Technology Transfer:
A Contact Sport

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"Put on your tennis shoes, get out there, and meet people!"

-loosely paraphrased from Dr. Joseph S. Heyman

Technology transfer is a dynamic process, involving dynamic people as the bridge between NASA Langley Research Center and the outside world. This bridge, for non-aerospace applications, is known as the Technology Applications Group. The introduction of new innovations and expertise where they are needed occurs through a "push" and "pull" process. A "push" occurs when a new technology is first developed with high commercial potential and then a company is found to licence or further develop the technology. The "pull" process occurs through problem statements. A company or group will submit a written statement of what they need and the shortcomings of commercially available technology. The Technology Transfer Team (T3) reviews these problem statements and decides where NASA LaRC can offer assistance. A researcher or group of researchers are then identified who can help solve the problem and they are put in contact with the company. Depending upon the situation in either method, a Space Act Agreement (SAA), or outline of the responsibilities for each party, is developed.

My mentor, Marisol Romero, developed a two-part project for me, centered around the process of handling problem statements. The first part was to follow through the answering of a problem statement, to develop a technology for someone and deliver it. The second part was to create a database of the expertise at Langley so that the T3s would know whether the Center could handle incoming problems and, if so, find a researcher whose expertise matched the need. In the creation of this database, I would have the opportunity to gain an overview of the center, as well be exposed to a number of engineering disciplines.

As the first part of my project, I assisted in answering a problem statement from an Adult Day Care Center in Virginia Beach. One of the patients, a young woman with cerebral palsy, needed a better computer interface. Her only method of communication was to select a word from a list, vocalized and recorded by computer. The switch she had been using to select a word required an attendant, and was difficult to use when her head position varied. For this project, Marisol asked Bruce Little, from the Fabrication Division, to mentor me. After a site visit to better understand the specifications of the project, Bruce Little and I sat down to design a solution. This was my first time designing and building a device, and Bruce Little was exceptionally receptive to my ideas. He made me feel like a team member rather than a simple observer of his work. We asked advice from people in several different areas of the center, and brought together pieces and ideas from all of them to make a "Chin Mouse".

A "Chin Mouse" device is a helmet mount with an adjustable arm extending underneath the chin. At the end of the arm is the microswitch apparatus, which is activated by a depressible platform. The helmet is fully padded, and can be adjusted in height and width, while the arm can be attached to either side. This provides the flexibility needed, while allowing independent access to the computer. The "Chin Mouse" is also easily adaptable for others with similar handicaps.

After the fabrication, I encountered the next step in the technology dissemination process, the legalities of intellectual property. I wrote and submitted an Invention Disclosure, and have followed the beginnings of the patent process with vested interest. More important than a possible patent, however, is the fact that our invention helped this young woman. Marisol, Bruce and I went to present it to her, and she seemed pleased

with it. (see attached photo and letter) The story has also been picked up by Channel 3 news and local papers, which provides positive community publicity for Langley and the technology transfer process.

In this particular case Marisol drew upon her previous contacts to choose Bruce Little for this project. This is the way that most problem statements are matched with researchers, ensuring cooperation but not taking full advantage of the Center resources. In order to allow the T3s to explore resources beyond their personal contacts, Marisol saw the need for the second part of my project: to gather information about the expertise at Langley and organize it into a database which can be searched for keywords to match a problem statement with a person who can support it.

I approached this second portion of my project by first was to gathering the functional statements of each group, division, and branch. This provided a fairly specific view on the type of research each section of the center was performing. Along with this information, I also received a detailed breakdown of the resources of the Fabrication Division, cataloging the type of personnel as well as each machine. This particular document also included the Fabrication Divisions of Ames, Dryden and Lewis, allowing us to possibly redirect a problem statement to a more appropriate facility. From this more general information, I was then able to begin interviewing specific people. This is the intended level of the database, in order to pinpoint an actual person to contact. I met the people I interviewed in three ways: through personal introduction, through further exploration of technologies Marisol was working with, and through problem statements I was given to work on. The people of this center were wonderful in their willingness to take the time to explain their work to me, and in this way I expanded my knowledge of the possible fields of engineering.

Marisol first introduced me to Milfred Thomas, who runs the Optical Damage Testing Laboratory. He is a laser expert, and to illustrate his work he allowed me to assist in the construction of a laser head. I was also given the opportunity to help him in the design and fabrication of a flow-measurement mount and power supply. Through Bruce Little I met Lisa Jones, an aerodynamic engineer studying crashworthiness, who provided a literal overview of the center while she explained her job from the top of the Impact Dynamics and Crash Testing facility. In working with Diane Flynn, a fellow LARSS student, I became well versed in composites, starting with a brief lecture on the subject by Paul Hergenrother, who works with composites and adhesives. Next, Dr. Ruth Pater, the Senior Polymer Scientist in the Materials Division, gave me a tour of her lab and a description of one of her inventions: the High Performance Polyimide, LaRC RP 46. Finally, Phil Ransone and Phil Glaude explained the carbon-carbon piston concept, providing a background on engines as well as the material.

While Marisol was currently working on the process of matching companies to several technologies, I was also able to observe the commercialization process, and became acquainted with several of the "hot" technologies. To gain a better understanding of these technologies, and to add to my database, I visited a few of the "hot" labs. The inventor of the Extended Attention Span Training system and the Crew Response Evaluation Window, Dr Alan Pope, gave me an overview of his work as well as that of the entire branch. The Crew/Vehicle Integration Branch works on the human factors issues, trying to create machine systems that complement and enhance human capabilities. Another new technology of interest is the piezoelectric material THUNDER, which I was introduced by Richard Hellbaum, Robert Fox, and Robert Bryant. This group of an electrical engineer, a microelectronics technician, and a chemist, respectively, are developing applications for this material which moves when voltage is applied to it, with a better displacement for energy input ratio than available elsewhere. Lastly, James McAdoo explained to me his

highly marketable method of Digital Mammography, a faster, better way to scan tissue using a mosaic of CCD's to generate high resolution digital images.

I was also given several specific problem statements to look at, and in my search to find researchers I added to my database. One of the problems was from a textile machinery manufacturer, who wanted a system for monitoring the alignment of a pocket on a shirtfront before sewing. I went to the Data Visualization and Animation Lab (DVAL), and found their expertise so useful that I arranged for them to present their work to several interested members of TAG including Joe Heyman, the Deputy Director. The DVAL team works in scientific visualization, which is applicable to everything from producing presentation quality videos to computational fluid dynamics. The next problem involved diagnosis of premature infants with Rentinopathy of prematurity, an eye disease resulting from abnormal retinal development and causing blindness. The difficulty arises in the observation of the retina and the display of the information gathered. Surgeons are using a video camera to record the retina, but are unable to compile the running film into a usable map of the blood vessel system. Complications arise from the lack of a point-of-reference for the images on the film, as the infants move their eyes. For this problem I went to Donald Cahoon, in the Atmospheric Sciences Division. He is an expert on remote sensing and offered to relay several suggestions to the requestor. The last person I met through problem statements was John Companion, who I approached for help on more than one occasion. He works in Non-Destrucrtive Evaluation, developing items such as a Tissue Simulating Gel and a Bladder Scanner for volume measurement.

Throughout the completion of my project, I met several other people whom I cannot fit into neat categories in my database. I was allowed to sit in on a meeting between the THUNDER team and representatives from McDonnell Douglas, during which I was able to watch ideas being thrown out as they were thought of, and in trying to follow the discussion I learned more than in most lectures. I was also able to meet the incoming class of astronauts when they visited Langley. I spoke with David Williams, who give me a personal perspective on the selection and the requirements of job which symbolizes NASA in the eyes of most people. I met the entire staff of TAG, an energetic and focused group. First and foremost is my mentor Marisol Romero, a member of the Technology Transfer Team in the Medical, Instruments, Sensors, Environmental, and Energy (MISEE) sector. She works with medical technologies and has an electrical engineering background. She was my guide and the hub of my network. I also gained a more in-depth and international perspective on technology transfer from another T3, Lance Bush, whose unique insight into technology transfer stems from his background as a space craft designer and his interactions with people involved in space policy throughout the world.

I have worn out my tennis shoes in ten weeks here, and I feel I have gained a broad perspective of NASA Langley Research Center and the Technology Transfer Process. Working through a problem statement provided me with the necessary procedural background to appreciate the need for a database to improve and expedite the process. My work is only a foundation, and its impact cannot be judged yet. Ideally, it will reflect the unique, multidisciplinary aspects of this center for TAG to draw upon. The future lies in communication and cooperation, and Langley is taking steps, in its tennis shoes, toward that goal.

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This letter is in reference to the development of the Chin Mouse by Marisol Romero, Bruce Little, and Nina Paynter. The Chin Mouse will be utilized by our clients who possess extreme motor impairments to access a computer, as well as small appliances. The advent of affordable computer technology has created a multitude of opportunities for persons with severe disabilities to interact with their environment. However, there are numerous variables which limit use and affect accuracy, such as range of motion and positioning. These factors greatly influence motoric ability to access. Commercially available devices did not address the need for flexibility in positioning or range of motion for Jennifer. Flexibility is the primary characteristic which differentiates the Chin Mouse from other devices. It can be easily adjusted to adapt its use for numerous individuals with severe motor disabilities.

The most difficult aspect of my work as a special educator for individuals with severe and profound disabilities is individualizing programming and equipment to best meet the needs of my clients. It is often the case commercially available products are insufficient. Products designed such as the Chin mouse with flexibility to adapt to changing needs are few and far in between. Manufacturers are more apt to produce products which address the needs of the majority of disabilities, rather than a specific impairment. This philosophy is understandable. Therefore, a tremendous need exists for assistive technology which addresses the needs of a few, but can be easily modified to be utilized by many. Marisol Romero, Bruce Little, and Nina Paynter have accomplished this.

Their professional expertise has improved the quality of Jennifer's life by providing the opportunity for Jennifer to access a computer independently.

On a personal level they acknowledged Jennifer with dignity and respect. An aspect of their visits that truly impressed me was the fact they spoke directly to Jennifer. They did not appear intimidated by her disability. They were also aware of the need to maintain confidentiality.

Please continue your community service program. The need for technical expertise and collaboration among organizations is overwhelming for our disabled population. Technical expertise is imperative to further assist individuals to achieve their greatest potential.

With Sincere Appreciation,

Rosann Fox

Rosann Fox
Clinician II

pc: Carol Smith