

Update on the Ongoing Community Workshop Process

By
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**for the Community Workshop
Program Committee**

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Community Workshop Program Committee

Jean Paul Allain	University of Illinois - Urbana-Champaign	Saskia Mordijck	The College of William and Mary
Larry Baylor	Oak Ridge National Laboratory	Jon Menard*	Princeton Plasma Physics Laboratory
John Canik	Oak Ridge National Laboratory	Tobin Munsat	University of Colorado - Boulder
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David Gates	Princeton Plasma Physics Laboratory	Oliver Schmitz	University of Wisconsin - Madison
Martin Greenwald	Massachusetts Institute of Technology	Uri Shumlak	University of Washington
David Hatch	University of Texas - Austin	Wayne Solomon	General Atomics
Nathan Howard	Massachusetts Institute of Technology	Mark Tillack	University of California – San Diego
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Deyong Liu	University of California - Irvine	Steven Zinkle	University of Tennessee - Knoxville
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* Co-Chairs

Goal of Community Workshop Process

The program committee established two over-arching goals for the community work process.

- 1) **Provide an open forum to hear community views on strategic charge questions I2 and F2 and opportunities in charge F1, and to provide community feedback on these views.**
 - Importance of burning plasma research (charge I2)
 - Key scientific and engineering opportunities (charge F1)
 - Guidance on a strategic plan if US is/is not partner in ITER (charge F2)

- 2) **Identify key aspects of a long-term U.S. fusion strategic plan (both with and without the U.S as a partner in ITER) including both domestic and international research, and identify points of community consensus on the most critical key elements of that plan.**

Important Guidelines for Workshop Process

Goal: Ensure the credibility and broad support from the community for any work product resulting from the workshop(s)

Principles:

- Value input of all workshop attendees
- Value full range of ideas - be inclusive, not exclusive
- Peer review essential for scientific credibility
- Empower workshop leadership, but with appropriate checks and balances
- Engage workshop program committee in full range of decision-making

Communication: Engage with community leaders, FES leadership, and NAS panel co-chair at timely intervals for feedback on process and goals

Brief Timeline of Community Workshop Process to Date

Dec 2016: NAS Task Description Released

Jan 2017: Fusion leadership (11 leaders from universities, labs, and industry) met to discuss community response to NAS charge

- Primary discussion focused on ways to organize a community process that promotes development of a community view for exciting paths forward for the US program

Feb. 2017: Leadership group “commissioned” D. Maurer, J. Menard, and M. Wade to coordinate development of community workshops

Mar 2017: Program committee established

Apr 2017: Announced 1st Workshop in July 2017 along with call for white papers on prospective strategic elements

July 24-27, 2017: 1st Workshop at Madison

- focused on presentation and discussion of proposed strategic elements

Madison Meeting Statistics

- **Approximately 125 attendees**
 - Included 4 NAS panel members
 - 31 institutions represented from universities, labs, and industries
- **44 plenary talks**
 - 15 institutions represented
- **97 Chits generated through online system**
- **Estimated 475 cookies consumed**

High Level Summary (1)

- Agreement that there are many exciting opportunities for US leadership
- Critical need for a strategic plan/roadmap for fusion research going forward
- The community should lead a on-going strategic planning process and set scientific priorities; This will ensure strong community support for the generated strategic plan

*Slides taken directly from D. Maurer's
Summary Talk of Madison Meeting*

High Level Summary (2)

- The US program has strengths but it is not healthy overall (universities and technology). The trajectory is in the wrong direction in general
- Discussion centered around being a science program vs. energy, but no clear consensus, good issue to discuss going forward

*Slides taken directly from D. Maurer's
Summary Talk of Madison Meeting*

Summary of Strategic Elements (1)

- Burning plasma is still an essential step for our field
- The program should have an element that would focus on developing HTS magnets for fusion applications; Potential game changer.
- Configuration research: A wide variety of comments, more discussion needed going forward
- General interest in and support for stellarator component to US program; Potentially transformative

*Slides taken directly from D. Maurer's
Summary Talk of Madison Meeting*

Summary of Strategic Elements (2)

- Theory/computation important component; Need to balance analytic theory, and computing at various scales (exa/capacity) for effectiveness and validation purposes
- PMI/divertor problems very important, compelling options need to be evaluated
- FNS/TB/blankets are a critical element on the path for fusion energy development; Concerns about timeline and number of steps in path to develop a FNSF

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Summary Talk of Madison Meeting*

Strategic Plan Requires Development of Information at Several Strategic Levels



Strategic Plan Requires Development of Information at Several Strategic Levels

From M. Greenwald's presentation at Madison workshop

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
 - Articulate shared values, principles, metrics – used to help make choices
 - Conduct situation analysis – where are we now? what are the gaps?
 - Identify risks and strategies required to retire or mitigate those risks
 - Develop set of strategic objectives – translate the mission into specific results needed for success
 - Develop a strategic roadmap – a time based plan to meet objectives
 - Include decision points, alternate paths where needed
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- Use the roadmap, risk assessment and values to set priorities
 - Allocate Resources
 - Assess progress and iterate – the plan shouldn't be static

Where our input to the NAS might be most helpful

Program Committee Approach to Development of these Different Levels (1 of 5)

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
- Articulate shared values, principles, metrics – used to help make choices
- Conduct situation analysis – where are we now? what are the gaps?

- Identify...
 - Develop...
 - Develop...
– In...
 - Use...
 - Allo...
 - Ass...
- 1) For purposes of advancing discussion, adapt NAS charge phrasing “national strategic interest in next several decades” for next round of discussions**
 - 2) Establish a working group on market attractiveness of fusion to inform future deliberations on mission**

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Program Committee Approach to Development of these Different Levels (2 of 5)

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
- Articulate shared values, principles, metrics – used to help make choices
- Conduct situation analysis – where are we now? what are the gaps?
- Identify risks and strategies required to reduce or mitigate those risks

Establish working group to develop principles, metrics, and criteria

needed for success

- Use the roadmap, risk assessment and values to set priorities
- Allocate Resources
- Assess progress and iterate – the plan shouldn't be static

Where our input to the NAS might be most helpful

Program Committee Approach to Development of these Different Levels (3 of 5)

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
- Articulate shared values, principles, metrics – used to help make choices
- Conduct situation analysis – where are we now? what are the gaps?
- Identify risks and strategies required to reduce or mitigate those risks
- Develop set of strategic objectives – translate the mission into specific results needed for success

1) Utilize numerous community studies conducted over the last decade

2) Establish working group to assess the impact of US access to ITER

- What gaps are created if US is not a partner
- What additional gaps are closed if ITER performs beyond baseline

where our input to NAS might be most helpful

Program Committee Approach to Development of these Different Levels (4 of 5)

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
- Articulate shared values, principles, metrics – used to help make choices
- Conduct situation analysis – where are we? what are the gaps?
- Identify risks and strategies required to retire or mitigate those risks
- Develop set of strategic objectives – translate the mission into specific results needed for success
- Develop a strategic roadmap – a time-based plan to meet objectives
 - Include decision points, alternate paths where needed

Establish working groups to develop key information on the risk, benefits, and challenges of taking specific strategic approaches to delivering fusion energy within the next several decades

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Program Committee Approach to Development of these Different Levels (5 of 5)

Strategic Planning: Many variants but generally

- Start with vision, mission and goals – what results are we hoping from the plan?
- Articulate shared values, principles, metrics – used to help make choices
- Conduct situation analysis – where are we now? what are the gaps?
- Identify risks and strategies required to retire or mitigate those risks
- Develop set of strategic objectives – translate the vision into specific results needed for success
- Develop a strategic roadmap – a time based plan to meet objectives
 - Include decision points, alternate paths where needed
- Use the roadmap, risk assessment and values to set priorities
- Allocate Resources

Where our input to the NAS might be

Defer this activity to post-Austin working group, which will take the output of the Austin meeting and develop a strategic roadmap that blends the most attractive features of the developed strategic approaches

Established Pre-Austin Working Groups

- **“Principles, Metrics, and Criteria for Assessing Strategic Plan” Working Group (led by I. Joseph, F. Turco, and H. Neilson):**
 - Develop a comprehensive set of principles, metrics, and criteria that are important in developing an exciting and credible strategic plan for delivering fusion energy in the next several decades.
- **“Attributes for Market Attractiveness” Working Group (led by D. Hatch, S. Hsu, M. Tillack):**
 - Develop list of attributes that utilities, energy institutes, environmental agencies, and private investors consider when assessing the potential for fusion for future energy markets.

Established Pre-Austin Working Groups

- **“Impact of Access to ITER” Working Group (led by C. Kessel, T. Munsat, O. Schmitz):**
 - Develop a list of the technical impacts (including scientific, technological, operational, ...) and programmatic effects (e.g., reputation, international cooperation) of the U.S. losing access to ITER under two scenarios:
 - a) the U.S. withdrawing from ITER and ITER continuing; and
 - b) loss of ITER in worldwide program.

This group should also develop a list of programmatic impacts of ITER succeeding in its mission and identify potential technical benefits that would be derived from ITER performing beyond its baseline level of performance.

Established Pre-Austin Working Groups

- **Strategic Approach Working Groups:**
 - Perform a gaps analysis (where necessary), assess risks, and develop a strategic roadmap with appropriately staged objectives, for the strategic approaches listed below.
 - In addition, the WG should discuss and enumerate the benefits, risks, and challenges of adopting this strategic approach as the primary pathway to achieve fusion energy in the next several decades.
 - Each of these WGs will be led by a member of the program committee to ensure timely development of the required information

Established Pre-Austin Working Groups

Strategic Approach Working Groups (2 of 4+):

- a) Proceed now towards DEMO* building on the present physics and technology basis
(led by S. Zinkle (ORNL), W. Solomon (GA), Ebrahimi (PPPL))**

- b) Deliver key technical achievements (e.g., $Q_{\text{plasma}} > 1$, $P_{\text{elec}} > 0$) as soon as possible, then optimize concept and develop technology for DEMO*
(led by G. Navratil (Columbia), C. Collins (GA), N. Howard (MIT))**

*Here, DEMO is not envisioned to be a specific device or concept but rather simply a marker for the U.S. having the capabilities in place to move forward with the practical demonstration of fusion energy. Example DEMO characteristics could include tritium self-sufficiency, net electricity production, and high availability.

Established Pre-Austin Working Groups

Strategic Approach Working Groups (2 of 4+):

- c) Extend the present basis by assessing potential innovations in mainline configurations (e.g. pursue advanced/compact/spherical tokamaks, quasi-symmetric stellarators, etc) and/or technology (e.g. pursue improved magnets, blankets, computing, etc), then proceed to DEMO* (led by D.Gates (PPPL), M. Greenwald (MIT), T. Carter (UCLA))**

- d) Develop several alternate concepts to sufficient states of maturity/performance to enable objective comparisons between alternates and mainline configurations, then down-select and proceed to DEMO* (led by J. Sarff (U. Wisconsin), L. Baylor (ORNL), U. Shumlak (U. Washington))**

- e) ...Potentially more working groups based on community recommendations**

Plan for Austin and Future Efforts

Austin Workshop

- **Presentations from the various working groups on the information they have developed**
- **Breakout discussions (similar to Madison) focused on**
 - Discerning community resonance/dissonance with various aspects of working group output
 - Refining (or at least suggesting refinements of) working group output to seek broad community consensus

Post-Austin

- **Establish a working group to develop a strategic plan(s) utilizing the information developed at the Madison and Austin workshops**
- **Develop working groups (as needed) to define goals, requirements, and potential development paths for specific program elements that are felt to be an important part of the developing strategic plan**
- **Spring workshop to discuss strategic plan → report to NAS**

In Addition, Program Committee Has Received Several Community Recommendations for Working Groups

- **Recommendations generally fall into threecamps:**
 - Mission/Vision
 - Further develop strategic elements proposed/discussed at Madison
 - Additional considerations/options for strategic approaches

Proposer	Working Group Recommendation
Daniel Andruczyk	Liquid Metals Technologies
Richard Moyer	Mission Statement for OFES Sponsored Research
Charles Greenfield	"Mission and Vision"
Hantao Ji and Troy Carter	Integrated Community Participation
Amanda Hubbard	Strategic elements
Martin Greenwald	Develop Strategic Elements
Amitava Bhattacharjee	Integrated Whole Device Model for Magnetic Confinement
Dick Majeski	Fast track options for fusion power on the grid
Ross Radel	Fusion Materials Radiation Damage

QUESTIONS?

Interested in participating?

- General information: <http://usmfrsd.org>
- Want to join a working group: <https://goo.gl/zb4TWW>
- Have ideas for additional working groups: <https://goo.gl/zkFv39>

Strategic Plan vs. Strategic Approach

Strategic Plan: Comprehensive framework that defines

- The mission – what is to be accomplished
- A vision for how the mission will be accomplished with acceptable risk
- Principles for making decisions along the way
- A roadmap that outlines how the plan will unfold.

To mitigate risk to the extent possible, strategic plans typically blend various approaches (see below) to achieving the mission into the roadmap leading to multiple potential branches in the roadmap. The pathway through the roadmap is determined by key decision points defining initiation/continuation/termination points for the various branches.

Strategic Approach: One of many potential singular paths in which the mission of a strategic plan could be accomplished. Approaches are typically differentiated through assumptions with regard to the current situation, risk uncertainties, risk tolerance, time frame, and competitor positioning.

Example

Situation & Mission

Current Situation:

- April 2
- 5000 troops in Kansas

Mission:

- By September 30, need to get minimum of 1000 troops to Sacramento

Desired:

- Safety of all troops
- All 5000 troops in Sacramento by October 30



Strategic Plan Development

What is most risk-acceptable plan to ensure 1000 troops arrive in Sacramento by September 30???

- 1 team of 5000 on one route
- Teams of 3000/2000 on separate routes
- Teams of 1000 on five routes
- None of the above

To arrive at the answer to the question above, need to establish:

- Principles for decision making
 - What will be valued!!
- Risk/reward/other considerations for specific approaches of how to get those troops there on time

Once these questions are answered, can go about developing the plan offers the best risk/reward by blending the various approaches appropriately



Strategic Approach Considerations:

What are the benefits of the approach?

What are the known challenges?

What uncertainties introduce risk to mission?

What's the probability of success?

What is the expected time frame for completion?

What's the roadmap for getting there on time?

