

**NSTX Upgrade Program Advisory Committee Meeting – PAC-31**  
**April 17-19, 2012**  
**Lyman Spitzer Building - B318**

**Charge questions:**

1. Are the planned NSTX-U team science activities appropriate during the Upgrade outage?
  - a. Comment on progress toward research milestones
  - b. Comment on the NSTX-U team plans and preparations for collaboration with other facilities to prepare for NSTX-U operation and contribute to fusion science generally.
  
2. Are the plans, preparation, and progress for the next 5 year plan strongly supportive of the NSTX-U and FES missions? (refer to the information below for mission elements).  
Consider two time periods:
  - a. Initial operation of NSTX-U, i.e. the first 1-2 run years
  - b. Longer term, i.e. years 3-5 of NSTX-U operation = later stages of 5 year plan

---

For reference, the NSTX-U research program mission elements are to:

- a. Advance the spherical tokamak (ST) as a candidate for a Fusion Nuclear Science Facility (FNSF)
- b. Develop solutions for the plasma-material interface, including the snowflake divertor and lithium / liquid metal plasma facing components (PFCs)
- c. Advance toroidal confinement physics predictive capability for ITER and beyond
- d. Develop the ST for fusion energy production, for example in an ST Pilot Plant

The FES vision for where the U.S. fusion program should be in 2021 is outlined below (from E.J. Synakowski - Associate Director, Office of Science for FES – APS-DPP November 14-18, 2011)

- **ITER Research** - The U.S. has a strong research team hitting the ground on a completed ITER project in Cadarache. This team is capable of asserting world leadership in burning plasma science
  
- **Fusion materials science** - The U.S. has made strides in fusion materials science and passed critical metrics in tokamak and ST operations with national research teams. It has assessed technical risks associated with moderate vs small aspect ratio and scope of mission, and is prepared to move beyond conceptual design of a fusion nuclear science facility

- ***Extend the reach of plasma control science and plasma-wall interactions*** - U.S. fusion research has successfully levered new international research opportunities, including program leadership, in long pulse plasma control science and 3-D physics. Opportunities also include the plasma-wall interaction science made possible with long pulses.
- ***Validated predictive capability*** - The U.S. is a world leader in integrated computation, validated by experiments at universities and labs. Such computation should be transformational, as it must reduce the risks associated with fusion development steps
- ***IFE science*** - FES has a leadership role in establishing the scientific basis of IFE through HEDLP and synergy with MFE in materials science
- ***Plasma science for discovery*** - The U.S. is the world leader in plasma science for discovery. Leverage has been successfully applied across agencies in Discovery Science with NNSA and NSF, and overseas