no hydrogen downstream of the shutoff valve. If the manufacturer is required to have detection when the vehicle is not operating, there would be no practical way to power the detection system.
US: the only time the driver gets the warning is when the vehicle is in operation.
OICA: clarification is required to ensure that the warning is required only when the vehicle is operating. There should be no requirement to detect hydrogen while parked.
CS: the simple solution is to change B.5.3.1.3.3 to "If, during operation (when the shutoff valve is open), a single failure results in a hydrogen…" and B.5.3.1.3.4 to "During operation (when the shutoff valve is open), a warning shall be provided…"
ISO: any leak from the storage system will not be detected while the vehicle is parked. There is an increased concern that the shutoff valve is not properly (sufficiently) tested in the current test procedures, given that there is no leak detection when the shutoff valve is closed (when the vehicle is not operating).
CS: there is no absence of testing of the valves - it will be in either Part A or B, depending on the WP.29/AC.3 administration decision.

Single Failure Conditions (proposal to change passenger compartment hydrogen limit to 1%)
OICA: it should not be changed, since it will be a much more stringent requirement than other gaseous vehicles. For example, the detection system for CNG is the driver's sense of smell, which only occurs when there is a leak of CNG into the passenger compartment. Since it is very difficult to ignite hydrogen at 4% (theoretical lower flammability limit - ignitable under very specific conditions not likely to be present in the passenger compartment), reducing this to 1% (25% of LFL) is not necessary. In reality, we do not need section (B.5.3.1.3.2), because it is automatically fulfilled.
Germany: we have already had this discussion in other meetings. We agreed that this was acceptable because it does not add any additional requirement. Inclusion of this section was a compromise from discussions at earlier meetings related to gas-tight housing. Leave the section in the text.

Single Failure Conditions (protection from over-pressurization of the low-pressure system - paper copy provided; electronic version will be posted)

GS: the amount of hydrogen in the low-pressure system is very low (<25 bar-liters). Rationale is given in Part A.5.3.3.1a (page 39).
Germany: the 25 bar-liter limit is only relevant at low pressure. If there is a failure of the pressure regulator, the low pressure system is seeing the container pressure (i.e., 70MPa)
OICA: Protection is provided. The consequence of such a failure will be detected. This proposal does not prevent the over-pressurization, it is just the reaction to higher pressure downstream. The justification provided in the document is not sufficient.
Germany: we are currently only detecting the leakage. We are concerned with a rupture, which is not addressed in the current GTR draft (which is based on the OICA proposal).
OICA: what would be the requirement?
Germany: see SGS 8-02, comment #38: "The hydrogen system downstream of a pressure reducer shall be protected against overpressure due to the possible failure of the pressure regulator. The set pressure of the overpressure protection device shall be lower than or equal to the maximum allowable working pressure for the appropriate section of the hydrogen system."
OICA: "set pressure of the overprotection device" - this is very design-restrictive.
Germany: does not agree that this language is design-restrictive.
OICA: there are other pressure-bearing systems (air compressor, tires) that are not covered by this requirement - will this require all pressure systems to be covered?
US: recommendation is to put this into Part A with the other type approval requirements.
Germany: this is not a type approval requirement - it is a performance requirement against burst/rupture. This is not addressed in type approval system. Cannot test the failure of the pressure regulator.
US: the group should try to develop performance-based language?
Germany: the low pressure system needs to be able to handle the failure of the pressure regulator. Need a design guideline.
US: this should be considered for Part A, if it is a design guideline.
ISO: Using the first sentence of the German proposal, this is a performance-based requirement that could be included in Part B.
US: This is consistent with other additions we have made.
GS: Compliance for type approval could be visual inspection.
OICA: ok as long as there is no restriction on how to do it. Over-pressurization is not necessarily bad and should be allowed, since there is a possibility to have a section that is over-pressurized but that does not burst.

Proposed text for Part B: "The vehicle fuel system downstream of a pressure reducer shall be protected against burst." Examples of how to do this could be added to Part A.

ACTION: All contracting parties and interested participants are asked to review the proposed language on protection of the vehicle fuel system against burst.

Single Failure Conditions (telltale)

Text is similar to that found in the GTR for ESC (electronic stability control) telltale.
CS: there is a lot of text in Part A that serves as background.

OICA: should be up to the manufacturer on how to warn the driver.
US: the icon to be used is not mandated. The manufacturer will decide what advice to give the driver.
Germany: the description in Part A is too long and should be reduced in length.
US: Text in Part A will be reduced significantly.
Japan: think text should be reduced in Part B to be consistent with previous discussions above on similar requirements.
Canada: symbol needs to be defined somewhere and needs to be consistent and understandable anywhere (text would not work)

ACTION: Manufacturers will provide information on the telltales/warnings that are visible or provided in their demonstration vehicles

5.3.2 Post-Crash Requirements
Fuel leakage limit
US: added that the hydrogen cannot accumulate into the enclosed areas. Proposed text: "the hydrogen fuel leakage shall not result in a hydrogen concentration in air greater than 4% by volume in the passenger, luggage, and cargo compartments."
OICA: there is no equivalent to this for CNG vehicles. Goes far beyond what is accepted worldwide.

ACTION: Interested parties will submit written comments on the proposed text for fuel leakage limit (post crash).

5.4 Electrical Safety
5.4.1 In-Use Requirements
5.4.2 Post-Crash Requirements
6 Test Conditions and Test Procedures
6.1 Compliance Tests for Fuel System Integrity
6.1.1 Crash Test for Fuel System Integrity
6.1.2 Compliance Test for Single Failure Conditions
6.1.3 Compliance Test for Fuel Cell Vehicle Exhaust System
6.1.4 Compliance Test for Air Tightness of Piping
6.2 Test Procedures for Compressed Hydrogen Storage
6.2.1 Material Qualifications
6.2.2 Test Procedures for Performance Durability
6.2.3 Test Procedures for On-Road Performance
6.2.4 Test Procedures for Service-Terminating Conditions

END of use of the draft GTR TOC numbering system

7. Electric Safety

7.1 Update on ELSA activities

No update.

7.2 Discussion

None

8. Miscellaneous Administrative Items

8.1 Approval of Decisions and Action Items of the 8th Meeting

To be distributed electronically

8.2 Next Meeting

May 2010 meeting in Seoul. 3 days for SGS meeting and half-day (if needed for SGS or co-sponsors' wrap-up)
Korea: proposal is for the week of May17th
NB: later agreed on June 15-18 as the meeting dates for SGS IX (Co-chair's note)
ISO: that is the same week as the WHEC in Essen, Germany and there will be an ISO meeting during that conference.
Germany: this is the only week that works in May and it cannot be moved to June
Proposal is accepted with reservations from several participants

Additional Meeting Schedule:
Late August/early Sept 2010 meeting in the US: proposed to be similar to Seoul format
US: co-sponsors will develop a proposal (date and place)

8.3 Other Issues

Extension of timeline for one year.
Action item lists must be completed by March 2010 to make better progress at SGS 9 meeting.