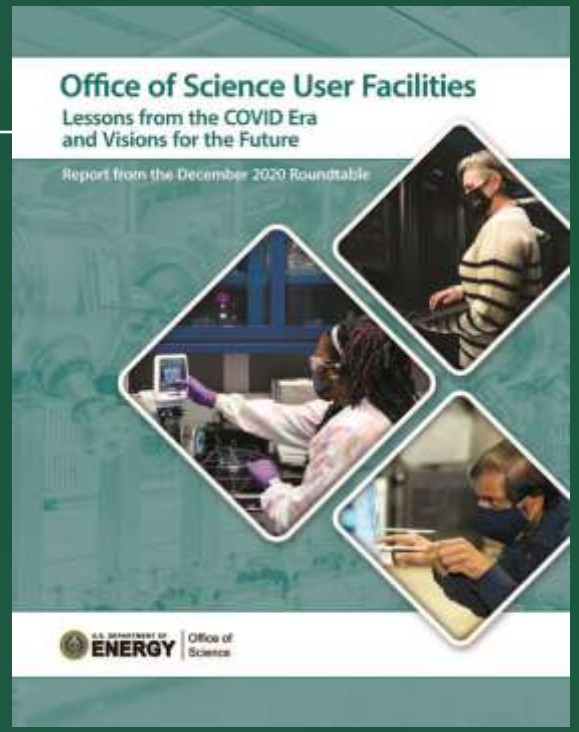
U.S. DEPARTMENT OF ENERGY | Office of Science

Office of Science User Facilities:
Lessons from the COVID Era and Visions for the Future

December 2-15, 2020



Presentation to BERAC, Friday October 22, 2021
Dr. Nigel J. Mouncey, JGI Director

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Charter

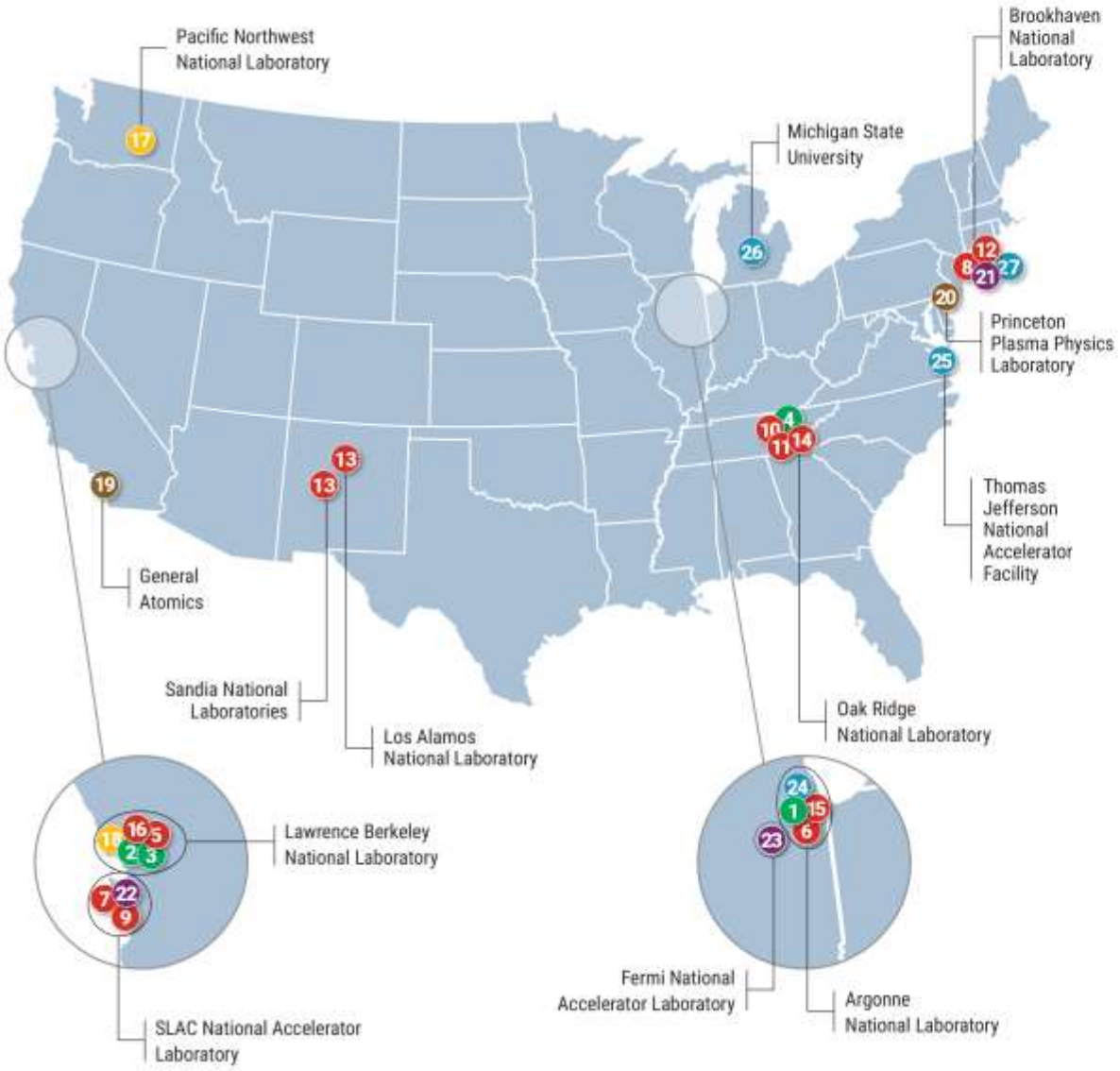
- The roundtable was chartered by the Office of the Deputy Director for Science Programs, in collaboration with the Science Programs Associate Directors and Office Directors (ASCR, BES, BER, FES, HEP, NP, Accelerators, Isotopes).

Motivation:

- The COVID-19 pandemic directly impacted many SC User Facilities. In-person user experiences were canceled, postponed, abridged, or altered to a virtual mode with a broad spectrum of outcomes. User program administrators, scientific staff, and operations staff seized opportunities and encountered barriers to virtual work adaptation. New or expanded reliance on data and information networks and software was elevated, surfacing limitations.
- While we expect life to return to some semblance of normalcy at an unpredictable future point, it is imperative for the SC Programs to capture insight from user, administrator, and operator experiences to fuel both near term tactical improvements and the genesis of a long-term vision for an even stronger, more resilient, and more enabling user facilities enterprise available to an even broader spectrum of users. The COVID-19 pandemic has presented an opportunity to consider permanent changes to user facility operations.

U.S. Department of Energy
Office of Science User Facilities, FY 2021

33,500+ users



Advanced Scientific Computing Research (ASCR)

1. **Argonne Leadership Computing Facility (ALCF)**
   Argonne National Laboratory
2. **Energy Sciences Network (ESnet)**
   Lawrence Berkeley National Laboratory
3. **National Energy Research Scientific Computing Center (NERSC)**
   Lawrence Berkeley National Laboratory
4. **Oak Ridge Leadership Computing Facility (OLCF)**
   Oak Ridge National Laboratory

Basic Energy Sciences (BES)

LIGHT SOURCES

5. **Advanced Light Source (ALS)**
   Lawrence Berkeley National Laboratory
6. **Advanced Photon Source (APS)**
   Argonne National Laboratory
7. **Linac Coherent Light Source (LCLS)**
   SLAC National Accelerator Laboratory
8. **National Synchrotron Light Source II (NSLS-II)**
   Brookhaven National Laboratory
9. **Stanford Synchrotron Radiation Lightsource (SSRL)**
   SLAC National Accelerator Laboratory

NEUTRON SOURCES

10. **High Flux Isotope Reactor (HFIR)**
    Oak Ridge National Laboratory
11. **Spallation Neutron Source (SNS)**
    Oak Ridge National Laboratory

NANOSCALE SCIENCE RESEARCH CENTERS

12. **Center for Functional Nanomaterials (CFN)**
    Brookhaven National Laboratory
13. **Center for Integrated Nanotechnologies (CINT)**
    Sandia National Laboratories and
    Los Alamos National Laboratory
14. **Center for Nanophase Materials Sciences (CNMS)**
    Oak Ridge National Laboratory
15. **Center for Nanoscale Materials (CNM)**
    Argonne National Laboratory
16. **The Molecular Foundry (TMF)**
    Lawrence Berkeley National Laboratory

Biological and Environmental Research (BER)

- **Atmospheric Radiation Measurement (ARM) User Facility**
  Multi-Site Global Network
17. **Environmental Molecular Sciences Laboratory (EMSL)**
    Pacific Northwest National Laboratory
18. **Joint Genome Institute (JGI)**
    Lawrence Berkeley National Laboratory

Fusion Energy Sciences (FES)

19. **DIII-D National Fusion Facility**
    General Atomics
20. **National Spherical Torus Experiment Upgrade (NSTX-U)**
    Princeton Plasma Physics Laboratory

High Energy Physics (HEP)

21. **Accelerator Test Facility (ATF)**
    Brookhaven National Laboratory
22. **Facility for Advanced Accelerator Experimental Tests (FACET)**
    SLAC National Accelerator Laboratory
23. **Fermilab Accelerator Complex**
    Fermi National Accelerator Laboratory

Nuclear Physics (NP)

24. **Argonne Tandem Linac Accelerator System (ATLAS)**
    Argonne National Laboratory
25. **Continuous Electron Beam Accelerator Facility (CEBAF)**
    Thomas Jefferson National Accelerator Facility
26. **Facility for Rare Isotope Beams (FRIB)**
    Michigan State University
27. **Relativistic Heavy Ion Collider (RHIC)**
    Brookhaven National Laboratory

Co-Chairs

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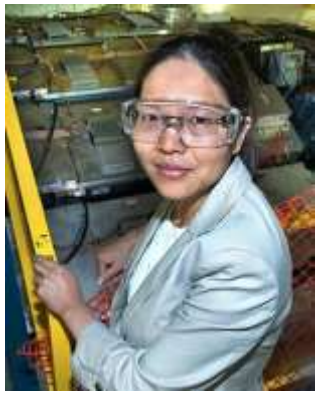

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Participants

Co-chairs
- Nigel Mouncey, LBNL (JGI, BER)
- Lijuan Ruan, BNL (RHIC, NP)
- Stephen Streiffer, ANL (APS, BES)

User research in virtual contexts
- Debbie Bard, LBNL (NERSC, ASCR), co-lead
- Richard Buttery, GA (DIII-D, FES), co-lead
- Ahmed Diallo, PPPL (NSTX-U, INFUSE, FES)
- Cynthia Keppel, JLab (CEBAF, NP)[1]
- Jonathan Lang, ANL (APS, BES)
- Emma McBride, SLAC (LCLS User, BES)
- Adam Slagell, LBNL (ESnet, ASCR)
- Indara Suarez, Boston University (CMS, HEP)
- Jerry Tuskan, ORNL (JGI User, BER)

User research in physically distanced contexts
- Hans Christen, ORNL (SNS/HFIR/NSRC, BES), co-lead
- Christine Clarke, SLAC (FACET, HEP), co-lead
- Mike Carpenter, ANL (ATLAS, NP)
- Mary Convery, FNAL (Fermilab Accelerator Complex, HEP)
- Rajesh Maingi, PPPL (NSTX-U, FES)
- Douglas Mans, PNNL (EMSL, BER)[1]
- Bronson Messer, ORNL (OLCF, ASCR)
- Tom Rabedeau, SLAC (SSRL, BES)
- Adam Rondinone, LANL (CINT, BES)[1]
- Matthew Whitaker, Stonybrook University (NSLS-II User, BES)

Facility operations in physically distanced or virtual contexts
- Mike Lindgren, FNAL (Fermilab Accelerator Complex, HEP), co-lead
- Gert Patello, PNNL (EMSL, BER), co-lead
- Siegfried Glenzer, SLAC (MEC, FES)
- Nicki Hickmon, ANL (ARM, BER)
- Mike Martin, LBNL (ALS, BES)
- Ben Maxwell, LBNL (NERSC, ASCR)
- Michiko Minty, BNL (RHIC, NP)
- Mark Palmer, BNL (ATF, HEP)[1]
- Brad Sherril, MSU (FRIB, NP)

User training/engagement
- Rolanda Jundt, PNNL (ARM, BER), co-lead
- Lisa Miller, BNL (NSLS-II, BES), co-lead
- Ashley Barker, ORNL (OLCF, ASCR)
- Gavin Davies, University of Mississippi (Fermi UEC, HEP)
- Chuck Greenfield, GA (DIII-D, FES)[1]
- Terry Law, PNNL (EMSL, BER)
- Janell Thomson, ORNL (SNS/HFIR, BES)
- Xiaochao Zheng, University of Virginia (JLab User, NP)

Computation, data, and network resources
- Kjiersten Fagnan, LBNL (JGI, BER), co-lead
- Jini Ramprakash, ANL (ALCF, ASCR), co-lead
- Chin Guok, LBNL (ESnet, ASCR)[1]
- Paul Mantica, MSU (FRIB, NP)
- Dave Schissel, GA (DIII-D, FES)
- Liz Sexton-Kennedy, FNAL (CIO, HEP)
- Jana Thayer, SLAC (LCLS, BES)

Crosscutting issues
- Cynthia Keppel, JLab (CEBAF, NP), co-lead
- Adam Rondinone, LANL (CINT, BES), co-lead
- Chuck Greenfield, GA (DIII-D, FES)
- Chin Guok, LBNL (ESnet, ASCR)
- Douglas Mans, PNNL (EMSL, BER)
- Mark Palmer, BNL (ATF, HEP)

[1] Also member of Crosscutting issues panel

Calendar

Pre-work	The Meeting			Post-work	
Solicitation of Factual Status docs Nov. 30 pre-launch meeting				Synthesis into a letter report due in January	
Kickoff Plenary	Breakout Panels Asynchronous self-scheduled	Co-Chairs Check-in with Panel Leads	Breakout Panels Asynchronous self-scheduled	Panels submit contributions to Co-Chairs	Closeout Plenary
Dec. 2 2020		Dec. 8		Dec. 11	Dec. 15

Factual Status of User Facilities

- At the outset of this roundtable, we wanted to capture key information on status of the User Facilities → User Facility Factual Status Document
- Key questions:
  - How has the COVID-19 pandemic affected your facility?
  - What approaches are you taking to provide productive user research experiences and services in a virtual context?
  - What, if any, changes to physical access have you implemented or considered for users, vendors, or maintenance personnel?
  - Have you identified any lessons learned as a result of the COVID-19 pandemic?
  - What has the COVID-19 pandemic revealed about the needs for virtual access to computational, data management/analysis, software, and network resources or other types of instrumentation?
  - Have project award periods been extended and if so, does this impact future proposal calls and facility operating costs (including budget carryover across the fiscal year)?
  - What have been the impacts on annual user facility meetings, strategic planning workshops, and short courses and schools (to train students, early career researchers, or future users)?
  - Any other comments

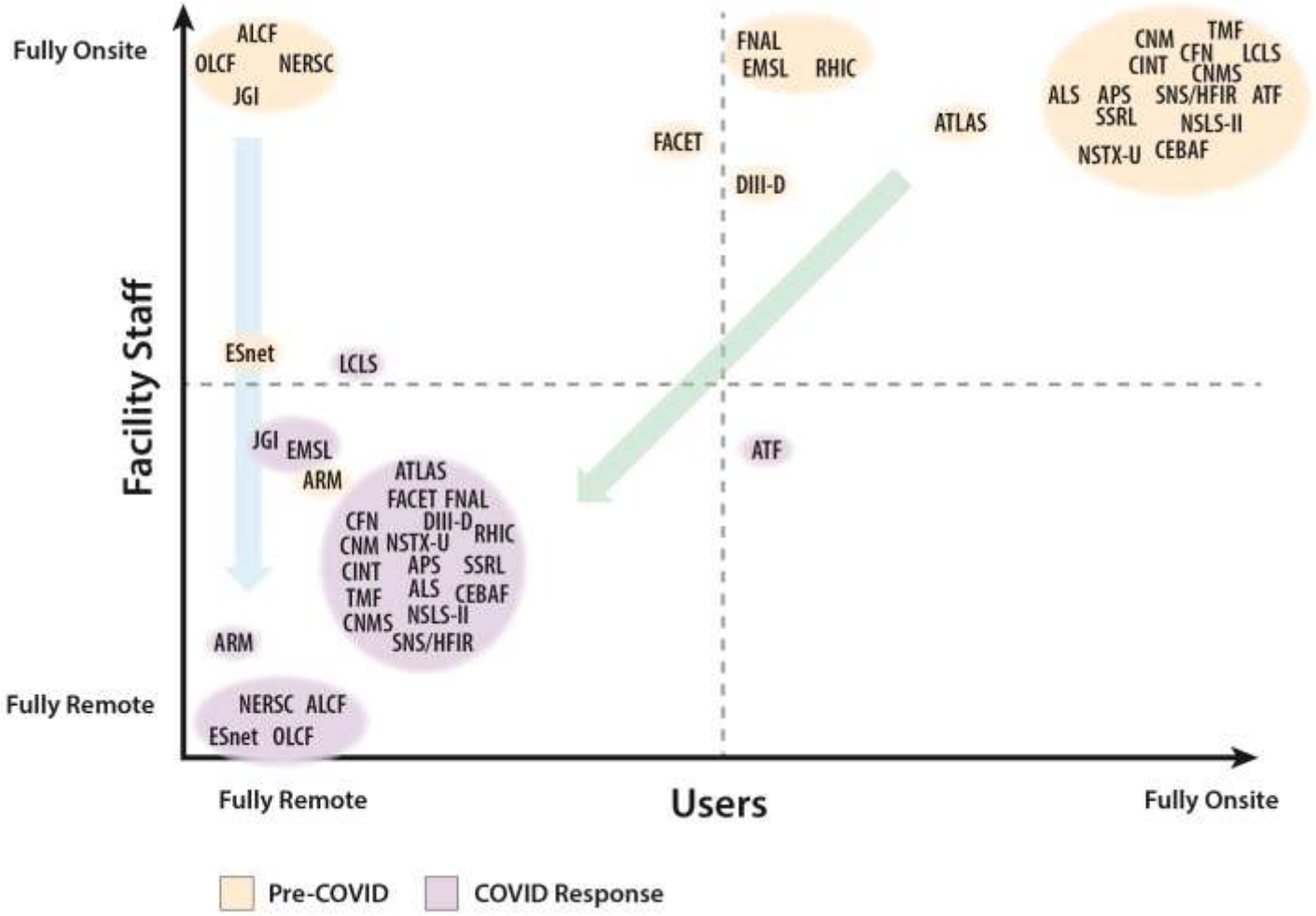
Factual Status Document - Key Themes

- Most User Facilities switched to full or predominately remote operations with limited onsite users and operated under new controls
- Virtual collaboration tools substituted for on-site presence, but significant gaps remain
- Lack of on-site presence impacts the concept of what a “user” means, in certain cases
- Concern that higher-complexity, higher-payoff experiments are being deferred at facilities with diverse experimental portfolios
- Additional burdens placed on staff to support remote Users
- Early career researchers and staff are significantly impacted
- New modalities to train Users have had to be implemented
- User outreach has become limited
- In general, scientific productivity from facilities is reduced
- Creative interactions and the progress of science severely hampered
- Cyber security and cyber productivity issues
- Remote operations have removed physical location and equity constraints and could broaden collaborations and user base

Roundtable Panels

Panel	Panel Leads
Panel 1: User research in virtual contexts	Debbie Bard, NERSC Richard Buttery, DIII-D
Panel 2: User research in physically distanced contexts	Christine Clarke, FACET Hans Christen, SNS/HFIR
Panel 3: Facility operations in physically distanced or virtual contexts	Mike Lindgren, Fermilab Gert Patello, EMSL
Panel 4: User training/engagement	Rolanda Jundt, ARM Lisa Miller, NSLS-II
Panel 5: Computation, data, and network resources	Kjiersten Fagnan, NERSC Jini Ramprakash, ALCF
Panel 6: Crosscutting issues	Cynthia Keppel, CEBAF Adam Rondinone, CINT

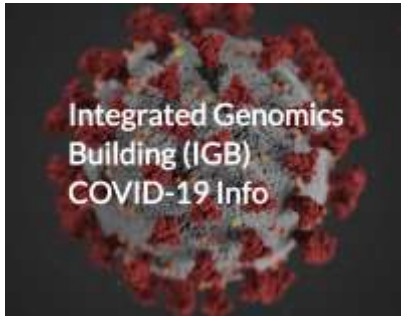
User Facilities Adapted Operations to COVID-19



- SC user facilities have diverse operation models and experienced significant disruptions because of the pandemic.
- Despite these challenges, they found ways to continue to conduct research and support users.
- There are two broad trends in how operations shifted from before the pandemic (orange circles) to fall 2020 (purple circles).
- In one case, facilities that had many remote users before the pandemic continued to support these users, but facility staff shifted to working remotely (blue arrow).
- In the other case, facilities that had mostly onsite users shifted both facility staff and users to working remotely (green arrow).

Shifting JGI Operations During COVID-19

- March-June 2020: 100% staff telework:
  - Continuation of normal data processing, data facilitation, analyses; administrative leave
- June 2020-July 2021: phased return of lab and operations staff:
  - Prioritization of staff for COVID-19 R&D -> User Production Platforms -> User Science Programs
  - Shift-work and distanced floor plan for optimal safe work in labs
  - Staffing schedules updated on a weekly basis – checkerboard approach for bench allocation, office occupancy schedules, staff website established to centralize key information
- July 2021-Present: maintaining limited onsite staffing:
  - Lab operations and R&D resumed to full capacity
  - Staff whose roles do not require onsite work are teleworking full-time
- January 2022 (?)-Onwards: hybrid workforce:
  - Developing plans for hybrid workforce: HR, meetings, equity, etc
  - Efficient space utilization and processes



IF virtual was as good, or better, than physical presence..

- We could better embrace the fact that increasingly it's not possible for the data to physically go to users after it's generated
- Resources devoted to travel could be used for other priorities
- The environmental impact of travel could be reduced
- There might be better configurations for facilities and operations that are more efficient
- We might be able to rely less on one-deep, expert-based approaches, and have more enduring, broader-based artifacts of the user facility universe (digital training materials, capture of experimental and facility configuration, data and design repositories,….)
- We could build more diverse, more inclusive user communities
- We could support a more diverse and inclusive staffing paradigm

Key Opportunities Identified

- Transfer lessons learned and best practices between the different SC facilities
  - Immediate need for COVID-related issues
  - Longer-term benefit of increased inter-facility engagement
- Develop new tools to engage and support broader user communities
  - Operations and execution tools and infrastructure
  - New tools that address existing weaknesses in virtual comms, collaboration, networking
- Harmonize, coordinate, federate data management tools/strategy/solutions
- Better create and capture digital products from trainings, meetings, workshops, conferences, etc.
- Scrutinize our pre-COVID operation modes and make changes for more efficient operations and better work-life balances at facilities
- Free staff to better focus on science, by capitalizing on automation and virtualization
- Rise to our responsibility towards early career staff and users, as well as new users, to ensure they can succeed

Concluding Remarks

- The pandemic has had profound and varying impacts on the SC user facilities.
- The balance between cost/impacts and benefit of remote user access are different for each facility.
- Opportunities have included increased breadth of access in certain cases, and a shift to a more efficient mode of operations for certain experiments.
- Costs have included increased burden on staff at facilities that historically had mostly on-site users, loss of engagement, hard but impactful experiments deferred.
- There is a loss of community built upon physical presence which puts mentoring, training, workforce development, scientific output, etc. at risk of severe damage.
- Virtual/remote access is a double-edged sword.
- We have the opportunity to capitalize on the rapid shifts necessitated by COVID-19 to move quickly to a new normal that might have been coming regardless.

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