

Center for Advanced Research Computing

Patrick Bridges

Director

2019 Annual Review of Category 3 Research Centers/Institutes | February 24, 2020

Mission

To lead and grow the computational research community at UNM.

To fulfill our mission, we will:

- Provide access to high-end computing resources and associated infrastructure;
- Offer specialized expertise and technical support;
- Coordinate and collaborate with other UNM programs that support the community; and
- Grow the collaborative user community through education, workshops, and outreach events.

CY 2019 Goals and Status

- Promote revised Computational Science and Engineering (CSE) graduate certificate program – outreach to affiliated faculty and departments, develop more specializations
 - Catalog updates completed May 2019. An admissions committee has been identified and we are working on creating an advisory board. Work has progressed on developing a data science specialization.
- Develop collaborative research community through outreach, workshops and symposia
 - 2019 saw 91 Introduction to Computing at CARC workshop attendees, a large increase over the 14 who attended in 2018
 - New Parallel MATLAB workshop was launched with 16 attendees
 - CARC Graduate Assistants held research presentations in the Workshop room at the end of each semester
 - A number of events took place at the UNM SC19 booth, including workshops on Virtual Residency and Software Carpentries
- Systems updates
 - Deployed a new NetApp enterprise storage system
 - Upgraded CARC core network infrastructure, making 10Gb Ethernet the default connection to all CARC HPC and storage systems
 - Launched Vivantio help ticket system
 - Deployed Jupyter notebooks, distributed MATLAB, and debugging queues to increase system accessibility
- Significant grant/contract opportunities
 - Submitted NSF cybertraining, NNSA MSIPP, HDR DSC, NSF IGE, NSF OAC, and PSAAP grant proposals in 2019
 - Received official notice in early 2020 that PSAAP was funded (\$4 million)
 - Submitted revised application to NSF cybertraining in early 2020
 - Multiple additional opportunities going forward: NSF IUSE:CUE, Potential Mid-scale Infrastructure Collaboration with RMACC, Network infrastructure opportunities with regional partners

Membership of Advisory Committee

- **Membership List**

- **Susan Atlas, Ph.D.** - Research Professor, Physics and Astronomy
- **Patrick Bridges, Ph.D.** - Director, CARC; Professor, Computer Science
- **Karl Benedict, Ph.D.** - Associate Professor, Director of Research Data Services. College of University Libraries and Learning Sciences
- **Jed Crandall, Ph.D.** - Associate Professor, Computer Science
- **Jeremy Edwards, Ph.D.** - Professor, Chemistry
- **Hua Guo, Ph.D.** - Distinguished Professor, Department of Chemistry and Chemical Biology, and Department of Physics and Astronomy
- **Patricia Henning, Ph.D.** - Associate Vice President for Research; Professor of Physics and Astronomy
- **Jane Lehr, Ph.D.** - Professor, Electrical and Computer Engineering
- **Keith Lidke, Ph.D.** - Professor, Physics & Astronomy
- **Barbara McCrady, Ph.D.** - Distinguished Professor, Psychology; Director, Center on Alcoholism, Substance Abuse, and Addictions (CASAA)
- **Monika Nitsche, Ph.D.** - Professor, Mathematics and Statistics
- **Marek Osinski, Ph.D.** - Distinguished Professor, Electrical & Computer Engineering; Center for High Technology Materials
- **Brian Pietrewicz, MBA** - Deputy CIO, Information Technologies
- **Andrea Polli, Ph.D.** - Mesa Del Sol Endowed Chair of Digital Media Professor, Fine Arts and Engineering University of New Mexico Department of Art and Art History
- **Edl Schamiloglu, Ph.D.** - Distinguished Professor, Electrical and Computer Engineering; Associate Dean for Research, School of Engineering
- **Gregory Taylor, Ph.D.** - Director, Long Wavelength Array; Director, Center for Astrophysical Research and Technology; Professor, Department of Physics and Astronomy
- **Lee Taylor, Ph.D.** - Associate Professor, Biology
- **Tom Turner, Ph.D.** - Associate Dean for Research, Arts & Sciences; Professor, Biology

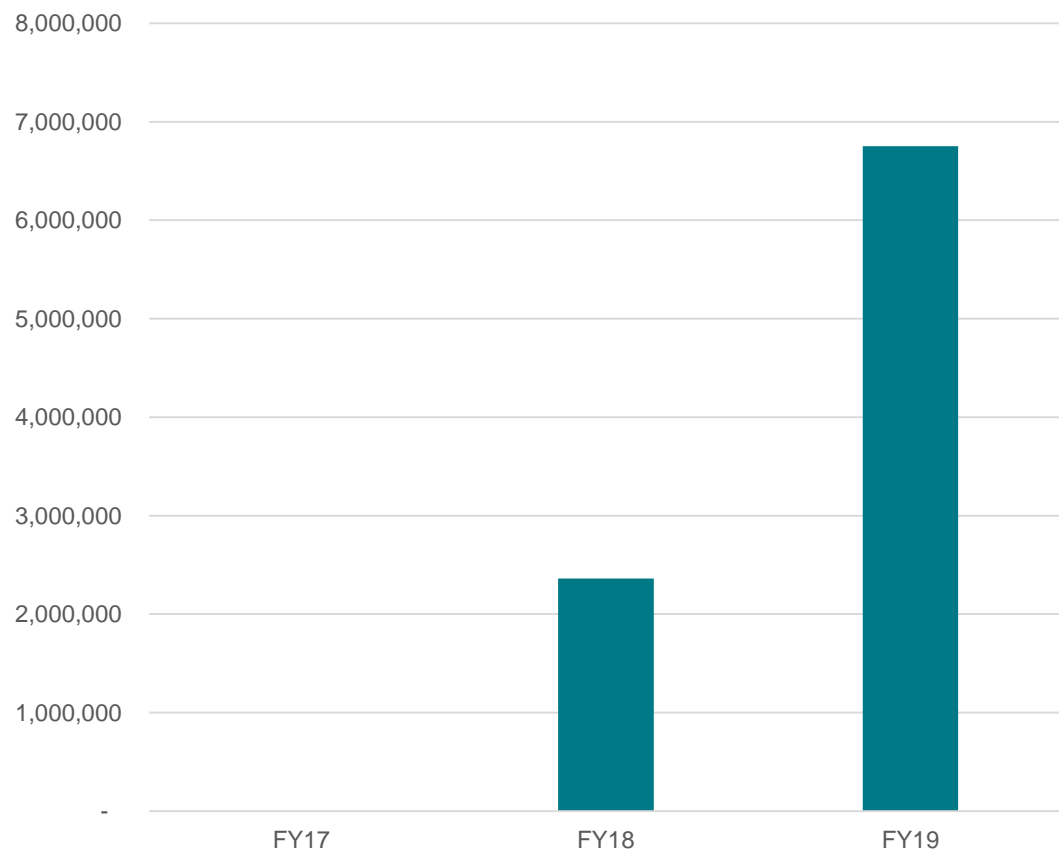
- **Date of CY2019 annual review with the Advisory Committee: not held yet**

CY 2019 Highlights

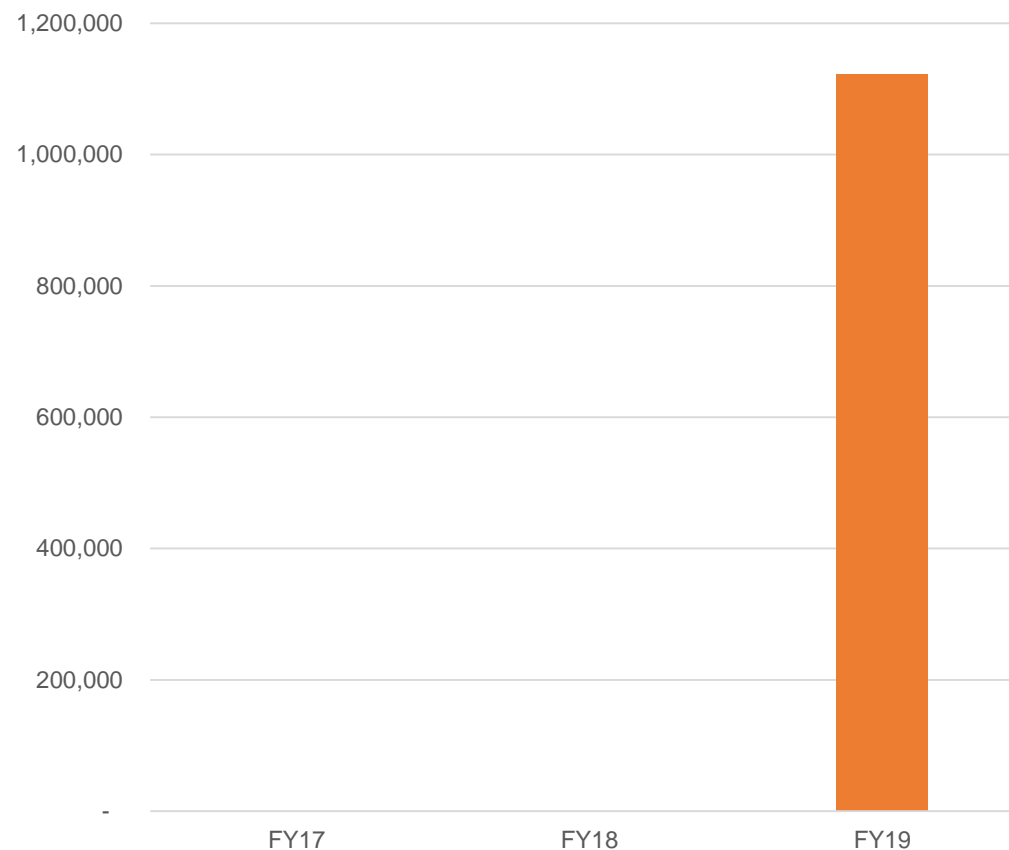
- Completed major system upgrades including deploying a new enterprise storage system; upgrading CARC core network infrastructure, making 10Gb Ethernet the default connection to all CARC HPC and storage systems; completed critical maintenance on one uninterruptible power supply (UPS), and retired the Galles general use supercomputer
- Leading research on multiple new awards, including support for research involving sensitive data in collaboration with UNM IT and Libraries
- Significantly increased center research proposal submissions and funding
- Hosted a table at UNM Day at the Roundhouse and delivered information packets to legislators' offices
- Hosted NM Supercomputing challenge student evaluations
- Attended and displayed research at our booth at ACM/IEEE International Conference on Supercomputing

Proposals & Awards

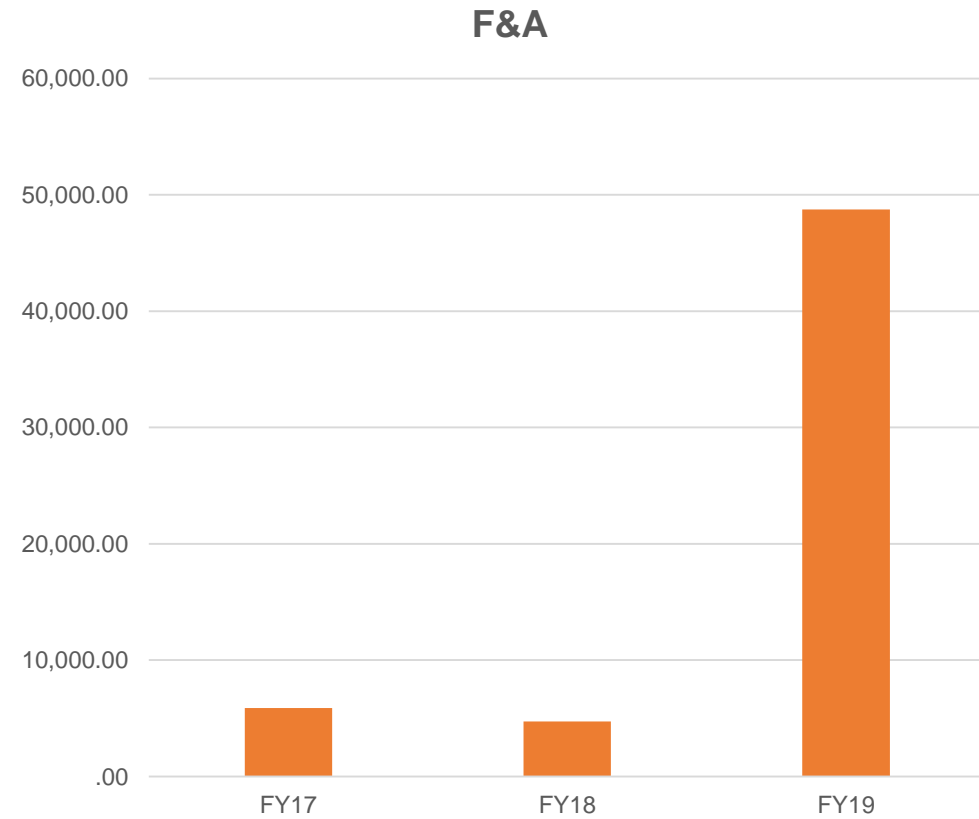
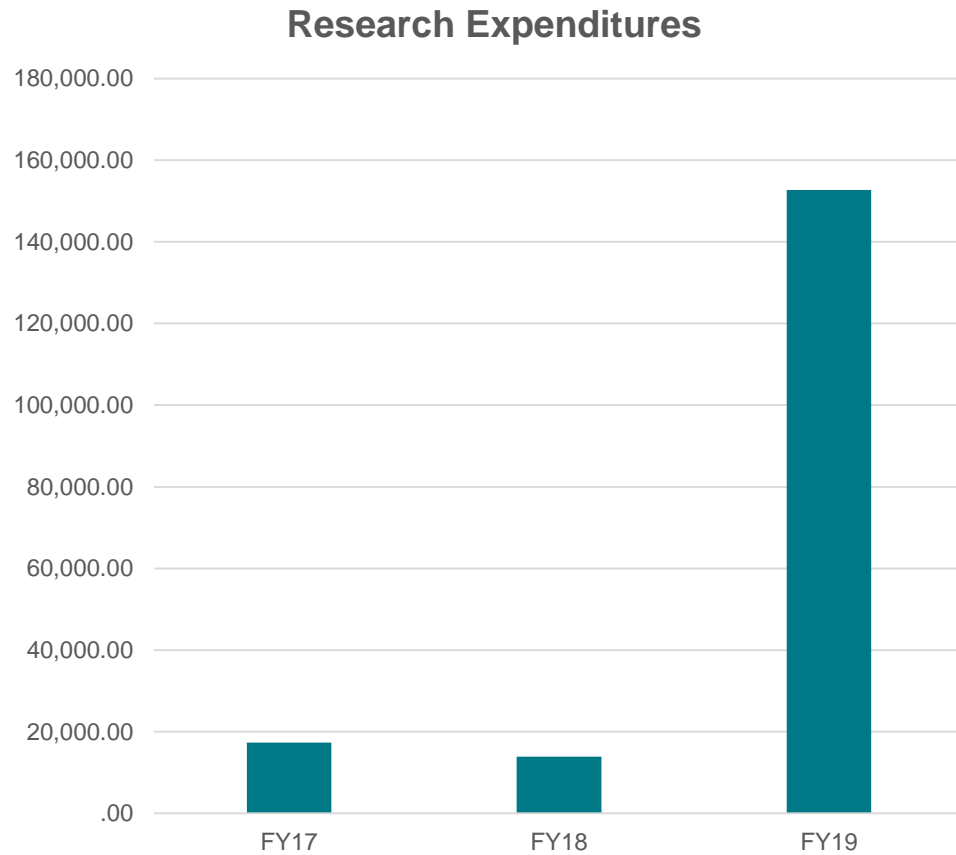
Proposals



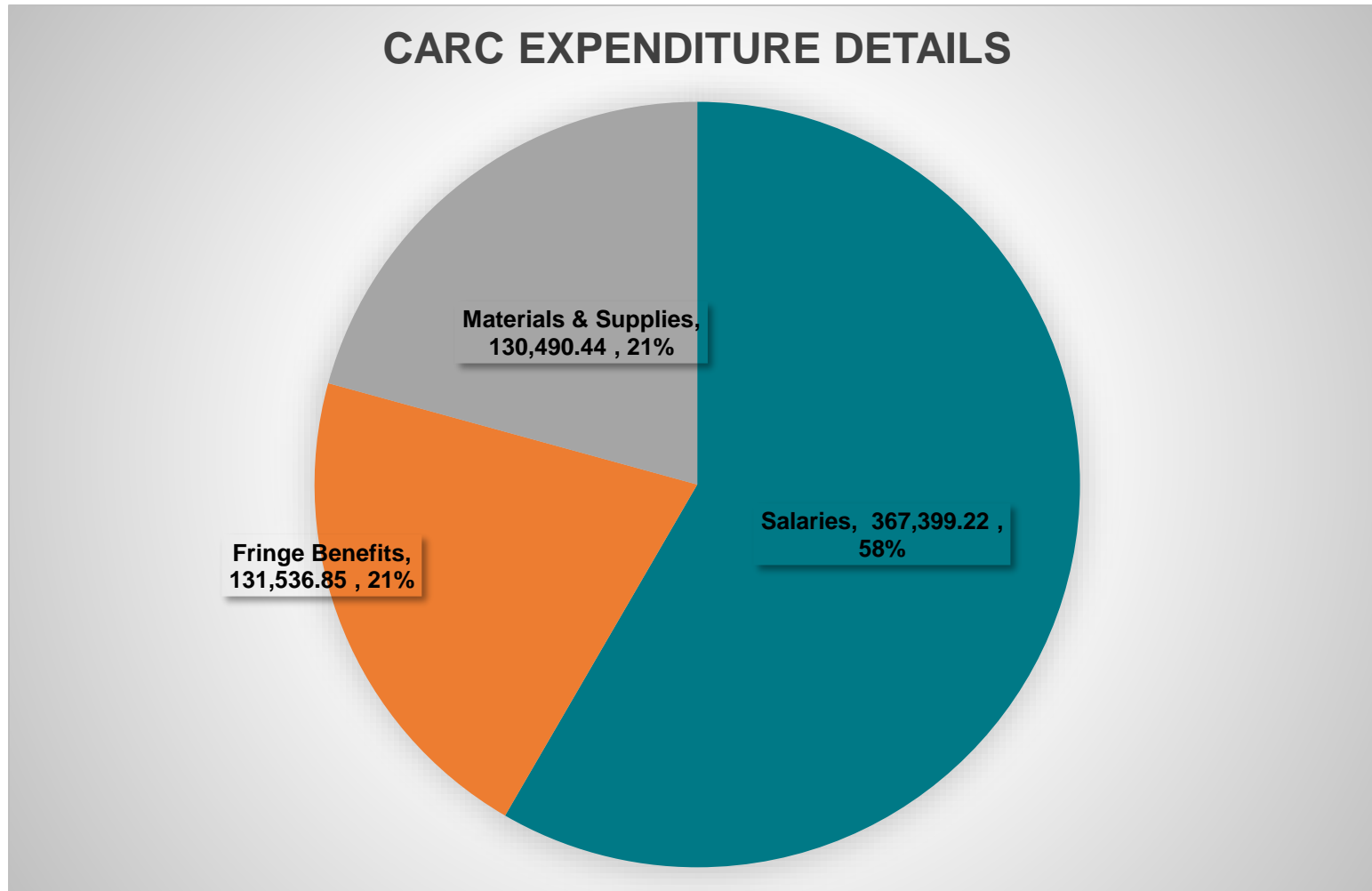
Awards



Research Expenditures and F&A



FY19 Sources of Revenue	
F&A Return	17,104.90
VPR Allocation	680,000.00
Other	4,000.00
FY18 to FY19 Reserves	26,424.18
Total	727,529.08



Research Center Impacts

- Trained 107 students, faculty and staff to use CARC resources in workshops held throughout the year
- Helped deploy the New Mexico Decedent Information Database, a project led by Prof. Heather Edgar and funded by the National Institutes of Justice. NMDID is the first national searchable database of whole-body decedent CT scans and is now available to researchers nationwide.
- The number of users, projects, jobs finished, and CPU hours provided to UNM continues to grow
 - 2017: 99,679 Jobs Finished; 7.2M CPU Hours provided
 - 2018: 217,427 Jobs Finished; 15.4M CPU Hours provided
 - 2019: 411,125 Jobs Finished; 17M CPU Hours provided
- CARC and multiple UNM PIs collaborated to begin acquiring new hardware to expand the Taos compute cluster
- Collaborating with NMSU via EPSCoR award to improve UNM and state computational research capabilities related to smart energy grids, including new storage at CARC

Return on Investment

- CARC supported 308 users and 92 PIs, with 411,125 jobs finished
- 56 publications in journals such as *Scientific Reports*, *Nanophotonics*, *Communications Physics*, *The Journal of Mathematical Physics*, *The Journal of Chemical Physics*, *The Astrophysical Journal*, *Materials Research Express*, *Radio Science*, *Viruses*, *Zoologica Scripta*, and *Water Resources Research*.
- Awards resulting in publications using CARC resources included funding from the National Science Foundation, National Institutes of Health, Department of Energy, Institute for Space and Nuclear Power Studies, Office of Naval Research, and the Air Force Research Lab among others.

Support a broad range of computational research activities by the UNM community

Provide substantial computational resources to researchers free of charge

Expert user support staff

Graduate student ambassador training program

STRENGTHS

Aging systems and facilities

Understaffed to meet campus demand

Building with significant security, maintenance, and utilization challenges

Lack of support for research with specialized needs or that handle sensitive data

WEAKNESSES

Utilize CSE program to expand research computing expertise on campus

Computational science workforce demand

Research and Education Funding opportunities within NSF Harnessing the Data Revolution Big Idea calls

Increase collaboration with other computational units on campus (Libraries, IT)

External collaboration with Labs (SNL, LANL) and industry

OPPORTUNITIES

Staff loss to retirement, external competition

Major system or facilities failure

Decreasing price of cloud computing systems

THREATS



Looking Ahead to 2020

- In early 2020, we received a \$4 million, 5-year DOE NNSA award to create the Center for Understandable, Performant Exascale Communication Systems (CUP-ECS). This project's anticipated start date is May 15.
- Continue to promote and improve revised CSE program – outreach to affiliated faculty and departments, develop more specializations
- Become an NSF XSEDE basic service provider (SP) and assess the requirements and potential benefits of further integration with NSF XSEDE services, as preparation for potential submission of NSF system acquisition and management awards.
- Develop and submit of an NSF MRI proposal for a new HPC CARC-hosted capacity HPC system in collaboration with multiple UNM PIs

Summary

- Made considerable progress on the immediate goals outlined in our strategic plan
 - Deployed new storage and virtualization systems, began the acquisition of specialized compute hardware in collaboration with UNM researchers, and updated core power and networking infrastructure to support current and future technical growth
 - CARC-supported students continue to enhance user support and help documentation on our website as well as learn to support users in their discipline on using CARC systems
 - Deployed new interfaces to CARC systems to increase their usability for research and education
 - Planning and organization of CSE certificate program relaunch in progress
- Engaged in major collaborative projects, strengthening cross-campus collaborations that increase center impact for the benefit of the UNM community
 - Shared storage resources with University Libraries
 - Decedent Information Database with OMI and UNM Arts and Sciences
 - Sponsored research with Libraries, IT, Psychology, and ECE on infrastructure for supporting research on sensitive data
 - Collaboration with NMSU research computing personnel through EPSCoR award to improve UNM and state computational research capabilities related to smart energy grids
- Submitted multiple sponsored research proposals, resulting in the selection of UNM CARC to lead a prestigious DOE NNSA PSAAP center in collaboration with researchers at the University of Tennessee at Chattanooga and the University of Alabama at Birmingham