

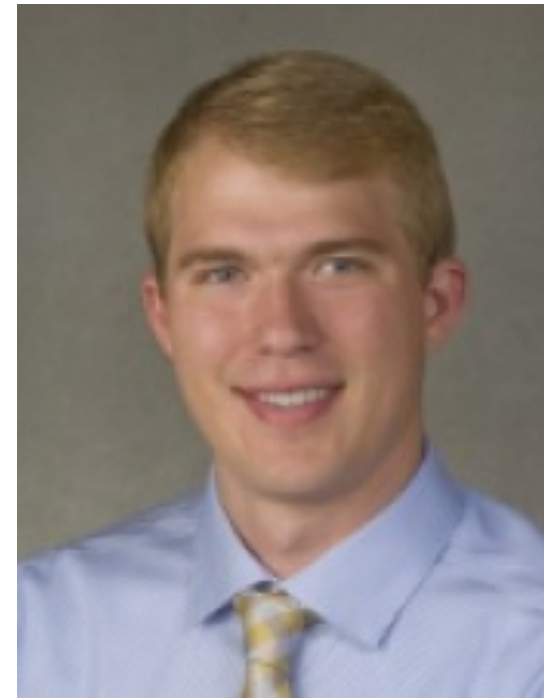
# FESAC Long Range Planning Subcommittee

Troy Carter

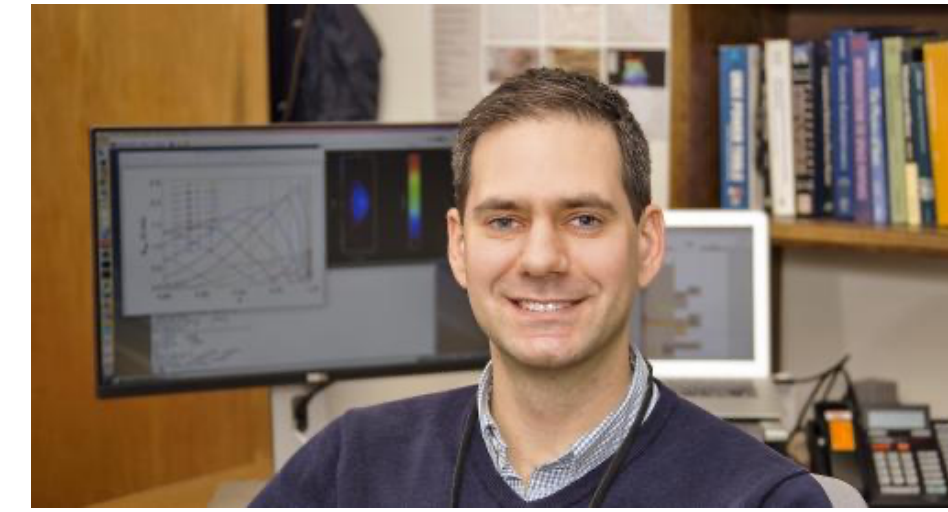
# Thank you to CPP Co-Chairs, PC Members, and the entire Community

## A Community Plan for Fusion Energy and Discovery Plasma Sciences

Report of the 2019–2020 American Physical Society Division of  
Plasma Physics Community Planning Process



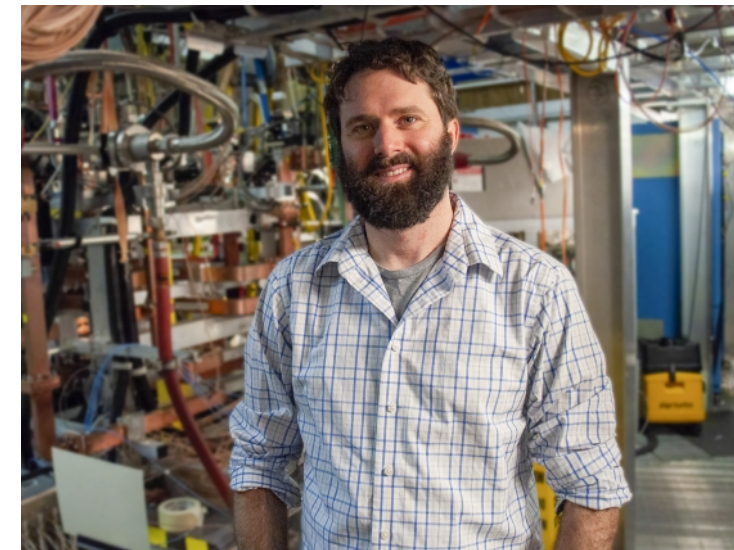
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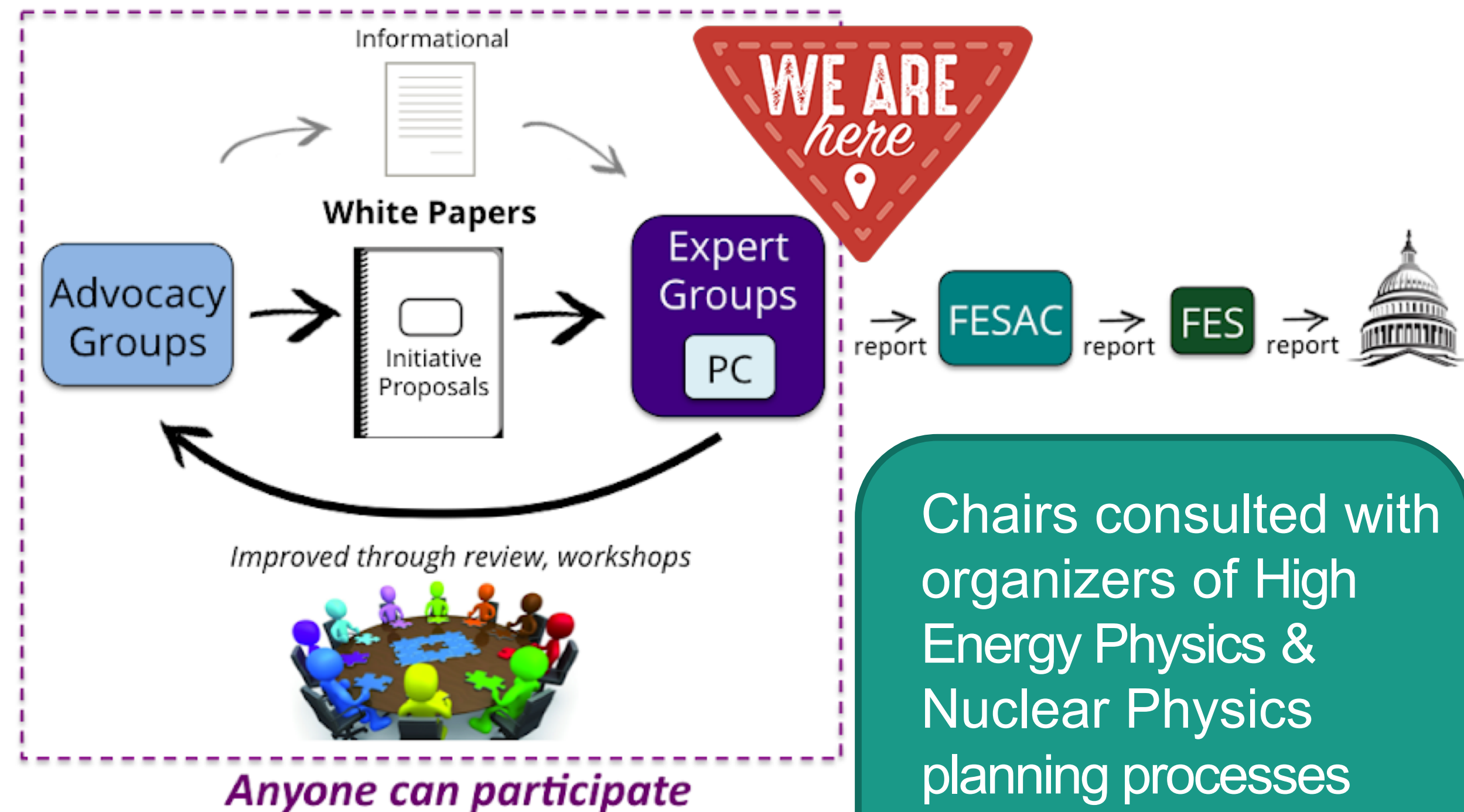
# DPP CPP was a tremendous success; community came together and made significant progress toward consensus prioritization/strategic plan



W.M. Solomon / CPP Houston opening / January 13, 2020

## Outline of the process

- Advocates in the community assembled Initiatives
- Expert Groups evaluated Initiatives
- Advocates updated Initiatives
- Expert Groups developed Strategic Blocks utilizing updated Initiatives
- Program Committee assembled draft strategic plan



# Reminder of why we are here

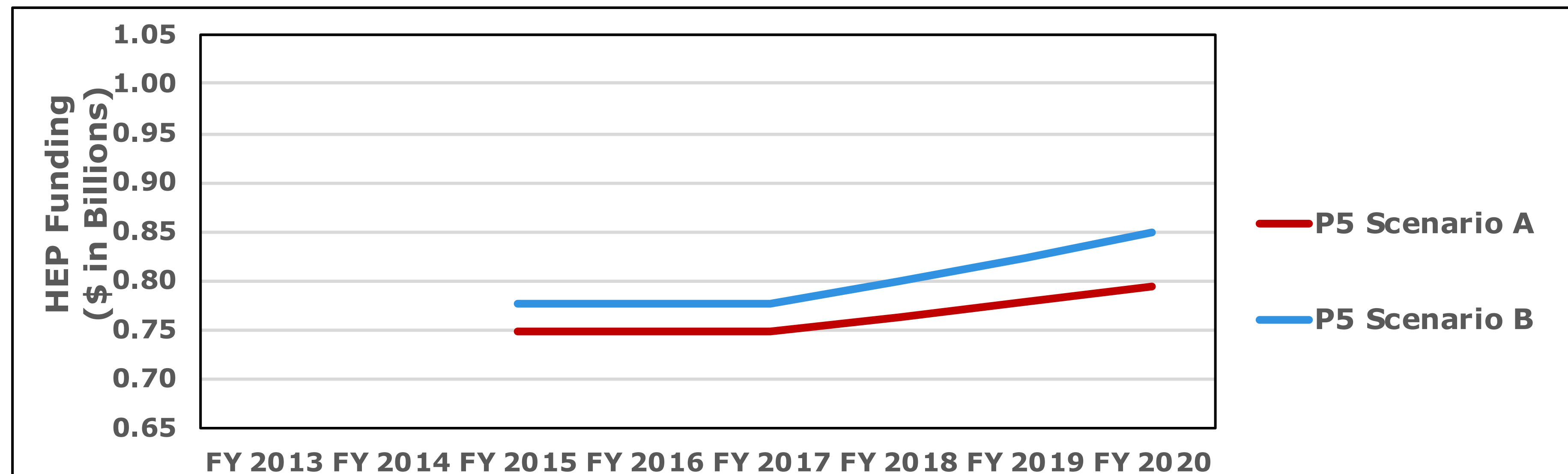
- This is the first time in a very long time that such a strategic planning process has been undertaken for the fusion research community and the first time ever that the whole portfolio has been considered, including broader plasma science
- Last “Snowmass” meeting in 2002, much more focused activity (pick between ITER, FIRE, Ignitor)
- Last SP activity was the 2014 FESAC Subcommittee process. This was focused on fusion research much more constrained, limited opportunities for community input
- Before this process, we had no plan, makes it extremely difficult for community and congress to respond to hardship and opportunity
- The community was told directly by congressional staffers that the fusion community was viewed as fractured and in-fighting. Want to see that we can work together to produce a plan before continue support current levels of funding & potential increases

High energy physics was in the same boat in 2014. The success of their P5 (“Particle Physics Projects Prioritization Panel”) saved the day (and their process was copied from Nuclear Physics who has done it for ages)



## High energy physics had budget constrained scenarios

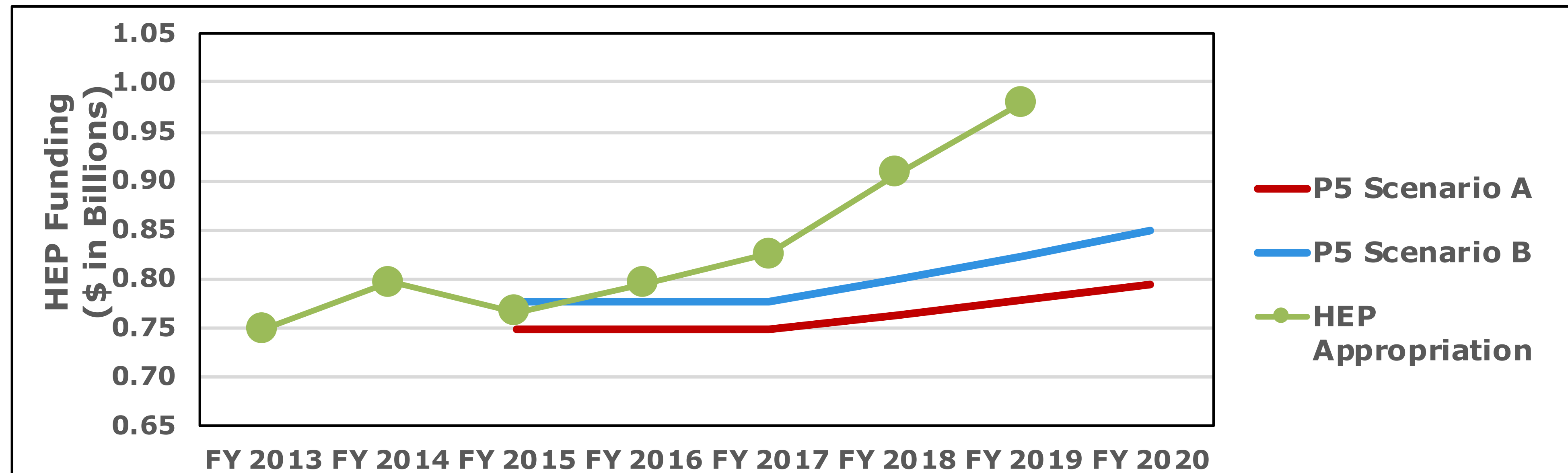
- High energy physics advisory panel (HEPAP) scenarios qualitatively similar to FESAC
  - Scenario A was the lowest constrained budget scenario (~2%)
  - Scenario B was a slightly higher constrained budget (~3%)
  - Scenario C was unconstrained, but prioritized list of specific activities





# Consensus has paid off in high energy physics (P5)

- FY 2019 Senate Energy and Water Development Appropriations Report:
  - “The Committee recommends \$1,010,000,000 for High Energy Physics. The Committee strongly supports the Department’s efforts to advance the recommendations of the Particle Physics Project Prioritization Panel Report [P5], which established clear priorities for the domestic particle physics program...”



# Reminder of why we are here

- DOE Leadership & Congress want the Fusion Energy & Plasma Science research community to develop a strategic plan for DOE FES based on consensus prioritization
- Charge covers all of the FES portfolio: “...should identify and prioritize the research required to advance both the scientific foundation needed to develop a fusion energy source, as well as the broader FES mission to steward plasma science.”
- Two part process, modeled after the P5 (Particle Physics Projects Prioritization Panel): Community led (APS DPP) Phase 1 (the DPP Community Planning Process or CPP) and Phase 2 led by FESAC to turn the Phase 1 output into official advice to DOE

# We've set the bar higher than P5

- Similar two-stage approach; Phase 1 community led, Phase 2 led by P5/HEPAP
- However, our Phase 1 was more extensive than theirs: they had a Snowmass activity in Phase 1, but Phase 2 (P5) ran several community workshops like our Madison, College Park, Knoxville, Menlo Park
- Our CPP process led a consensus, community vetted/reviewed process through the end of several community workshops, much further than in the HEP community.
- The next P5 process (starting now) acknowledges the need for more peer review in the community/APS-led phase



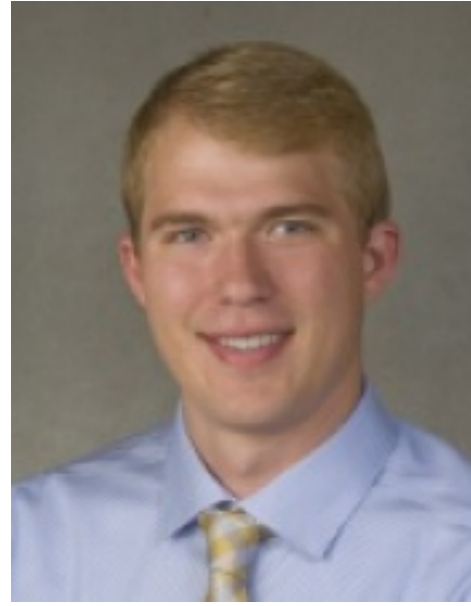
# We're now starting Phase 2

- The CPP report will represent official community input to Phase 2
- FESAC Long Range Planning Subcommittee will use this input to answer the FESAC charge on long range planning for DOE FES
- The subcommittee will deliver its report to FESAC, who has ultimate authority for approving and transmitting it as official advice to DOE

# FESAC Charge Language

- Identify specific research areas, in which the U.S. should establish or enhance global leadership
- Maintain a healthy and flexible program, which incorporates the roles and contributions of universities, national laboratories, and industry, to deliver science results through next decade
- Maintain, upgrade, and/or pivot current small-, mid-, and large-scale facilities, including DIII-D and NSTX-U, and also initiate new experiments/facilities/projects
- Identify international collaborations and partnerships giving U.S. scientists access to devices with unique capabilities
  - Provide support for private-public partnership ventures
  - Position U.S. to obtain maximum benefits in ITER burning plasma science era
- Considering budgetary constraints, technical readiness and feasibility for any activity to proceed. Using FY 2019 enacted budgets, assume:
  - Constant level of effort(defined as the published OMB inflators for FY 2022-2031)
  - Modest growth (use 2% above the published OMB inflators)
  - Unconstrained budget

# FESAC Long Range Planning Subcommittee



Prof. Scott Baalrud



Prof. Riccardo Betti



Prof. Troy Carter



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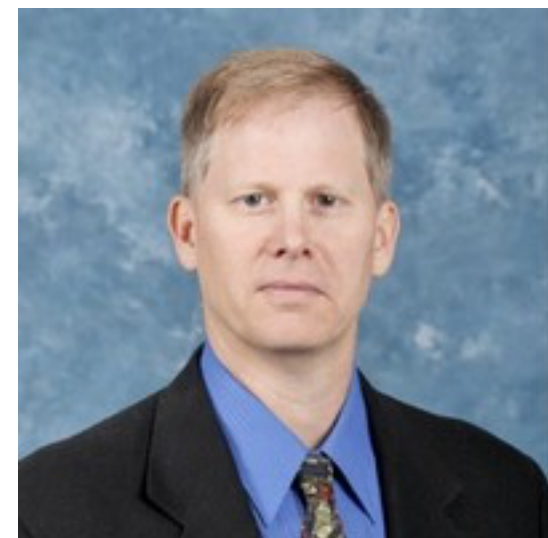
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Prof. Anne White



Dr. Don Rej (ex officio)

# FESAC Long Range Planning Subcommittee



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Prof. Riccardo Betti



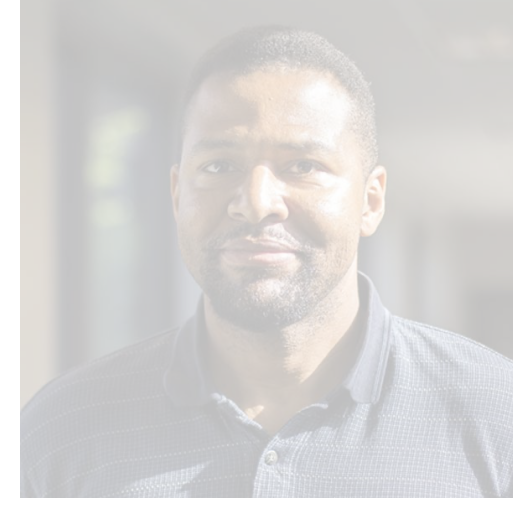
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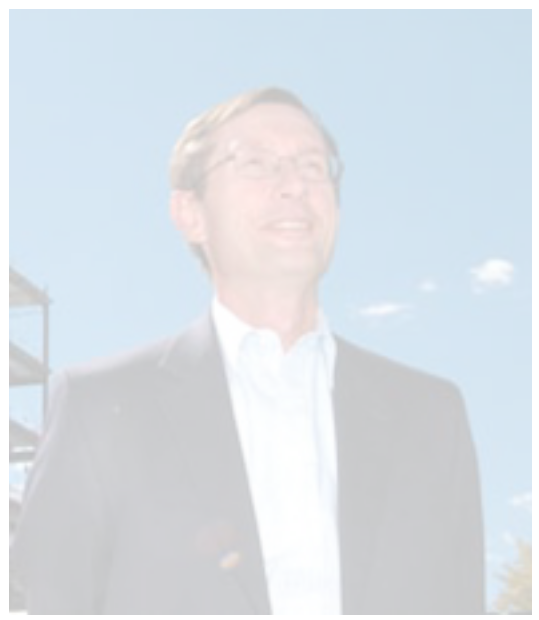
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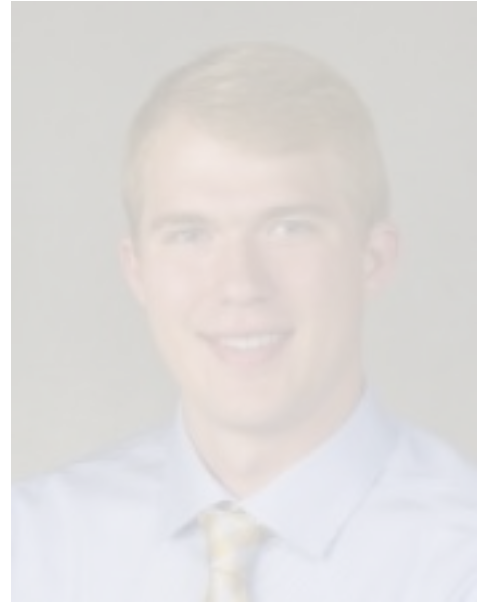
Prof. Anne White



Dr. Don Rej (ex officio)

## CPP Co-Chairs & PC members

# FESAC Long Range Planning Subcommittee



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Prof. Riccardo Betti



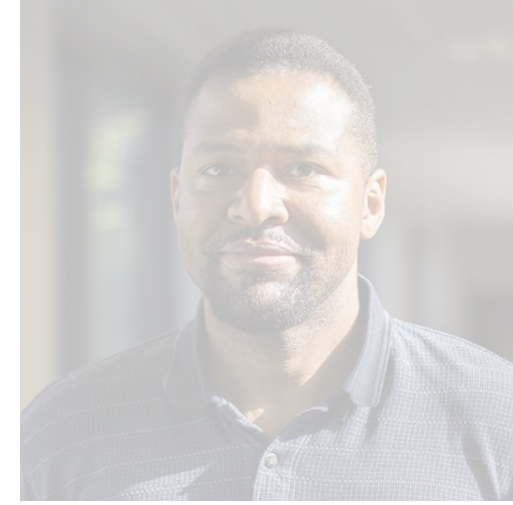
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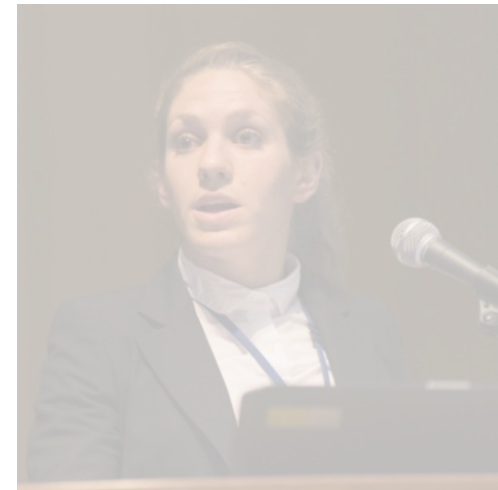
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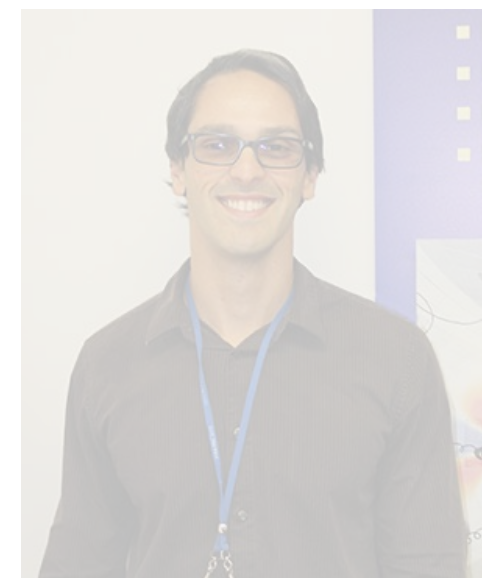
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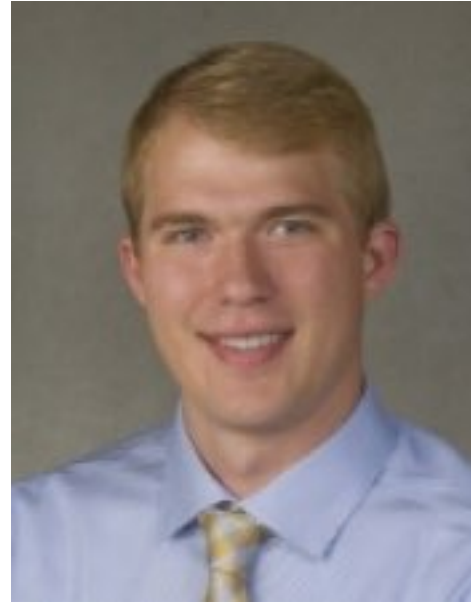
Prof. Anne White



Dr. Don Rej (ex officio)

## High Energy Density Physics

# FESAC Long Range Planning Subcommittee



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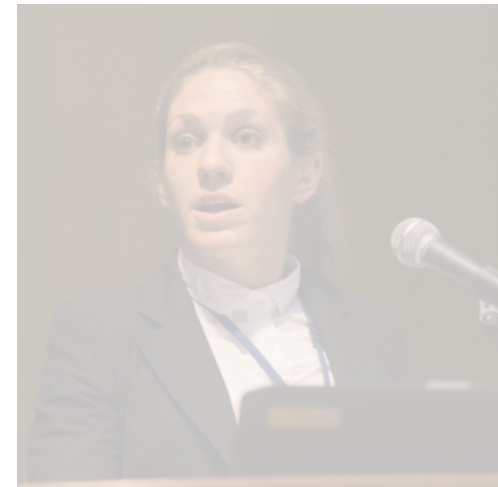
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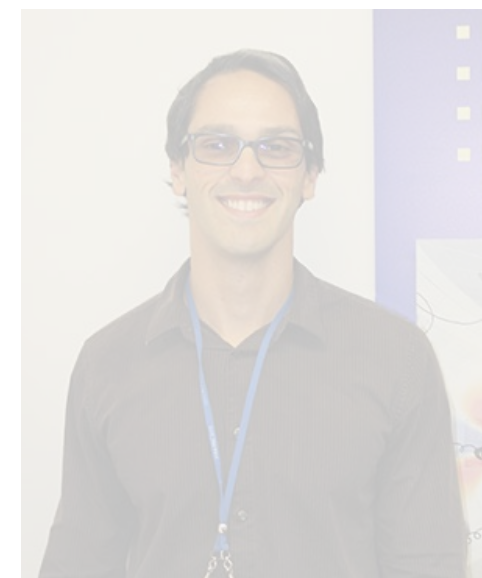
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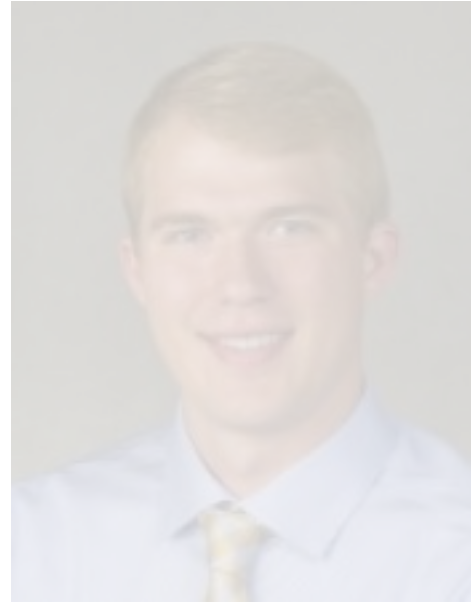
Prof. Anne White



Dr. Don Rej (ex officio)

## General Plasma Science

# FESAC Long Range Planning Subcommittee



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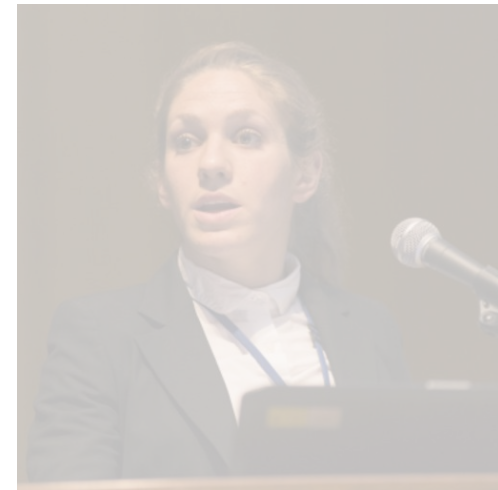
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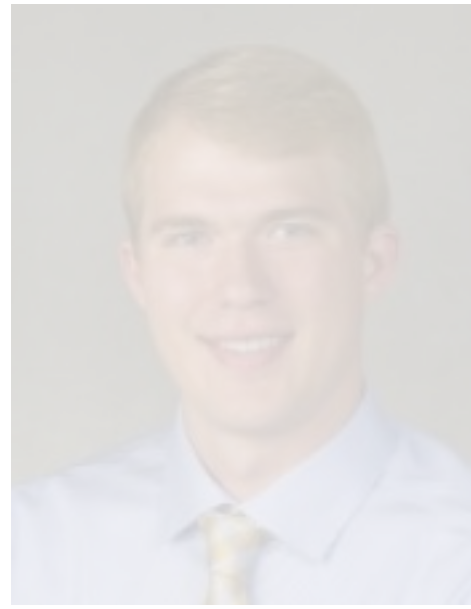
Prof. Anne White



Dr. Don Rej (ex officio)

Magnetic Fusion Energy

# FESAC Long Range Planning Subcommittee



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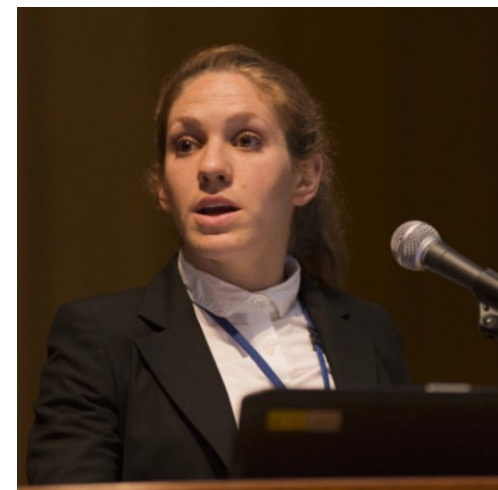
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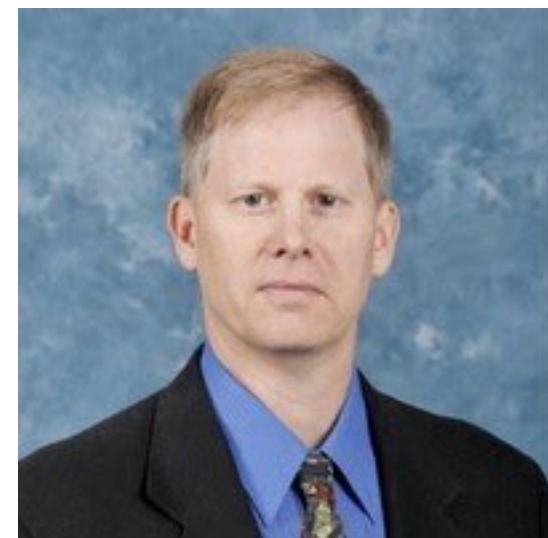
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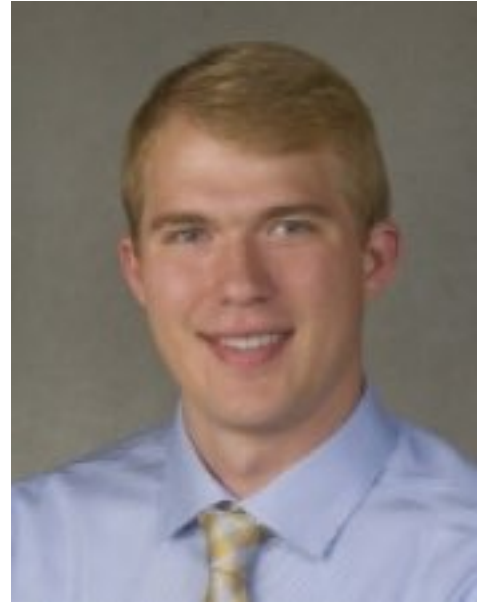


Dr. Don Rej (ex officio)

**Fusion Materials and Technology**



# FESAC Long Range Planning Subcommittee



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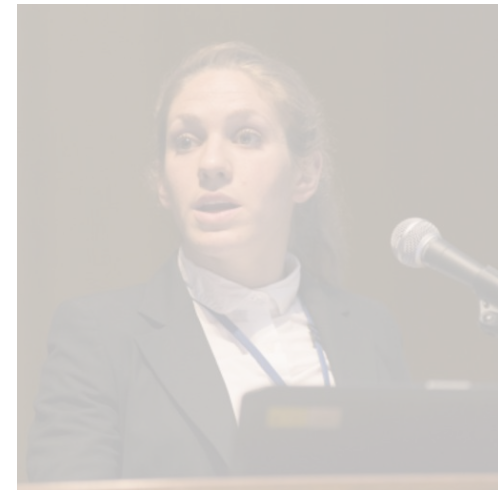
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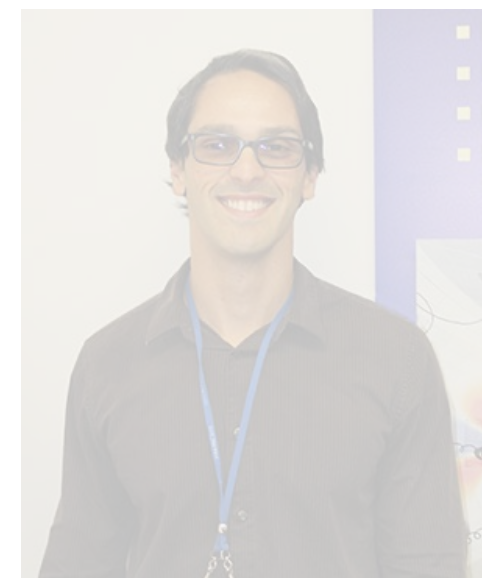
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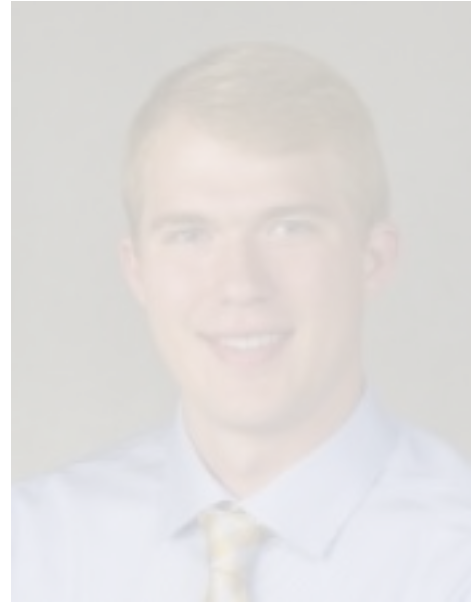
Prof. Anne White



Dr. Don Rej (ex officio)

Discovery Plasma Science Leaders

# FESAC Long Range Planning Subcommittee



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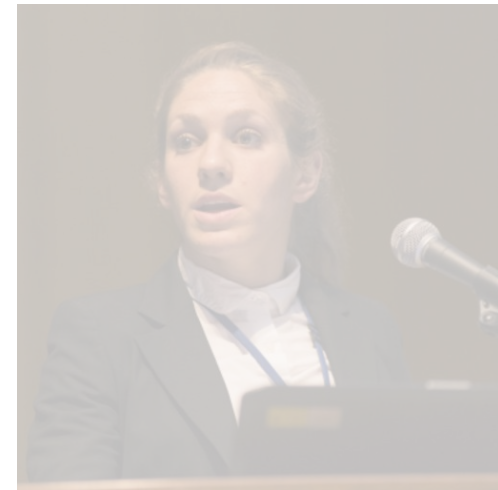
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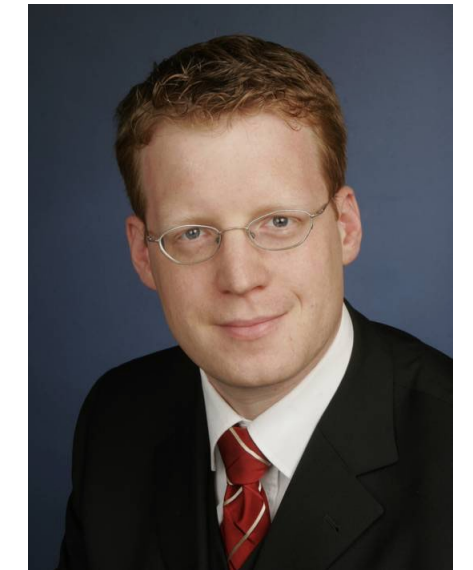
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Dr. Francois Waelbroeck



Prof. Anne White



Dr. Don Rej (ex officio)

Fusion Science and Technology Leaders

# FESAC Subcommittee on Long-Range Planning

| Name                     | Institution                            | Scientific Discipline    |                        |                        |                                 |                             | Geographic Location |       |         |      | Type of Institution |          |              | Gender |        |
|--------------------------|--|--------------------------|------------------------|------------------------|---------------------------------|-----------------------------|---------------------|-------|---------|------|---------------------|----------|--------------|--------|--------|
|                          |  | Discovery Plasma Science | Magnetic Fusion Energy | Theory and Computation | Fusion Materials and Technology | High Energy Density Plasmas | Northeast           | South | Midwest | West | University          | Industry | National Lab | Male   | Female |
| Baalrud, Scott           | University of Iowa                     | X                        |                        |                        |                                 |                             |                     | X     |         | X    |                     |          | X            |        |        |
| Betti, Riccardo          | University of Rochester                |                          |                        |                        |                                 | X                           | X                   |       |         | X    |                     |          | X            |        |        |
| Carter, Troy (Chair)     | University of California, Los Angeles  | X                        |                        |                        |                                 |                             |                     |       | X       | X    |                     |          | X            |        |        |
| Cary, John               | Tech-X Corporation                     |                          |                        | X                      |                                 |                             |                     |       | X       |      | X                   |          | X            |        |        |
| Ellis, Tyler             | Commonwealth Fusion Systems            |                          | X                      |                        |                                 |                             | X                   |       |         |      | X                   |          | X            |        |        |
| Foster, John             | University of Michigan                 | X                        |                        |                        |                                 |                             |                     | X     |         | X    |                     |          | X            |        |        |
| Geddes, Cameron          | Lawrence Berkeley National Laboratory  |                          |                        |                        |                                 | X                           |                     |       | X       |      |                     | X        | X            |        |        |
| Gleason, Arianna         | SLAC National Accelerator Laboratory   |                          |                        |                        |                                 | X                           |                     |       | X       |      |                     | X        |              | X      |        |
| Holland, Chris           | University of California, San Diego    |                          |                        | X                      |                                 |                             |                     |       | X       | X    |                     |          | X            |        |        |
| Humrickhouse, Paul       | Idaho National Laboratory              |                          |                        |                        | X                               |                             |                     |       | X       |      |                     | X        | X            |        |        |
| Kessel, Chuck            | Oak Ridge National Laboratory          |                          |                        |                        | X                               |                             |                     | X     |         |      |                     | X        | X            |        |        |
| Lasa, Ane                | University of Tennessee                |                          |                        |                        | X                               |                             |                     | X     |         | X    |                     |          |              | X      |        |
| Ma, Tammy                | Lawrence Livermore National Laboratory |                          |                        |                        |                                 | X                           |                     |       | X       |      |                     | X        |              | X      |        |
| Maingi, Rajesh           | Princeton Plasma Physics Laboratory    |                          | X                      |                        |                                 |                             | X                   |       |         |      |                     | X        | X            |        |        |
| Schaffner, David         | Bryn Mawr College                      | X                        |                        |                        |                                 |                             | X                   |       |         | X    |                     |          | X            |        |        |
| Schmitz, Oliver          | University of Wisconsin                |                          | X                      |                        |                                 |                             |                     | X     |         | X    |                     |          | X            |        |        |
| Shumlak, Uri             | University of Washington               |                          | X                      |                        |                                 |                             |                     |       | X       | X    |                     |          | X            |        |        |
| Snead, Lance             | Stony Brook University                 |                          |                        |                        | X                               |                             | X                   |       |         | X    |                     |          | X            |        |        |
| Solomon, Wayne           | General Atomics                        |                          | X                      |                        |                                 |                             |                     |       | X       |      | X                   |          | X            |        |        |
| Trask, Erik              | TAE Technologies, Inc.                 |                          | X                      |                        |                                 |                             |                     |       | X       |      | X                   |          | X            |        |        |
| Waelbroeck, Francois     | University of Texas at Austin          |                          |                        | X                      |                                 |                             |                     | X     |         | X    |                     |          | X            |        |        |
| White, Anne              | Massachusetts Institute of Technology  |                          | X                      |                        |                                 |                             | X                   |       |         | X    |                     |          |              | X      |        |
| Rej, Donald (ex officio) | Los Alamos National Laboratory         |                          | X                      |                        |                                 |                             |                     |       | X       |      |                     | X        | X            |        |        |

# Others who are critical to the committee's work

- Laurie Moret played a key role in enabling the success of the CPP process as a strategic planning consultant; I'm very glad to have her continue in an advisory role for this subcommittee
- Sam Barish will be our FES Liaison for this process and will participate in subcommittee meetings
- We're very lucky to have two of the CPP Co-Chairs continuing work with this subcommittee. The five others from the "Magnificent 7" will participate in discussions during the Phase 1-Phase 2 transition: Nathan Ferraro, Lauren Garrison, Nathan Howard, Carolyn Kuranz, John Sarff.
- **We will also have access to folks with project & management expertise to help us be realistic about cost and schedule**

# Committee work so far and plans

- Subcommittee has already had several Zoom calls (Feb 21, Feb 28, Mar 5, Mar 12) discussing the framework for our process as we awaited the final CPP report
- Subcommittee will have a day-long Zoom call tomorrow. Agenda: Q&A with CPP Co-Chairs, Presentation on NAS BP report from Mike Mael, Work in Breakout groups (DPS & FST)
- Planning to invite presentations on other NAS reports (Decadal, Brightest Light), PPP, Projects, etc...
- Weekly Zoom meetings will continue; in person meetings as they are allowed (hoping in June?)
- Hoping to finish report in time for NAS-style peer review, delivery in Dec

# Will respect the consensus CPP report, continue to interact with community

- Aiming for a concise, compelling, “punchy” report from this subcommittee, pointing to the CPP report for details
- Plan to continue to invite input; focus of early work will be to identify needs for information gathering
- Anticipate opportunities for entire community to provide input, additionally will have targeted solicitation for input (e.g. to assist in gathering information on cost and schedule for particular initiatives)
- Would like to try to utilize the CPP website infrastructure and existing expert group structure in this process

# Thank you!

- **Most important output from this process is a compelling plan that has broad consensus from the community. We need to speak with one voice in advocating for the future of fusion energy and plasma sciences research**
- Achieving this is my primary goal in leading this subcommittee, but I can't do it without all of you. Please continue to engage in this process and be prepared for further requests for input to help us complete this extremely important task