Proposal to Establish The Center for Research and Education in Interdisciplinary Computation (CREIC)

Currently at UCO there are a number of faculty members who are conducting research projects and teaching courses that require computational knowledge and tools. These dedicated faculty members are currently engaging students in and out of the classroom in computational projects. The results of these projects are disseminated at regional, national, and international conferences as well as in scholarly journals. Computational techniques have become an essential part of these research, educational, and applied projects. Diverse projects in molecular interaction modeling, DNA protein sequence mapping, severe weather prediction, complex electrical circuit design, data mining, and public health decision-making, all have significant computational components. The Center for Research and Education in Interdisciplinary Computation, **CREIC**, will serve as a much needed technical resource for diverse and interdisciplinary research and educational projects requiring advanced computational facilities and support.

UCO faculty members involved in research and other projects have been successful in obtaining on campus and external grant funding over the last several years through work in their disciplines and by forming interdisciplinary collaborations. This center will strive to enable high-level interdisciplinary computational projects and new avenues of computationally oriented grantsmanship. By its nature, computational research is interdisciplinary, and it involves wide-reaching disciplines. Science and engineering research projects often top the list of applications of high performance computing (HPC), but given the rapidly changing availability of computing power and software tools, students and faculty in business, design, social sciences, nursing, forensic science and other disciplines, have a need to use HPC.

HPC has become a vital component in many areas of science and engineering and in other areas including forensics, business, health, and weather prediction. Many projects in science and engineering research completed in the last fifteen years would not have been possible without HPC. UCO faculty members have been involved in such projects in collaborations with other institutions, but seldom on the UCO campus. The time has come to develop HPC resources, infrastructure, and support at UCO to enable modern research and education in this area.

CREIC Goals
The driving forces in the formation of CREIC are:

1 **Research Education** - Train the next generation of scientists, engineers, and other computational practitioners.
   a The National Academies Press report entitled "Rising Above the Gathering Storm - Energizing and Employing America for a Brighter Economic Future" (2006) indicates the need for more engineers and scientists trained at the graduate level and emphasizes the fact that access to advanced level science and engineering instrumentation is currently at a deficit.

b   Training on instrumentation such as HPC is a critical national need.

2   **Attract Top Notch Faculty and Students** - Well-supported HPC Research Equipment attracts faculty and students who want to use HPC to solve problems at the leading edge of their fields.
   a   Support of HPC and other leading edge research equipment and facilities been shown to have a positive effect in recruiting.

3   **Faculty Research Productivity** - Enable and support the continued and growing success of UCO faculty to conduct student-centered research and seek competitive federal, and other external, funding.
   a   The number of submissions to federal (National Science Foundation (NSF) and National Institutes of Health), state, industrial, and private agencies from UCO has risen dramatically in the last few years, and the number of funded external grants is increasing. NSF funds support successful faculty who are making ever-growing contributions in their fields.
   b   Major journal articles authored by UCO faculty are being published frequently.

4   **Return on Investment** - HPC centers are typically self-sufficient and attract new funding opportunities.
   a   From "Investment in High Performance Computing: A Predictor of Research Competitiveness in U.S. Academic Institutions," presented by Amy Apon Ph.D., Oklahoma Supercomputing Conference, Oct. 2010: In 2006, the top funded NSF research universities with HPC obtained about *4 times the NSF funding* as other top funded research universities that did not have HPC.

5   **Student Retention**
   a   Undergraduate students engaged in transformative research projects are more likely to complete their bachelor's degrees and more likely to attend graduate school.
   b   There are a number of studies that have found that small group learning, including *undergraduate research, improves persistence in STEM* (Science Technology Engineering and Mathematics) courses:
      i   Springer, Leonard, Stanne, Mary E., and Samuel S. Donovan, 1999, "Effects of Small-Group Learning on Undergraduates in Science, Mathematics, Engineering," Review of Educational Research, 69(1), pp. 21-51.

      ii   Gregerman, Sandra R., Lerner, Jennifer S., Hippel, William von., Jonides, John., and Biren A. Nagda, 1998, "Undergraduate Student-Faculty Research Partnerships Affect Student Retention," The Review of Higher Education, 22(1), pp. 55-72.

6   **Interdisciplinary Programs** - Research "cross-training" in different disciplines is becoming standard in many graduate programs. This center and its outreach programs

will complement existing interdisciplinary efforts on campus and allow more interactions for students and faculty from a variety of disciplines.

7. **STEM (Science, Technology, Engineering, and Mathematics) Enhancement** - This center will offer training and generally complement and expand the opportunities for students and faculty in existing STEM programs at UCO (such as CURE-STEM, CIBER, and the NSF Bridge Programs).

CREIC Operational Objectives
This center will:
- Develop and promote computational tools to extend and enable avenues of scientific, technological, engineering, and mathematical inquiries for UCO faculty researchers.
- Support faculty and faculty-student collaborative projects with training, software setup, and technical support of software related issues.
- Provide quality HPC educational outreach programs for UCO faculty and students that enhance both the research and educational environments.
- Serve as a central point of contact for computational projects and other academic computing issues.
- Grow computational, networking, and storage capabilities to support the institutional and academic missions and visions.
- Identify and disseminate external funding opportunities that add to the capabilities of UCO HPC facilities and support interdisciplinary computational research and research educational outreach.

CREIC Organizational Leadership
- A Director, appointed by the Dean of CMS, will oversee the operation and organization of the Center.
- An Advisory Committee made up of investigators will advise the Director.
- Existing CMS computer staff will assist the Director in meeting the needs of faculty and students to achieve research and educational goals.