

NREC Critical Hires

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1. General Background for NREC Critical Hires

In general at the NREC we are looking for excellent people who possess the following traits:

- Plow through challenges aggressively and have lots of initiative.
- Practical skills and a proven ability to "get things done". Like to get hands dirty.
- Creative, aggressive and independent thinkers - willing to ask for help, but capable of solving hard problems on their own.
- Curious learners and generalists who want to know everything and aren't afraid of moving outside their own field to learn about another discipline or a client's domain.
- Geeks -- which means:
 - A deep love of the subject matter and the work. Engineers who design robots at work and then go home and work on race cars or toy robots. It can't just be someone's job! A great mechanical engineer knows how to weld and machine, a great computer science guy has built their own PC, etc...
 - Real, profound understanding of technology.
 - Wide and deep familiarity with the range of techniques, methods, components and products in their specialty.
- People with excellent communication skills and who can work in a team environment.

2. Robotics Engineers (multiple positions)

The Robotics Engineer position requires individuals who can formulate logical statements of system computing and engineering problems, assist with planning and technical direction for projects, and work with colleagues and end users to design, develop and implement complex robotic systems. These systems require the design and development of electro-mechanical hardware, real-time control algorithms, sensor interfaces, serial and Ethernet communications, computer vision, learning, path planning, kinematic and dynamic modeling of robots, graphical simulation, data logging and analysis and GUIs.

Basic Requirements (across all job postings)

These positions require a BS Degree (MS preferred) or equivalent experiences in Robotics, Information Science, Computer Science, or Software, Electrical, Computer, or Mechanical Engineering. Most Robotics Engineers will have 3+ years experience designing and implementing software systems, most likely related to or directly involving robots.

2.1. Deere/USDA Project Robotics Engineers

Contact: Herman Herman

The Deere and USDA Agricultural Automation project are developing automated systems for farming applications. We are developing systems that can work in real-work environment in addition to conducting exciting research and development in computer vision and robotics. As part of this program we will be retrofitting and deploying a fleet of automated large tractors. We are looking for a few good engineers who are excited about building some of the best robotics systems in the world. We need excellent engineers:

- Systems engineer ([CMU Job #TBD, NREC #N0001](#))
- Software engineer ([CMU Job #TBD, NREC #N0002](#))
- Embedded software engineer ([CMU Job #TBD, NREC #N0003](#))
- Mixed software and electrical engineer ([CMU Job #TBD, NREC #N0004](#))

Preferred Requirements:

- Experience with mobile robots
- Experience with developing and deploying real-time systems
- Experience developing mobile robot perception systems, especially visual odometry, video stabilization, visual SLAM, and related techniques.
- Experience integrating and field testing such subsystems on real robotic platforms

2.2. ANS Project Robotics Engineer (CMU Job #4220, NREC #N0005)

Contact: Pete Rander

The ANS project is taking on one of the toughest challenges you'll ever find: developing the US Army's first fully autonomous production-ready autonomy system. The ANS project is part of FCS, the Future Combat System being developed to revolutionize the way the Army operates. NREC is developing nearly the entire planning and control systems, including the two most challenging aspects of planning and control: global planning and obstacle avoidance. The project needs several engineers able to evaluate promising ideas from the best research and eager to design, integrate, and test them in an expanding robotic path planning subsystem.

Preferred Requirements:

- Experience developing mobile robot path planning and control subsystems, especially in global and local path planning.
- Experience integrating and field testing such subsystems on real robotic platforms.
- Experience with kinematic and dynamic modeling of robots and graphical simulation.

2.3. SACR Project Robotics Engineers

Contact: Pete Rander

The SACR project is developing a radical new approach to user interfaces that leverages state of the art real-time robotic perception, 3D modeling and computer graphics hardware acceleration. This revolutionary technology has already begun a revolution in teleoperations systems, and is prepared to go even further on a set of projects that will demonstrate this capability on small UGVs. The project needs engineers specializing in video stabilization, video odometry, visual SLAM, and related techniques. The project also needs engineers specializing in computer graphics, OpenGL, shaders, and GPGPU programming.

Preferred Requirements for Computer Vision Expert (CMU Job #TBD, NREC #N0006):

- Experience developing mobile robot perception systems, especially visual odometry, video stabilization, visual SLAM, and related techniques.
- Experience integrating and field testing such subsystems on real robotic platforms

Preferred Requirements for Computer Graphics Expert (CMU Job #TBD, NREC #N0007):

- Experience developing real-time, optimized graphics applications in OpenGL using recent techniques such as shader programming
- Experience leveraging computer graphics hardware in non-traditional applications, from innovative refactoring of algorithms to leverage traditional GPUs up through the use of recent GPGPUs to solve engineering and scientific computing problems

- Ideally, some experience in computer vision and (semi-)automatic construction of 3D models

2.4. EOD Project Robotics Engineers

Contact: Alonzo Kelly

We are working on exciting technologies to improve the performance of the EOD robots, such as the Talon and the Packbot, so they can perform more tasks and are easier to use. These technologies include autonomous capabilities, novel perception capabilities, and novel user interfaces. We have an immediate need for robotics engineers with experience related to any combination of computer vision (especially stereo vision and visual localization), modeling and simulation, computer graphics, and mobile robot or manipulator autonomy. Successful engineers are expected to develop these capabilities, implement them and test them on real-robots in real-world environment.

Preferred Requirements for Perception (CMU Job #TBD, NREC #N0008):

- Experience developing mobile robot perception systems, especially visual odometry, video stabilization, visual SLAM, and related techniques.
- 3D computer vision including stereo vision, vision-based localization, visual tracking.

Preferred Requirements for Autonomy and Control Expert (CMU Job #TBD, NREC #N0009):

- Experience developing real-time control algorithms
- Optimal estimation and control including Kalman filters, model predictive control, system identification, and machine learning.

Preferred Requirements for Computer Graphics Expert: (CMU Job #TBD, NREC #N00010):

- 3D computer graphics and/or graphics user interfaces - especially involving video processing. Familiarity with Open GL and Open Scene Graph preferred.
- Experience leveraging computer graphics hardware in non-traditional applications, from innovative refactoring of algorithms to leverage traditional GPUs up through the use of recent GPGPUs to solve engineering and scientific computing problems

3. Software Engineers

Software Engineers develop custom software for a variety of robotic control systems, comms systems, sensors, planners, autonomy packages and user interfaces. Most software used at NREC is developed in-house and is typically written in C or C++ with an emphasis on high performance and high reliability. Many of the algorithms used are state-of-the-art and are developed at NREC or at CMU. Software Engineers must be efficient coders, but must also be capable of modifying and creating sophisticated algorithms as required to support advanced robotic capabilities, and must be capable of fielding and testing complete, reliable robotic systems. Successful software engineers in the robotics field are likely to be individuals who also have knowledge, interests and skills in mechanical, electrical and related areas.

Basic Requirements (across all job postings):

- BS Degree (MS preferred) in Robotics, Computer Science, or Software, Electrical, Computer, or Mechanical Engineering or similar program with strong software component.
- Strong experience designing and implementing software systems, most likely related to or directly involving robots.

3.1. Gold Fields Project Software Engineer ([CMU Job #4621](#), [NREC #N0011](#))

Contact: Bill Ross

The Gold Fields project is developing a tough, high-degree-of-freedom, extreme-mobility robot for use in a variety of industrial applications. This machine will rely heavily on cutting edge software and algorithms to provide high performance in extreme environments. The project needs several junior software engineers to help develop control systems, planning software, and user interfaces for this robot.

Preferred Requirements:

- Solid C/C++ programming skills and experience.
- Demonstrated ability to complete major software projects.
- Experience in multiple areas of autonomous vehicle development including processing hardware, embedded systems, Linux, artificial intelligence, global and local path planning, kinematic and dynamic modeling of robots, graphical simulation, computer vision algorithms, position estimation, sensor placement and configuration, field testing, field logistics and deployment; Integration and testing experience with robotic vehicle communications systems (e.g. MESH, UDP, TCP/IP, CAN)

4. Mechanical Engineers

Mechanical engineers at the NREC work on all aspects of robot research, development, testing and deployment. Typical roles include concept development, system analysis, overall system design and detailed design, production and testing of individual systems and components. Typical designs include diesel engines and hybrid power systems, suspensions, electric motors for propulsion and actuation, complete custom hull designs with careful attention to thermal and toughness criteria, and the design of custom sensors and actuators. The strongest robotics mechanical engineers will be multi-disciplinary with some knowledge of electrical and software and good hands-on skills with machine tools and fabrication equipment.

Basic Requirements:

- BS Degree (MS preferred) in Robotics, Mechanical Engineering or closely related discipline.
- Strong experience designing and implementing mechanical systems, most likely related to or directly involving robots, with some background in related areas such as control electronics and software. Basic hand-on skills with mechanical systems and good knowledge of welding, machining and other fabrication methods.

4.1. Gold Fields Project Mechanical Engineer (CMU Job #TBD, NREC #N0012)

Contact: Bill Ross

The Gold Fields project is developing a tough, high-degree-of-freedom, extreme-mobility robot for use in a variety of industrial applications. This machine will rely heavily on cutting edge mechanical designs to provide high performance in extreme environments. The project needs several mechanical engineers to help develop power systems, custom gearboxes, custom electric motors, sensors and the like. The focus will be on fast, hands-on design, build, and test cycles with strong emphasis on high-performance and real-world reliability and toughness.

Preferred Requirements:

- Experience with SolidWorks, FEA tools, MasterCAM, CNC machining.
- Experience with diesel engine installation, thermal design, brushless DC servo motors, planetary gearboxes, servo amplifiers, power systems, basic C programming.

5. System Safety Engineer

NREC is taking a leadership role in developing safe field robots. The System Safety Engineer at NREC oversees development of different robotic vehicles in search of safety hazards and advises on mitigation strategies. This involves the use of standard hazard-analysis techniques (e.g., FMEA, FTA, HAZOP) as well as familiarity with safety standards. It also involves working with development teams to review component and system designs and to improve their safety. Responsibilities also include safety testing, incident tracking, and maintaining documentation.

Basic Requirements

Our System Safety Engineer position calls for a working knowledge of software, electrical, and mechanical engineering, because safety-critical robotic systems include aspects of each. Communication skills are critical to understand systems developed by others and to convey safety hazards identified. The position requires a BS degree in computer science, software, electrical, computer, or mechanical engineering (an MS degree is preferred). Three or more years experience designing complex electromechanical or software systems is required. Ideally the candidate will also have two or more years of experience in design verification or safety engineering.

5.1. APD Project System Safety Engineer (CMU Job #TBD, NREC #N0013)

Contact: Mike Wagner

This position involves performing safety engineering for a large, high-speed unmanned ground vehicle. The program is fast-paced and is looking for qualified people to form an agile, efficient safety team. Safety analyses will primarily focus on software, digital communications, and power systems.

Preferred Requirements:

- Experience on a team or management of a team tasked only with verification, validation, or debugging of a technical design.

Critical Hire Positions

- Experience applying industrial safety standards, particularly IEC 61508, MISRA, MIL 882, or equivalent.
- Experience with software verification.
- Two or more years experience with electrical circuit design.