

## **2022 CASC Top Priority Areas: Address Staffing Challenges to Recruit, Retain, and Develop a Skilled, Diverse Workforce**

### **Summary Statement**

Institutions should standardize job descriptions and define career paths for professionalization of the workforce and work to improve internal communication with HR departments at their institutions. Research sponsors should take steps to expand RCD workforce participation, as well as diversity, equity, and inclusion on their own and in multi-organization partnerships. CASC should improve information sharing for jobs and career paths, engage with and promote participation by a more diverse set of institutions in the RCD community, and approach workforce development on a community-wide basis.

### *Why it Matters*

The ability to plan, develop, and utilize cyberinfrastructure platforms and other resources depends not just on funding for technology. The primary enabler of the support services for computational research is the expertise of a host of staff members for CI operations, consulting on hardware and software, data analysis and management, training, and direct participation in research project teams. Finding, hiring, and retaining people for these support positions requires recognition, credit, and respect for their work as part of the research enterprise, along with relevant job titles and career paths, steady funding, and changes in culture to allow a greater diversity of the workforce. In addition, flexible work environments are now a critical component to staff looking for their next opportunity.

CASC member institutions are facing challenges related to hiring staff. The issue is not how one institution fares against other institutions; it is about how academic research computing & data (RCD) can overcome the issue and attract people from other organizations and industry. We are focusing more on the challenges related to these questions. One could also argue that they provide new opportunities: the creation of new funding channels, new creative training programs, and new career paths. In short, the field is growing.

Almost every research area now requires access to RCD resources, so an RCD team is a critical requirement to support cyber-enabled research efforts. There is an expanding need for RCD across all areas of campus, as research domains that previously did not engage in computational efforts now need easy-to-use resources and training to accomplish their goals. As a result, the number of requests for assistance – and the need for more RCD staff – has risen quickly. RCD supports all research areas, from medical applications, linguistics, computational sciences, and engineering, to all forms of data analytics, including Business and Agriculture. Research computing is complex, requiring above-average IT skills and expertise far above those required for basic PC/Mac and Windows-based servers.

Many researchers who would like to take advantage of research computing, research data management, and related products/services come from backgrounds where computing resources are not widely used and thus have neither the technical expertise nor social support to use them effectively. In these cases in particular, RCD staff are a critical part of enabling research. Allowing people to manage their own infrastructure leads to security issues and inefficient use of resources. While many researchers can ultimately muddle through running their own systems, they often cannot find or retain the diverse array

of expertise needed to move their research portfolios forward. RCD staff with strong skill sets and diverse backgrounds add to the value we can bring to research programs.

Hiring highly experienced staff in RCD roles often proves nearly impossible, making developing and retaining existing staff a necessity. Staff members are the lifeblood and most essential piece of any organization, determining success or failure as much as – if not more than – any technology. Diversity within the staff, whether in life experience, domain expertise, or skill sets, enhances their contributions and ability to interface with diverse individuals. The complexity of the Research Computing landscape necessitates above-average skills from IT and other professionals. Retention and development are vital to obtaining the workforce we need, especially given the difficulties in recruiting caused by the demand for experienced staff.

### *Current Challenges*

#### Recruiting/Finding talent

Academic RCD organizations face the same retention challenges as industry organizations, often with the added complexity of smaller organizations with less funding and fewer career paths. Finding staff can be difficult because few IT professionals or recent graduates know about HPC, and when they do, the opportunity cost of an HPC career seems too high. Moreover, staff who have been working in HPC for a long time may not want to move to new locations, and some experienced HPC staff are worried about working on obsolete technologies. Thus, technically skilled people are tough to identify and hire and are easily poached by industry for higher salaries and remote work.

For some centers, hiring consultants and scientists has been much more commonplace than hiring and retaining research infrastructure experts, research software engineers, and other RCD support staff talent. At such institutions, upper management, HR, and other stakeholders may not fully appreciate that RCD staff positions often require specific background and experience different from those needed by faculty, or for more general IT positions. This lack of awareness can lead to gaps in perception of the integral roles that RCD staff play in supporting faculty as part of the research process, and of the value their activities bring to the institution.

As with any technical field, increased awareness about the field in high school and college can increase entry to the field and create a skilled workforce. However, many of the skills required to work in RCD are not typically taught in formal classrooms, and the path to a career in RCD is not clear. With the rapid changes in technology, the knowledge base expands (today the RCD profession is concerned not only with HPC, but also networks, storage, and cloud services) making it difficult for any curricula to keep up.

For budget and time reasons, it can be difficult for RCD staff to provide student internships. While enriching for the students, internships require significant time commitment from the institution with limited hope of retaining participants because of stiff competition from industry. In particular, most RCD roles often receive low compensation relative to similar positions in industry, and HPC centers and other RCD workplaces have struggled to showcase the appeal and benefits of the academic vs.

corporate world to new undergraduate students. Consequently, the field suffers from a limited talent pool.

For job applicants, the ability to work from home is now not only a consideration, but for many a requirement. Many institutions are currently working on how to support the new challenges of providing a hybrid or fully remote working environment. For roles that require onsite work, location is often an issue, as recruiting from out of state is often difficult. For locations with lower population diversity, even if strong talent can be recruited, diverse hiring may remain a challenge.

### Diversity, Equity, and Inclusion

Today the talent pool for entry-level RCD positions remains predominantly white and male, so a clear focus on diversifying the talent stream will be required. However, in this case, diversity represents not just gender, background, or ability, but also different ideas, views, and experiences. For example, the RCD workforce remains very focused on physical sciences, with far fewer people in RCD from a social science background. This disparity is becoming increasingly important as more social sciences researchers begin using advanced computing.

While the lack of diversity in the RCD workforce is an acknowledged challenge across institutions, many remain focused on competing with each other to recruit what diverse talent there is from a relatively small pool. Addressing the root causes remains out of reach for most institutions. Finally, there are too few RCD positions compared to what are needed to adequately support the research needs of a growing research community. This is particularly acute in areas relating to artificial intelligence (AI), machine learning (ML), and data mining, creating a significant gap between supply and demand.

### Training

In most centers, the number of required service operations expands as the community grows. Expanding operations has often been an obstacle to providing other services such as training or consultation. Training presents a double-edged challenge: highly skilled staff members do not have time for training built into their workday – whether that means continuing training for themselves, or educating others. They are frequently learning on the job, and the job of training students or junior staff falls to the wayside.

Recruiting students has certainly helped address some staffing needs; the challenge is that much of the work needs to be done for limited gain (short period of productive time vs. comparably long period of training time.) There are also concerns about whether training student interns is worth it because they come out of research computing training with advanced technical skills and are unlikely to stay and continue full-time at the academic center. Moreover, sharing the workload is challenging with student interns because many RCD professionals have root access to systems but for operational security reasons cannot give interns the same level of access.

Finally, while learning on the job is good, there is a need for continued professional development for existing research computing facilitators (RCFs) to maintain up-to-date skill sets.

## Retention & Salaries

One of the main problems experienced by academic research computing centers is retaining staff, especially in competition with industry.

First, remote working gives industry easier access than ever to recruit RCD professionals away from academic institutions. In the past, RCD staff at centers might choose to stay because of the town, the people, or because the institution is the best employer, but this is changing rapidly. Second, industry, particularly commercial cloud providers, need many of the same skills required by HPC centers and have been hiring at lightning speed, making it increasingly difficult for HPC centers to find qualified staff. Finally, AI, ML and data mining is becoming ubiquitous in many industries, creating additional supply-side staffing challenges. Computational and data science-oriented researchers who would potentially become RCD staff are aware that their skillsets are highly marketable and are going into industry to make much larger salaries.

There is no straightforward path to develop the skills needed in academic RCD, unlike in Engineering or other disciplines. In addition, the organizational hierarchy in RCD is not well-known or well-established. Different institutions follow different models, and positions with the same titles may have completely different responsibilities. Unfortunately, universities often have complicated processes for realigning positions and salaries.

*“We also have continued challenges in hiring less experienced candidates where it can be difficult to adjust salaries quickly as they gain experience. We either have to offer larger salaries to unproven candidates or end up with experienced candidates with proportionally lower salaries.”*

## Institutional HR Challenges

With institutional university and lab Human Resources (HR) organizations, getting the current work tasks done is often perceived as more important than building up people’s skills and careers, so universities put fewer resources and less time into those efforts. Consequently, supervisors are left to stumble forward with local staff development attempts rather than formal training. HR offices tend to be inflexible in language that HPC centers may use; levels of experience/education that must be required; salaries that can be offered; “soft skills” or emotional intelligence to be listed as desirable; and helping with appropriate titles and career paths (particularly for staff). And the HR timeline can be terribly slow – it can take multiple weeks for a candidate to progress from Finalist to Hired. Promotion may also be out of the hands of the manager/department and in the hands of HR.

*“Our university system has recently realigned all staff positions across universities, not making any distinctions between an R1 institution and the 4 year colleges. Now a scientific computing professional falls in the same staff category as systems administrator, with the same salary ranges and basic requirements - e.g. I cannot explicitly list a Ph.D. as a requirement.”*

RCD staff require advanced skill sets that are distinct from conventional IT support, but HR often equates them with conventional IT support positions. Thus, finding staff with the necessary skills is

difficult. Without a clear model of what RCD staff do and how they differ from IT staff, HR is unlikely to provide an appropriate compensation model, which hinders efforts at employee retention. HR departments do not know how to classify job categories and titles and may not understand who they are competing against for talent, leading to a lack of defined career and promotional path.

Frequently even the Center Directors do not have any say over what the HR team does. This includes not utilizing blind resume reviews, making sure HR advertises the job in a wide variety of places, and allowing employees to work remotely when possible. Campus politics and internal boundaries can also impact Center hiring, as RCD staff may need to be shared by multiple departments. Such boundary crossing issues can create friction related to personnel management as well as funding.

*“Central HR has done an assessment of IT ranks, but did not consider scientific computing professionals as an independent category. They’ve bundled the RCD positions we have with any other departmental IT staff, those who take care of desktops, computer labs, printing, etc.”*

#### *Vision of Success*

Any results of workforce development programs across CASC member institutions should include some of the following elements: 1) a standardized job description for RCD professionals, with a suggested career path; 2) support from University or institutional leadership and HR departments for hiring within this path; 3) diverse pools of qualified applicants from across the United States; and 4) training and retention programs that support RCD staff and inspire staff. Diversity, Equity, and Inclusivity will be ‘baked in’ to any successful RCD staffing program. Suggested approaches needed to realize this vision are discussed in greater detail below.

#### RCD Professionalization

Multiple organizations are working to formalize the definition of RCD staff and RSE activities for job descriptions. The Campus Research Computing Consortium (CaRCC) RCD Professionalization working group<sup>1</sup> is formally defining several RCD career paths in HR-friendly language that can be used for future listings. CaRCC has also developed good information on job types and levels for HPC staff covering system administration, researcher/user support, and software engineering. In addition, US-RSE<sup>2</sup> is making “Research Software Engineer” a universal job title that institutions can hire for, with specific knowledge and responsibilities.

*“Hiring scientists is working well, and I am not facing diversity issues in hiring staff scientists. The staff who do get hired are very motivated to learn new skills and generally stick around for a long period. We are able to sponsor GC and H1B for our staff. This has been a big help.”*

National-scale supercomputing centers such as TACC, PSC, IU, Purdue, and others are often able to offer training and workforce development programs for students, staff, and researchers both at their own organizations as well as programs offered for broader community consumption. In addition,

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<sup>1</sup> <https://carcc.org/rcd-professionalization/>

<sup>2</sup> <https://us-rse.org/>

Research Experiences for Undergraduates (REU) and summer camps for minority students are broadening the pipeline at a younger age, showing more kids that computer science is an exciting career choice.

To meet workforce recruitment pressures, RCD organizations sometimes take steps on their own that go well beyond those specified by grants or funding agency requirements to develop the available workforce better. For example, TACC offers four-month professional internships for software development, and OU has produced a long series of Virtual Residencies and training opportunities aimed at developing Campus Champions as well as general HPC system administration expertise<sup>3</sup>. Such investments in training junior staff and students before they graduate enable centers to hire from the pool of participants trained through such programs and improve operations and skill sets at the institutions where these participants are based.

*“We have to take the respect that we deserve.”*

A successful center, with a positive, encouraging culture would hope to see people turn down jobs with industry because they prefer the university environment for consulting positions. They can highlight the comparatively low-stress work of academic environments vs. industry. Centers may also allow RCD staff to participate in a wide range of programs (such as teaching or supporting summer camps) or hands-on support when building a system, which leads to a more collaborative and cohesive workplace. In addition, it is important to ensure RCD staff receive credit for being an integral part of the research work.

Many academic centers find new staff through:

- Summer internship programs, which provide opportunities and structure for mentoring potential new RCD workforce members
- Referrals from current researchers, though this needs to be expanded to more disciplines
- Hiring internally from student workers who are graduating
- Community engagement opportunities for staff engagement and professional development

Academic centers have found creative ways to find new staff members. Summer internship programs offer these junior professionals opportunities to learn new skills. In addition, commercial recruiting firms are becoming aware of the RCD space and may be willing to assist in hiring searches. With a little effort, members can ensure that their job listings are shared with a wide range of national and international organizations. For example, Women in HPC posts/reposts jobs from member institutions and retweets listings from many organizations globally<sup>4</sup>. In addition, the National Center for Women & Information Technology (NCWIT) is helping organizations rewrite their job descriptions to make

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<sup>3</sup> <https://www.tacc.utexas.edu/about/jobs/internships> and <http://www.oscer.ou.edu/virtualresidency.php>

<sup>4</sup> <https://womeninhpc.org/community/jobs>

them less gender-specific or more welcoming<sup>5</sup>. Efforts such as these, in combination with cross-posting at a variety of sites, should help increase the diversity of the talent pool.

The workforce pipeline needs to expand to provide a sufficient number of qualified candidates for academia as well as industry. There are a variety of paths to this goal, including engagement with students before they get to college: K-12 engagement serves to promote awareness and literacy in the skills of RCD. For some, it can be hands-on training to let them feel the excitement of working with powerful computers while helping to advance vital research.

With a more formalized job description and career path should also come shared access to self-paced, online training resources for staff development. Along with the suggested career path, our centers should offer career guidance and advice to help interested people navigate through the forest of RCD landscape, whether they have degrees in computer science or any other discipline. Successful RCD staff are able to coordinate between domain scientists and their computing needs.

The RCD ecosystem provides several community engagement/professional development opportunities for staff engagement, including workshops and conferences such as PEARC and the international Supercomputing (SC) conferences. RCD staff encouraged to participate in these activities tend to be more fulfilled and seek to share what they learn to help more people. Finally, institutions that allow and foster freedom of expression among staff in a welcoming work environment that values staff contributions have seen growth and stability. It is vital to cultivate positive relationships with university faculty in a range of disciplines, as they are often willing to speak up and help the administration recognize that funding RCD is a strategic investment.

It would help tremendously if research centers and organizations could showcase career pathways into and out of academic RCD teams, to and from industry. Without providing this confidence of transferability, we will struggle to find people. In addition, staff will be more likely to remain at the center if they see a defined path for promotions. This may require more structured and developed training programs to identify job and career paths and more competitive pay scales to allow centers to compete with industry based on total compensation and work/life balance. Centers will benefit from standardized titles for Facilitators, Research Software Engineers, and Systems Analysts. These jobs are not currently alike across campuses, and this discrepancy impacts salaries and merit raises. Thus, clear career paths for advancement and professional development for RCD staff are paramount.

RCD staff should also be allowed and encouraged to engage in their own research in addition to supporting others' work, which can contribute to their sense of job satisfaction. Finally, given the impact of the pandemic, our institutions must recognize that remote work opportunities are essential to bringing in the expertise we require to address the ever-expanding research needs of the institution.

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<sup>5</sup> <https://ncwit.org/resource/jobdescriptionchecklis t/>

### Support from University and HR

*“This is a heavy lift and not for the faint of heart and requires patience. We have been working with our internal HR for 3 years now and are just now starting to see some positive results. The development of technical leaders & managers will be critical to helping address the problems both near and long term.”*

Our center directors need materials for use with university or organizational administration regarding the competitive nature of the HPC staff environment, justifying the unique job families and higher salaries required to recruit and maintain the staff necessary to support expanding research computing requirements. In some cases, user populations have doubled in the last 3-4 years. Developing close collaboration with high-level administrators such as VPRs and CIOs will ensure no duplication or friction between the various RCD staff positions. A formalized job description will help when working to define these RC-related positions.

A better relationship with HR will hopefully bring the ability to recruit with diverse groups, both locally and globally. Changing hiring practices and modifying job descriptions should further increase the diversity of our talent pool. In addition, it has become clear that our centers and our industry overall should focus on diversity in recruiting, introducing younger students to the workforce – especially students in different disciplines – to advanced computing, and inviting them to experience activities that bring them closer to computing careers. Sharing the materials from CaRCC and other groups mentioned above and in the “Resource Links” section at the end of this document with HR departments may help address this issue by providing examples of successful recruiting tactics.

### Diversity in Recruiting

By now, most universities have produced a statement committing to diversity, equity, and inclusion in their hiring processes. These values must be emphasized in each job posting, and the university needs to follow through. Diversity is not just about statistics; it is also essential to ensure that diverse representation exists across all levels, including leadership.

Centers would benefit from a push to recruit more users from non-STEM domains; they need to be able to talk to faculty and show them what other researchers have done. However, it is difficult to find people who have that knowledge to have those conversations. Student workers might have more domain knowledge, and we can help them with the computing knowledge. In addition, many immigrants are working at centers, and the ability to sponsor H1B/green cards would make a difference in hiring rates.

In addition to pursuing broader dissemination of job postings, we need to prioritize access to RCD programs for HBCUs, small colleges, and other underrepresented groups. While there have been programs to bring underrepresented students to scientific research, many still lack an introduction to scientific research computing support. This second career path could be similar, if not even more interesting, to underrepresented students than the path to becoming a research scientist.

## *Recommendations and Next Steps*

### Best Practices for Member institutions

1. **Standardize Job Descriptions and Define Career Paths.** Undoubtedly the most common thread on the “wish list” for next steps is the development of a standardized set of skills for RCD staff and a suggested career path for promotions. This would support the centers that are struggling to keep staff and those who are contending with their HR department for recognition that RCD staff should be handled differently than regular “IT people.”
2. **Improve Internal Institutional Communication with HR.** Though it requires a great deal of effort, ensuring a good relationship with University or organizational management and HR is vital to solidifying RCD positions as different from IT and essential to research computing operations. As with any communication channels, it would be best if these were to operate in a two-way manner. Formalizing the skill set and career path, and having comparative numbers from other centers, would support this effort, as would getting feedback from HR Departments on best practices in hiring and recruitment.

### Positions to Research Sponsors

1. **Expand RCD Workforce Participation.** A greater variety of funding programs should include explicit provisions for workforce development as funded parts of their programs and solicitations. These should not be left to the institution to fund out of its own resources. The Federal Government should continue to expand the H1B visa program, and other programs that allow hiring workers in specialized fields.
2. **Pursue Multi-Organization Partnerships.** The Federal Government should continue to support programs such as Research Coordination Networks (RCNs), which seek to advance a field or create new directions in research and/or education by supporting groups of investigators to communicate and coordinate their research, training and educational activities across disciplinary, organizational, geographic and international boundaries.

### Actions for CASC

1. **Improve Information Sharing for Jobs and Career Paths.** CASC should post or link to example job descriptions and recommended career path options from CaRCC and other organizations to its website, where they can be shared with the community, and updated as needed.
2. **Engage with and Promote a More Diverse Set of Institutions.** CASC should look for ways to engage with HBCUs and other MSIs, including the National Association for Equal Opportunity in Higher Education (NAFEO), the Hispanic Association of Colleges and Universities, etc.
3. **Approach Workforce Development on a Community-Wide Basis.** CASC Members may wish to share their training and workforce development activities, so that staff from other

centers can sign up or replicate the training at their site. This could be done through the CASC website or a Google Calendar.