Codes and Standards: Hydrogen Fuel Purity Specifications

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Fuel Purity Workshop

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FreedomCAR

bp

Shell

ChevronTexaco

ConocoPhillips

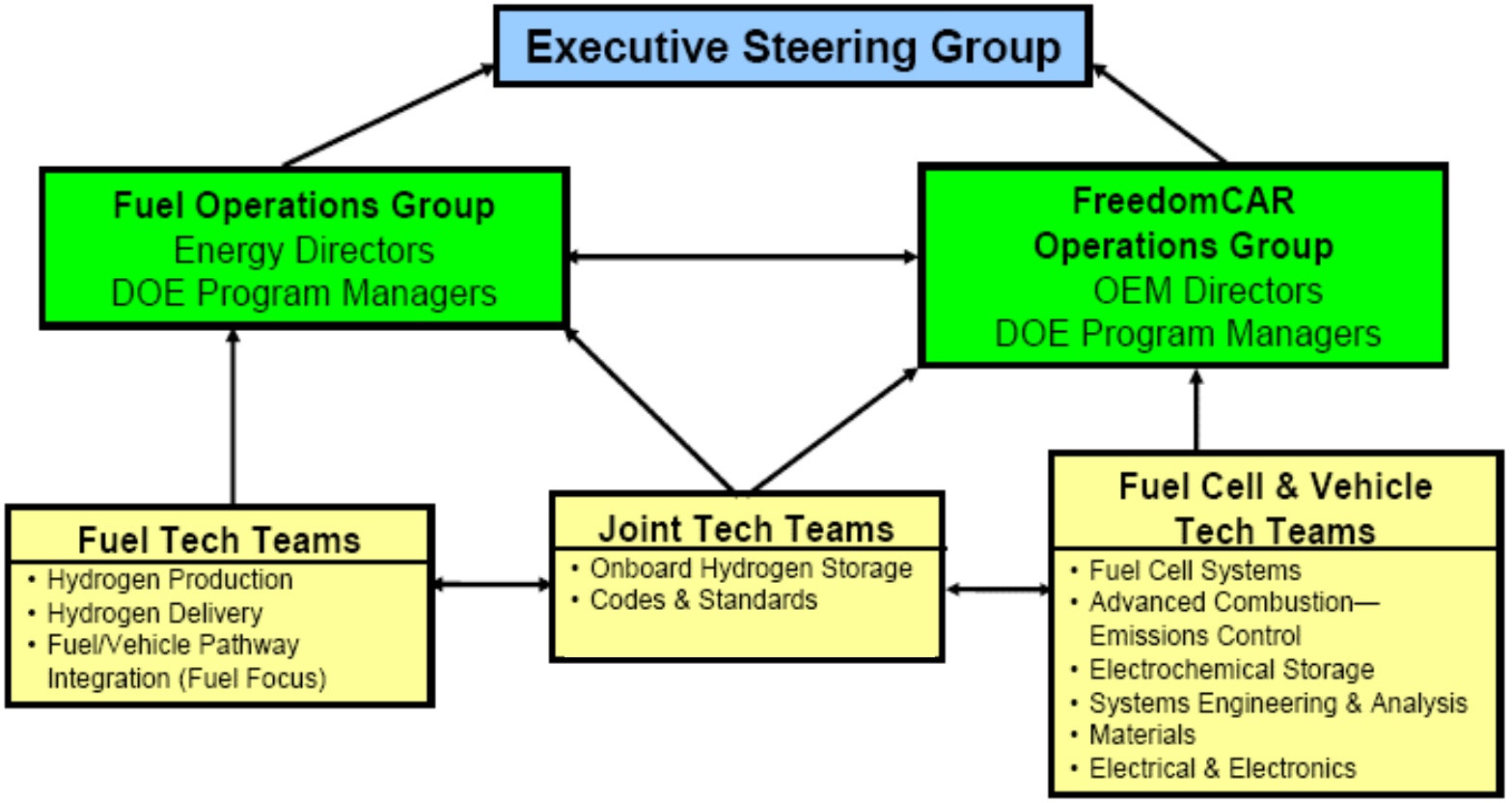
GM

Ford

DaimlerChrysler

ExxonMobil

FreedomCAR and Fuel Partnership Organizational Structure



Codes and Standards for Commercial Hydrogen/Fuel Cell Vehicles

FreedomCAR

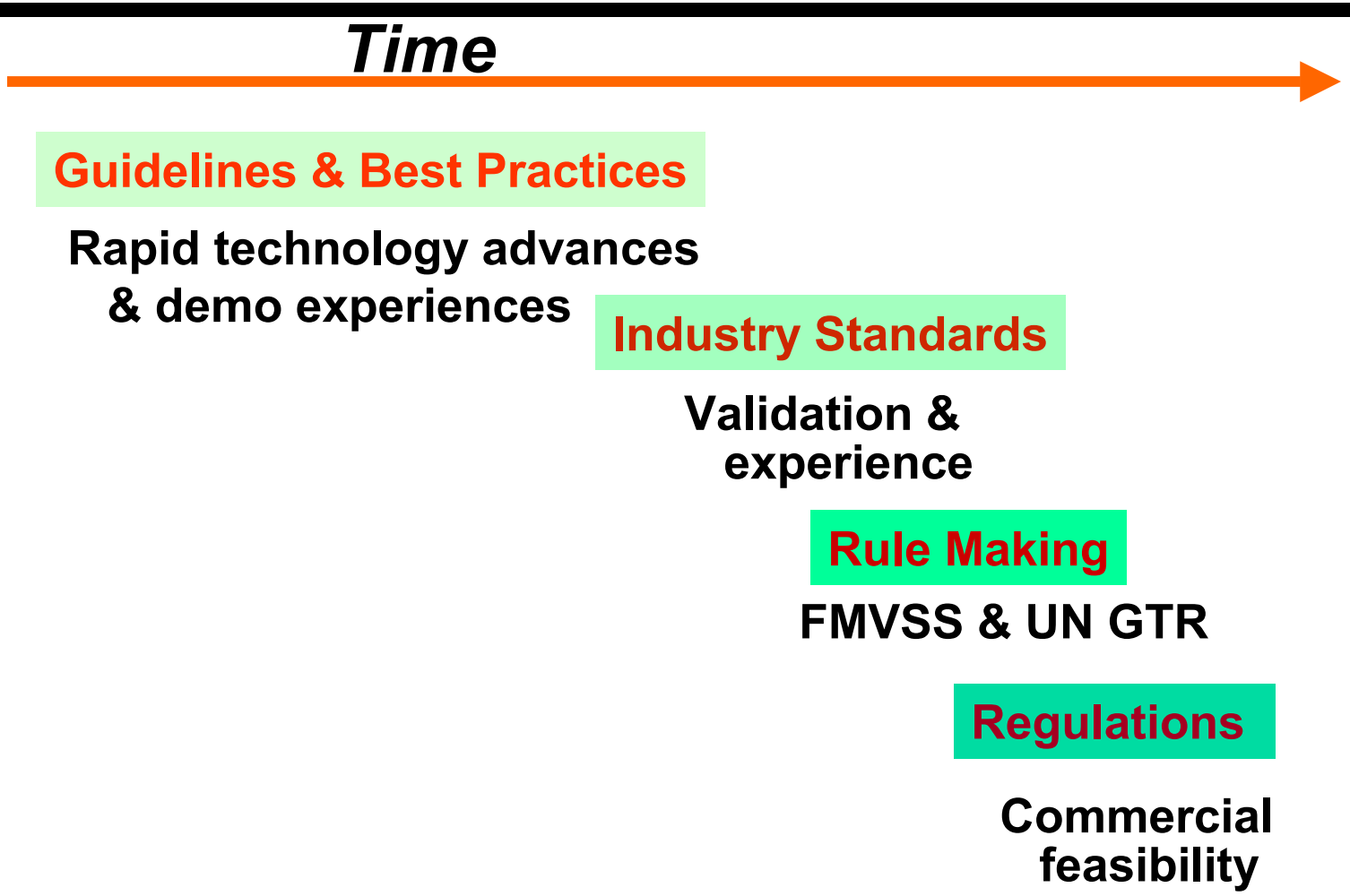
Goal is to support commercialization decision in the 2015 timeframe

- **Ensure acceptability to all stake-holders**
  - **Regulators, insurers, public**
- **Enable commercial feasibility**
- **Facilitate rapid introduction of technical advances**

Issues

- ***What we want to avoid***
  - **Premature Standards, Codes, and Regulations that slow introduction of new technologies**
  - **Competing national and international SDOs and professional organizations**
- ***What we want to encourage***
  - **Flexible guidelines that enable demonstration & validation projects**
  - **Consistent Standards that enable global introduction of fuel cell vehicles**

Potential Rollout of Standards



Plan of action

- Develop R&D roadmap to produce required information and experience for robust standards
  - expert input from all stakeholders
  - transparent methodology
  - publicly accessible
- Support technology development efforts
- Develop template for implementation of codes/regulations and standards in the US
- Support the development of training/educational materials
- Actively encourage coordination of international initiatives with the R&D roadmap

FreedomCAR Approach

Tech Teams will provide input to hydrogen purity specification:

Fuel Cell Systems, Hydrogen Storage, Hydrogen Production, Hydrogen Delivery, Hydrogen Fuel/Vehicle Pathway Integration, and Codes and Standards

- **interaction between fuel cell and hydrogen storage system characteristics as well as production and delivery attributes and options**
- **trade-offs between cost and feasibility of production/delivery options and fuel cell/storage system performance, durability**

Fuel Cell Tech Team Status

- **Initial specification for hydrogen from the storage system to the fuel cell inlet**
  - **10 ppb S, *1 ppm CO*, 100 ppm CO_2, 1 ppm NH_3, 100 ppm NMHC on C-1 basis, *<2% O_2 ,* N_2 , Ar, particulates conform to ISO 14687**
- **Revisions under consideration based on durability data and experience in fuel cell vehicle validation projects**

Hydrogen Storage Tech Team

- Output from storage system conforms to inlet specification from Fuel Cell Tech Team
- Storage system may add hydrogen purity requirements at the vehicle/fueling interface

Hydrogen Storage Tech Team Status

- Current research focus on new/ improved materials for storing H_2
  - Metal hydrides [e.g. alanates (Ti-doped $NaAl_4$)]
  - Carbon-based adsorbents (e.g. Nanotubes)
  - Chemical hydrides (e.g. $NaBH_4$, MgH_2)
- Researchers considering required hydrogen purity into storage material as well as possible impurities out of the storage system that impact fuel cell performance
- Matrix of impurities and effects is being developed