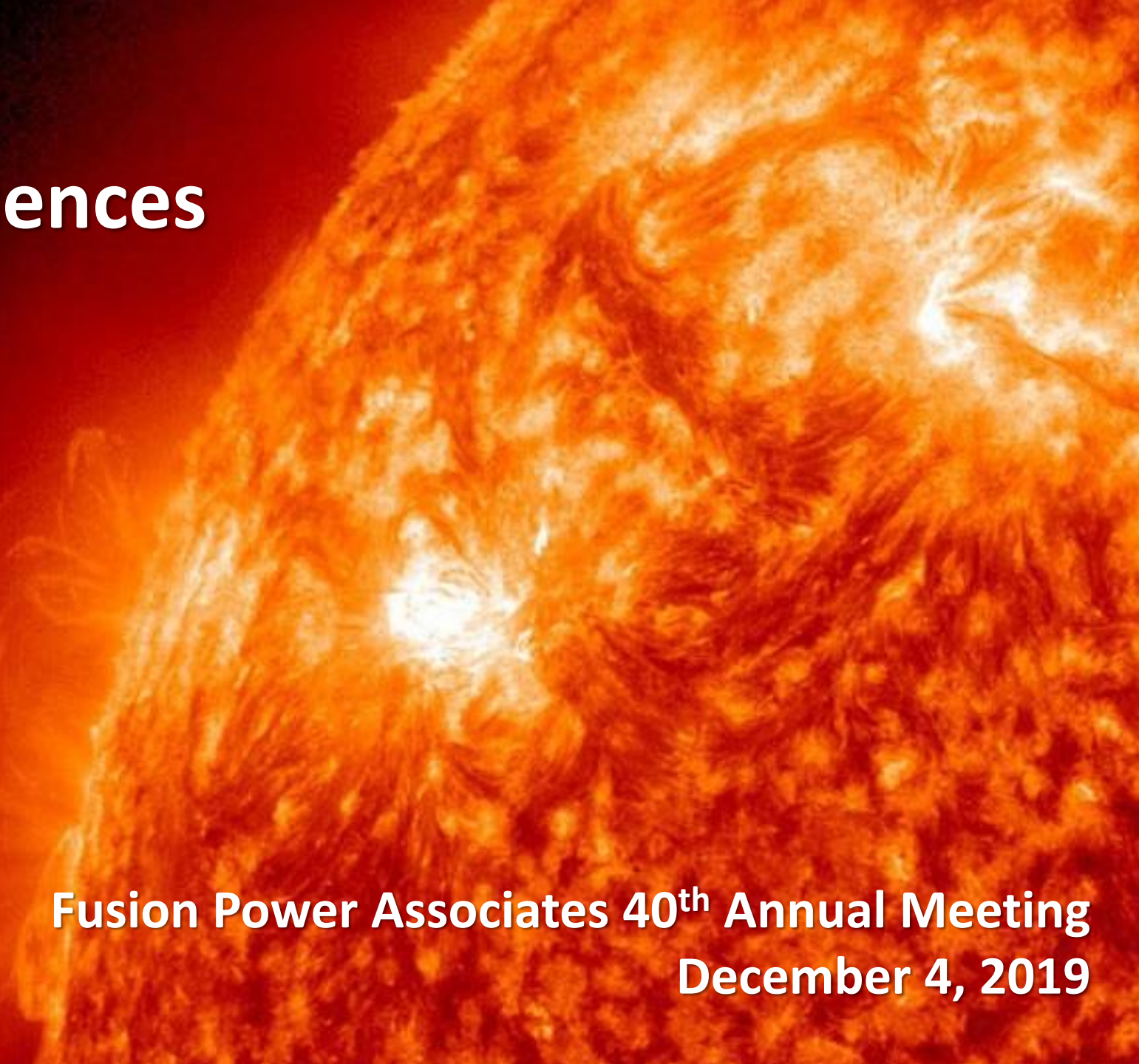
Fusion Energy Sciences Perspective

James W. Van Dam
Associate Director
Office of Science
Fusion Energy Sciences

U.S. DEPARTMENT OF ENERGY
Office of Science



Fusion Power Associates 40th Annual Meeting
December 4, 2019

1. Budget Updates

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The FY 2019 FES budget enabled a number of accomplishments

- **U.S. Contributions to ITER project**: Completed testing of the first superconducting central solenoid magnet module. Cash contributions were made in FY 2019 and recently in FY 2020..
- **DIII-D:** Successfully completed 12 run weeks in FY 2019. The world's first toroidally steerable, off-axis neutral beam injector was installed on schedule and successfully operated. In FY 2020, DIII-D research is utilizing the new neutral beam and other heating/current drive systems to investigate steady-state plasma scenarios.
- **NSTX-U Recovery Project**: Successfully achieved SC approval of its baseline cost and schedule, and authorization of long-lead procurements.
- **Materials Plasma Exposure eXperiment (MPEX) MIE project**: Completed conceptual design. The project plans to complete preliminary design in FY 2020. Critical Decision-1 integrated project review was held Oct 16-18.
- **Matter in Extreme Conditions (MEC) Petawatt Upgrade**: Achieved approval of its Mission Need (CD-0).
- **Quantum Information Science (QIS):** FES made awards in connection with its first-ever solicitation in QIS.
- **international Collaborations:** The portfolio was re-competed in FY 2019; ten multi-institutional awards were made for collaborative research on long and short pulse tokamak facilities in Asia and the EU. Also, U.S. scientists are designing and building a high-speed pellet fueling system for the W7-X stellarator.
- **Innovation Network for Fusion Energy** (**INFUSE**): FES established this to support private-public partnerships. The initial awards were selected in September.
- **Machine Learning:** FES held a workshop, jointly with ASCR, to identify priority research opportunities in AI/ML.

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Highlights from the House and Senate marks for the FY 2020 budget

- **From the House Energy and Water Development mark [May 2019]**
  - The Committee recommends **$688,000,000** for Fusion Energy Sciences
  - Within available funds, the recommendation provides **$20,000,000** for High Energy Density Laboratory Plasmas, including activities for LaserNetUS
  - Within available funds, the recommendation includes **$4,000,000** for a Fusion Public-Private Partnership Program
  - The recommendation includes **$21,000,000** for MPEX
  - The Committee recommends **$230,000,000** for the U.S. contribution to the ITER project
- **From the Senate Energy and Water Development mark [September 2019]**
  - The Committee recommends **$570,000,000** for Fusion Energy Sciences
  - The Committee recommends **$180,000,000** for the domestic, in-kind contributions and related support activities of the ITER project
  - Encourages supporting optimal facility operations levels for DIII-D
  - Recommends **$30,000,000** for the Material Plasma Exposure eXperiment
  - Supports the Matter in Extreme Conditions Petawatt Upgrade project and recommends **$14,400,000** in construction funding and **$1,400,000** in other project costs funding.
  - The Committee recommends **$20,000,000** for LaserNetUS
  - Provides up to **$20,000,000** over the budget request for the continuation of the INFUSE program
  - Directs the Department to create a Fusion **Public-Private Partnership Cost Share Program** that advances multiple fusion advanced reactor technologies and recommends up to **$20,000,000** for this new program
- **FY 2020 has begun with two Continuing Resolutions, the second to December 20, 2019.**

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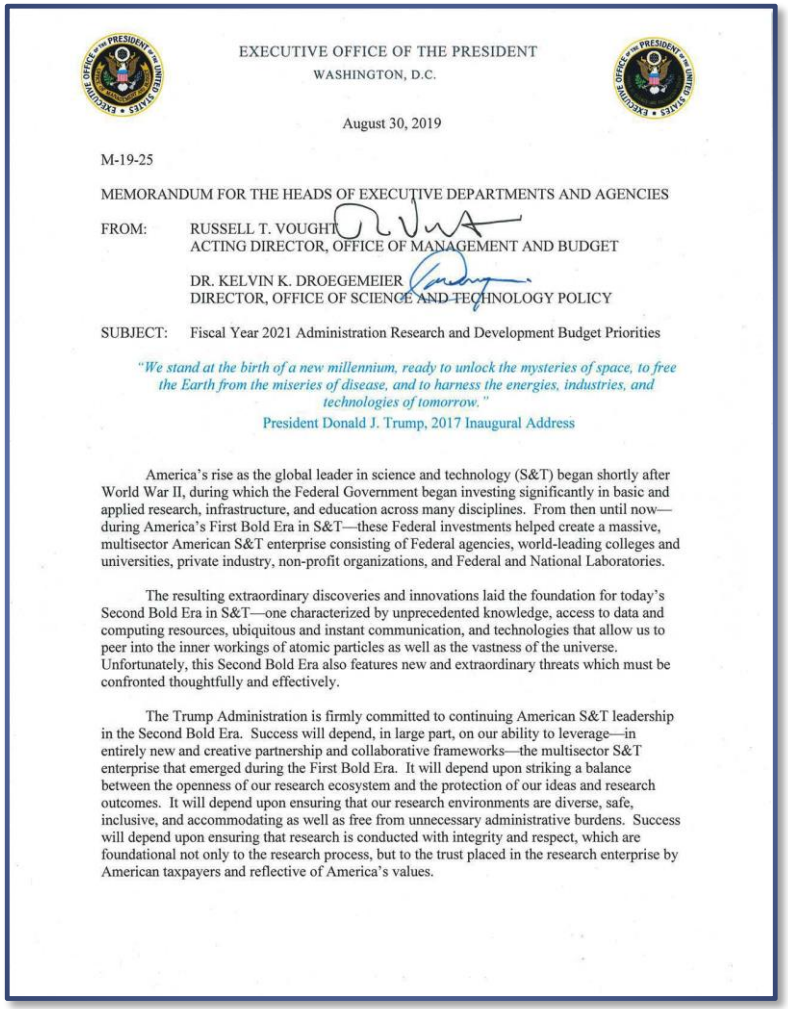
FES FY 2021 Budget Request will address Administration R&D priorities and practices

- **American Leadership in Industries of the Future:**
  - FES investments in transformational technologies such as artificial intelligence / machine learning, quantum information science (QIS), data science, microelectronics, advanced manufacturing, and high-performance computing will accelerate progress in several mission areas
- **American Energy & Environmental Leadership**:
  - Early-stage research in fusion could contribute to American energy dominance by making available to the American people a robust base-load electricity clean energy technology that relies on widely available and virtually inexhaustible fuel sources.
  - Investments in our major fusion facilities and smaller-scale experiments will maintain and modernize our research infrastructure for continuing to conduct world-leading research
- **Build & Leverage a Diverse, Highly Skilled American Workforce:**
  - The unique scientific challenges and rigor of fusion and plasma physics research contribute to the development of a well-trained STEM-focused workforce, which will contribute to maintaining and advancing U.S. competitiveness and world-leadership in key areas of future technological and economic importance, as well as national security
- **Create and Support Research Environments that Reflect American Values:**
  - FES-supported research is guided by the principles of Integrity and scientific rigor, diversity and inclusiveness, and emphasis on safety and protection of American research assets
- **Support Transformative Research of High Risk and Potentially High Reward**:
  - Research on high-temperature superconductors, additive manufacturing, low-temperature plasmas, and high-energy-density plasmas lead to connections with and spinoffs for U.S. industry
- **Build, Strengthen, and Expand Strategic Multisector Partnerships:**
  - Established partnerships within DOE (ASCR, BES, HEP, ARPA-E, NNSA) and outside (NSF) maximize leverage and increase the cost effectiveness of FES research activities
  - Private-public partnerships through the INFUSE program leverage opportunities in critical fusion research areas (e.g., diagnostics, theory and simulation, materials science, and magnet technology)



EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C.

August 30, 2019

M-19-25

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: RUSSELL T. VOUGHT
ACTING DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET

DR. KELVIN K. DROEGEMEIER
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

SUBJECT: Fiscal Year 2021 Administration Research and Development Budget Priorities

"We stand at the birth of a new millennium, ready to unlock the mysteries of space, to free the Earth from the miseries of disease, and to harness the energies, industries, and technologies of tomorrow."
President Donald J. Trump, 2017 Inaugural Address

America's rise as the global leader in science and technology (S&T) began shortly after World War II, during which the Federal Government began investing significantly in basic and applied research, infrastructure, and education across many disciplines. From then until now—during America's First Bold Era in S&T—these Federal investments helped create a massive, multisector American S&T enterprise consisting of Federal agencies, world-leading colleges and universities, private industry, non-profit organizations, and Federal and National Laboratories.

The resulting extraordinary discoveries and innovations laid the foundation for today's Second Bold Era in S&T—one characterized by unprecedented knowledge, access to data and computing resources, ubiquitous and instant communication, and technologies that allow us to peer into the inner workings of atomic particles as well as the vastness of the universe. Unfortunately, this Second Bold Era also features new and extraordinary threats which must be confronted thoughtfully and effectively.

The Trump Administration is firmly committed to continuing American S&T leadership in the Second Bold Era. Success will depend, in large part, on our ability to leverage—in entirely new and creative partnership and collaborative frameworks—the multisector S&T enterprise that emerged during the First Bold Era. It will depend upon striking a balance between the openness of our research ecosystem and the protection of our ideas and research outcomes. It will depend upon ensuring that our research environments are diverse, safe, inclusive, and accommodating as well as free from unnecessary administrative burdens. Success will depend upon ensuring that research is conducted with integrity and respect, which are foundational not only to the research process, but to the trust placed in the research enterprise by American taxpayers and reflective of America's values.

OMB/OSTP memo on the FY 2021 Administration R&D priorities (30 Aug 2019)

2. Programmatic Updates

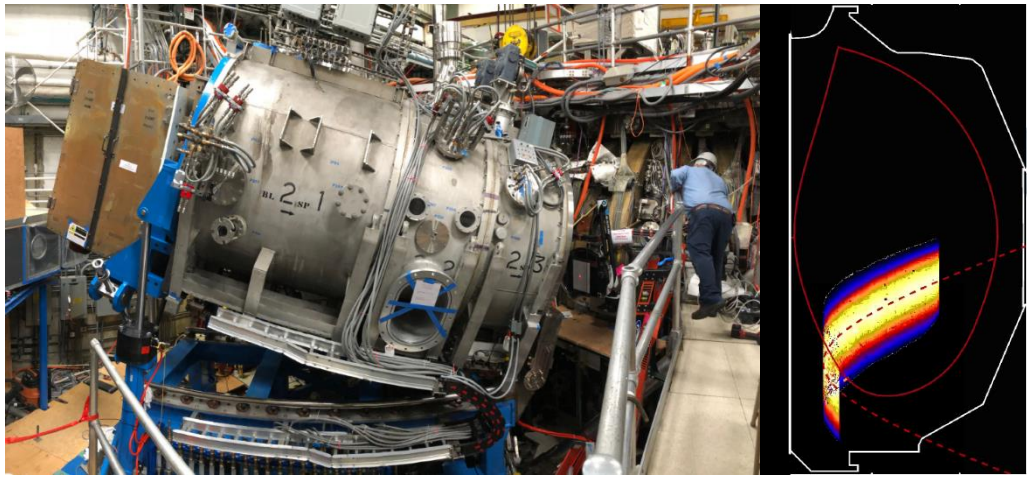
DIII-D National Fusion Facility

FY 2019 Highlights and Achievements

- Completed Long Torus Opening activities during 12-month vent period, including installation of toroidally steerable, off-axis neutral beam injector
- Completed 12-week experimental science campaign
- Demonstrated top-launch electron cyclotron current drive system
- Fabricated helicon antenna modules
- Designed high-field-side lower hybrid system

FY 2020 Plans

- 20-week experimental campaign
  - Study steady-state scenarios with two off-axis NBI
  - One-week hydrogen campaign
  - 1-2 week Frontier Science Campaign
- Install helicon antenna
- Fabricate prototype for mid-plane 3D field coil

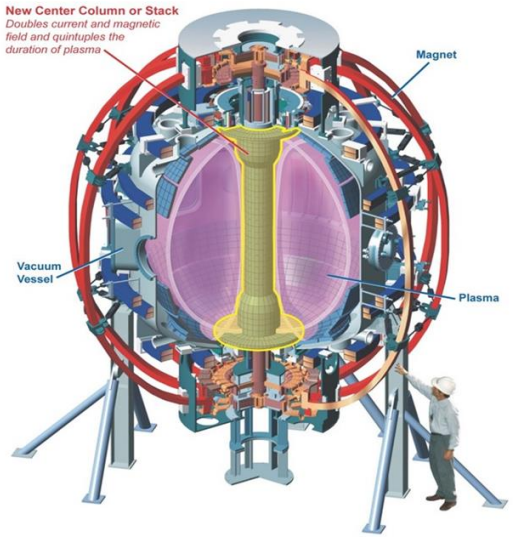


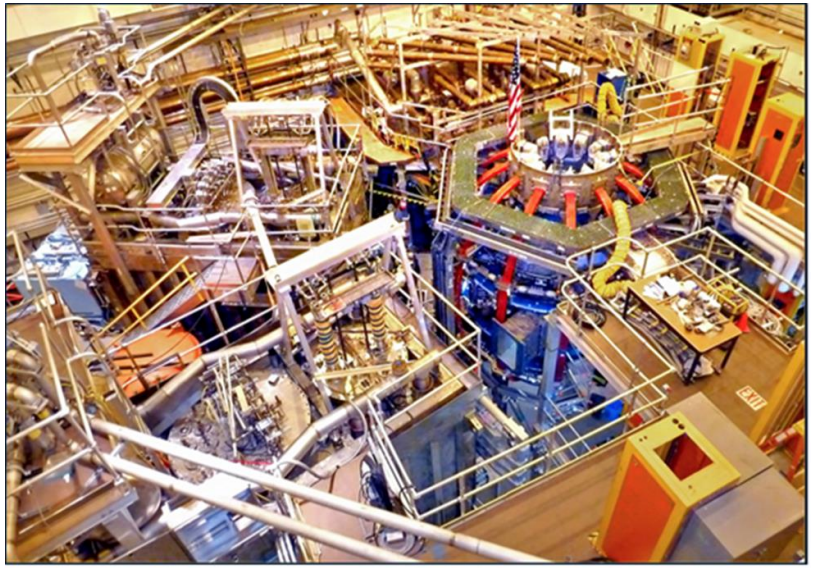
Off-axis neutral beam and imaging from beam-into-gas commissioning

Helicon antenna modules and 1 MW klystron from SLAC

National Spherical Torus Experiment-Upgrade

- **An Independent Project Review was held August 27-29 to baseline the NSTX-U Recovery Project**
  - Review panel noted that the project is quite mature, given the overall completion of ~50% (with over 70% design complete), and concluded it is ready to begin major construction
  - The baseline cost of the NSTX-U Recovery project is $199.4M, with a completion date (CDE-4) of July 2022 (and early finish in FY 2021)
- **An ESAAB-equivalent meeting was held on September 30**
  - CDE-2/3A received final approval to begin construction
- **Prior-authorized early construction activities had already been underway**
  - Clean room winding lines to fabricate poloidal field coils are complete
  - Procurement of all graphite material for PFC replacement is complete





The NSTX-U Test Cell

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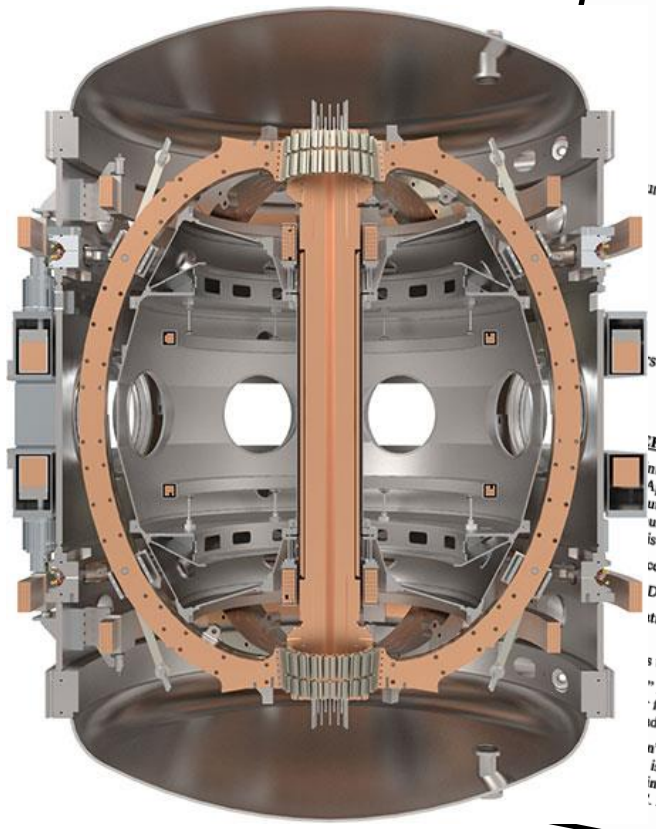
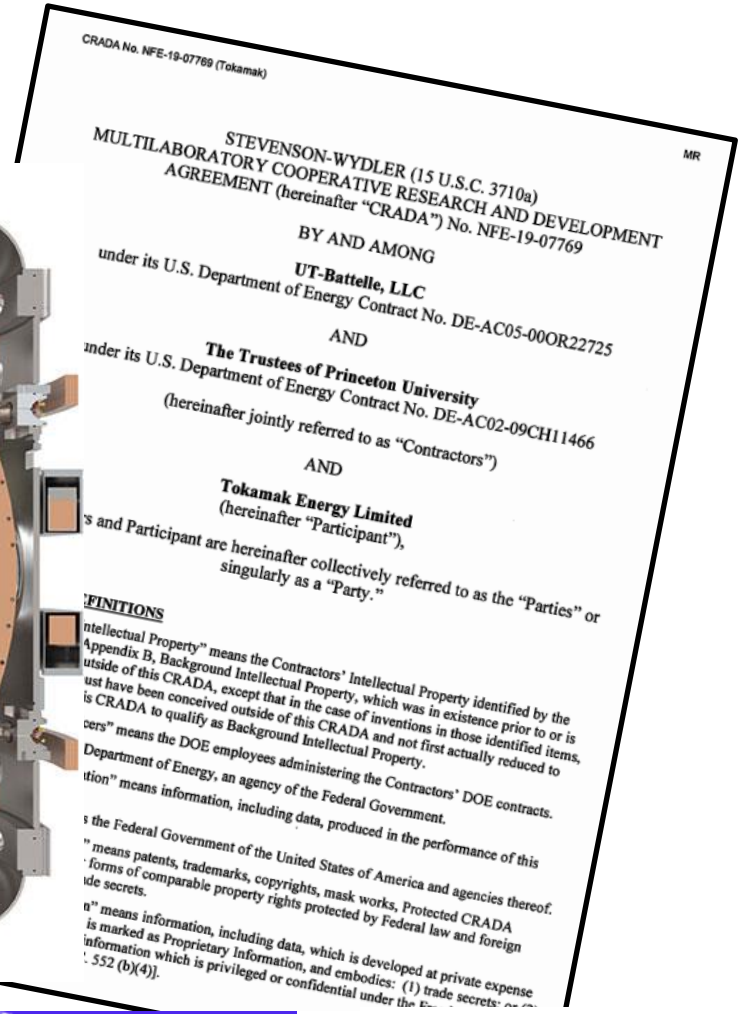
First-of-a-kind collaboration to conduct open public science on a privately funded fusion facility





CRADA No. NFE-19-07769 (Tokamak)

STEVENSON-WYDLER (15 U.S.C. 3710a)
MULTILABORATORY COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT (hereinafter "CRADA") No. NFE-19-07769

BY AND AMONG

UT-Battelle, LLC
under its U.S. Department of Energy Contract No. DE-AC05-00OR22725

AND

The Trustees of Princeton University
under its U.S. Department of Energy Contract No. DE-AC02-09CH11466

(hereinafter jointly referred to as "Contractors")

AND

Tokamak Energy Limited
(hereinafter "Participant"),

's and Participant are hereinafter collectively referred to as the "Parties" or singularly as a "Party."

'FINITIONS

ntellectual Property" means the Contractors' Intellectual Property identified by the Appendix B, Background Intellectual Property, which was in existence prior to or is utside of this CRADA, except that in the case of inventions in those identified items, ust have been conceived outside of this CRADA and not first actually reduced to is CRADA to qualify as Background Intellectual Property.

ers" means the DOE employees administering the Contractors' DOE contracts.

Department of Energy, an agency of the Federal Government.

tion" means information, including data, produced in the performance of this

s the Federal Government of the United States of America and agencies thereof.

" means patents, trademarks, copyrights, mask works, Protected CRADA forms of comparable property rights protected by Federal law and foreign ide secrets.

n" means information, including data, which is developed at private expense is marked as Proprietary Information, and embodies: (1) trade secrets information which is privileged or confidential under the
. 552 (b)(4)].

- This month ORNL, PPPL, and Tokamak Energy signed a CRADA covering a ~ 2-year collaborative research program
- FES awarded a total of **$3.9M** to ORNL and PPPL to carry out open public research on the privately funded ST40 spherical tokamak, located in the U.K.
  - University subcontracts are also supported
- The collaborative research intends to study world-leading high toroidal magnetic field (up to 3 T) spherical tokamak plasmas to explore:
  - ST energy confinement scaling's w.r.t. high B_T & I_P
  - λ_q at B_{pol} nearly 2 x greater than NSTX-U and MAST-U
  - Maximum achievable ST pedestal pressures by temporarily relocating the NSTX-U Thomson pulse-burst laser system to ST40
- This CRADA could serve as a model for future public utilization of privately funded fusion facilities (international or domestic)

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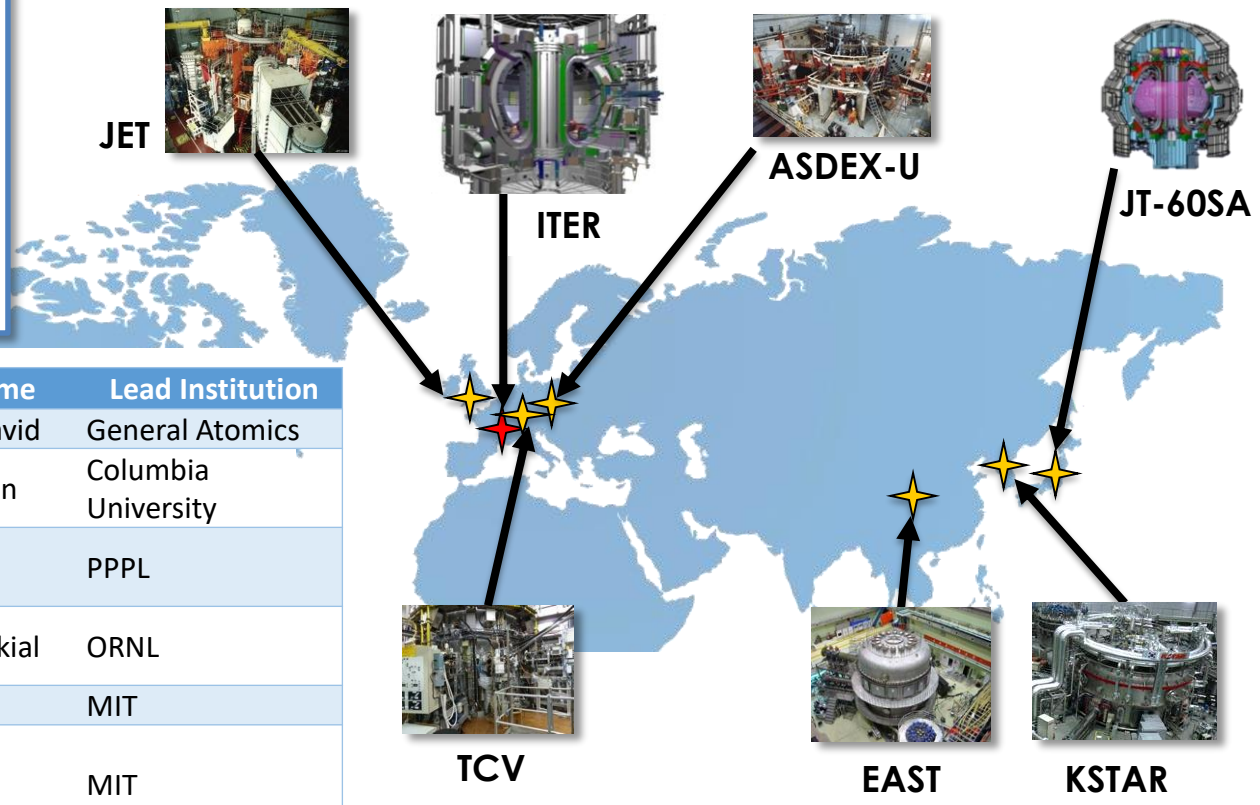
Burning Plasma Long Pulse: Tokamak

Competitive solicitation conducted in FY 2019 involved activities on both long- and short-pulse tokamaks

- Interdisciplinary teams from multiple U.S. institutions are supported for collaborative research aimed at advancing the scientific and technology basis for sustained long-pulse burning plasma operation



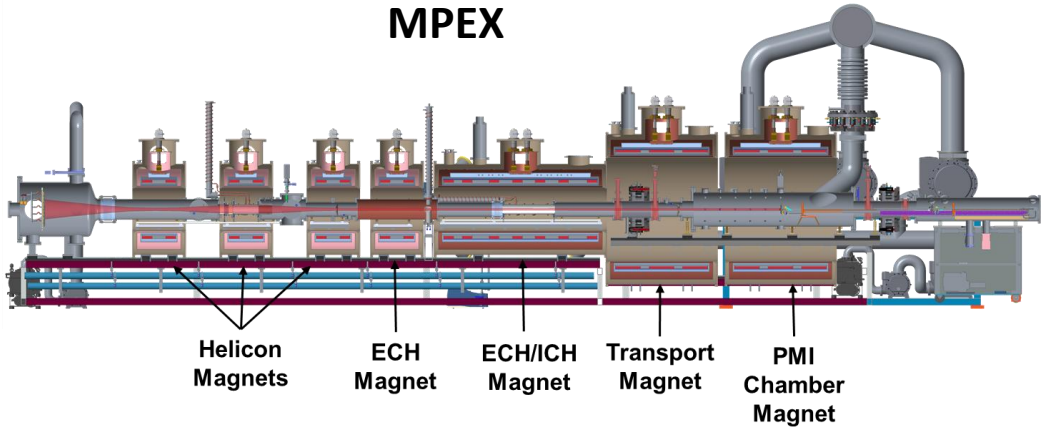
Collaborative Proposal Title	Facility	Lead PI Name	Lead Institution
Long Pulse High Performance Scenarios and Control in EAST	EAST	Humphreys, David	General Atomics
Disruption Prediction and Avoidance in High Beta Long Pulse KSTAR Plasmas – Real Time Expansion	KSTAR	Sabbagh, Steven	Columbia University
Physics Basis, Optimization, and Control for Integrated 3D Edge Long-Pulse Tokamak Scenarios	KSTAR, AUG, COMPASS	Park, Jong-Kyu	PPPL
Evaluation of Tungsten as the Main Plasma-Facing Material in a Long-pulsed Tokamak	WEST	Unterberg, Ezekial	ORNL
Boundary, SOL, and Divertor Physics Studies on TCV	TCV	Marmar, Earl	MIT
Turbulent Transport Studies at ASDEX Upgrade Enabled by Correlation Electron Cyclotron Emission and nT-phase Diagnostic	AUG	White, Anne	MIT
Validation of energetic particle transport models for time-dependent integrated simulations of burning plasmas	JET, AUG, TCV	Podesta, Mario	PPPL
Disruption Mitigation Solutions for Long-Pulse Tokamaks	JET, KSTAR	Baylor, Larry	ORNL
Fast Particle-Wave Interactions and Alfvén Eigenmodes in the JET Tokamak Plasmas	JET	Porkolab, Miklos	MIT
Design and Development of an Electron Cyclotron Emission Diagnostics Suite for Compass Upgrade Tokamak	COMPASS-U	Houshmandyar, Saeid	University of Texas

Construction projects for new world-leading facilities

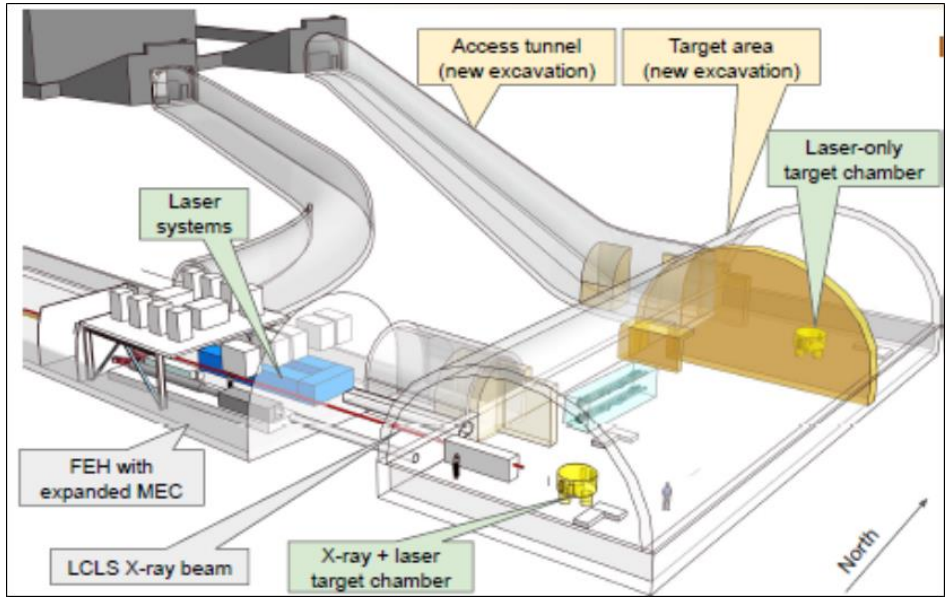
- **FES has initiated a new Major Item of Equipment project for a Linear Divertor Simulator**
  - Mission Need and CD-0 approval were achieved in FY 2018
  - CD-1 Independent Project Review was held October 16-18, 2019

- **FES is considering an MEC petawatt laser facility upgrade**
  - Mission Need and CD-0 approval were achieved in FY 2019
  - Addresses a recommendation in the 2017 NAS report *Opportunities in Intense Ultrafast Lasers: Reaching for the Brightest Light*

MPEX



MEC Upgrade



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New Magnet Test Stand capability

- **Magnet Test Stand** for high-critical-temperature superconductor cable and magnets
- Jointly funded by FES and High Energy Physics
- At Fermilab
- LBNL will be designing and fabricating a large superconducting dipole magnet (15 T) to be used in the Magnet Test Stand

Right: Dr. James Siegrist (AD for HEP program)

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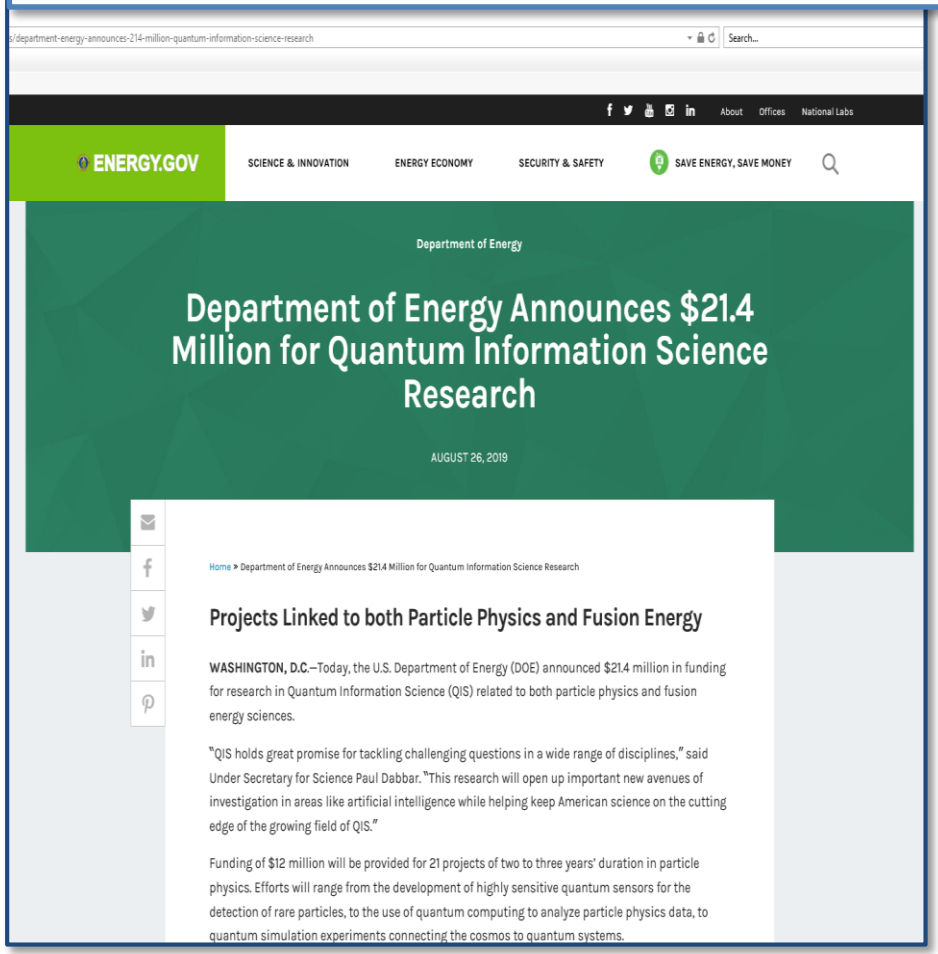
FES selected its first awards in QIS

Projects include the exploration of near- and long-term quantum computing opportunities for fusion and plasma science; the use of plasma science techniques to simulate trapped ion crystals of relevance to quantum simulation and sensing; the exploration of new realms of quantum behavior at high-energy-density conditions; and the use of near-term quantum computer hardware to formulate fusion-relevant chemistry and materials science phenomena.



PI Name	Institution	Project Title
Parker, Scott	University of Colorado, Boulder	Plasma Theory Connections to Quantum Information
Gomes Loureiro, Nuno	Massachusetts Institute of Technology	Quantum algorithms for fusion-plasma dynamics
Kostuk, Mark	General Atomics	Quantum Computing for Fusion Energy Materials
Alexeev, Yuri	Argonne National Laboratory	Quantum Computing for Fusion Energy Materials
Joseph, Ilon	Lawrence Livermore National Laboratory	Quantum Leap for Fusion Energy Sciences
Collins, Gilbert	University of Rochester	High Energy Density Quantum Matter

Machine Learning / AI Workshop

- FES & ASCR held a joint workshop April 30 – May 2, 2019, on **Advancing Fusion with Machine Learning**
- **Chair** & **Co-Chair**: David Humphreys (General Atomics), & Ana Kupresanin (LLNL)
- Among the objectives was to identify areas where application of Machine Learning / Artificial Intelligence (ML/AI) techniques and data science more broadly can have a transformative impact on FES mission areas
- Seven **Priority Research Opportunities** were identified
- The final report is available on the FES website

Workshop on Advancing Fusion with Machine Learning Priority Research Opportunities (PROs)

Accelerating Science	Enabling Fusion Energy
PRO 1: Science Discovery with ML *Hypothesis Generation and Experimental Guidance*	**PRO 4: Control Augmentation with ML** *Diagnostics to Data, Dynamic Models for Control, Fusion Trajectory Design*
PRO 2: ML Boosted Diagnostics *ML Boosted Diagnostics, Physics Enhanced Data*	**PRO 5: Extreme data algorithms** *Extreme-scale Processing, In-situ Data Analysis*
PRO 3: Model Extraction and Reduction *Data-driven Models, Reduction of Complex Code Algorithms*	**PRO 6: Data-enhanced Prediction** *Prediction of Disruption Events and Effects, Plasma Phenomena and State Prediction*
PRO 7: Fusion Data ML Platform	

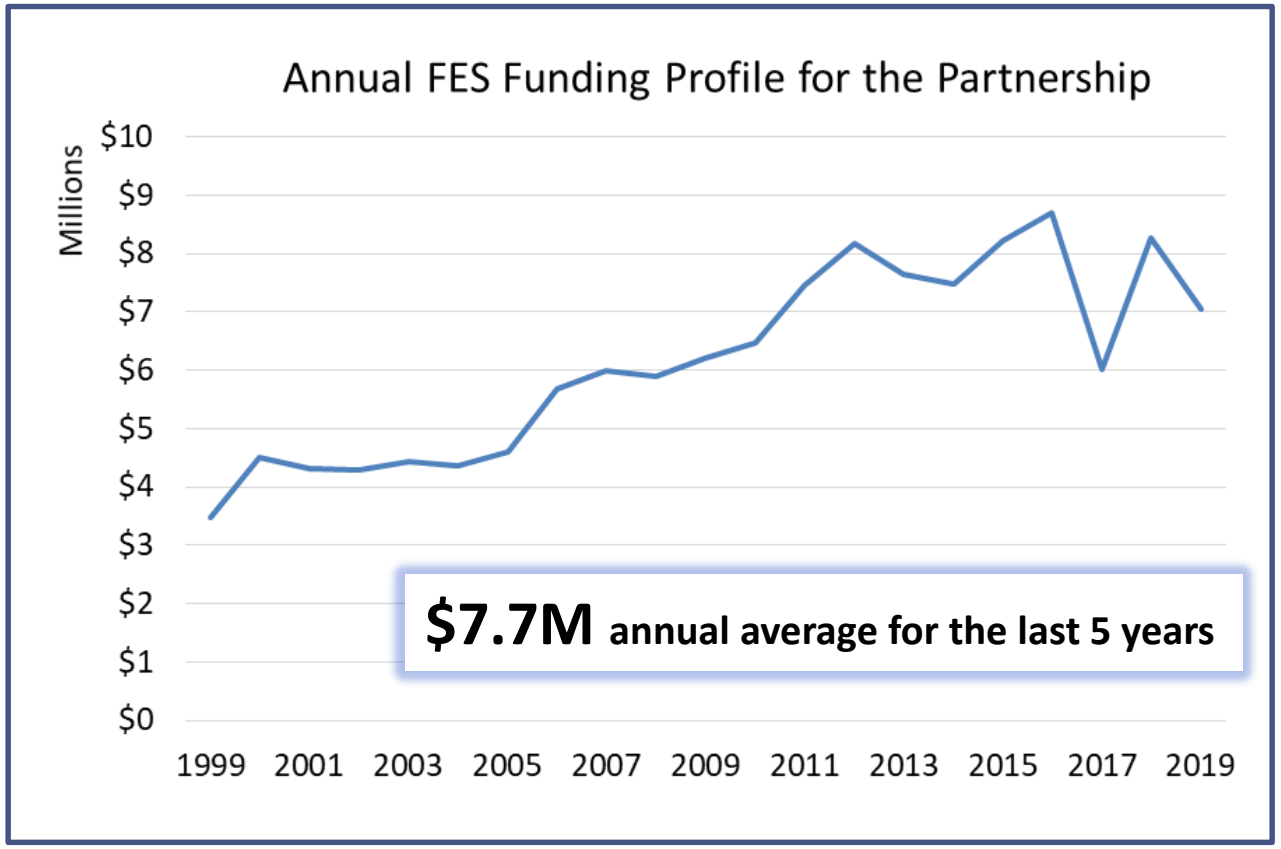
https://science.osti.gov/-/media/fes/pdf/workshop-reports/FES_ASCR_Machine_Learning_Report.pdf

NSF/DOE Partnership: Over $7 million funded by DOE in 2019

NSF/DOE Partnership includes:

- ✓ General Plasma Science
- ✓ Exploratory Magnetized Plasmas
- ✓ and HEDLP

FY 2019 FES contribution **$7.0 M**



- FES provided $7.0 million FY 2019 funds for the Partnership, supporting 11 new and 3 supplemental proposals in basic plasma, non-neutral/dusty plasma, HED plasma, and low-temperature plasma
- This includes $2.7 million for Basic Plasma Science Facility's (BaPSF) continuing operation and collaborative research at UCLA

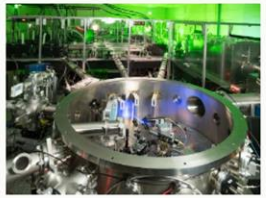
LaserNetUS

https://www.lasernetus.org/

Facilities | Facilities Access | Proposal Submissions | Events | Annual Meetings | Contact | Search this site...

Facilities

Colorado State University



Advanced Beam Laboratory

Contact:
Jorge Rocca, euvlasers@colostate.edu

Website

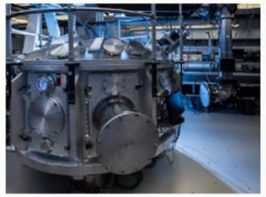
Lawrence Berkeley National Laboratory

Berkeley Lab Laser Accelerator (BELLA) Center

Contact:
Thomas Schenkel, t_schenkel@lbl.gov

Website

Lawrence Livermore National Laboratory

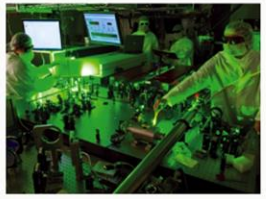


Jupiter Laser Facility

Contact:
Robert Cauble, cauble1@llnl.gov

Website

Ohio State University



Scarlet Laser Facility

Contact:
Douglass Schumacher,
schumacher.60@osu.edu

Website

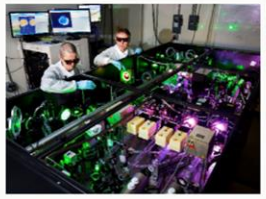
SLAC National Accelerator Laboratory

Matter in Extreme Conditions

Contact:
Gilliss Dyer, Gilliss@slac.stanford.edu

Website

University of Michigan



Center for Ultrafast Optical Science

Contact:
Karl Krushelnick, kmkr@umich.edu

Website

University of Nebraska - Lincoln

University of Rochester

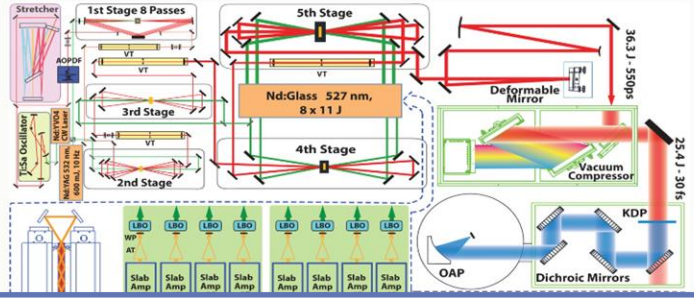
University of Texas - Austin

Advanced Beam Laboratory

Colorado State University

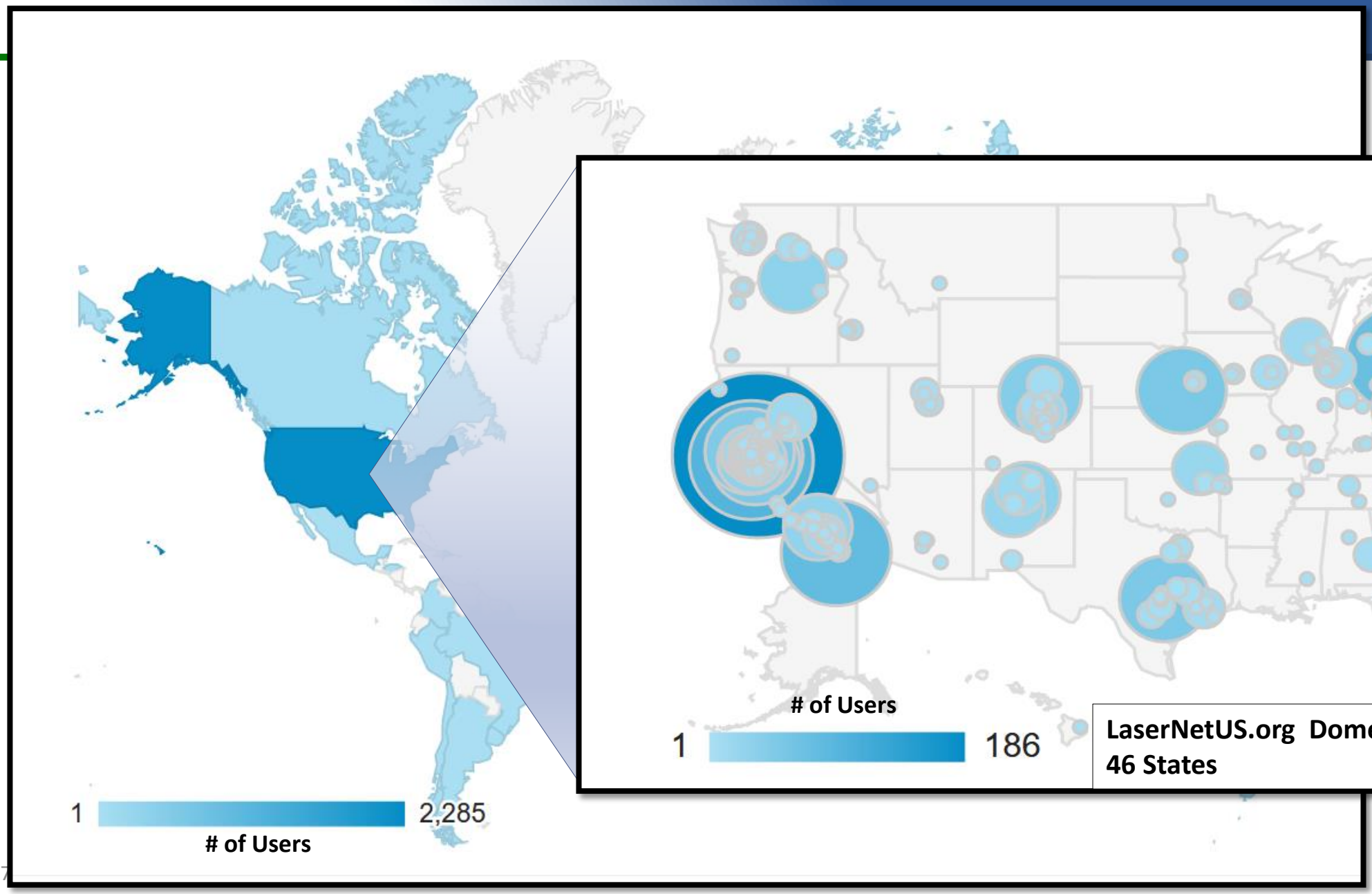
Colorado State University Petawatt-Class Laser is an ultra-short pulse Ti:sapphire laser system that produces ultrahigh-contrast λ = 400 nm femtosecond pulses of up to 10 J, obtained by frequency doubling 800 nm pulses of 30 fs duration. An intensity of 6.5×10^{21} W/cm² is obtained focusing the beam with an f/2 parabola. An f/1parabola will be available after July 2019 that is expected to deliver intensities $>1 \times 10^{22}$. The beam/pulse parameters presently offered by the laser are summarized in the Laser Modes table.

A schematic diagram of the laser is shown in Figure 1. It consists ofa conventional Ti:Sa front end that delivers λ=800 nm pulses into a chain of three high power Ti:Sa amplification stages pumped by Nd:YAG slab amplifiers. The 250 mJ output of this laser front end is further amplified in three multi-pass Ti:Sa amplifiers pumped by the frequency doubled output of eight compact flash lamp-pumped high energy Nd:glass slab amplifiers, developed at CSU. The slab geometry has long been recognized as a way to significantly reduce the limitations in repetition rate inherent to the more commonly used rod geometry. These pump laser allows Ti:sappire system operation at a repetition rate of up to 3.3 Hz in burst mode. The beam propagates in a zig-zag path in the gain medium aided by total internal reflection in the polished wall of the slabs eliminating first-order thermal and stress-induced focusing, and also reducing stress-induced birefringence.



- **LaserNetUS website is managed by SLAC for the consortium**
- **It has all the information that users need including detailed information on facility capabilities and proposal submission process**

Google Analytics to gauge interest in LaserNetUS



LaserNetUS.org Domestic Users: interest from 46 States

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New INFUSE private-public partnership program


Dennis Youchison, Director


Ahmed Diallo, Deputy Director

OAK RIDGE National Laboratory

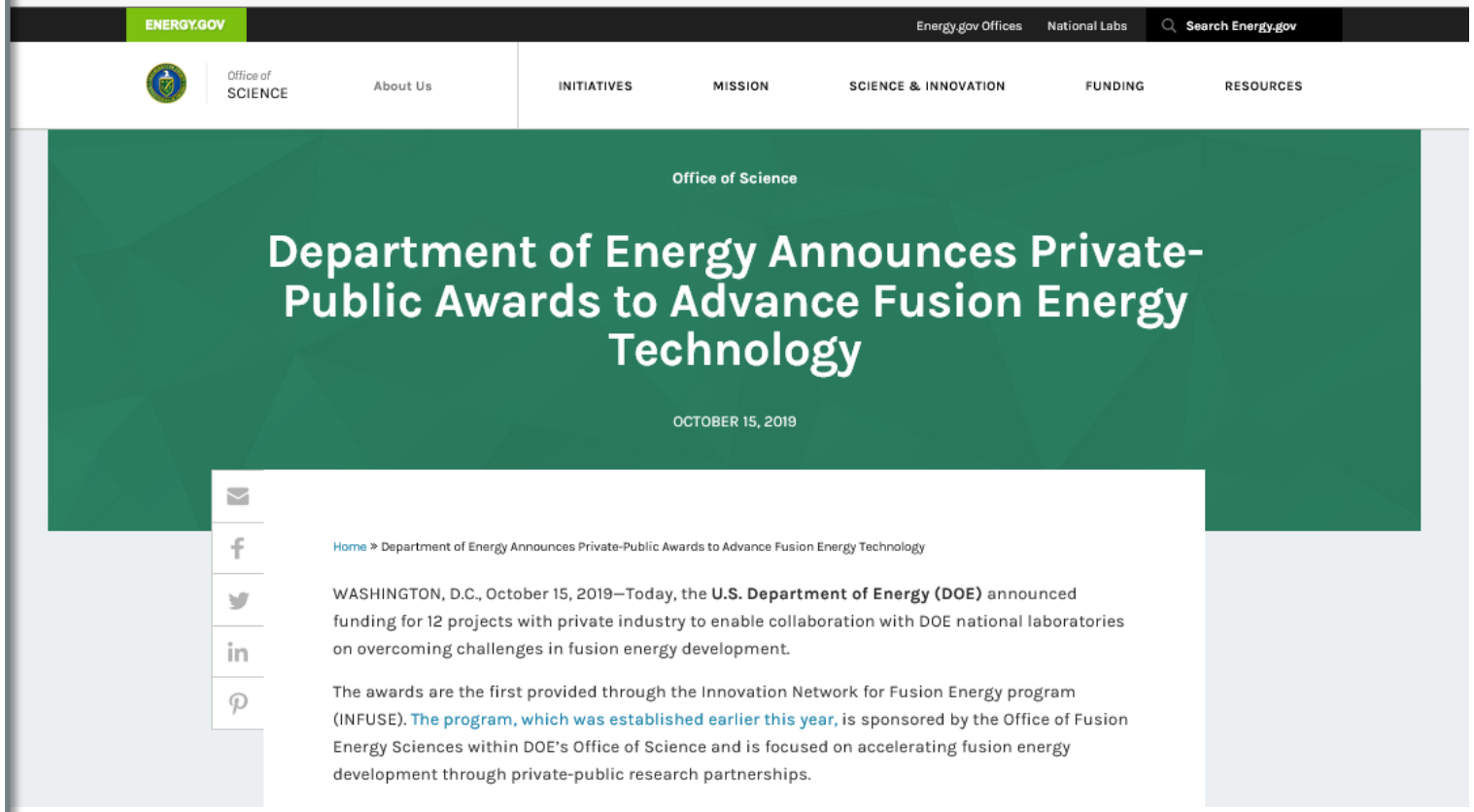
PPPL

https://infuse.ornl.gov/

- **Innovation Network for Fusion Energy (INFUSE)** program for fusion R&D was announced in June
- INFUSE accepted basic research applications focused on innovation for fusion energy in enabling technologies, materials science, plasma diagnostics, modeling & simulation, and MFE experimental capabilities
- INFUSE partnership awards (@$50K-$200K) are made to DOE national labs to help eligible private-sector companies overcome critical scientific and technological challenges in pursuing fusion energy
- Request for Assistance (RFA) call issued on June 1 and closed on July 7, 2019
  - 21 RFA proposals were received from 11 companies
  - ORNL and PPPL carried out the merit review of the RFA proposals
  - FES selected 12 projects for awards

INFUSE awards

- Awards were made to BNL, LANL, LBNL, LLNL, ORNL, and PPPL to partner with:
  - Advanced Conductor Technologies
  - Commonwealth Fusion Systems
  - HelicitySpace
  - HyperJet Fusion Corporation
  - Proton Scientific Technologies
  - TAE Technologies, Inc.
- Topical areas included enabling technology, modeling & simulation, plasma diagnostics, and access to experimental capabilities
- The awards are subject to a successful negotiation of company-lab CRADAs

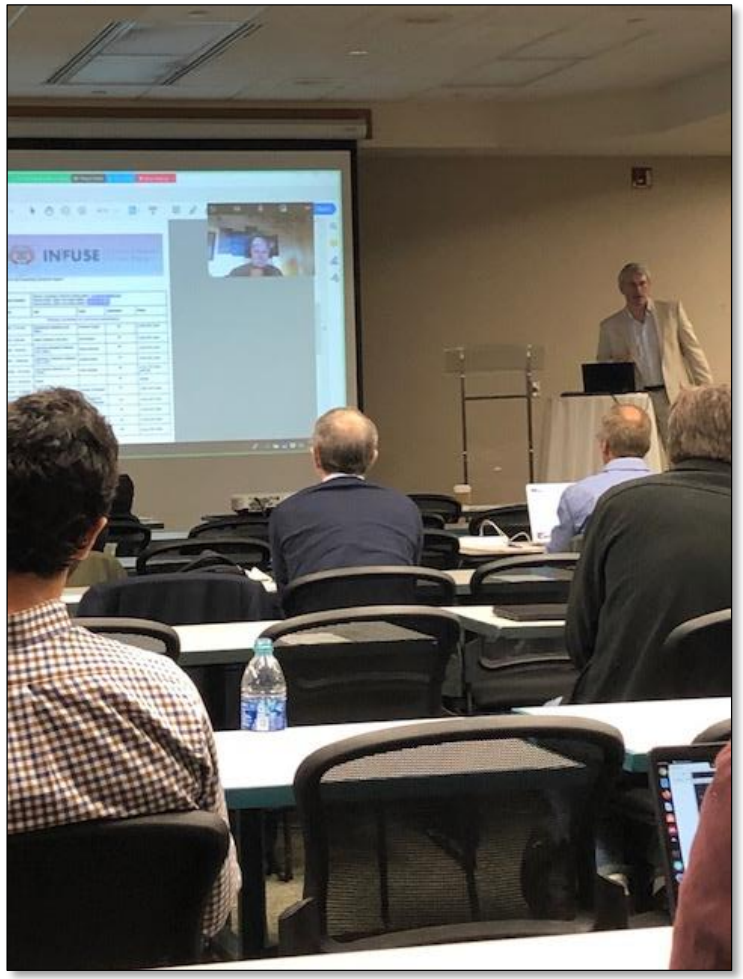


Full list with abstracts can be found at:
https://infuse.ornl.gov/2019-infuse-awards-2/

First Annual INFUSE Workshop

- The first INFUSE workshop was held **November 22-23**, in Knoxville, TN
- Attended by 48 participants, the purpose of the workshop was to inform the private fusion industries about the capabilities at the DOE national laboratories, to learn from the private companies about their needs, and to discuss lessons learned from the FY 2019 pilot program
- The INFUSE leaders also discussed program updates and future plans
- Attendees included the Point-of-Contacts from the 10 participating labs (BNL, INL, LANL, LBNL, LLNL, ORNL, PNNL, PPPL, SNL, and SRNL); representatives from nine private fusion companies, ARPA-E, and the Fusion Industry Association; and DOE-FES staff

INFUSE Innovation Network for Fusion Energy

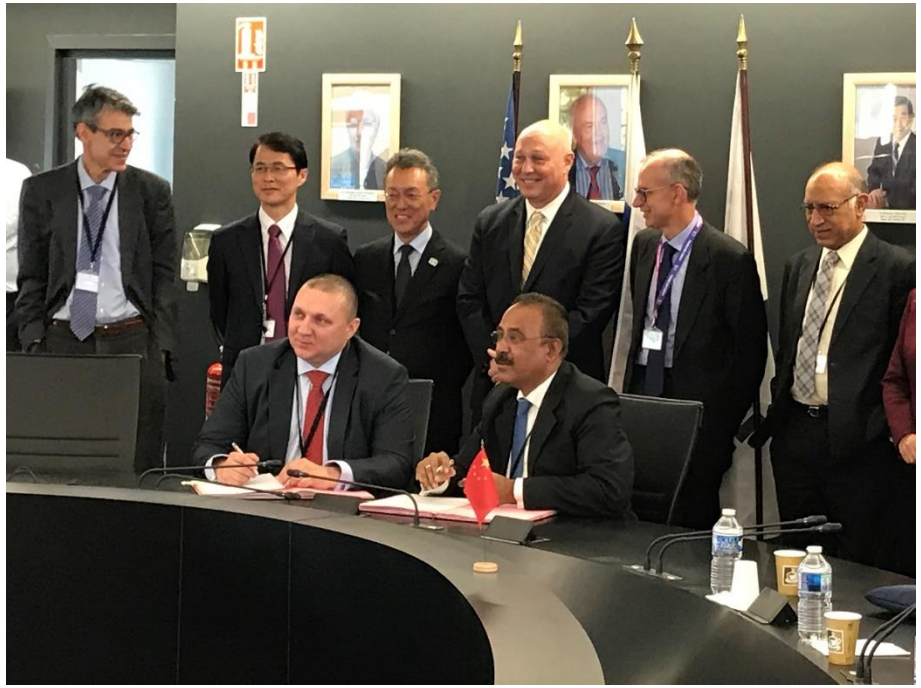


https://infuse.ornl.gov/

3. ITER Updates

Construction progress at ITER Complex

ITER Council Meeting (Nov 20-21)



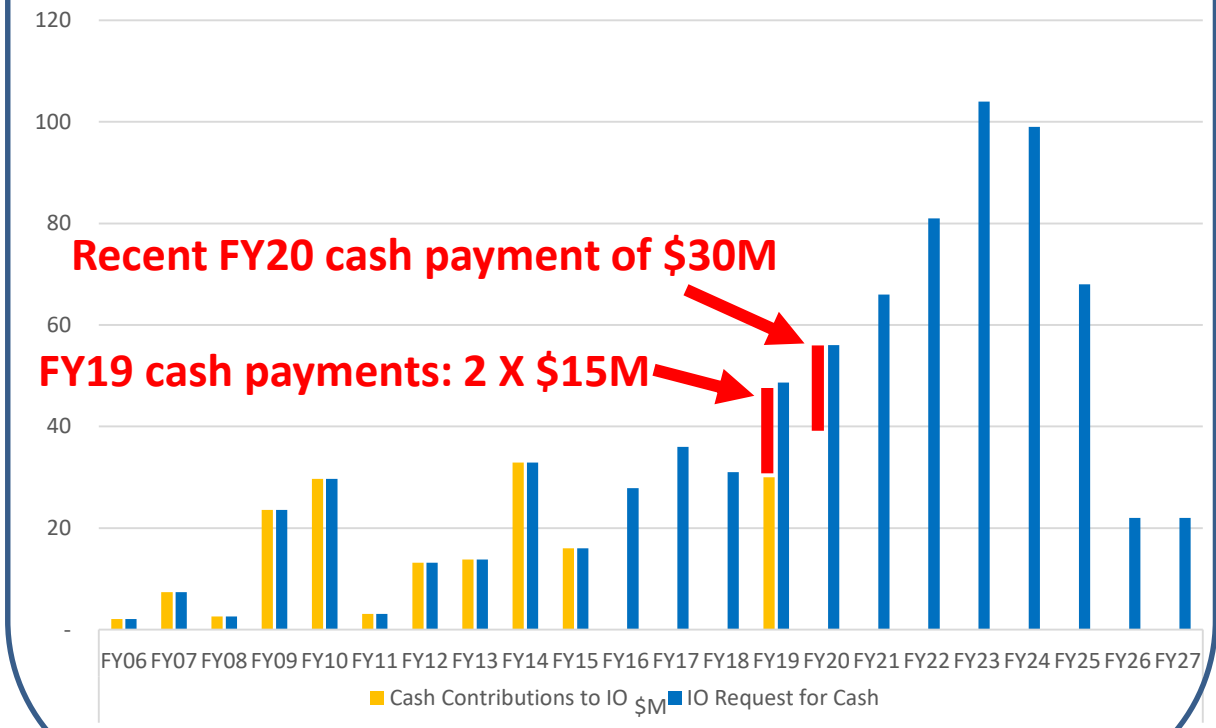
Signing of ITER Management Assessment contract

Interior of Assembly Hall

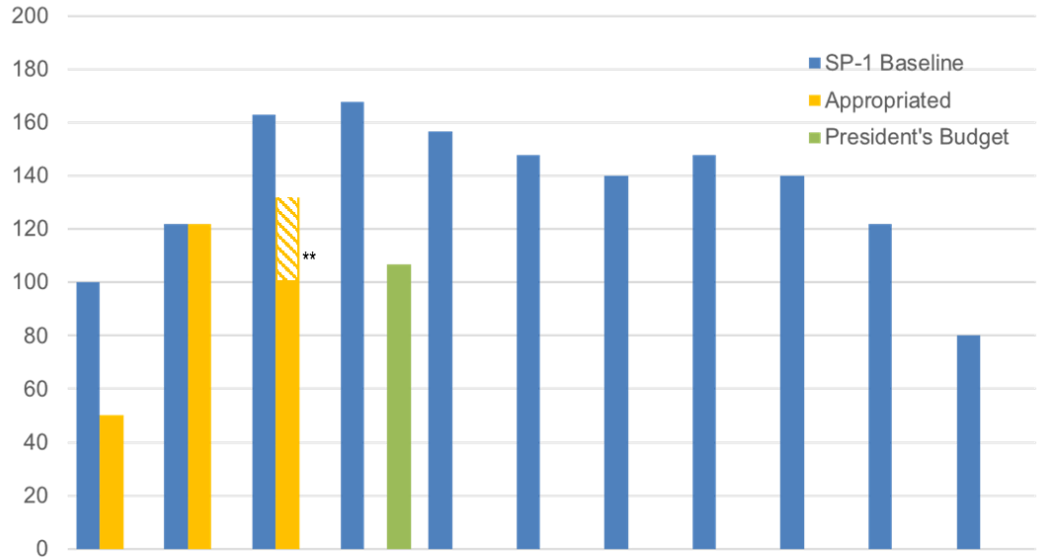
Tour of Tokamak Complex (B2): DG B. Bigot and SC-1 C. Fall

U.S. Contributions to ITER project

Cash contributions



Funding for in-kind hardware components



$M	Prior Years*	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	Total
SP-1	1,012	100	122	163	168	157	148	140	148	140	122	80	2,500
App.	1, 012	50	122	132**	107 (PB)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

U.S. ITER Subproject-1 (First Plasma) is 60% complete

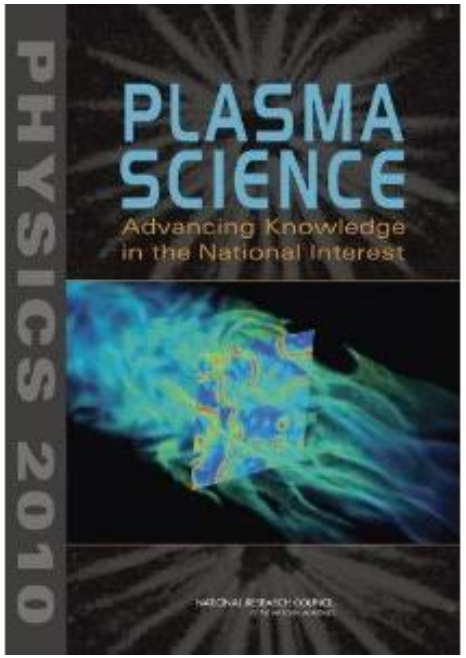
4. Program Planning

National Academy recent studies

2018 Burning Plasma Research
(Chairs: Prof. Michael Mauel & Prof. Melvin Shochet)

Burning Plasma Research (December 2018):

- "The scientific and technical benefits from the study and operation of ITER are compelling and critical to the development of fusion energy for the United States."
- "The United States should remain an ITER partner as the most cost-effective way to gain experience with a burning plasma at a scale of a power plant."



2010 Plasma Decadal Survey
(Chair: Prof. Steve Cowley)

2019 Plasma Decadal Survey
(Chairs: Prof. Mark Kushner & Prof. Gary Zank)

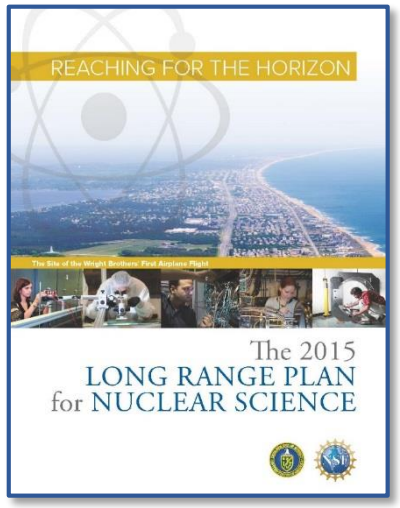
Decadal Assessment of Plasma Science (underway)

- **Objective:** Conduct a study of the past progress and future promise of plasma science and technology and provide recommendations to balance the objectives of the field in a sustainable and healthy manner over the long term
- **Multiple federal sponsors: DOE** (FES, HEP, NNSA, ARPA-E); **NSF**; **DOD** (AFOSR, ONR)

U.S. DEPARTMENT OF ENERGY
Office of Science

Long-range strategic planning activity launched in FY 2019 for FES program

- The plan will be comprehensive and will include all FES program areas
- Process is similar to that used by the Office of Science High Energy Physics (HEP) and Nuclear Physics (NP) programs for the development of the HEP-P5 report and NP-Long Range Plan



Phase 1: Community-organized activities

Community Awareness
Inform the community that a FESAC charge is coming

⇩

Subfield community self-organization

⇩

FESAC charge issued

⇩

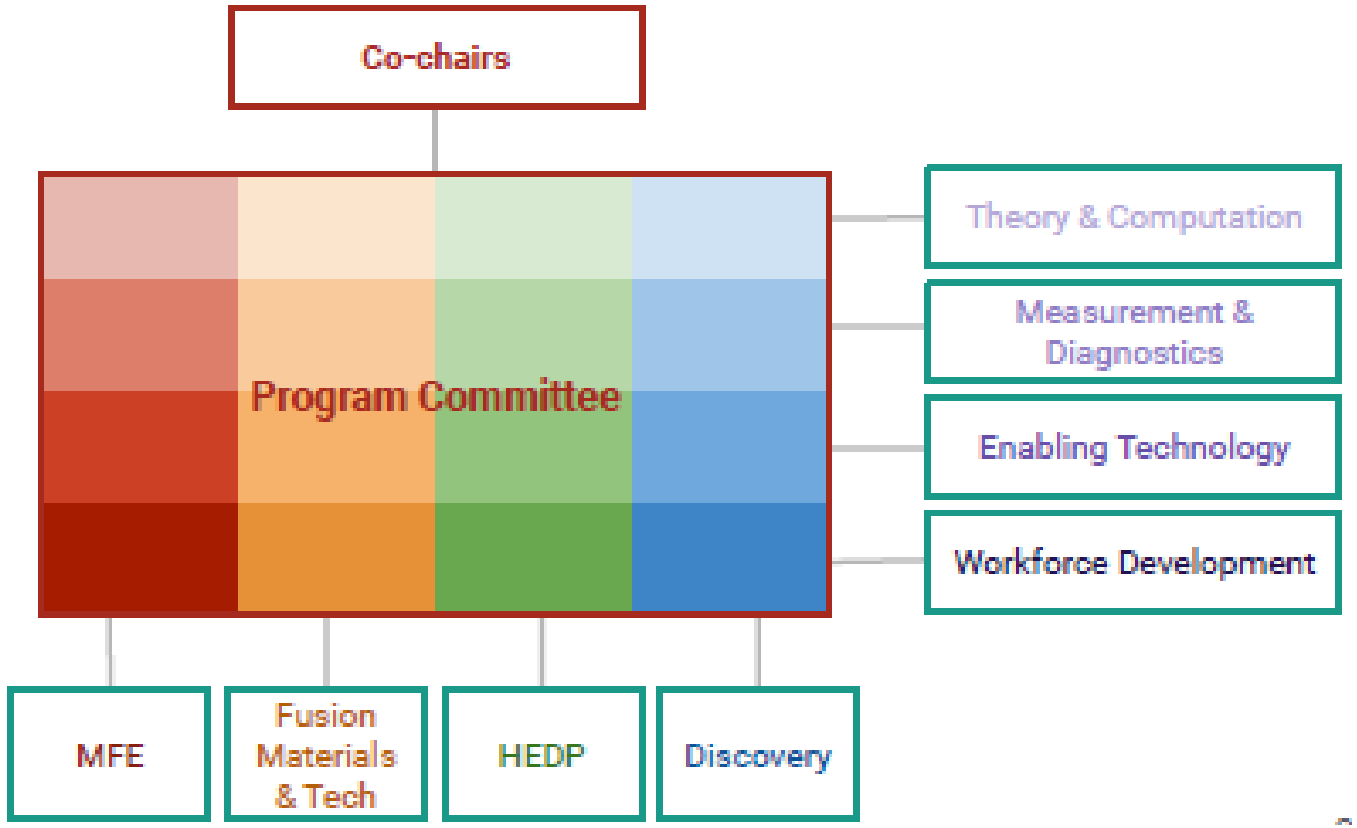
FES tasks APS-DPP to convene topical town hall meetings

⇩

"Snowmass" meeting

Phase 2: FESAC federal advisory committee

LRP Community Planning Process



- Numerous town halls
- Two rounds of community workshops (July & November)
- Hundreds of white papers
- Program Committee writing retreat
- CPP-Houston ("Snowmass") Meeting: week of Jan 13
- FESAC Meeting: Mar 16-17

Fusion regulatory framework

- **Congress has expressed its interest on understanding the regulatory approach for Advanced Nuclear Reactors, including nuclear fusion reactors**
  - *Nuclear Energy Innovation and Modernization Act*, S.512 (January 2018)
  - *Nuclear Energy Innovation Capabilities Act of 2017*, S.97 (January 2018)

- **Early in 2019, FES along with ARPA-E formed an informal working group with the Nuclear Regulatory Commission to exchange information**
  - Acknowledge Kurt Heckman for initiating this

- **DOE and NRC senior management are aware of this activity and have been involved in planning future engagements**
  - Acknowledge Undersecretary Paul Dabbar and NRC Chair Kristine Svinicki for help and support

- **Currently planning to hold a one-day public forum on fusion regulation on March 18, 2020, in Rockville, in conjunction with a FESAC meeting (March 16-17, in Rockville)**
  - DOE and NRC are developing a draft agenda for this public forum

Enhanced inter-agency interactions

- **Advanced Research Projects Agency–Energy**
  - FES and ARPA-E are exploring joint collaboration possibilities
- **National Institutes of Health**
  - DOE began partnering with NIH in 2016 to transform cancer research through advances in high-performance computing technology and AI under the Cancer Moonshot program.
    - The partnership is jointly funded by NIH, NNSA, and SC-ASCR (ECP)
  - Recent meeting of all SC program offices with several NIH institutes
    - SEAB Task Force Report on Biomedical Sciences (2016)
    - HEWD mark-up language for FY 2020 budget
  - Possible coordination areas: data science and artificial intelligence, bio-imaging, cancer therapy, medical isotopes

5. People

U.S. DEPARTMENT OF ENERGY
Office of Science

DOE updates since the last FPA meeting

Secretary of Energy Rick Perry announced that he will depart in December 2019

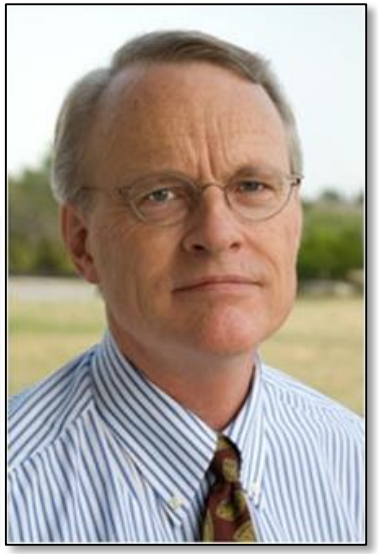
Deputy Secretary of Energy Dan Brouilette has been confirmed to be the next Secretary of Energy

U.S. DEPARTMENT OF ENERGY
Office of Science

SC and FES updates since the last FPA meeting

Dr. Chris Fall was sworn in on May 31, 2019, as the Director of the DOE Office of Science

After a year of phased retirement, **Dr. Mark Foster** fully retired on October 26, 2019



Dr. James Van Dam became permanent Associate Director of Science for Fusion Energy Sciences on May 26, 2019

U.S. ITER Project Office leadership

Dr. Kathryn McCarthy

Announced as new USIPO Director (will join ORNL in March 2020)

- Vice president for science and technology and laboratory director for the Canadian Nuclear Laboratories (2016-2019)
- Previously held a variety of engineering and leadership roles at Idaho National Laboratory, including director of domestic programs in INL's Nuclear Science and Technology Directorate, etc.
- Member of National Academy of Engineering (2019)
- Fusion Energy Sciences Advisory Committee member (1999-2013)
- US ITER technical advisory committee member (2010-2013)

SINCERE APPRECIATION TO:

Dr. Ned Sauthoff
USIPO Project Director
(2006-2019)

Suzanne Herron
USIPO Project Controls Director
(2009-2019)

Lester Price
USIPO Interim Project Director

FY 2019 Early Career Research Awards

FES made four university awards and two laboratory awards in FY 2019

Dr. Arianna Gleason
SLAC
Ultrafast visualization of hydrodynamic evolution: understanding void collapse at extreme high pressure conditions

Dr. Timothy Stoltzfus-Dueck
PPPL
Development and Testing of Reduced Models of the Edge Radial Electric Field

Prof. Ryan McBride
Univ. Michigan
The Physics of Micro-Pinches

Prof. Hussein Aluie
Univ. Rochester
Scale-Aware Modeling of Instabilities and Mixing in HED Flows

Prof. Karl Hammond
Univ. Missouri-Columbia
Lithium–Divertor Interactions and Helium/Hydrogen Trapping in Lithiated Metals

Prof. Elijah Thimsen
Washington Univ. in St. Louis
Structure of Plasma-Water Interface

28th IAEA Fusion Energy Conference

- **FEC 2020**
  - 12-17 October 2020
  - Nice Acropolis Convention Center (Nice, France)

- **FES coordinator for US program committee**
  - Dr. Matthew Lanctot