**Selected NSF National Robotics Initiative Grants**

Extracted from <http://www.nsf.gov/news/news_summ.jsp?cntn_id=125390>

**[The Intelligent Workcell - Enabling Robots and People to Work Together Safely in Manufacturing Environments](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208598)**  
**Carnegie-Mellon University (Paul Rybski)**  
This research will develop an "Intelligent Workcell," to enable people and industrial robots to work safely and more efficiently within the same workspace. New capabilities in robotic workcell monitoring will likely result. Smart work environments know where you are and what you need, and what you're doing to avoid hindrance and to support assistance.

[**Virtualized Welding: A New Paradigm for Intelligent Welding Robots in Unstructured Environment**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208420)  
**University of Kentucky Research Foundation (Ruigang Yang)**  
Zeroing in on welding done with widespread use as a manufacturing component and done by highly skilled workers, this project will develop a new robotic platform with novel 3D modeling and visualization algorithms designed to complement the skills and expertise of a human welder with advanced sensing tools of a robotic one. The primary use for this new technology is in manufacturing. Successful completion of the proposed project paves the foundation for intelligent welding robots with closed-loop intelligent control. Such a robotic system can perform high-speed and high-precision welding while allowing more variations in the work pieces and environments. In addition, virtualized welding can be integrated with a mobile platform to allow welding in places that are hazardous or unsuitable for human welders.

[**Managing Uncertainty in Human-Robot Cooperative Systems**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208540)  
**Johns Hopkins University (Peter Kazanzides)**  
This research aims to capitalize on the distinct yet different strengths of humans (perception and reasoning) and machines (precision, accuracy and repetitiveness in information fusion, task planning and simulation) to design truly cooperative systems, managing uncertainty to achieve successful human-robot partnerships to perform complex tasks in uncertain environments.  It will build manufacturing and medical testbeds (for minimally invasive surgery during which slight variations such as tremors, twitches or breaths can affect conditions) on which cooperative skills will be applied and tested.

[**Collaborative Research: Multilateral Manipulation by Human-Robot Collaborative Systems**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1227406)  
**\*Stanford University (Allison Okamura). University of California - Santa Cruz (Jacob Rosen), Johns Hopkins University (Gregory Hager), University of California - Berkeley (Pieter Abbeel)**  
This project seeks to emulate the expert-apprentice relationship using human beings and robots. It focuses on developing ways in which robots can learn from human activity in order to help humans by providing more hands, eyes and brain power as necessary, enabling multilateral manipulation from multiple vantage points.  Applications in the manufacturing plant or in the operating room are potentially numerous.

[**Collaborative Research: Purposeful Prediction: Co-robot Interaction via Understanding Intent and Goals**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1227495)  
**\*Carnegie-Mellon University (James Bagnell), Massachusetts Institute of Technology (Joshua Tenenbaum), University of Washington (Dieter Fox)**  
This project focuses on recognizing human intention--that is, teaching a robot to forecast what a human is going to do, so that robots may more effectively collaborate with humans. The inability of robots to anticipate human needs and goals today represents a fundamental barrier to the large-scale deployment of robots in the home and workplace. This project seeks to develop a new science of purposeful prediction using algorithms that may be applied to human-robot interaction across a wide variety of domains.

[**A Design Methodology for Multi-fingered Robotic Hands with Second-order Kinematic Constraints**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208385)  
**\*Idaho State University (Alba Perez Gracia), the University of California Irvine (J. Michael McCarthy)**  
This research focuses on the adoption and integration of specific characteristics of human hands in robots in order to accomplish a desired task, whether that entails lifting a small, unusually-shaped part for assembly or moving a bulky object. This tool will increase the ability of industry to design high performance, cost-effective multi-fingered robotic hands and other end effectors.

[**Collaborative Research: A Dynamic Bayesian Approach to Real-Time Estimation and Filtering in Grasp Acquisition and Other Contact Tasks**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208468)  
**\*Rensselaer Polytechnic Institute (Jeffrey Trinkle), State University of New York (SUNY) at Albany (Siwei Lyu)**  
This project is developing techniques to enable robots to grasp objects or perform other contact tasks in unstructured, uncertain environments with speed and reliability. Using the proposed method, sensor data tracks the continuous motions of manipulated objects, while models of the objects are simultaneously updated. Applications include search and rescue, planetary exploration, manufacturing, even home use with every day and important uncertainties such as effectively moving a bowl whether it is full or empty.

[**Context-Driven Haptic Inquiry of Objects Based on Task Requirements for Artificial Grasp and Manipulation**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208519)  
**Arizona State University (Veronica Santos)**  
This work focuses on the sense of touch. The project aims to advance artificial manipulators by integrating a new class of multimodal tactile sensors with artificial, humanlike hands and developing inquiry routines based on contextual touch. Weight given to each mode of tactile sensing (force, vibration, temperature) will also be tuned according to the context of the task. The research explores how to make use of this stimulus, in order to enable assistive robots to better grasp, hold and carry objects.

[**Contextually Grounded Collaborative Discourse for Mediating Shared Basis in Situated Human Robot Dialogue**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208390)  
**Michigan State University (Joyce Chai)**  
This project focuses on human-robot dialogue, bridging the chasm of understanding between human partners and robots that have completely mismatched capabilities in perceiving and reasoning about the environment. This project centers on developing techniques that will support mediating the shared perceptual basis for effective conversation and task completion. With an ability to use what is known to shed light on what is not yet known (that is, using the power of inference-in situations that give clues to meaning), this research could benefit many applications in manufacturing, public safety and healthcare.

[**Improved safety and reliability of robotic systems by faults/anomalies detection from uninterpreted signals of computation graphs**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208687)  
**California Institute of Technology (Richard Murray)**  
This research centers on detecting error conditions--that is, figuring out when things are going wrong, and/or when conditions may have been tampered with or altered by a human. This project addresses the main challenges of designing robots that can operate around humans to create systems that can guarantee safety and effectiveness, while being robust to the nuisances of unstructured environments, from hardware faults to software issues, erroneous calibration and less predictable anomalies, such as tampering and sabotage.

[**Measuring Unconstrained Grasp Forces Using Fingernail Imaging**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208626)  
**University of Utah (Stephen Mascaro)**  
This project develops the technology for unconstrained, multi-fingered measurement of human grasp forces using a fingernail imaging technique. Human subjects freely choose where to place their fingers on objects, allowing for unconstrained multi-finger grasping. The co-robot then detects the individual finger forces of a human partner by ascertaining blood flow, as measured through color change on a fingernail. A co-robot trained with the appropriate calibration data could recognize and emulate or adapt to a human partner's grasp forces, measured using only vision.

[**Robust, highly-mobile MEMS micro-robots based on integration of piezoelectric and polymer materials**](http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1208233)  
**University of Michigan Ann Arbor (Kenn Oldham)**  
This project focuses on developing tiny, millimeter or sub-millimeter scale robots (smaller than fleas) whose skeletal system is composed of crystal and ceramic, which makes them highly maneuverable with stronger, mini muscles.  Prototypes will be developed, tested and perfected. These micro-robots could be eventually used to get into hard-to-reach places, and to crawl around to observe things up close or to complete a task. Applications range from exploration to surveillance, from observation to micro-surgery.