Title of Investigation:

Car for the Blind

Principal Investigator:

Michael Comberiate (Code 400)

Other Team Members:

Dr. Nancy G. Maynard (Code 900)

External Collaborators:

Jeff Witt, National Federation of the Blind (NFB); Dr. William "Red" Whittaker, Carnegie Melon University; Roger Bostelman, National Institute for Standards and Technology (NIST); and Erik Goodman and George Stockman, Michigan State University

Initiation Year:

2004

FY 2004 Authorized Funding:

$20,000

Actual or Expected Expenditure of FY 2004 Funding:

$20,000

Status of Investigation at End of FY 2004:

Transitioned to other funding — National Federation of the Blind (NFB)

Expected Completion Date:

Completed

Purpose of Investigation:

The purpose of this investigation was to develop a plan that would establish a special Challenge to demonstrate technologies, which ultimately would allow blind persons to drive a car under normal driving conditions. Furthermore, we intend directly stimulate innovation in development of blind user/driver interfaces for vehicles.

FY 2004 Accomplishments:

Working closely with Jeff Witt, a representative of the National Federation for the Blind (NFB), NASA funded $20,000 and helped to coordinate a special workshop at Carnegie Melon University on Dec. 2, 2004. The principal challenge of the workshop was to break down the challenge of developing a "Car for the Blind" into smaller, intermediate goals, which would then be addressed by researchers from universities and other organizations. Workshop participants made a number of presentations illustrating their own applications of already-existing technology and devices that could find applications in enhancing the mobility of a blind person. These included:

- Personal Braille notebooks
- Talking GPS/laptops

- Reading machines that scan documents and read them back
- Ultra-high resolution (technology is available, but requires massive computations)
- Ground truth mapping
- Drive-by topography (memorizing the topography with centimeter accuracy)
- Auto generation of detailed route
- Dynamic speed regulation
- Logic to interact with traffic
- High-performance navigation (refers to the ability to drive around objects in the path of the programmed destination)
- Pointing and stabilization of sensors
- Fast multimode sensor fusion
- Decision-making for swerving versus stopping

Now, efforts are underway to adapt the above technologies to enhance the mobility of a blind person. Recognition of this challenge as worthwhile and requiring the kind of innovation that this group of entrepreneurs gets excited about, was a successful first step.

Planned Future Work:

This investigation was funded to initiate a workshop to plan a technology challenge, but not to conduct it. However, we have been more than a catalyst for encouraging both the NFB and a number of technologists to take this challenge seriously and we can see a need to continue in that capacity. We believe spin-offs will benefit other handicapped persons as well as NASA's planetary exploration efforts. If we are to realize these benefits, we must keep the effort going, even though the ultimate goal of a blind person driving a car is far from realistic now. For the next six months, we will continue to be a team member and a catalyst for establishing the Engineering Challenge, which is intended to develop some new technologies that meet our objectives. We do not, however, have any funds and the Director's Discretionary Fund (DDF) provided almost no additional manpower for any major commitment from NASA; so, we'll have to work mainly on a limited, best-effort basis.

The blind person wants the opportunity to make cognitive decisions for the vehicle he or she is driving. Our technologies must bring information about the vehicle and the environment to the blind driver in a form that he or she can easily understand and act on in a timely manner. This is akin to tele-robotic operations. Hence, our challenge is applying technologies that sense the environment and provide "non-visual" signals that are meaningful and precise to the driver. This is quite a challenge since there is no direct substitute for vision when it comes to detail resolution and scope. Technologies that we would like to use in the future in this Challenge include: voice-commanded destination; assisted driving; and high-performance at speed, which is the vehicle's ability while moving to determine if an object in the path is small enough to drive over or if the vehicle needs to go around it. Currently, various sensors on the market will sense the environment, but we need to adapt them to our purposes.

Summary:

This project's innovative features are derived from the fact that all vision-navigation systems produce sensed signals, which require vision to interpret. The potential payoff to the NASA Goddard Space Flight Center is the application of these new systems to our exploration missions, where the environment cannot be sensed in visible light. In addition, these technologies would benefit tele-robotic operations.