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FR09 Panel 2: International Activities
Harmonization of Prototypes

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Background

- **In 2007, France, Japan, and the United States shared similar plans and timeframes for developing sodium-cooled fast reactor (SFR) prototypes.**
- **The 3 research agencies: CEA, JAEA and DOE (U.S.) signed a Memorandum of Understanding in Jan 2008 to cooperate on SFRs**
  - Harmonize SFR prototype development
  - Ultimate goal of deploying SFR prototypes through an efficient collaborative process
- **Much was accomplished in laying the groundwork for mission and requirements, fuels, technology innovations, and infrastructure.**
  - "International Project Harmonization for SFR Development" presented at GIF Symposium (Sept 2009) in Paris
- **Recent U.S. policy shift away from accelerated deployment of commercial scale SFR prototype**

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Memorandum of Understanding Work Scope

- **The original MOU included 8 activities**
  - Design goals and high-level requirements
  - Safety principles
  - Power level and reactor configuration studies
  - Fuel comparisons
  - Start-up fuel facilities
  - Technology innovations for SFR cost reduction
  - Infrastructure collaboration
  - Target dates for prototype development

- **A revision to the MOU in August 2008 added 3 new tasks.**
  - Monju restart
  - Minor actinide fuel or target qualification
  - Advanced fast reactor fuel cycle characteristics.

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Prototype Mission Objectives

- **A set of Mission objectives was developed for Advanced Fast Reactor Prototype(s)**
  - Demonstrate effective actinide management while generating electricity
  - Demonstrate fast reactor safety
  - Demonstrate design features for cost reduction and financial risk minimization
  - Provide capability for fast spectrum irradiations
  - Demonstrate reactor safeguards and security
- **It was recognized that more than one prototype may be needed to fully satisfy all mission requirements**

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Fuels Research and Development

- **The three participants have similar constraints:**
  - Start-up without minor actinide fuel
  - Lack of existing facilities to fully address the needs
- **Potential SFR fuel types were compared**
  - oxide, metal, carbide, and nitride (with and without minor actinides)
- **Examined fuel fabrication requirements and facilities available to produce start-up fuel**
- **General areas of collaboration:**
  - Fuels and materials irradiation tests
  - High-burnup capability development
  - Fuel transient safety tests

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Technology Innovations for Cost Reduction

- **Several cost reduction technologies were identified as potential collaboration areas going forward, e.g.**
  - Large diameter seamless piping
  - Compact fuel handling systems
  - Integrated auxiliary systems, such as integrated purification systems
  - ***Advanced materials for structures and components*** ✓
  - Passively-cooled nuclear instrumentation, detectors, and other instrumentation
  - Large-capacity steam generator technology development
  - Advanced energy conversion technology

- **Many additional technologies were identified that indirectly affect costs (safety, reliability, performance), e.g.**
  - Radiation and thermal resistant insulation
  - ***In-service inspection and repair*** ✓
  - Natural circulation decay heat removal
  - Sodium/water reaction detection
  - Seismic isolation (2D and 3D)

✓ ***Developed detailed work plans for these technologies.***

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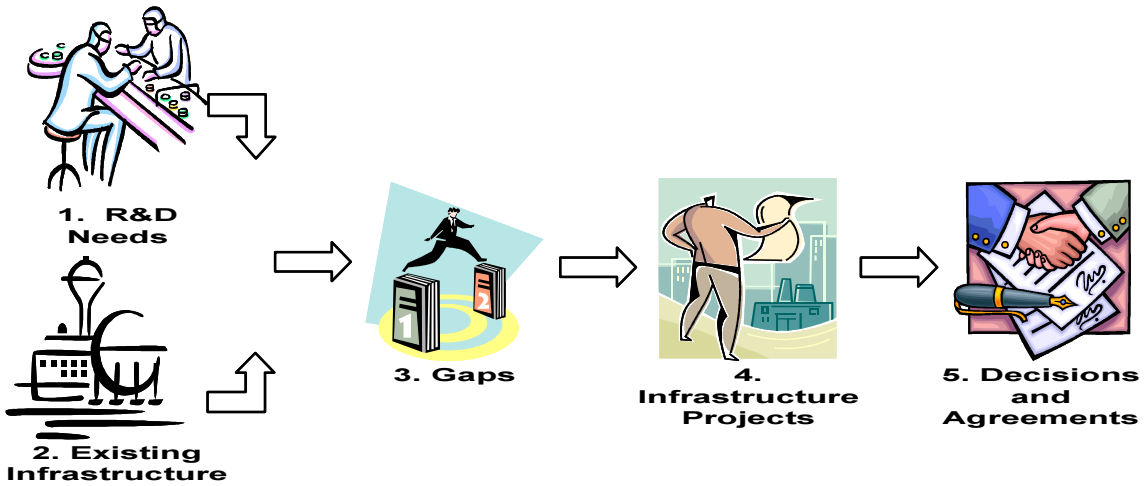
Infrastructure Collaboration

…*the significant physical and intellectual investment in infrastructure required to support SFR development need not be duplicated…but rather can be shared and harmonized in an efficient and equitable fashion..*



- **Four priority projects selected**
  - Address high-priority R&D needs
  - Complex and costly
  - Generally supported by the three participants

- **JAEA's large-scale sodium test loop**
- **CEA's TRIPOT - static sodium component test facility**
- **DOE's TREAT - transient overpower test facility**
- **CEA's MASURCA - zero-power critical facility**

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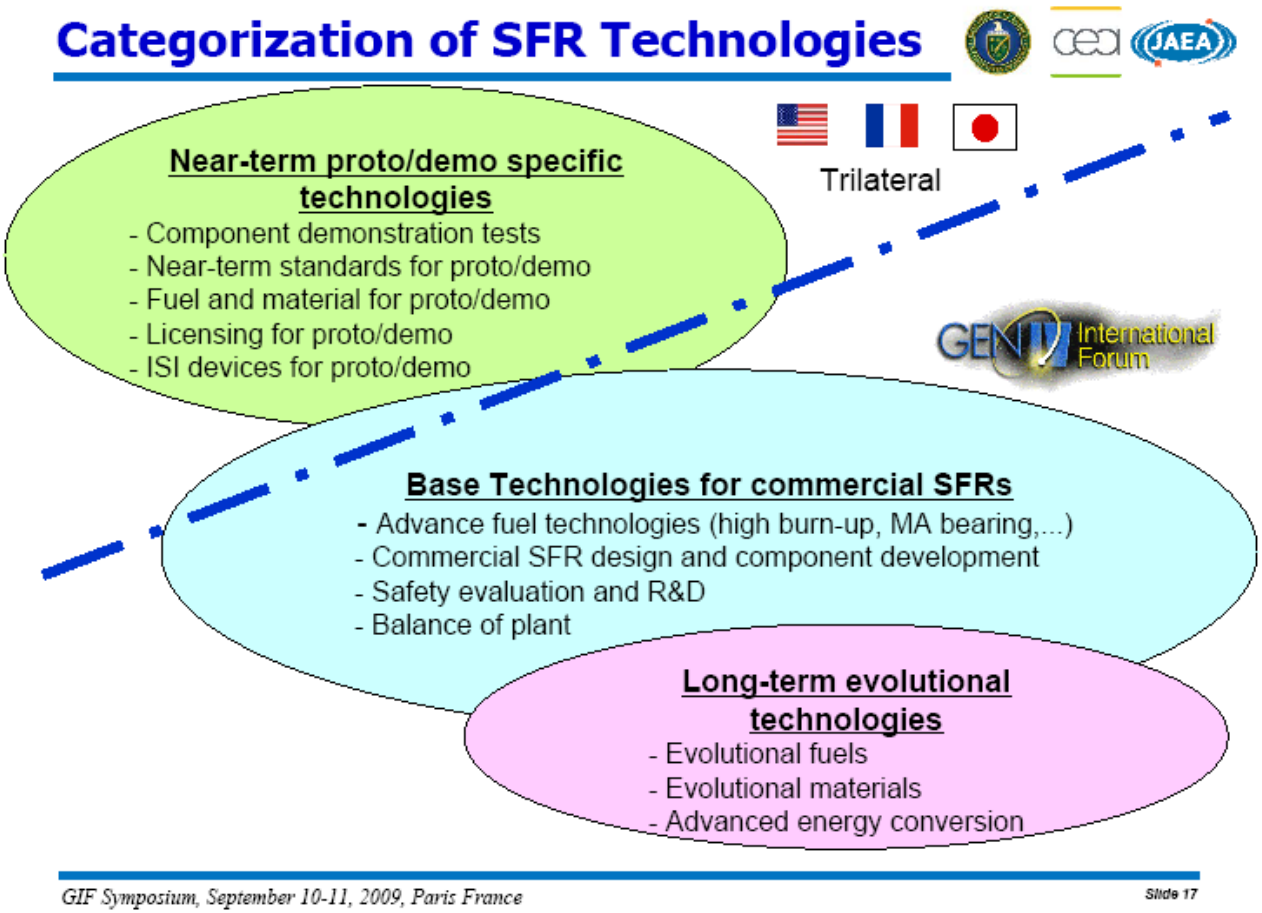
Framework for Cooperation



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Challenges and Opportunities for the Future

Challenges:

- High cost of R&D, technology development, and supporting infrastructure
- Long time frame needed to develop and deploy prototypes
- Differences between the national programs

Opportunities:

- Build upon past successes in international collaborations
- Leverage existing international agreements to their fullest
- Maintain an open dialogue to explore future opportunities for international collaboration