Integrated University Program (IUP) and Prospective Topics for Nuclear Safety Research

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Welcome and Logistics

- Appreciate your interest and contributions through participation in the IUP
- We will take questions at the end of the meetings first from the webinar and then from the phone
- Please message us on the webinar with any IT support needs
- Presentation materials can be found on the NRC Public Meeting Webpage or ADAMS under ML17146A627

Integrated University Program

Nancy Hebron-Isreal, Program Manager

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Integrated University Program

- Congressionally Authorized in 2009 Omnibus Appropriations Bill
  - Authorized $45M Total per Year for 10 Years
  - $15M for NRC, DOE, NNSA per Year
  - Directed $5M Non-Mission Related/$10M Mission Related

- Integrated University Program Hosted by NRC ($15M)
  - $5M = Faculty Development
  - $10M = Scholarships and Fellowships; Including Scholarships to 2-year Trade Schools and Community Colleges

Integrated University Program

- NRC IUP Provides Support for Education in Nuclear Science, Engineering and Related Disciplines to Develop a Nuclear Workforce

- All Grants Benefit the Nuclear Workforce

Integrated University Program – *Subprograms*

- ***Scholarships****
  - For Undergraduate Students
  - 2 years, up to $200,000
  - Maximum of $10,000 per Student per Year
  - Minimum GPA Requirements 3.0
- ***Fellowships****
  - For Graduate Students
  - 4 Years, up to $400,000
  - Maximum of $50,000 per Student per Year
  - Minimum GPA Requirements 3.3
- ***Trade Schools/Community College Scholarships****
  - For Undergraduate Students at 2-Year Educational Institutions
  - 2 years, up to $150,000
  - Maximum of $10,000 per Student per Year
  - Maintain Satisfactory Academic Progress

Integrated University Program – *Subprograms (Cont.)*

__NOTE__: Service Agreement Component to All Scholarships and Fellowships – 6 months in Nuclear-Related Employment for Each Year or Partial Year of Academic Support*

- ***Faculty Development***
  - For Probationary, Tenure-Track Faculty During the First 6 Years of their Career
  - 3 years, up to $600,000 Maximum Program

  (Minimum Grant $300,000 without Institution Match; up to $450,000 from NRC with $150,000 Institution Match)

- All Grants Fully Funded Upon Award

Citizenship Requirements

- Faculty Development Grants
  - Professors with a Valid H-1b Visa or Green Card (or Other Permanent Residence Status) May Participate

- Students that are United States Citizens or a Noncitizen National of the United States, or have been Lawfully Admitted to the United States for Permanent Residence are Eligible

- Individuals on Temporary or Student Visas as well as Refugees and Asylees are not Eligible

Grants Awarded – thru 2016

- 423 IUP Grant Awards
  - 127 Faculty Development
  - 101 Scholarships
  - 119 Fellowships
  - 76 Trade School / Community College Scholarships
  - Awards Posted on NRC's Grants Webpage:
    - http://www.nrc.gov/about-nrc/grants/awards.html

Plans for FY 2018

- Funding Opportunity Announcement to be Posted on Grants.gov in late Summer 2017
  - Proposals Due October 2017
  - Solicit Peer Reviewers
  - Review Panels Determined/Conducted November/December 2017
  - Estimate Final Awards Announced in April 2018, but Maybe Later if Appropriations are Delayed
  - All Awards are Based on Availability of FY 2018 Budget

IUP Highlights

- Has Supported Institutions in 35 States and Puerto Rico
- Emphasized Participation of:
  - Trade Schools and Community Colleges
  - Minority Serving Institutions
  - Health Physics, Radiochemistry, PRA, Seismology, and Other Nuclear Related Areas
- Over 100 Faculty Supported
- Over 3,200 Students Supported by Scholarships/ Fellowships, Each with a Signed Service Agreement
- Continued Cooperative Work with DOE and NNSA on the Integrated University Program

Minority Serving Institutions Program

Tuwanda Smith, Manager Minority Serving Institutions Program

Office of Small Business and Civil Rights

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Minority Serving Institutions Program (MSIP)

- President Bush Authorized NRC to Conduct Partnership Programs
  - Highlighted in the Energy Policy Act of 2005
  - Carry-out White House Education Initiatives
- MSIP Established 2006
  - Five Subprograms

MSIP Mission & Objectives

- Assist NRC to Fulfill its Federal Obligations
  - Provide Support and Assistance to MSIs
  - Promote Workforce Development
  - Assure Diversity and Inclusion

MSIP Internal Partners

- Broad Agency Support
- Integrated University Program
- University Champions

MSIP External Partners

- White House Initiatives Offices
- Federal Departments and Agencies
- MSIs/Educational Institutions
- Nonprofit/Profit Organizations
- State and Local Governments
- Private/Public Organizations
- Community/Professional Interest Groups
- Providers of Other Programs and Activities

Moving Forward

- Continued NRC Commitment
- Agency and Other Opportunities
- Partnership Engagement
- MSIP Support

"Diversity is needed to bring together the brightest minds to create solutions to business, economic, and social challenges of the 21st century and beyond"

Dr. Artika R. Tyner

Quote by Dr. Tyner, who is the Associate Vice President of Diversity & Inclusion at the University of St. Thomas, Leadership Author, and Civil Rights Attorney

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Prospective Topics for Nuclear Safety Research

Kimberly A. Webber, Deputy Director
Division of Safety Analysis

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Overview

- United States faces challenges as its nuclear industry matures
  - Aging power plants and emergent issues
  - Development of new technologies to mitigate issues
  - Interest in advanced non-light water reactor designs
- Non-power reactor research areas
- NRC report “Research Activities,” NUREG-1925
  - https://www.nrc.gov/docs/ML1606/ML16060A414.pdf

Topics – Safety Systems and Accident Analysis

Richard Lee, Branch Chief
Division of Safety Analysis

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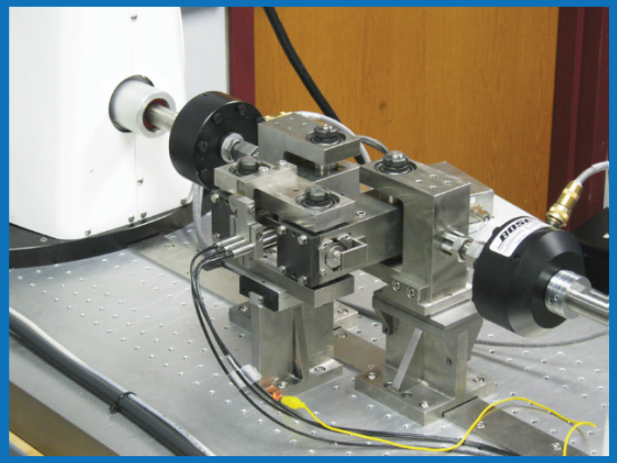
Operating Reactors

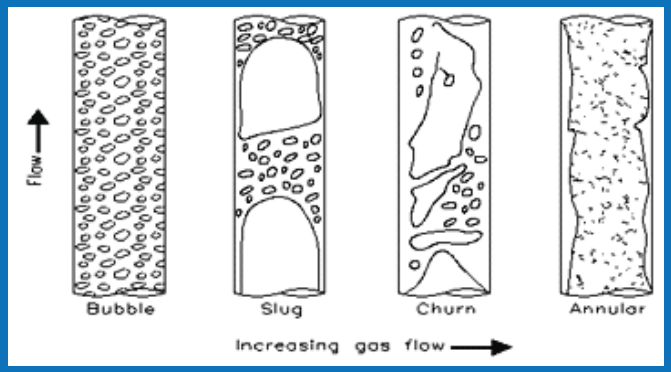
- **Fuel and Neutronics Analysis**
  - Enhanced Advanced Technology Fuel
    - Assess FAST against Halden data
    - SCALE Code Assessment
  - Interoperability with Other Codes
    - CFD Coupling
    - DOE-NE CASL/NEAMS Coupling

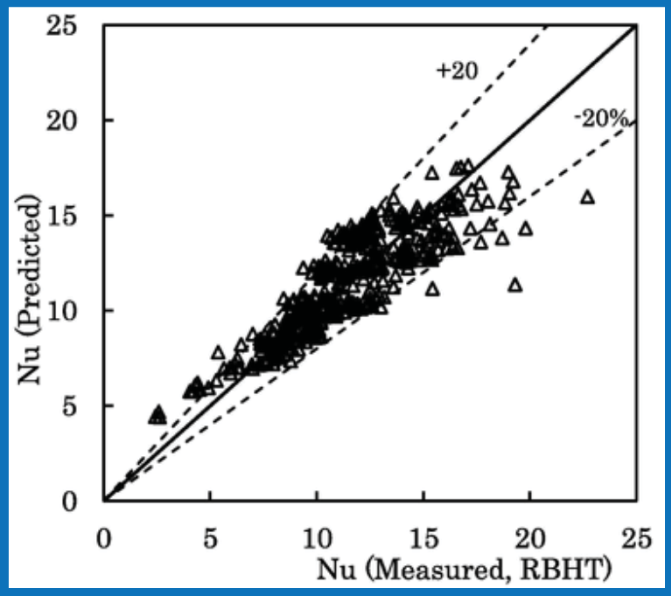


Testing of Irradiated Materials

Operating Reactors

- **Thermal-Hydraulics & Computational Fluid Dynamics**
  - TRACE Code Assessment
    - Passive Cooling Systems
    - Analysis of Systems Performance with Advanced Technology Fuels
    - Uncertainty Methods
  - Numerical Methods
  - Interoperability with Other Codes
    - CASL/NEAMS Coupling
    - CFD Coupling
  - Multiphase Experiments
    - Mechanistic Model Development
    - High Pressure Conditions
    - Subcooled Boiling & Condensation Models



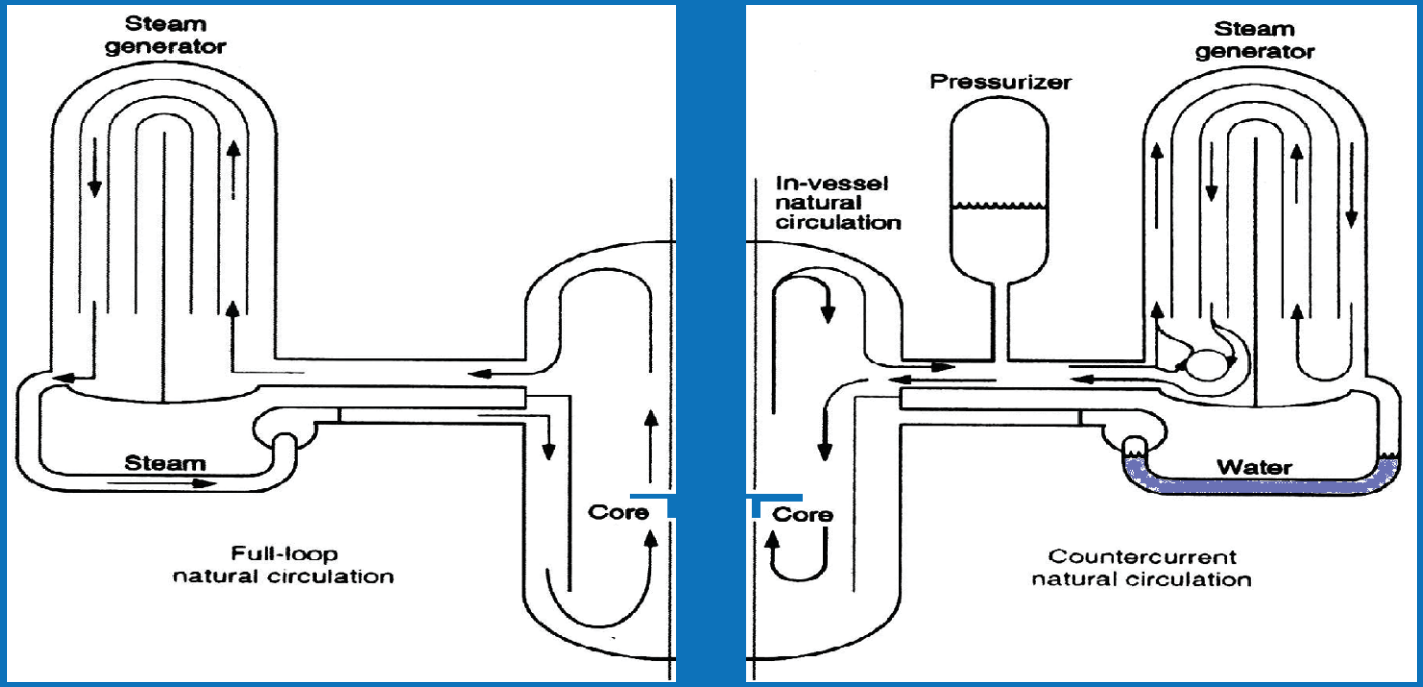


Operating Reactors

- **Severe Accidents**

  Low Probability/High Consequence Scenario- Severe Accident Induced Steam Generator Tube Rupture

  - Loop Seal Clearing
  - Scaling Distortion and Experimental Measurement for CFD Validation



Two Flow Patterns – PWRs with U-tube Steam Generators

Operating Reactors

- **Radiation Protection**

  Low-Dose Research

  – Reduce the Uncertainty of Low-Dose Health Effects and How that Impacts Radiation Protection Standards

  – Research Through Epidemiology and Radiation Biology

Non-LWR Technology

- Key Drivers and Issues
  - Significant Interest in Non-LWR Designs
    - Gas-Cooled Reactors
    - Liquid-Metal Cooled Reactors
    - Molten Salt Reactors
      - Solid Fuel, with Coolant Salt
      - Fuel Salts
  - Experimental and Analytical Needs Exist
    - Thermal Hydraulic Systems Data Needed
    - High Temperature Materials Performance
    - Neutronics
    - Fuels Performance and Code Applicability
    - Severe Accident Scenarios, Design Basis Source Term, and Offsite Consequences
    - Radiation Effects

Topics – Digital I&C, Materials, and Seismic/Structural Engineering

Tom Boyce, Branch Chief
Division of Engineering

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Digital Instrumentation and Control and Electrical Engineering

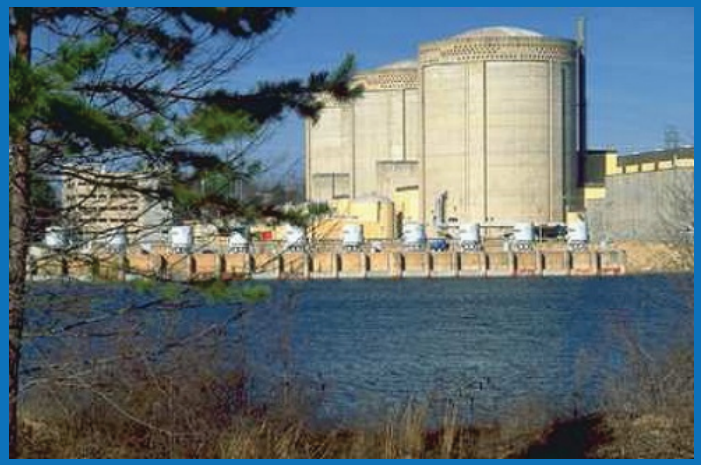
- Safety-Security Assurance of Digital I&C Systems
- Some Challenges from Rapid Technological Changes
  - Evaluation Criteria that can be applied with consistency
  - Common Cause Failures
  - Unexpected Interactions
  - Third Party Certification
- Modernization of the I&C Regulatory Infrastructure
- Electrical Component Qualification
  - Cable Degradation and Monitoring

Materials Degradation, Aging, and Component Integrity

- Probabilistic Fracture Mechanics Assessment Tools
  - Reactor Pressure Vessel Embrittlement
  - Steam Generator Tube Integrity
  - Piping Rupture
- Effects of Operational Environments
  - Primary Water and Irradiation Assisted Stress Corrosion Cracking
- Non-Destructive Examination (NDE) Evaluation Techniques and Tools
- Spent Fuel Storage Cask Degradation and NDE
- Advanced Non-Light Water Reactor Materials

Structural, Seismic, and Geotechnical Engineering

- Aging of Concrete Structures
  - Detection and Monitoring Technologies
  - Irradiation Related Degradation of Concrete Structures
  - Concrete Degradation through Alkali-Silica Reaction
- Seismic Hazards, including Source Ground Motion and Site Response
- Risk-Informed, Performance-Based Seismic Safety
  - Soil Liquefaction Analysis
  - Fragility of Structures & Components
- Advanced Construction & Repair
  - High Performance Concrete & Composite Materials



Topics – Risk Analysis

Nathan Siu, Senior Level Adviser
Division of Risk Analysis

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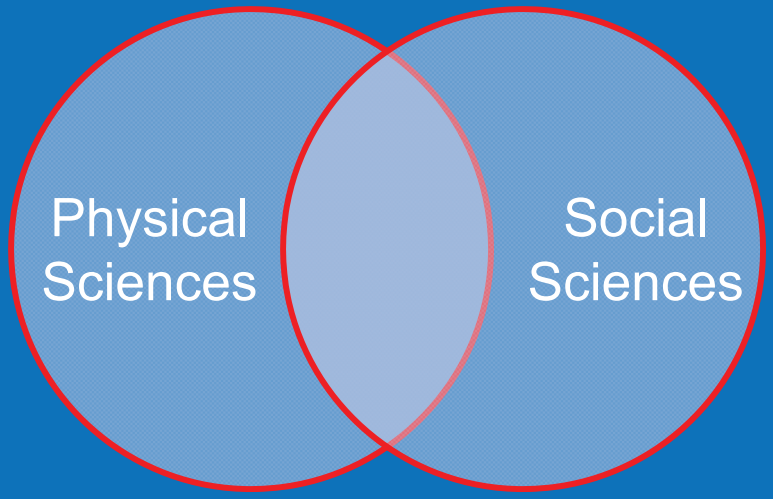
Risk Assessment and Risk Management

- Risk
  - What can go wrong?
  - What are the consequences?
  - How likely is it?
- Benefits of using risk information
  - Consider broader set of potential challenges
  - Help prioritize challenges
  - Consider broader set of defenses

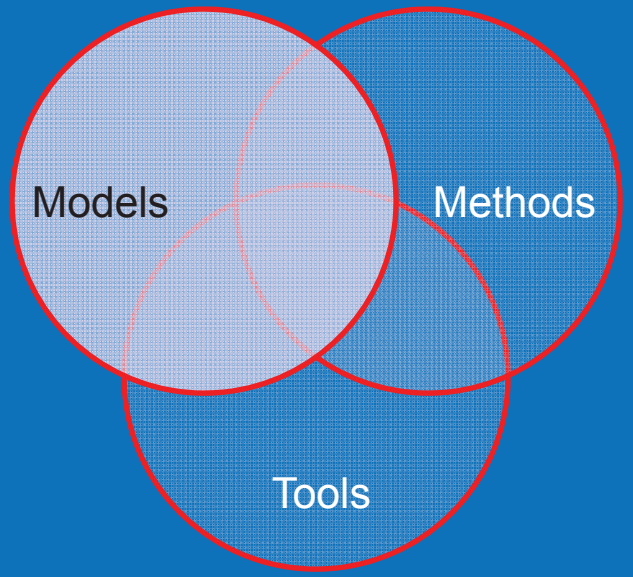
General Topic Areas for Risk-Related R&D

- Risk assessment technology => support the development, review, and use of risk models (including supporting phenomenological/system models)
- Risk-informed decision support => support decision makers in using risk information



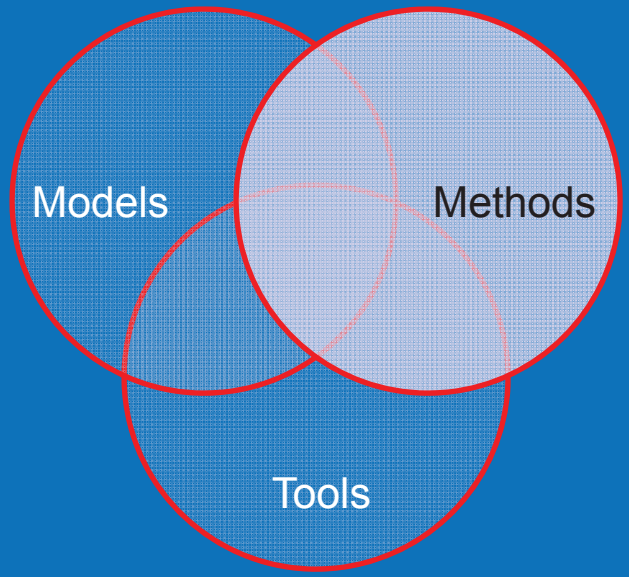
Risk Assessment Technology: R&D Topic Areas

- Models
  - Human and organizational performance and reliability
  - Common cause failures
  - Internal and external hazards
  - Severe accident progression
  - Emergency preparedness and response
  - …



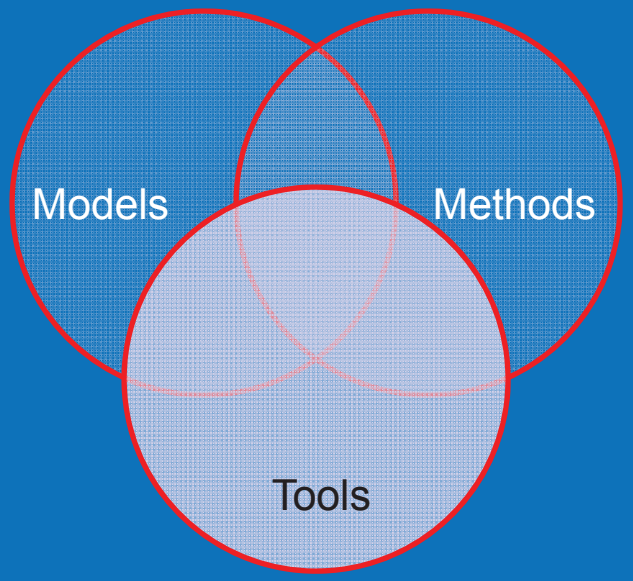
Risk Assessment Technology: R&D Topic Areas

- Methods
  - Dynamic, simulation-based analysis
  - Advanced statistical methods
  - Computational efficiency
  - Expert elicitation
  - …



Risk Assessment Technology: R&D Topic Areas

- Tools
  - Searches (“what can go wrong?”)
  - Screening
  - Complex model reviews
  - Learning from operating experience
  - …

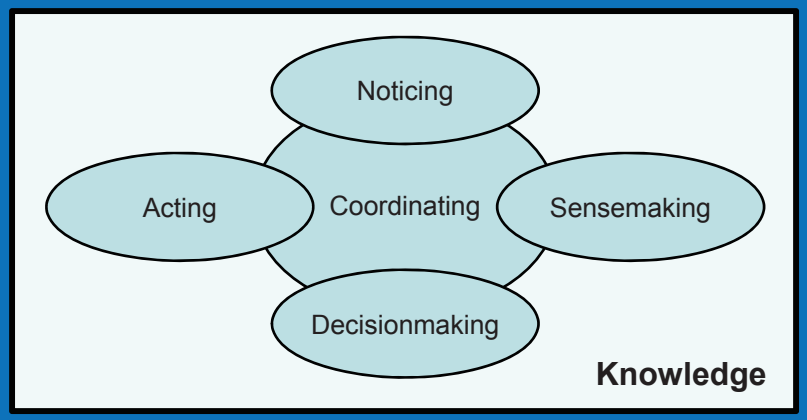


Common Decision Problem Characteristics

- Low probability/high consequence scenarios
  - Sparse empirical data, large uncertainties
  - Potentially major impacts for “wrong” decisions
- Requires systems viewpoint; sensemaking/deliberation challenges include
  - Breadth: multiple disciplines, heterogeneous analyses
  - Complexity: number of possibilities, phenomena, metrics
  - Sensitivity: details matter
- Involves group decisionmaking
  - Broad range of individual roles, backgrounds, preferences
  - Multiple steps: acknowledgment, screening, in-depth consideration

Risk Management: R&D Topic Areas

- Individual Support
  - Risk communication: content, preferences, and practices
  - Risk understanding: exploration and synthesis
  - Establishing preferences (multiple options, multiple attributes, large uncertainties, time pressure, ...)
- Group Support
  - Meeting support
  - Process support



Opportunity for Questions

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