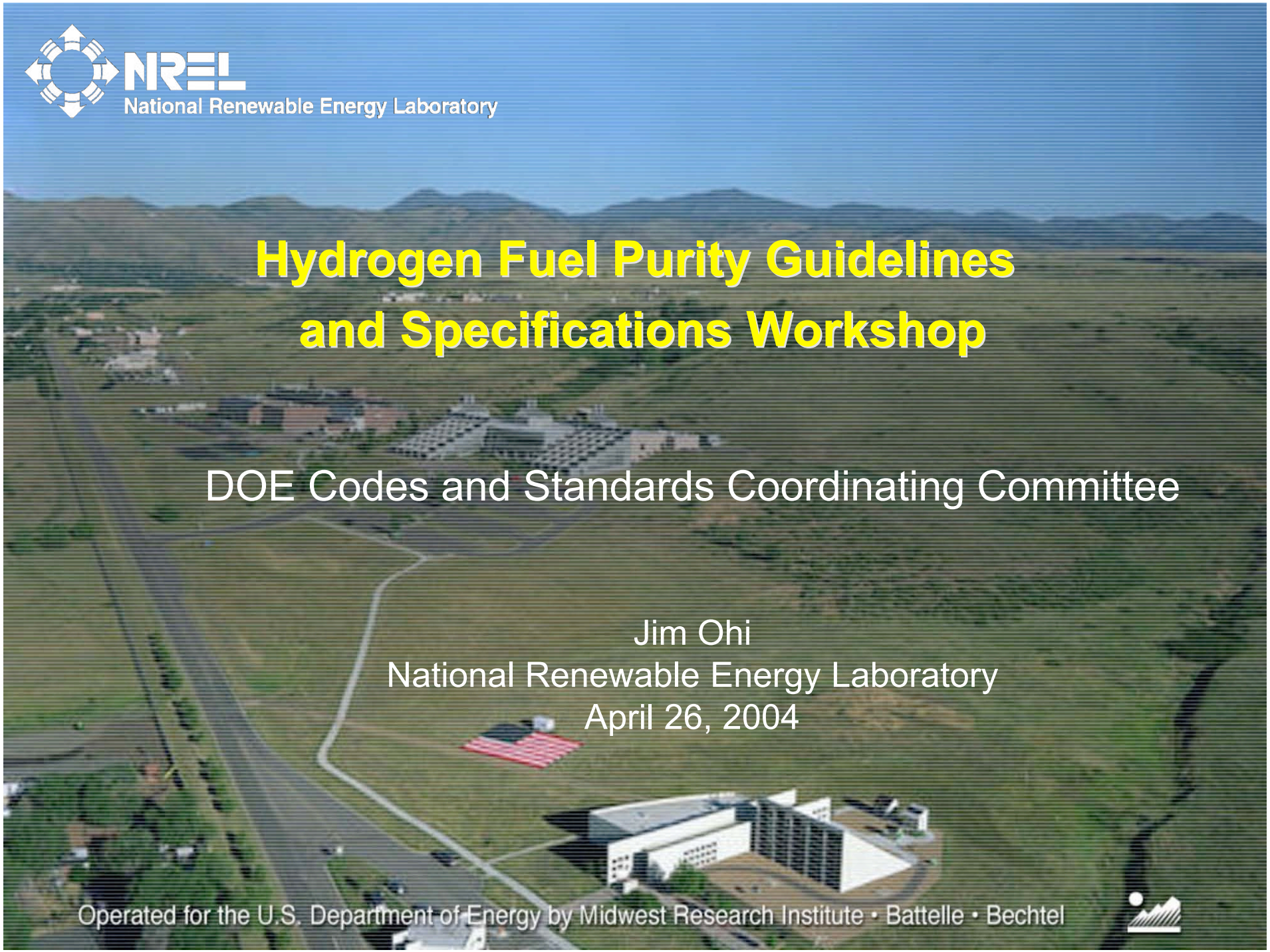

NREL
National Renewable Energy Laboratory
Hydrogen Fuel Purity Guidelines and Specifications Workshop
DOE Codes and Standards Coordinating Committee
Jim Ohi
National Renewable Energy Laboratory
April 26, 2004
Operated for the U.S. Department of Energy by Midwest Research Institute • Battelle • Bechtel

Overall Timetable

commercialization decision

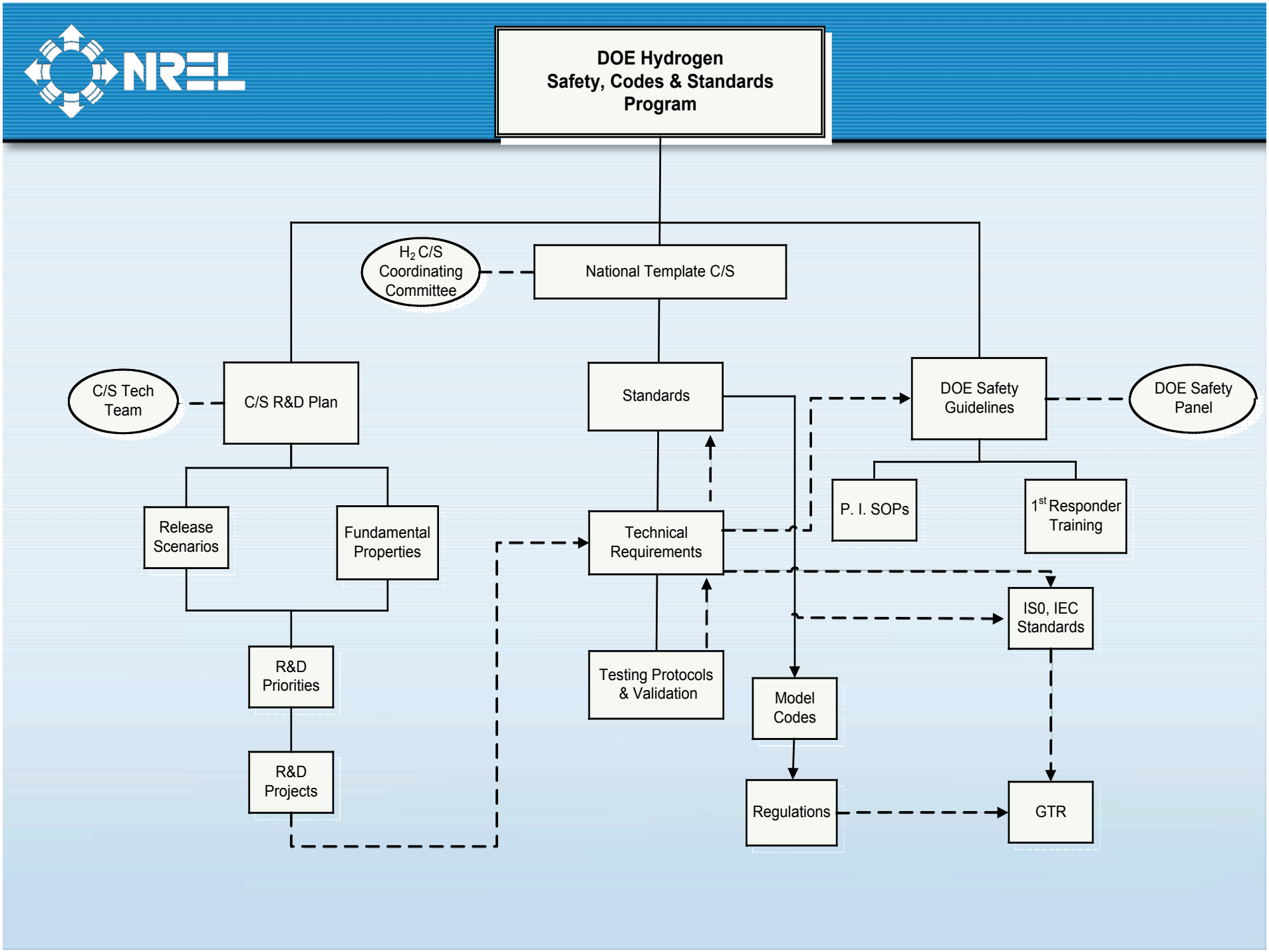
2003 2004 2005 2006 2007 2008 2010 2015

release scenarios
fundamental properties
FVC formation
LFL
sensors
materials handbook
whole system design

setbacks
underground bulk storage
pipelines
fuel specs
containers
dispensers

crashworthiness modeling, testing
FMVSS
GTR vehicle systems

R&D
Codes and Standards
Regulations


DOE Hydrogen
Safety, Codes & Standards
Program
H_2 C/S Coordinating Committee
National Template C/S
C/S Tech Team
C/S R&D Plan
Standards
DOE Safety Guidelines
DOE Safety Panel
Release Scenarios
Fundamental Properties
P. I. SOPs
1st Responder Training
Technical Requirements
IS0, IEC Standards
R&D Priorities
Testing Protocols & Validation
Model Codes
R&D Projects
Regulations
GTR

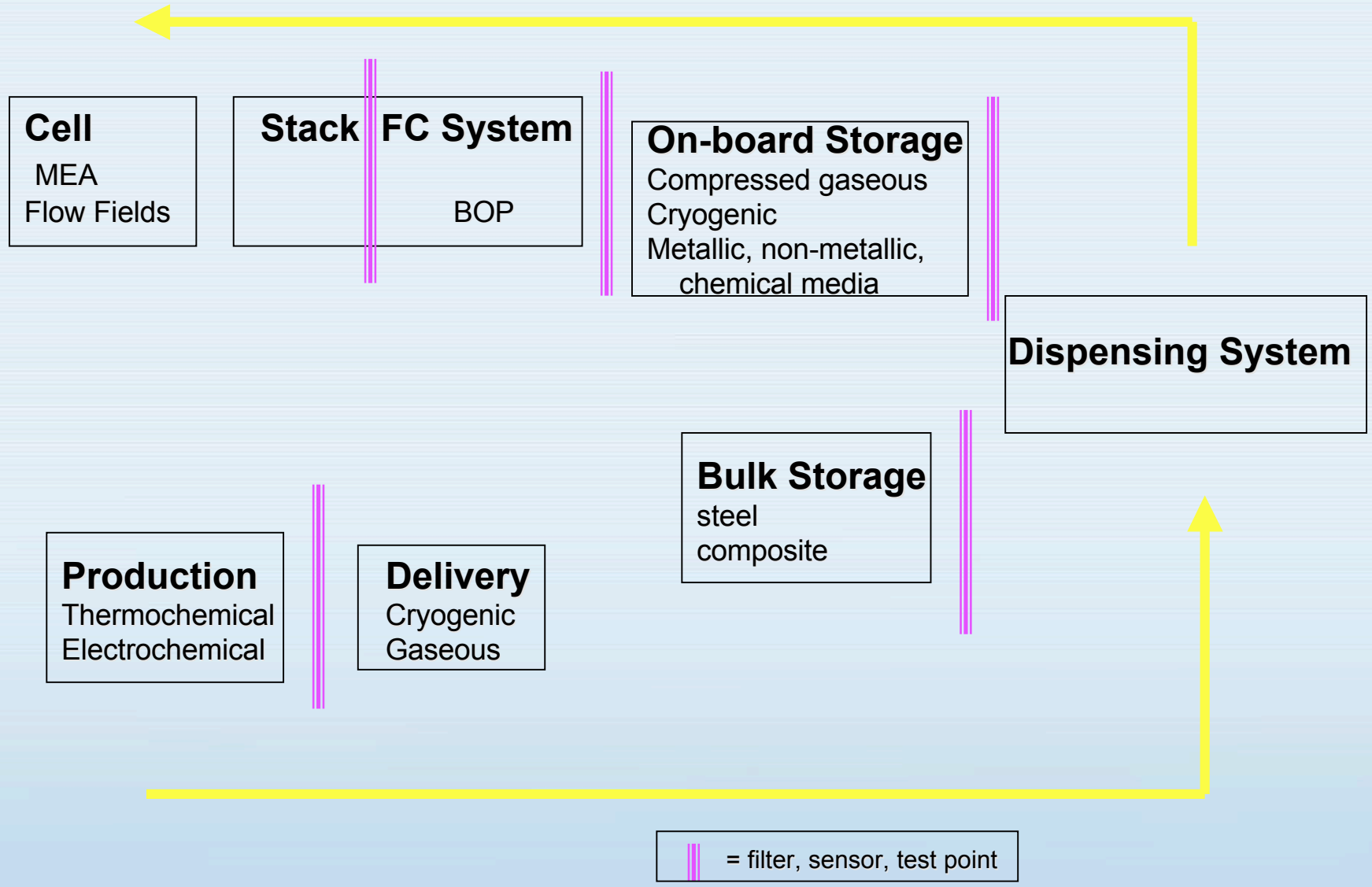
Purpose

- Better understanding of who is doing what
  - objectives
  - terminology, definitions
  - scope
  - timetable
  - participants
- Rough work breakdown structure
  - total "fuel cycle" for which purity requirements must be defined
    - levels or tiers required corresponding to each segment of fuel cycle
    - criteria for technically sound, economically viable guidelines/standards
    - R&D to define levels of purity appropriate for each segment
    - timetable for guidelines and standards
    - estimated R&D budget for R&D
    - cost of analysis to ensure appropriate purity level at each segment of fuel cycle

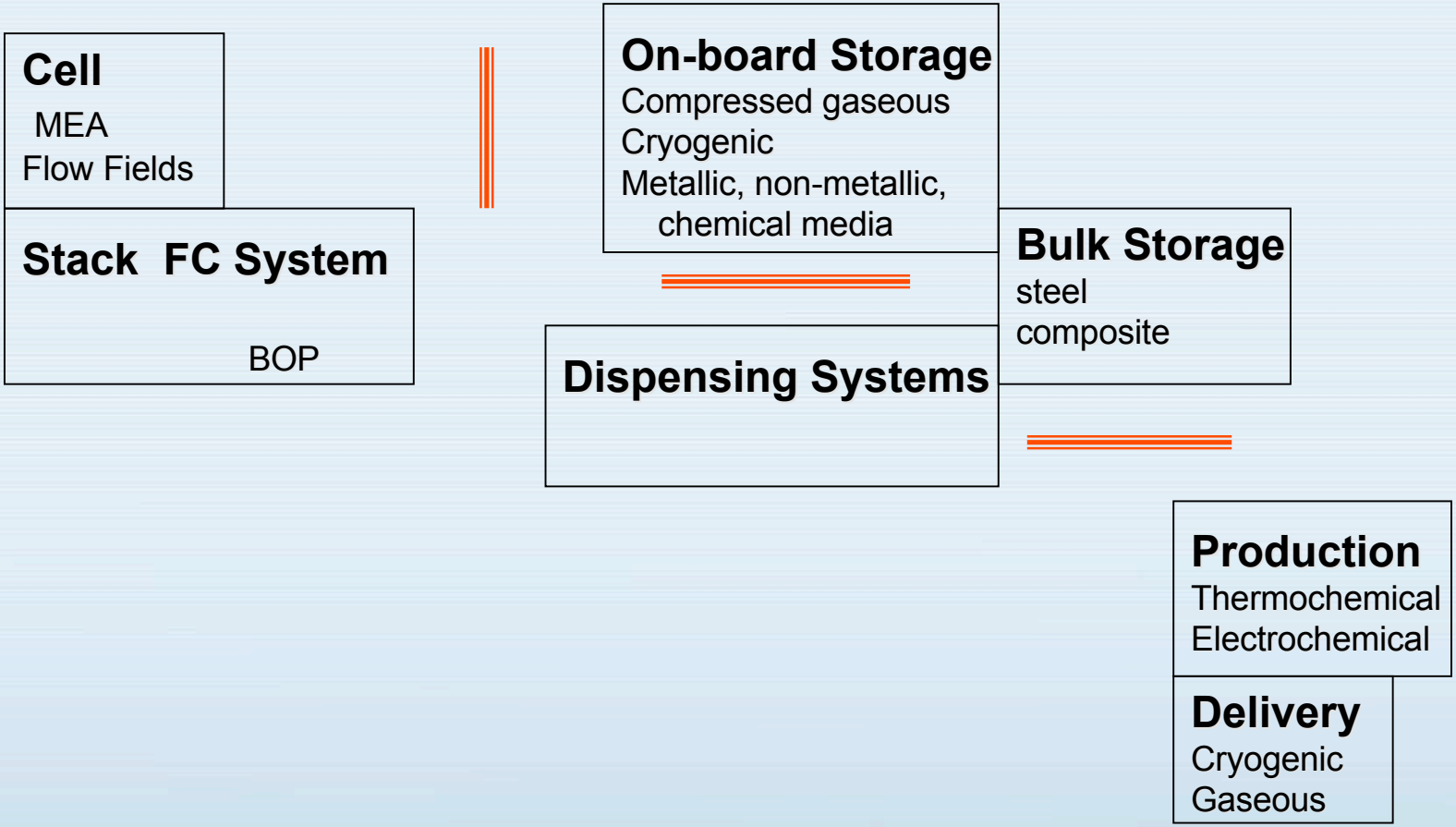
Desired Outcome

- Consensus “mini-template” for hydrogen fuel purity specifications
  - delineate key areas of effort
  - lead and supporting organizations for each area
  - preliminary outline for R&D program
    - key tasks
    - timetables
    - budgets

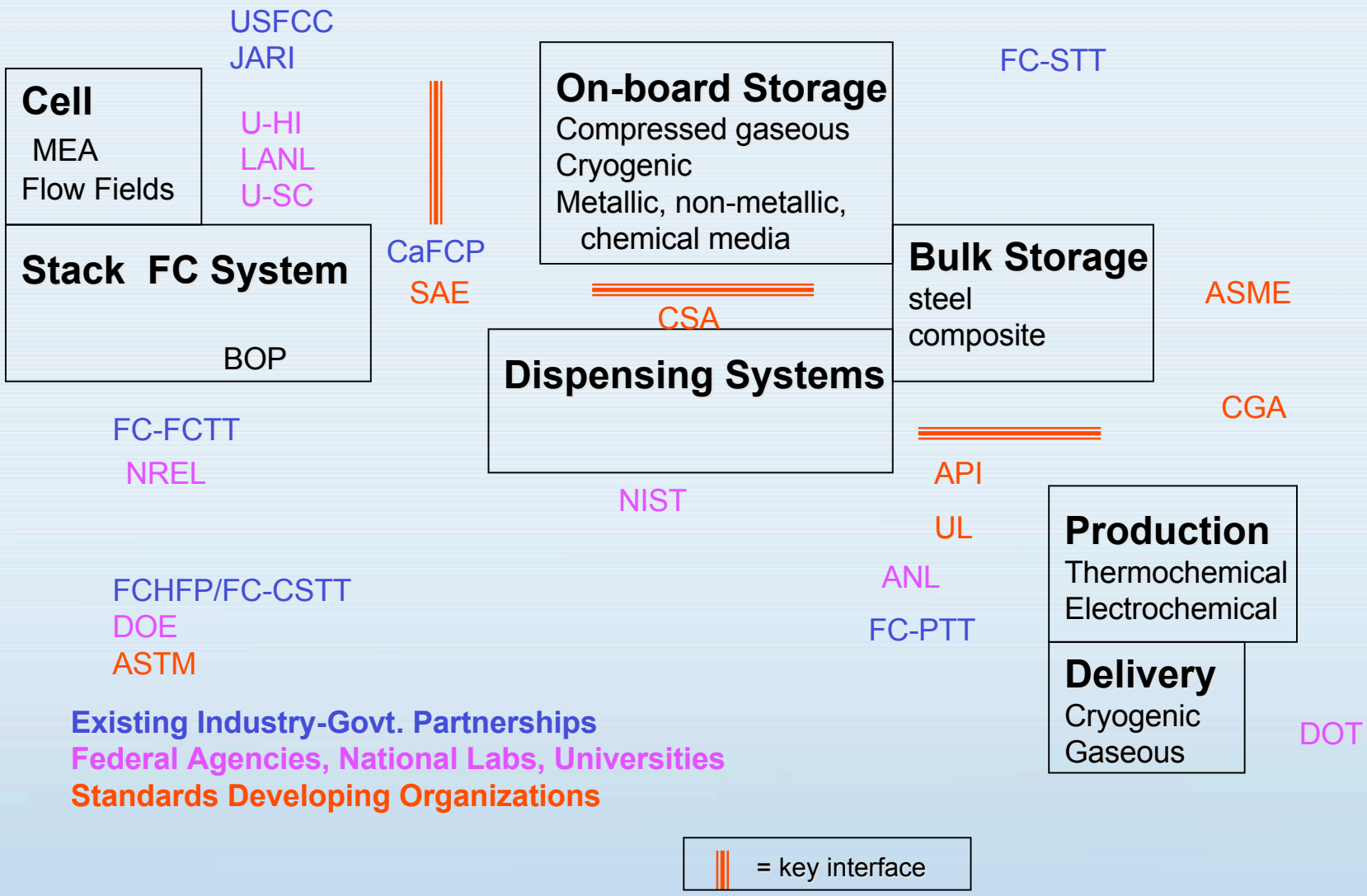
Problem Definition: Fuel Cycle



Problem Definition: Fuel Cycle Segments



Fuel Cycle Segments: Key Actors



Timing

- **Phase 0**
  - Problem Definition/Disaggregation
  - Terminology
  - Team building (interface of different teams/groups)
- **Phase 1**
  - Test protocols (vehicle and fuel systems; on-board storage)
  - Modeling capabilities, esp degradation mechanisms-linked with adv. Diagnostic techniques
  - Test Plan (accelerated testing,
  - R&D Plan (for testing and targets) assess
    - Assess effect of impurities on current SOA (stacks, fuel systems)
    - Assess sources of impurities and detection, clean up options
- **Phase 2**
  - Testing
  - Data analysis
- **Phase 3**
  - Data integration
    - performance, durability, cost
  - Preliminary guidelines
  - Feedback to Phase 1 and Technology Dev
    - Improve tolerance of components to impurities
      - Improve capabilities to clean-up on board
    - Improve capabilities to reduce impurities in fuels
  - Output to SDO

Next Steps

- **Phase 0**
  - Problem Definition/Disaggregation
  - Terminology
  - Team building
- **Phase 1**
  - Test protocols
  - Test Plan
  - R&D Plan
- **Phase 2**
  - Testing
  - Data analysis
- **Phase 3**
  - Data integration
    - performance, durability, cost
- **Phase 4**
  - Preliminary guidelines
  - Output to SDOs

Ad hoc Technical Working Group

R&D Planning Team

Test Teams

Technical Working Group

"All"

Next Steps

Technical Working Group

- focus on technical requirements
  - R&D
  - analysis
- provide locus for technical coordination and integration
  - R&D Planning Team
  - Test Teams
- provide outputs to industry-government partnerships
- provide outputs to SDOs