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Hydrogen Safety Codes, Standards and Regulations Overview

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PATH Codes and Standards Workshop
Honolulu, HI
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Outline

- Definitions
- Participants
- Development Process
- Need for Codes and Standards
- Issues/Barriers and how to resolve
- Government role in RD&D
- Government Technical Regulations
- IPHE Role

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Definitions

- **Codes**
  - **Specify requirements, components, and procedures for use**
  - **Developed through voluntary code publishing groups**
  - **Usually established/adopted by jurisdictions**
  - **Legally binding; i.e. building codes**
  - **International codes**

    set by agreement

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Definitions

- **Standards**
  - **Technical definitions, guidelines, and instructions for design, manufacture, and testing**
  - **Set minimum performance or component requirements**
  - **Technical experts from industry and governments**
  - **International standards**

    are typically voluntary,

    consensus based;

    i.e. equipment standards

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Definitions

- **Regulations**
  - **Legally binding, developed through national administrative process or international agreement**
  - **Typically incorporate by reference safety codes and standards**
  - **Developed in advance of deployment and commercialization to protect public safety**

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Performance vs. Prescriptive Code/Standard

- Performance code/standard
  - Not specific to any given application
  - Set high-level requirements,
  - Describe how a device or system should perform
  - But may not define specific requirements or thresholds for various applications or how the performance should be achieved
- Prescriptive code/standard
  - Specific to a given use
  - Detailed design requirements
  - Components may not be suitable for use in other applications
  - Limited in accommodating new technologies and approaches
  - Easier for code officials to apply

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Major Participants

- **Codes**
  - ICC International Code Council
  - NFPA National Fire Protection Agency
  - ASME International American Society of Mechanical Engineers
- **Standards**
  - IEC International Electrotechnical Commission
  - ISO International Organizations for Standardization
  - ANSI American National Standards Institute
  - SAE Society of Automotive Engineers
  - CSA International
  - CGA
- **Regulations**
  - UN ECOSOC Sub-Committee of Experts on the Transport of Dangerous Goods
    - –UNECE WP.29 World Forum for Harmonization of Vehicle Regulations
  - National Governments
  - US DOT, EPA

Example Standard Development Process

Example Regulatory Development Process

(1) Identify Need
Industry/Gov
Year 0

(2) Review available standards
Government
Year 1-3

(3) Research Phase
Gov/Industry
Year 1-5

(4) Advance Notice of Proposed Rulemaking
Government
Year 4-5

(5) Comment period – receive and analyze
Industry/Public/Gov
Year 4-5

(6) Notice of Proposed Rule
Government
Year 5

(7) Comment period – receive and analyze
Industry/Public/Gov
Year 5-6

(8) Draft Final Rule and Final Regulatory Evaluation
Government
Year 7-8

(9) Reject/accept or modify and publish final Regulation
Government
Year 8-9

(10) Second Notice of Proposed Rulemaking if necessary
Government
Year 10

International Regulations

In order to meet industry-targeted commercial integration of hydrogen vehicles by 2010, or US DOE commercialization decision target of 2015, steps (2) and (3) must be started no later than 2005

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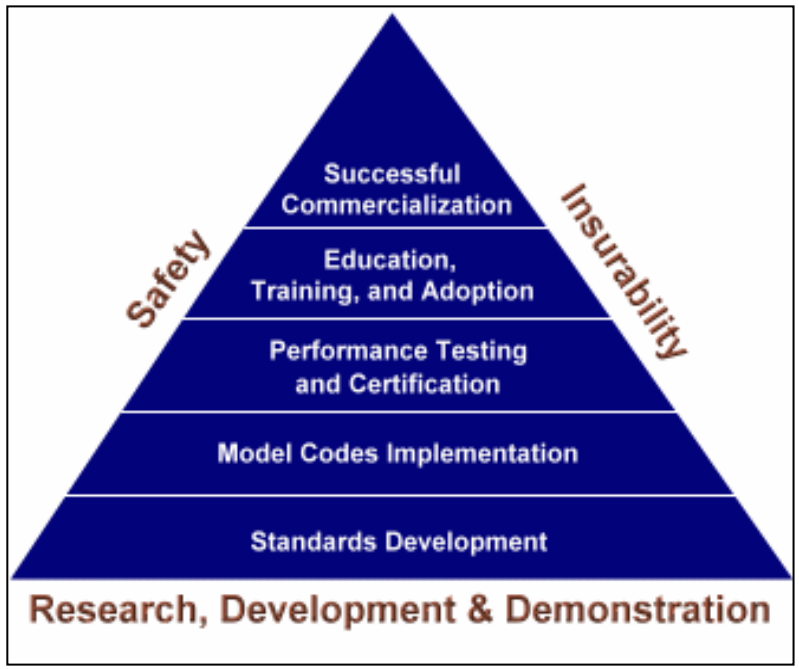
Need for Codes and Standards

- **Safety assurance**
- **Public confidence**
- **Enable commercialization**



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Issues

- Hydrogen has been used and transported safely for many decades
  - However, its use as a vehicle fuel is new
- Current standards tend to be based on industrial experience rather than consumer/commercial use by the public
- Tendency to adopt industrial standards to transport (separate applications)
- Reliance on CNG standards
- Insufficient technical data available

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Major Barriers

- Complex system of development
- Overlapping and competing standards
- Manufacturers are driven by need to sell product
  - Debate on control of standard
  - Drive to target standard to accommodate a specific product
- Usage and language are precedent setting – may compromise long-term safety or limit technology
- International standards still have limited governmental development role
- Large number of local government jurisdictions (approx 44,000 in U.S.)
- Non-uniform training of officials

Goals and Objectives

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Perform underlying research to facilitate the development and harmonization of international codes and standards.

- **Assess sufficiency of domestic & international hydrogen and fuel cell codes and standards – both established and in the process**
- **Identify information needs**
- **Maintain an R&D roadmap designed to fill information gaps**
- **Insure information developed is available to codes and standards developing organizations**
- **Attempt harmonization while insuring domestic needs**
  - **Get a GTR before national regulations prohibit successful implementation**

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Approach

- **Perform underlying R&D**
- **Assess current practices and status of technical development efforts**
- **Support of performance-based, non-prescriptive Codes and Standards development that facilitate technology introduction, but do not hinder future technology evolution**
- **Identify gaps and needs between current efforts and those necessary for performance-based standards**
- **Determine resources needed to collect and disseminate critical information to codes and standards groups**
- **Roadmap for a Global Technical Regulation adopted in June 04 (WP 29) now we need the stakeholders to implement the Roadmap.**

Government Role

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Because of the large number of interested parties, those which represent competitive entities and that are both national and international, governments are uniquely positioned to facilitate progress toward harmonized codes and standards and improved safety

- **Lead non-competitive basic research**
- **Coordinate international participation**
- **Facilitate relationships among cooperative and competing industries**
- **Publish and disseminate results**
- **Educate Codes and Standards officials, first responders, and policy makers**

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4 Key Target Research Areas

- **Hydrogen Behavior**
  - **physical/chemical, combustion and flammability, material properties & interaction, sensing/mitigation**
- **Vehicles**
  - **Fuel storage system, components, sensors, whole vehicle performance, failure modes**
- **Infrastructure**
  - **Production, distribution and delivery, fueling stations**
- **Interface**
  - **Fuel quality, refueling components**

Roadmap details Needs or Gaps for each Target Area to ensure RD&D efforts are properly directed

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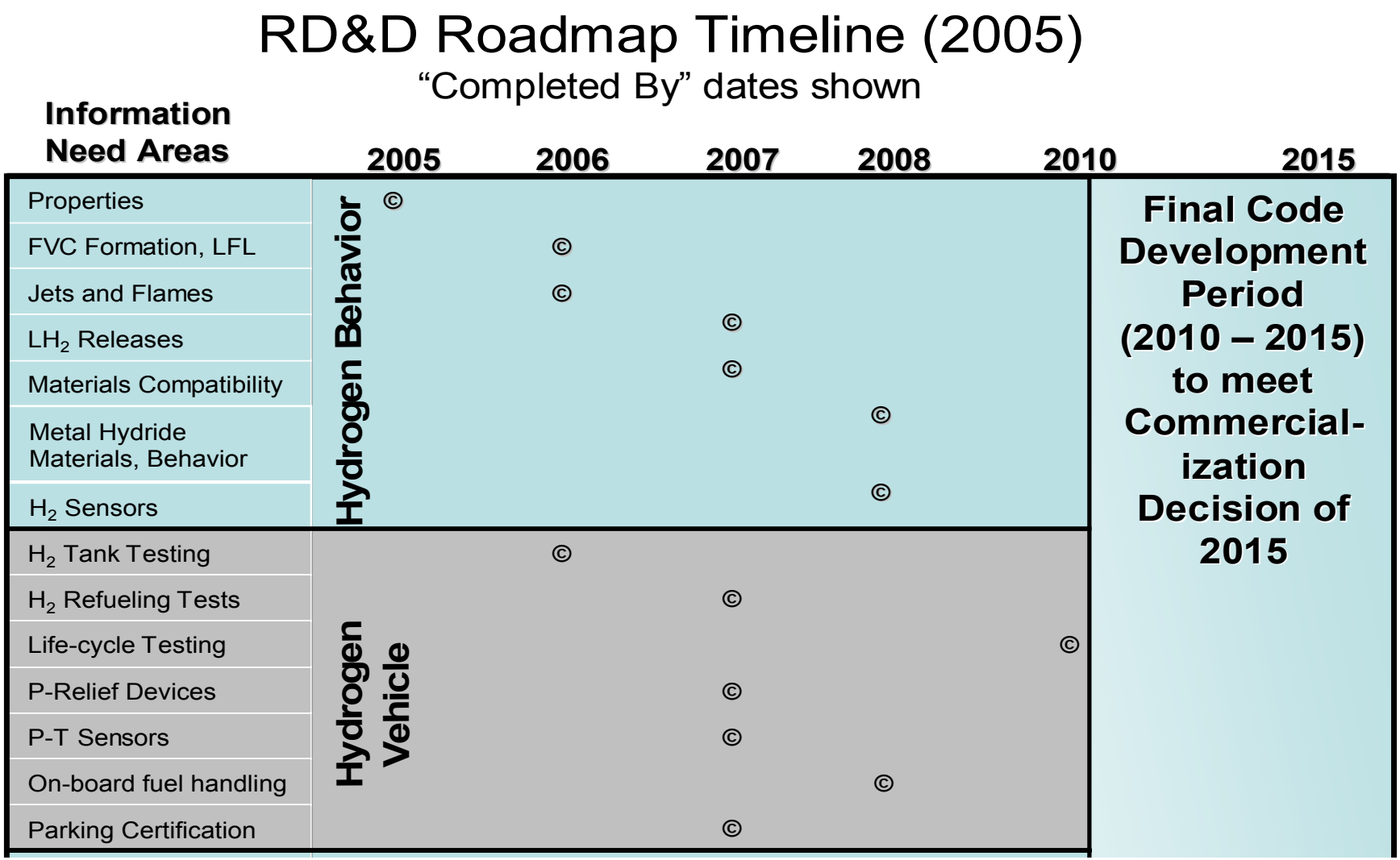
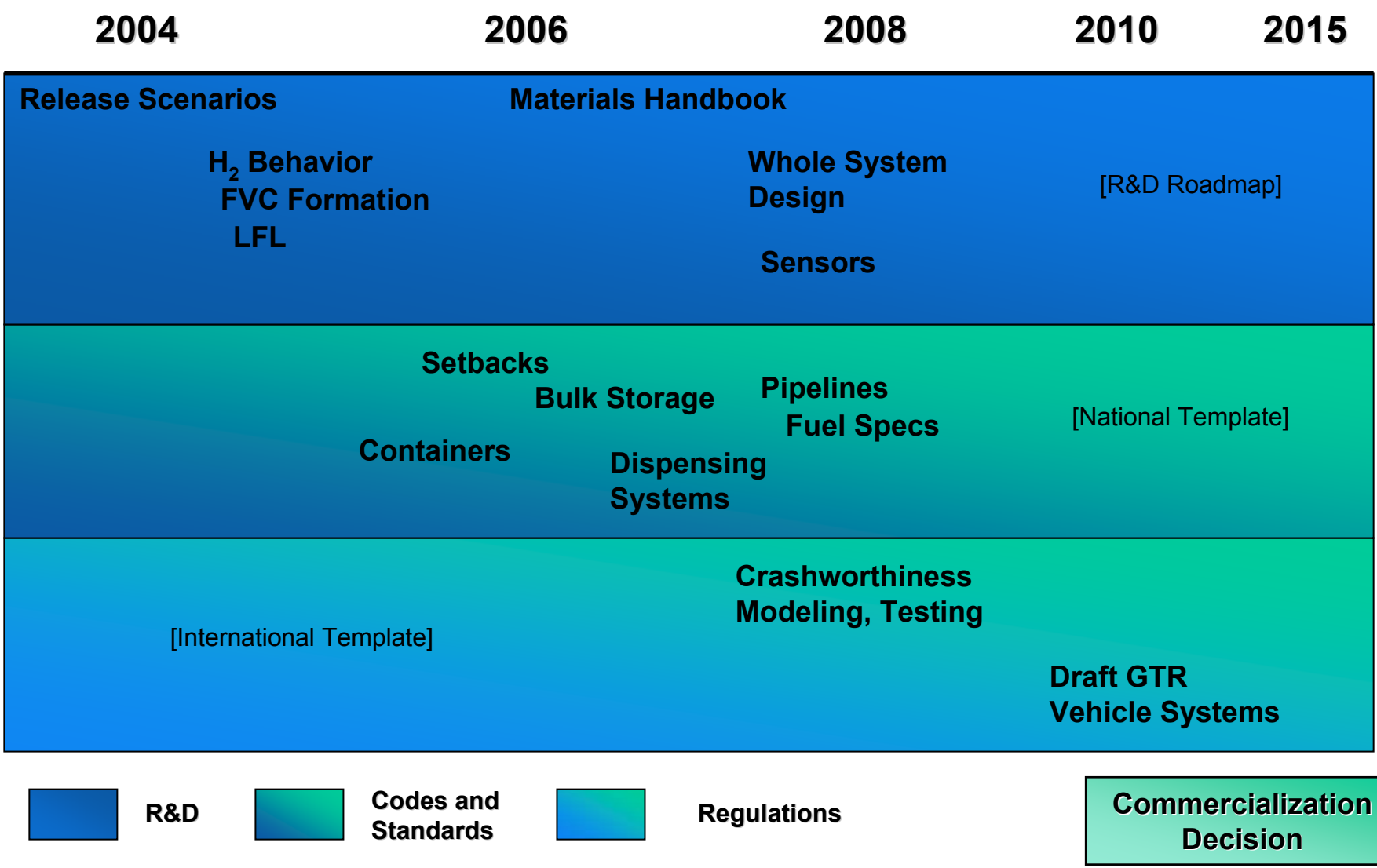
Vehicle R&D Roadmap Timeline



Overall Timetable



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Global Technical Regulations

- Global Technical Regulation framework for fuel cell vehicles under UNECE 1998 Agreement
  - Consensus based
  - Flexible to allow application to all countries, regardless of approval process
  - Existing international standards incorporated by reference
  - EU, US, Canada, Japan, and numerous other non-EU countries are signatories (23 total)
  - At least 5 year development process

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IPHE Activities

International Partnership for the Hydrogen Economy

The IPHE represents a major opportunity for international cooperation on Codes and Standards activities

- **Scoping Paper is a critical document to shape future Codes and Standards international cooperation**
- **Global communication and facilitation**
- **Help create a uniform "language" for data collection**
- **Opportunity to promote performance-based global standards and regulations that enable technology introduction while allowing evolution**
- **Safe introduction of Hydrogen powered vehicles into the market place.**

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US Activities

- **NHTSA 4 year Plan - success of the timely regulatory development and safe deployment of the hydrogen technology depends on the cooperation and active participation of all interested parties**

- **Enable New Transport and Distribution Pathways**
  - **Assess new and emerging technologies**
  - **Safety R&D to accommodate new technologies and allow integration in the system**
  - **Evaluate laboratory technologies for safety and reliability in widespread commercial use**

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Conclusion

- Safety of hydrogen can be addressed through comprehensive testing, certification, and functional standards
  - just like with any other fuel
- Coordination is the key
- Ultimate commercialization and technology decisions will be made by the commercial sector, governments must provide the regulatory and safety framework within which these choice can be made

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