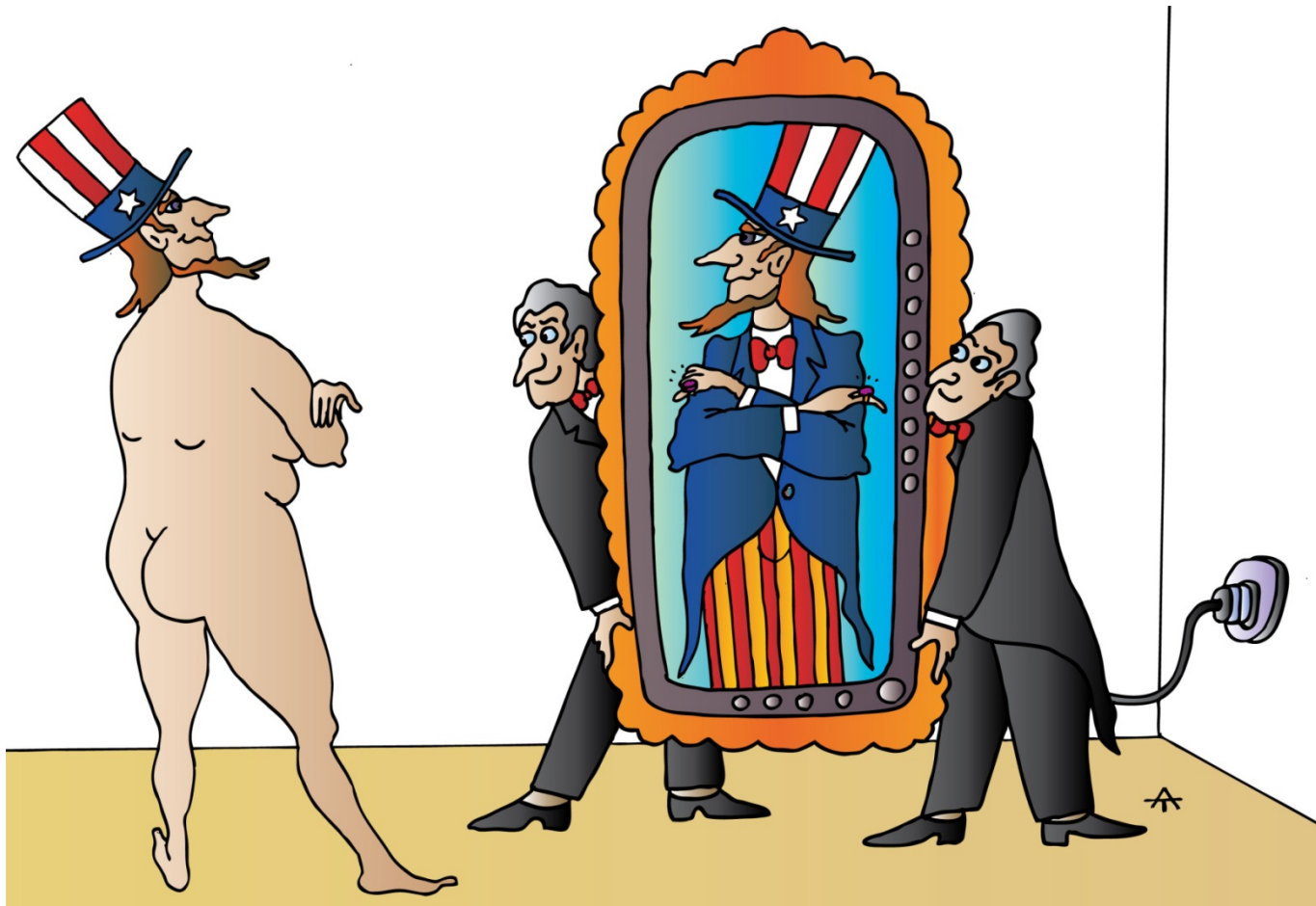


Input to Priorities Panel
August 7, 2012

Jeff Freidberg
MIT

The Emperor of Fusion has no Clothes



Four Points

- ITER
- US Fusion program
- PPPL
- Management of US Fusion program

ITER

- At \$5B ITER = Good idea
- At \$25B ITER = Bad idea
- Why? Two reasons



ITER is sucking the life out of the base program

Cost is way too High



- Almost proves that tokamak fusion is uneconomical
- Comparison (1 GW overnight cost)
 - Coal \$ 3B
 - Gas \$ 1B
 - Nuclear \$ 4B
 - Wind \$ 2B
 - Solar-T \$ 3B
 - ITER \$25B

Why is the cost so high?

- World's most inefficient management structure
- Technological over-reach
 - R&D in real time
 - Drawn out schedule

Recommendation

- Provide convincing evidence that future costs will be much lower
- If the US continues with ITER
 - Pay your bills in full on time
 - Not at the expense of the base program
- If you can't do this, pull out of ITER

The US Fusion Program

- Fusion Energy – science/engineering + economics
- Tokamaks and stellarators (high B)
 - Good science/engineering
 - Tough economics (large magnets)
- Other alternates (low B)
 - Better economics (smaller magnets)
 - Tough science
 - I doubt that physics can be beat
 - Still important – basic science, education
- Everybody has materials problems



My Assessment

- We are losing our leadership
- We need a next generation experiment
- Probably a tokamak
- D-T mission probably too expensive
- Steady state may be best mission
- Sending our scientists to Asia doesn't cut it

Recommendation

- PPPL, GA, MIT, community design an **AFFORDABLE** experiment
- \$2B - \$4B too expensive
- If a good design and mission – pool resources and build it
- Invest in materials research
- Invest in magnet research

PPPL

- Our National Lab for fusion
- Needs a strong program
- Needs to be in a position of leadership
- My concern:
 - Current direction (ST) is not a good option
 - Tough MHD, heating, current drive, transport
 - I doubt it will achieve its mission
- Still, there are strong ST advocates

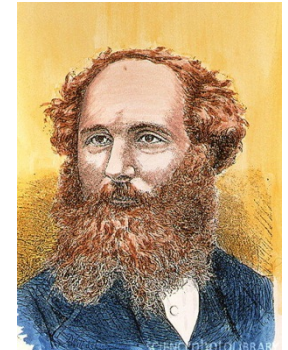
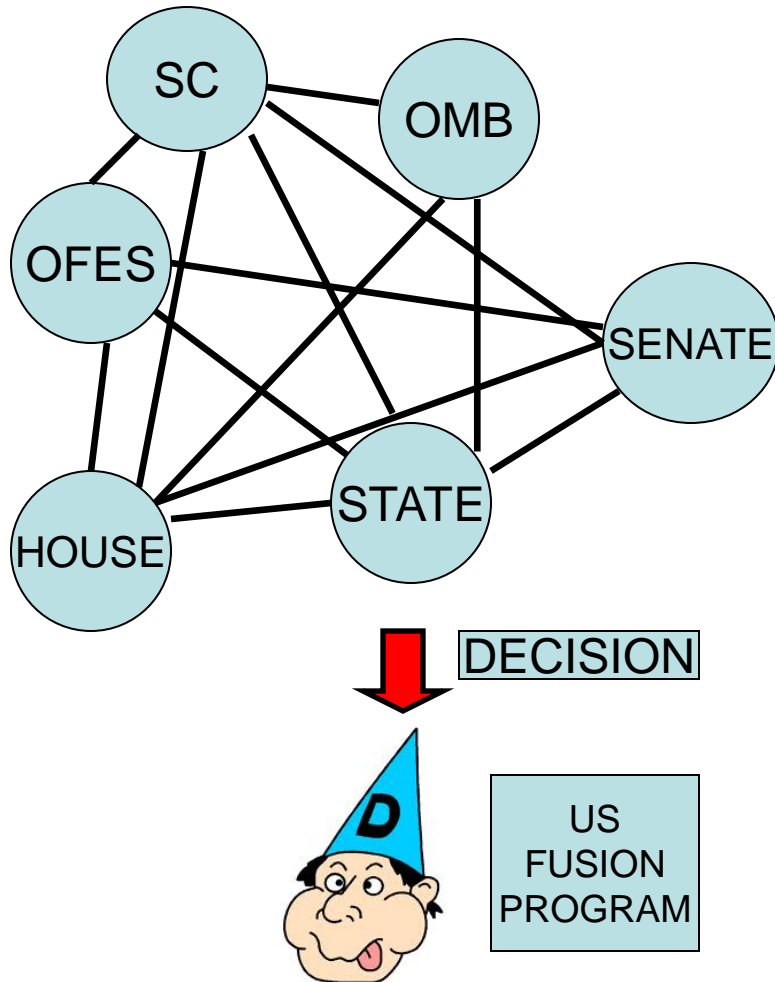
Recommendation

- NSTX-U and NCSX both on the table
- DoE may have a problem – get over it!
- Fusion scientists review dual PPPL proposals
- Let the best concept win

Gunfight at the
PPPL corral



Current decision making process



Recommendation

- Inform DoE that
 - Their decision making process is unacceptable
 - Directions and priorities should be set by the fusion science community