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Managing the Assistive Technology Resource Center

An Interactive Qualifying Project Proposal submitted in partial fulfillment

of the Bachelor of Science degree at

Worcester Polytechnic Institute

By

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Abstract

Since its inception in 1999, Worcester Polytechnic Institute's (WPI) Assistive Technology Resource Center (ATRC) has produced assistive technology devices and disseminated related technological information in the Worcester region. The 2013-2014 ATRC Interactive Qualifying Project (IQP) continued the organizational efforts of the previous five ATRC management IQP teams and was divided into two areas: outreach and operations management. For the outreach component, the team improved the Center's communication with organizations outside of WPI. The website was redesigned to reflect the Center's most recent projects and involvement with the community while also becoming W3C compliant. A new template for the ATRC newsletter was created, and two newsletters, one in the fall and one in the spring, were written and distributed. Two videos were also produced. One video provided a complete overview of the ATRC by explaining the Center's mission, related courses, and project work. The second video depicts a mobility device created by a senior design team. The team also developed an extensive contacts database to aid future teams with the distribution of the newsletter and for contacting potential project partners. The operations management component improved the Rehabilitation Engineering Laboratory's policies. A standard operating procedure document was created for future teams that includes all of the tasks that must be accomplished for the Center's operation with detailed instructions for completing each task and a checklist for when each task must be completed. General laboratory signage was also replaced and a laboratory index denoting the tools and supplies available in the Rehabilitation Engineering Laboratory and their locations was also created.

Acknowledgements

The team would like to thank several people who helped direct us in the project thus far. First and foremost, the project would have been impossible without the guidance and suggestions of professors Allen Hoffman and Holly Ault. The team is also very thankful for the assistance from Director of Research Computing and Academic IT Support Siamak Najafi, Computer Operations Manager Randolph Robinson, Digital Initiatives Librarian Jessica Colati, Mechanical Engineering Administrative Assistant Statia Canning, Instructional Media Specialist Jim Monaco, and the officers from both *The Towers* and EPICS.

Table of Contents

List of Figures

List of Tables

1. Introduction

Nearly one-fifth of adults in the United States have a disability (Centers for Disease Control and Prevention, 2013). According to the World Health Organization, a disability is "any restriction or lack (resulting from any impairment) of ability to perform an activity in the manner or within the range considered normal for a human being" (World Health Organization, 2004). Disabilities include physical, sensory, or cognitive impairments and negatively impact one's quality of life and ability to perform daily activities.

To aid persons with disabilities, assistive technology devices have been developed. Assistive technology devices are defined as "any item, piece of equipment or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities" (Assistive Technology Act of 2004, 2004). These devices enable individuals to overcome their disabilities and accomplish a desired task (Alper, 2006). Commercial assistive technology products are available, but they are designed for use by a wide range of individuals. Some individuals require more specialized and individualized devices from assistive technology centers.

There are several types of assistive technology centers. All of these centers want to placate the difficulties individuals with disabilities face, but they have different methods for accomplishing this goal. Care organizations use assistive technology to support persons with disabilities. Awareness organizations increase the public's understanding about disabilities and the challenges that these individuals cope with on a daily basis to spur the development of effective assistive technology devices. Referral organizations direct persons with disabilities to the proper personnel to provide assistive devices. In addition, there are organizations developing

assistive devices. Without the technical expertise of these organizations, the development and use of assistive technology devices would not be possible.

The Assistive Technology Resource Center (ATRC) at Worcester Polytechnic Institute (WPI) is one center concentrating on the technical aspect of assistive technology devices. Established in 1999, the ATRC designs personalized assistive devices and serves as a central resource for the dissemination of assistive technology information. For the past fifteen years, WPI undergraduate and graduate students have developed assistive devices with the ATRC primarily focusing on needs related to physical impairments, and this has positioned the ATRC in the forefront of assistive technology in Worcester and the surrounding region.

Since 2008, there have been five Interactive Qualifying Projects analyzing the ATRC's operations. An Interactive Qualifying Project (IQP) is a project by WPI undergraduates where teams of students "conduct research, using social science methods, directed at a specific problem or need" (Interdisciplinary and Global Studies Division, 2014). Students participating in the ATRC operational studies have served as laboratory managers and simultaneously proposed and implemented policies to improve the ATRC's operations. These studies have significantly improved the ATRC's internal structure; however, the Center's outreach has remained stagnant. Therefore, the current study's primary goal was to improve the ATRC's outreach system.

The current study, which was completed during the 2013-14 academic year, improved the ATRC's outreach capabilities, recognition in both the WPI community and surrounding region, and internal organization. Media was developed to facilitate outreach and increase the ATRC's ability to recruit students and projects. The organizational methods proposed by previous studies were examined and enhanced to improve the daily operation of the laboratory. This study placed the ATRC in a position to satisfy its mission statement for the next few years.

2. Background

Before delving into the project, it was necessary to research the history and work of the WPI ATRC along with other assistive technology centers in the local area and across the nation. Past IQP reports were read and analyzed to discover any techniques that have been effective in previous years for the WPI ATRC that could be implemented in the current project.

2.1. WPI ATRC

2.1.1. History

In 1998, Worcester along with the rest of central Massachusetts was lacking a center specializing in the design of assistive technology and dissemination of related information. While there were existing organizations dedicated to assisted living, physical therapy, and special education, the area lacked a center dedicated to the technical side of assistive care. WPI's Rehabilitation Engineering Laboratory had worked in conjunction with several outside facilities serving persons with disabilities; however, Professors Allen Hoffman and Holly Ault believed something more substantial would be beneficial for the WPI and surrounding region.

Because of the efforts of Professors Hoffman and Ault, WPI's Assistive Technology Resource Center (ATRC) was established in 1999 using a generous grant from the Fairlawn Foundation. Located on the first floor Higgins Laboratories in HL 129, the Center allows for undergraduate and graduate students to design assistive devices and serves a centralized source for assistive technology information (Ault, 2001).

2.1.2. Mission

In their 2001 report, Ault, Catricala, and Hoffman described the two main objectives for the ATRC:

1) *To provide a centralized information resource for rehabilitation professionals within the region.*
2) *To provide a technically based resource for either the modification or the design and development of customized assistive devices.*

(Ault, 2001)

Using these two primary goals, they formed the mission statement for the ATRC. As of 2012, the mission statement is as follows:

> *"The mission of the ATRC is to foster the use of assistive technology through collaboration with professionals associated with local and regional clinical, educational, governmental and social service organizations that serve persons with disabilities. The ATRC disseminates technical information regarding the availability and use of assistive devices. When an appropriate commercial device is not available, the ATRC will collaborate with cooperating organizations in developing modifications to existing devices or the design of a custom device. The ATRC focuses on mechanical and electro-mechanical devices."*

(Herzog & Oo, 2013)

2.1.3. Overview

Facilities

Located on the first floor of Higgins Laboratories, the ATRC occupies two rooms. The Center's primary room is a 700 square foot workspace in the Rehabilitation Engineering Laboratory (HL 129) complete with past projects, specialized equipment, and tools. Additionally, the ATRC has a small conference room (HL 123) for meetings between faculty members and either clients or students.

Personnel

The ATRC continues to be run by Professors Ault and Hoffman, who oversee the IQPs and MQPs conducted in the ATRC, as well as a student club (EPICS) and several of the classes that utilize the ATRC's facilities. Professor Planchard is also involved in the Introduction to Engineering Design course, in which students complete projects in the ATRC laboratory; however, he is not involved with other projects completed at the Center. Graduate and undergraduate students, under the direction of Professors Hoffman and Ault, carry out projects through the Center. Most of the students are involved in projects designing or modifying assistive technologies and devices, however some are involved in the operational and organizational side of the ATRC. In 2004, the ATRC received a grant to establish the EPICS program and this grant also provided funding for teaching assistants (TAs) to help manage the laboratory. Then an intern from Assumption College managed the Center for one year, but the management role has since been incorporated into the annual management Interactive Qualifying Project.

Projects

The ATRC affiliates itself with myriad of biomedical and mechanical engineering courses and projects. While Higgins Laboratories is home to WPI's Mechanical Engineering Department, biomedical engineers are also affiliated with the ATRC due to the overlap between their program and the biomechanics concentration for mechanical engineers.

The ATRC is closely tied to three undergraduate courses: Introduction to Engineering Problems (ES 1020), Introduction to Engineering Design (ME 2300), and Rehabilitation Engineering (ME 3506). In the spring of 2004, Advanced Engineering Design (ME 4320) was added to the list of courses utilizing the ATRC. Introduction to Engineering Problems is a

freshman level course focusing on the design process, and students are exposed to engineering techniques through case studies and reverse engineering activities. During the course, students design and evaluate a prototype. Introduction to Engineering Design is a sophomore and junior level course where students form project teams and follow the design process to create a working prototype, which may focus on designs for a person or persons with a specified disability. Rehabilitation Engineering is a junior and senior level course where students study ergonomics to create assistive technology devices to aid persons with disabilities in performing activities of daily living (ADLs), as well as educational and recreational activities. Advanced Engineering Design is a senior level course where students develop and test a complex prototype related to assistive technology (WPI, WPI Undergraduate Catalog 2013-14, 2013). The official course descriptions can be found in Appendix F.

Along with courses, the ATRC supports several major undergraduate projects. Since its inception, nearly 60 projects have been completed within the Center. First, several students have completed their Interactive Qualifying Project (IQP) with the ATRC. Typically completed during a student's junior year, the IQP connects science and technology with social issues (WPI, Interactive Qualifying Project, 2013). Past projects have worked to improve the operation of the ATRC and develop a wheelchair maintenance manual. Second, the ATRC has supported many Major Qualifying Projects, or MQPs. Conducted in a student's major field, the MQP is an intensive project where seniors use the knowledge that they have accumulated during their time at WPI to solve a real problem (WPI, Major Qualifying Project, 2013). From these projects, a wide range of assistive technology devices such as orthoses and wheelchairs have been designed and manufactured. Third, the ATRC has supported graduate research and has sponsored several

graduate theses, which typically feature projects similar in nature to MQPs except with a higher degree of complexity.

Outreach

Since half of their mission statement pertains to directly serving individuals with disabilities by creating assistive devices, the ATRC strives to be active in its outreach efforts to gain clients and recognition in the region. Like most organizations, the ATRC hosts an informative website explaining the Center's mission and several notable past projects (Assistive Technology Resource Center, 2014). The Center produces and releases several publications that provide updates on their current goals and projects, which include biannual newsletters, brochures, and research papers. Lastly, the ATRC conducts presentations to potential clients and provides tours of the facilities to visiting individuals and students.

In past years, the ATRC has partnered with a variety of local institutions. Their most frequent partner has been the Massachusetts Hospital School in Canton, Massachusetts, which is a school whose goal is to provide medical, educational, recreational, and rehabilitative services to children and adults (Massachusetts Hospital School, 2013). Several devices have been produced in collaboration with the Massachusetts Hospital School such as a backpack access device and a portable bow mount system for archery. Another recurring partner is the Seven Hills Pediatric Center in Groton, Massachusetts. Also, the ATRC has worked with several organizations in Worcester to create assistive devices such as the city's public school system. Along with these partners, the ATRC actively seeks new clients and organizations in order to assist more individuals and offer students a wide range of projects.

EPICS

Not only does the ATRC sponsor undergraduate and graduate course projects, but it also supports Engineering Projects in Community Service (EPICS). Founded at Purdue University in 1995, EPICS is an organization featured at 21 universities across the globe including WPI. The program has two goals. First, it aims to educate undergraduate engineers in the design process and give them real world problem-solving skills. Second, EPICS is designed to help individuals and non-profit organizations who may not have access or the necessary resources to hire a professional engineering team (EPICS University, 2013).

WPI's EPICS chapter has been in existence since 2004 and has completed a wide range of assistive technology projects. In 2010, EPICs produced a short video on the club's activities that won second place in a national Engineering Week competition. WPI's EPICS chapter is not an official on-campus club according to the Student Activities Office.

2.2. Work by Previous IQP Teams

Six IQPs evaluating the operation of WPI's ATRC have been conducted since the ATRC's opening, including five in the past six years. These reports have developed a list of methods to optimize the Center's operation and organization both internally and externally.

A review of the operational IQPs with the ATRC demonstrates that project teams have done an excellent job on internal tasks; however, the outreach component of the project has been stagnant over the past five years. While a detailed Five Year Plan for the ATRC's operation was provided by the 2008 Lyons and Trimby study (Lyons, 2008), subsequent teams have failed to follow the plan and outreach tasks have been neglected in favor of internal tasks, and this can be seen in Appendix A.

Teams have excelled at organizing and maintaining the rehabilitation laboratory. Extensive signage has been placed throughout the laboratory with accompanying schematics listing the locations of tools and supplies. The Herzog and Oo study, the most recent IQP, also developed task lists for the maintenance of the ATRC detailing a schedule for cleaning the laboratory, conducting inventories, and prepping the Center for the start of new terms (Herzog D. a., 2013). The team also devised a much needed project storage system using large tubs that keep projects organized.

Previous IQPs have also made great progress on the Projects database using Microsoft Access. This database serves as a central resource for the ATRC's past projects and list of contacts. Last year's IQP attempted to make this database even more accessible by transferring the project information to the library's Digital Commons online database, which would make it more accessible to those outside of the WPI community.

Teams have also consistently updated the ATRC's publications to reflect the Center's newest projects. Every few years, both the brochure and newsletter have been redesigned while also having the information updated. These two publications feature the ATRC's most recent and accurate information, and are easily modifiable since previous IQP teams have left detailed templates for future teams. Leaving materials such as templates available increases the likelihood and speed that a particular task is completed.

Outside of these two publications, the ATRC has struggled to generate publicity. Surveys conducted by the Begins and Zeveska IQP revealed that the ATRC has a visibility problem, as 76% of surveyed students had never heard of the ATRC and 91% had never used the ATRC (Begins, 2012).

The student EPICS club in particular has struggled to be recognized by the WPI community. Due to limited participation, EPICS is not considered an official on-campus club by the Student Government Association (SGA). From the same survey conducted by the Begins and Zeveska IQP, 86% of students had never heard of EPICS, which is extremely detrimental for the club's prospects of gaining new members.

Many project teams seem to improve one facet of the previous IQP team's work rather than making a noticeable leap forwards. While IQP teams make recommendations at the end of their reports, many teams neglect these recommendations and instead develop their own plan. The lack of communication between project teams leads to IQP teams making lateral progress in many areas of their project rather than continuing the previous team's work.

While the ATRC completes course projects, IQPs, MQPs, and graduate projects for outside individuals or organizations, IQP teams should search for additional contacts and partners. The first two management IQPs developed contact lists; however, the following three IQPs failed to find new contacts, leaving the ATRC's list outdated. In these five years, organizations could have gone out of business or had personnel changes.

The ATRC has done a great job creating projects since its inception and the management IQP teams have done an exemplary job ensuring that the ATRC is internally functioning well. The ATRC's outreach efforts and visibility around the WPI campus must be improved. A complete list of progress by the previous IQP teams can be seen in Table 1 in the following section and a detailed list of tasks accomplished by each IQP team can be found in Appendix A.

Progress by Previous IQP Teams

Black- Not suggested at the time of the project
Green- Major progress made towards the goal
Red- No progress was made
White- Proposed
Yellow- Satisfied the goal, but did not make major improvements

Table 1- Progress of Previous IQP Teams

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Archiving Information	MT	The ATRC should have an organized method for storing information and making it available for use by future teams	Proposed a database for projects	Created a database of contacts	Created an extensive document for the ATRC's past projects		Updated the Microsoft Access project database and began the process of digitizing it with the Library; also archived information on a flash drive
AT Center Best Practices	LT		Analyze other AT university centers like Lemelson & UMass Lowell				
Brochure	LT		Updated the brochure format	Updated the brochure's info and used the previous year's format	Updated the brochure's info and used the previous year's format	Redesigned the brochure & updated its info	Updated the brochure's info and used the previous year's format

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Center for AT Information	MT	Central resource for collecting & disseminating AT information	Proposed a database for projects, suggested media, updated & published the brochure	Created a database of contacts & past projects and also updated the website and newsletter	Created documents for the ATRC's past projects and marketing	Redesigned the brochure, newsletter, & website to better share AT information	Worked with the Library to begin the process of digitizing the ATRC's project database
Contact List	LT		Found 91 contacts for AT organizations, AT centers, clients, schools, & students	Found 47 new contacts for AT organizations, AT centers, schools, & businesses		Re-establish contact with organizations the ATRC worked with in the past	
Database of Contacts & Projects	LT		Current and past contacts & projects should be catalogued in an electronic database	Created a Microsoft Access database for contacts & past projects	Created a document instead of a database for past projects		Updated the Microsoft Access project database and began the process of digitizing it with the Library
Document of Past Projects	GK				Created a comprehensive document of the 61 AT projects completed at WPI since 1991		Updated the database instead of the project document

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
EPICS Assistance	HMW			Publicized EPICS through the brochure, newsletter, & website	Included projects from EPICS in the past projects & marketing documents	Began the process of re-establishing EPICS after WPI's chapter disbanded	Re-established WPI's EPICS chapter and the organization modified an electric wheelchair so that it could safely operate on a beach
Five Year Plan	LT		Created with a full task list by year	Completed four of the six proposed tasks; advanced its organization and media	Fell behind on updating media sources and organizing the laboratory	Did an excellent job updating the media sources for the ATRC, but did not directly work on outreach methods	Satisfied interior goals, but did not do any outreach goals
Global AT Projects	MT	AT projects could be done at global MQP & IQP sites					
Grant List	LT		Find grants the ATRC could apply for to gain extra funding				
Integrated with Project System	MT	Center would sponsor many AT IQPs & MQPs					

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Lab Inventory	BZ					Composed a detailed list of the ATRC's tools to keep track of them and conducted a lab inventory to order parts as necessary	Conducted lab inventories as recommended
Lab Organization	LT		Suggested methods for improving lab organization in the Five Year Plan	Created a detailed lab schematic and labeled the cabinets and drawers in the lab to inform users of their contents		Conducted a tool & supply inventory and created a schematic for the locations of tools & supplies	Created new laboratory signage, created new term and weekly task lists, and developed methods for storing projects
Lab Schematic	HMW			Created a detailed lab floor plan with the location of important items & tools		Added the location of tools & supplies to the schematic	Updated the tools schematic and the lab's floor plan to reflect the lab's downsizing
Labels/Signs for Tools & Materials	LT		Signs and labels should be added to alert users where items are located	Cabinets and drawers were labeled		Created a schematic for the location of tools & supplies	Replaced the old laboratory signs

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Management Structure	MT	Director and smaller positions filled by other faculty or students	Suggested future IQP teams could manage the lab and proposed a role review for ATRC personnel	Proposed duties for the ATRC lab manager		Created standard operating procedures for future IQP teams	Created detailed weekly & term task lists
Marketing Document	GK				Created a marketing document to build interest with clients & students		
Media Reviewed for Effectiveness	LT		ATRC media sources should be reviewed for their effectiveness	Determined the newsletter is an aggressive & useful advertising tool	Determined a marketing document would be a comprehensive & useful tool for outreach	Redesigned the format of the brochure, newsletter, & website to be more appealing	Updated the information of the media sources
Newsletter	LT		Newsletter's format should be updated and include section on clients & sponsors	Updated the newsletter's format and added information on clients, sponsors, & recent projects	Published the newsletter with updated info and the same format	Updated the newsletter's format	Updated the newsletter's information
Project Management	HO						Created a project management outline for project teams

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Project Storage Improvements	HMW			Suggested that a formal method for storing and organizing projects is necessary			Created a formal system for storing projects using large, storage tubs
Publicize ATRC	LT		ATRC should have projects publicized in WPI media	Updated pre-existing media, but did not create any new forms of media	Created the marketing document	Redesigned the brochure, newsletter, & website; suggested emailing these documents to the WPI community	Created fliers to promote EPICS and updated the information for the media sources
Recruit Across WPI	MT	Center would need to recruit students to complete projects	Efforts made to increase WPI media, which would boost student interest in the Center		Marketing document designed intended to help recruit students	Surveyed WPI students about their interest in working with the ATRC & suggested emailing the brochure & newsletter to the WPI community	Created fliers to recruit students to EPICS
Scheduling	HMW			Proposed a sign in/sign out sheet to keep track of who is using the laboratory			Created a system to reserve the ATRC's conference room (HL 123)

Progress of Previous IQP Teams							
Item	**Proposed By**	**Martin & Thamilavel (MT)**	**Lyons & Trimby (LT)**	**Hristov, Mawhiney, & Wilson (HMW)**	**George & Kalluri (GK)**	**Begins & Zeveska (BZ)**	**Herzog & Oo (HO)**
Surveys	LT		Survey AT organizations & clients to develop best practices for outreach for the ATRC			Surveyed WPI students on the ATRC's convenience & visibility	
Website	MT	Website with contact info, past projects, & AT/rehab links	Updated the website to meet W3C Guidelines	Updated the website's information and made modifying the site easier using WinSCP		Created a new ATRC website using Adobe Dreamweaver & WinSCP	Updated the website's information, but the changes never went online

3. Goals

After studying the progress of previous IQP studies and the fundamental missions of the Center, several primary goals were developed. The overarching goal of the study was to ensure the long-term success and longevity of the ATRC by improving its operation and outreach.

3.1. Outreach Goals

The team had the following outreach goals for the 2013-14 academic year:

1) Improve the ATRC's outreach capabilities.
2) Increase the ATRC's recognition and presence in Worcester and the surrounding region.

3.2. Operations Management Goals

The team had the following operations management goals for the 2013-14 academic year:

1) Improve the ATRC's information and laboratory organization.
2) Increase the ATRC's recognition by the WPI community and ability to recruit students for projects.

4. Methodology

This chapter overviews the methods that the team undertook to improve the Center's outreach and operations management.

4.1. Outreach

To improve the ATRC's outreach capabilities and recognition in the Worcester region, the team developed a diverse library of media offerings for future IQP teams to use. This library includes both electronic and print media and will enhance the Center's outreach endeavors. The team also compiled a list of organizations to receive the newsletter and future ATRC updates. The team was able to use the media that was developed to facilitate meetings with representatives from outside organizations in order to increase the ATRC's presence in the region and ability to find and maintain project partners.

In order for the ATRC to complete more projects, students need to be familiar with the Center. Student awareness about the Center could be increased by table-sitting in the Campus Center, writing articles in WPI publications such as *The Daily Herd* and *The Towers*, and sending the ATRC brochures or newsletters out as emails to the WPI community.

4.1.1. Media

Media enables individuals to share information in a wide range of forms, both digital and print. At the start of the project, the ATRC's media library included an incomplete and outdated website, an informational brochure, and a four-page newsletter. The project team decided to improve the Center's existing media offerings while also establishing new options such as an online project database, an informative video, and a Facebook page.

Website

At the start of the project, the ATRC website was unsatisfactory. In the digital age, small organizations such as the ATRC are heavily reliant upon websites in order to maintain visibility. Intuitively designed websites with fast-loading, frequently-updated, and fast-loading content enable organizations to increase their recognition and ability to satisfy their mission statement or goals (Purinton & Rosen, 2004). However, the pre-existing ATRC website impeded outreach efforts, as the page was very outdated and lacked a professional appearance. Therefore, it was a major goal to redesign the website to help facilitate outreach and attract potential partners.

Visitors to the extant page were greeted with a message that the ATRC web page was under construction. Soon after, visitors would quickly discover several missing files or inactive links that suggested the website was inactive. This was compounded by the fact that the site had not been updated since February 2012, which was eighteen months before the start of the current project. Not only was the page missing the ATRC's most recent projects and accomplishments, but some of the pre-existing information had become outdated such as the organization's mission statement and facilities. The website was also not fully accessible for persons with screen readers, which conflicted with the ATRC's desire for technology to assist persons with disabilities rather than impede them.

Finishing the website's construction and updating the information was a straightforward process after gaining editorial access to the website. The primary obstacle was the website's accessibility. Inclusive design is important for a website. According to the Web Accessibility initiative, webpage accessibility "focuses on people with disabilities- people with auditory, cognitive, neurological, physical, speech, and visual impairments" (Designing for Inclusion, 2012).

The World Wide Web Consortium (W3C) offers web content accessibility guidelines that promote accessibility. While they are designed primarily for persons with disabilities, following these guidelines makes web content more accessible regardless of the user agents (device or browser) or constraints (light, hands-free environment, etc.) that the user may be operating under (Chisholm, 1999). W3C compliant sites offer equivalent alternatives for both auditory and visual content and feature an intuitive, user-friendly design that transforms gracefully to any browser or device.

Cascading style sheets (CSS) in particular can improve a website's accessibility (Cascading Style Sheets, 2014). These style sheets allow the user to easily edit the fonts, colors, and spacing of a web page. W3C compliant web pages avoid the use of conflicting color schemes, and the CSS code controls the site's background and text colors. CSS also allow the user to optimize a web page's format for both display and printing to ensure that no information is prematurely terminated or awkwardly spaced. Important identifying information can be embedded in CSS as well and makes the page easier to find using a search engine and increases the likelihood that it will receive traffic.

To evaluate a website's W3C compliance, there are several applications available online that determine its accessibility. The applications scan a website's code and determine its accessibility based its visual design and presence of alternatives for both visual and auditory content. These applications are well-versed in CSS and HTML code; however, a website could be inaccurately labeled as non-W3C compliant if the webpage used an uncommon or recent command.

For this project, Sitebeam was selected. Not only does Sitebeam test a website's accessibility, but it also tests a website's content, marketing, and technology (Sitebeam, 2014).

Accessibility refers to how accessible a website is for users with disabilities or mobile devices. Content refers to the quantity and quality of the website's content. Marketing refers to how well marketed a website is through its descriptor tags and social media integration. Technology refers to how well the website incorporates more complex HTML into its code to improve the website's functionality. Sitebeam computes a numerical score from zero to ten for each category with ten being the best, and then generates an overall score.

Analytical software was also identified as a useful feature for the ATRC. This software allows one to gauge a website's traffic by logging how many different Internet Protocol (IP) addresses have visited the website over a specified period of time (GoStats, 2014). These metrics enabled the team to study whether or not the Center's publicity and recognition improved over the course of the project quantitatively. GoStats was ultimately selected as the project's analytical software because of its ability to provide statistics about the number of visitors, the number of pages visited by each visitor, and the duration of each visitor's session.

Print Media

Print media was equally as important as electronic media. During personal interactions, distributing a tangible copy of the brochure or newsletter would be extremely beneficial since these documents are concise summaries about the ATRC's overall and recent activities. Over the past decade, the ATRC has published four-page, biannual brochures and newsletters.

The Begins and Zeveska study designed modifiable templates for both the brochure and the newsletter (Begins, 2012). Both publications included information about the ATRC's most recent projects, personnel, and publications. A brochure produced with their template can be seen in Figure 1 and Figure 2, and a newsletter using their template can be seen in Figure 3.

Figure 1- Old Brochure Template (Exterior)

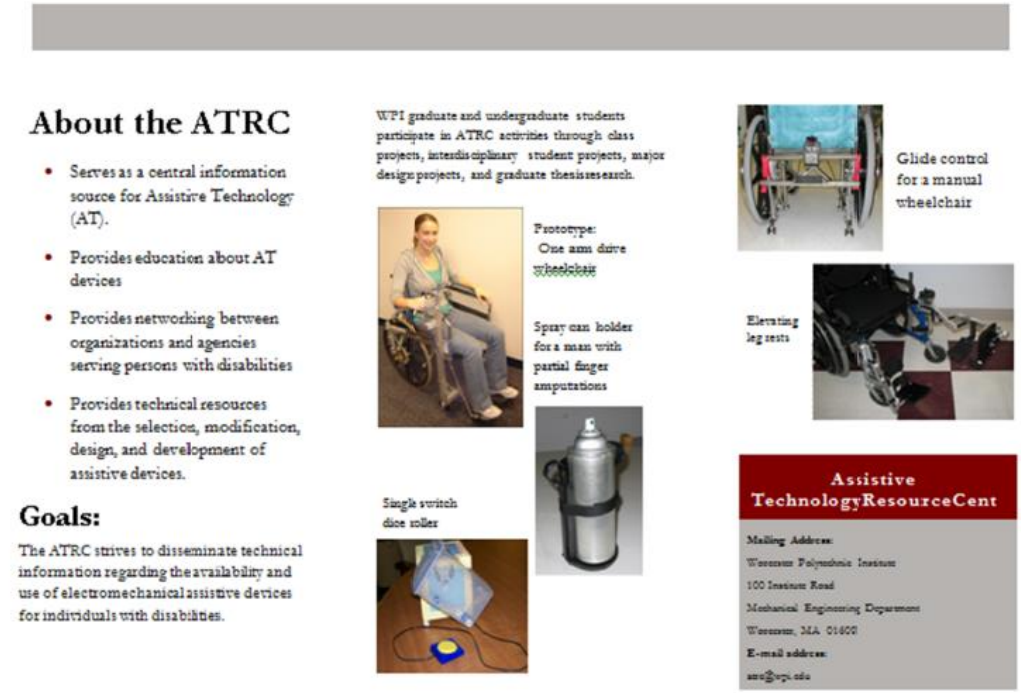


Figure 2- Old Brochure Template (Interior)

WPI ATRC Newsletter

Assistive Technology Resource Center

Summer 2012

Volume 11, Issue 1

Summary of 2011-2012 Activities

The 2011-2012 academic year was a very active time for the ATRC and the associate Rehabilitation Engineering Laboratory. A number of student projects from undergraduate design courses are highlighted on pages 2 and 4 of this newsletter. In addition, two provisional patent applications were filed for devices completed in the spring of 2011. The first was for an attachment for a walker that aids in preventing lateral falls. The second application was for an electromechanical reacher/gripper device. Additionally, a student team comprised of Anthony Begins and Stephan Zewska developed a plan to improve the operation and external communications associated with the ATRC.

These improvements include:

- Updated Website with future updates scheduled (http://www.me.wpi.edu/ATRC/)
- Reinstatement of the newsletters
- Newsletters expanded from two to four pages
- Updated mailing lists
- Reorganized the Rehabilitation Engineering Laboratory
- Updated the tools and supplies associated with the laboratory.

What's Inside:

Recent News

Recent Projects: 2 & 4

About EPICS : 3

About Us/Contact : 4

Do you have an idea for a student design project?

The ATRC actively accepts ideas for potential projects from agencies that provide services to persons with disabilities. In the past, WPI students have worked in collaboration with agencies such as the Massachusetts Hospital School, the Seven Hills Pediatric Center, the Massachusetts Department of Developmental Services and various other programs.

History and Mission of the ATRC

In 1999, the Rehabilitation Engineering Laboratory at Worcester Polytechnic Institute received a grant from the Fairlawn Foundation to develop an Assistive Technology Resource Center (ATRC). The mission of the ATRC is to foster the use of assistive technology through collaboration with professionals associated with local and regional clinical, educational, governmental and social service organizations that serve persons with disabilities.

The ATRC at WPI disseminates technical information regarding the availability and use of assistive devices. When an appropriate commercial device is not available, the ATRC will collaborate with cooperating organizations in developing modifications to existing devices or the design of a custom device. The ATRC focuses on mechanical and electro-mechanical devices. (http://www.me.wpi.edu/research/ATRC/About/)

Figure 3- Old Newsletter Template

The team decided to continue using the brochure template since it was both informative and aesthetically pleasing. Alternatively, the team decided to redesign the newsletter template since the previous iteration was bland and failed to attract one's attention. In order to receive layout suggestions and ideas for the newsletter's redesign, the team talked with current editors on Worcester Polytechnic Institute's student newspaper, *The Towers*. The editors suggested a prominent header boasting the school's colors and ATRC logo to lure potential readers. To improve the newsletter's organization, the editors also suggested the use of divider lines to separate articles and clearly partition the content.

Project Database

A project database would be beneficial for both the operation and outreach of the ATRC. A comprehensive projects database with information on each project's topic, authors, advisors,

and year would demonstrate the ATRC's ongoing activities with outside organizations while also chronicling previous projects for reference by the Center's supervisors.

Previous teams created an offline Microsoft Access database with detailed entries for each project. While useful for internal reference, the database was difficult to share externally and upload to the ATRC website. The George and Kalluri study offered a potential solution with the creation of a project document (George, 2010). This document featured a detailed paragraph for each past project. While the document could easily be uploaded to the ATRC website as a PDF, the document's design was not as intuitive and the absence of a search function made the document cumbersome to sift through for particular projects.

The 2012-13 Herzog and Oo study identified an ideal solution in Worcester Polytechnic Institute's Gordon Library's Digital Commons online database. The Digital Commons "collects, organizes, preserves, and showcases WPI's collective scholarship" (George C. Gordon Library, 2014). The ATRC would be able to create and maintain its own digital database on the Digital Commons and share the link on its website to showcase its project history and attract project partners. Entries in the ATRC database could be searched or sorted by title, author, year, or topic to expedite the data retrieval process, as the team identified several key words for each report based upon its content. In addition, links for any IQP, MQP, or graduate thesis completed since 1997 could accompany the entries to provide the user with more extensive information on each project.

Video

In 2010, WPI's EPICS chapter produced an informative, two-minute video for Engineering Week. The video provides a brief yet thorough overview of the organization, and is an excellent way to introduce EPICS to unfamiliar parties. Our team was inspired by EPICS's

video to create a video about the ATRC. The video includes the Center's location, mission, goals, projects, and affiliated courses. By presenting the most important information about the ATRC, the video will be a valuable marketing tool for the Center when contacting organizations about collaborating. This video will also be a valuable resource to recruit prospective students and generate interest in assistive technology development.

Additional videos will also be developed about individual projects. These short videos will be one to two minutes in length and include the project team discussing and demonstrating their project. All of the ATRC's videos will be made public on YouTube to further increase the Center's publicity and demonstrate past projects.

Social Media

In order to expand the ATRC's outreach capabilities, it was decided that a social media page would be beneficial for keeping interested persons up to date with what is going on in the laboratory. Facebook opens a new avenue through which the Center can be found, allowing for outreach to a different group of people than can be reached through traditional print media and the website. To develop the page from scratch, research was carried out to determine common trends and best practices for creating such a page based on the Facebook pages of WPI organizations and other similar AT centered organizations throughout the United States. Ultimately, the team determined that the goal of the ATRC Facebook page would be to keep the organization's name in the public's mind and redirect people to the main ATRC website. The research from the five assistive technology Facebook pages that the team studied can be seen in Appendix B.

Based on this research a page was created with a basic description of the ATRC, its mission, contact information, and a link to the website. Once the page was created, posts to the

wall were made on a regular basis, with content focusing on news and events concerning AT, and especially any connected to WPI, the Worcester area, and the ATRC. The goal of a Facebook page is not to contain all of the information about the organization, rather it is to give a brief overview of the organization, and to keep an up to date timeline of what is going on within it. This page is meant to provide a gateway to accessing more detailed information through links to articles, videos, and most importantly the website.

Contacts Database

In addition to organizational improvements to the laboratory, some additions to the organizational practices of the ATRC in general were made. The most significant of these was creating a unified contacts database, containing older contacts that the ATRC maintained, as well as all organizations and individuals who were found through research (for outreach). Not only does this list include contact information, it contains information about the scope and goals of the activities that the organization/individual carries out. Some such information includes the types of disabilities of the clients that they serve, key events that they hold throughout the year, whether or not contact has been made with them, as well as other information that might be useful to those running the ATRC as well as those involved in projects at the Center when looking for groups to contact. This tool is meant to be used as an initial "overview" that will allow for those involved in the ATRC to quickly scan a large list of contacts, and determine which ones might be helpful as collaborators on a project.

4.1.2. Client Meetings

A key part of conducting outreach is meeting with members of outside organizations to develop a network of contacts from a variety of organizations involved in assisting those with disabilities as well as providing and developing AT. While emails and other forms of

communication are important in developing relationships with such individuals, face to face meetings can be much more productive, especially when communicating with people who are unfamiliar with the ATRC. These meetings allow not only face-to-face communication, but also allow for tours of the facilities, and presentations of past and current projects, making them ideal for familiarizing people with the ATRC (or for learning about new centers).

Research was conducted on each organization before any meeting. In the week before the meeting, the subject matter and expectations for the meeting were discussed in the weekly meeting with Professors Hoffman and Ault to ensure that the visit would be productive and advance the Center's standing. Any meetings at WPI featured a tour of the rehabilitation laboratory where Professors Hoffman and Ault demonstrated past projects. Over the past year, the team met with individuals from Massachusetts Department of Developmental Services, Seven Hills, and the Enactus programs at Mercy College and Worcester State University. The discussion centered on how their projects could mesh with the WPI project system and academic schedule. The team also met with individuals from Worcester Academy and WPI's Office of Multicultural Affairs about providing workshops to educate middle school students about assistive technology.

4.2. Operations Management

The team identified several areas internally where the Center's organization could be bolstered to improve the daily operation of the ATRC. Developing best practices for the ATRC's operation could provide guidelines for future IQP teams and eliminate the challenging transition phase at the start of the year when the new management team begins their project. After a brief hiatus, EPICS returned after the Herzog and Oo study, so the team wanted to assist the organization's growth by generating positive publicity for the club around campus.

4.2.1. Best Practices for Operation

In order for the ATRC to be better organized and managed, research was done to determine some best practices for operation of a laboratory, and how other similar organizations and laboratories carried out their day to day organizational activities. This was compared to the current operational procedures and identified any areas that needed improvement, or any items that could be addressed to improve the operation of the laboratory. Organizations such as EPICS (at other schools like Purdue) and other service-learning centered project centers, as well as AT centers were investigated, as these were the closest parallels to the ATRC. The practices that these use were compared to the standard operating procedures developed by past IQPs, particularly the recommendations from the past years project (Herzog D. a., 2013). Problems with the organization of the laboratory were identified, such as the registration of projects, and the tracking of laboratory use by individuals, and addressed through additional organizational methods such as updated signage and a sign-in binder for the laboratory. The largest addition to the existing organizational tools for the Center was the creation of an operational checklist, built on the recommendations of the past IQPs, that gave daily, weekly, monthly, and beginning and end of term tasks to be carried out by the ATRC manager (future IQP teams, work-study students, or others). The focus of this document is to improve the Center's organization by keeping future managers of the laboratory on task. It is important that activities like cleaning, inventory, checking the ATRC email address, and checks on the compliance of the laboratory with safety codes (like keeping a path to the eye-washing station clear) are done regularly.

4.2.2. Operational Procedures

Based on the observations of the state of the laboratory at the beginning of the project, some improvements to the ATRC's organization were made. As discussed above, signage in the

laboratory was updated, including a sign informing those entering the laboratory that they should sign in to a binder with their names, what they did in the laboratory, and what times they were in the laboratory. In addition to this, signs indicating the location of tools were updated, and tools that were misplaced were put in the correct location. A laboratory index, outlining where different tools are located in the laboratory was developed once all tools had been put away, allowing individuals using the laboratory to easily locate the needed tools and materials for their project. In an attempt to ensure that the laboratory had sufficient tools and materials, an inventory of important items was made at the beginning of the project; this allowed for future inventories at points throughout the year, to ensure that no items had gone missing, and that consumable materials that are commonly used are replaced as necessary.

4.2.3. EPICS

After brief hiatus, EPICS was restarted in the spring of 2013 thanks to the efforts of the previous IQP group led by Dale Herzog `14 and Wut Yee Oo `14. Last year, the organization successfully modified an electric wheelchair so that it could safely operate and travel along the uneven surface of a beach. Led by project manager Sarah Chamberlain `16, the wheelchair was designed for her sister who is affected by cerebral palsy. A comparison of the wheelchair before and after the modifications appears in Figure 4 and Figure 5.

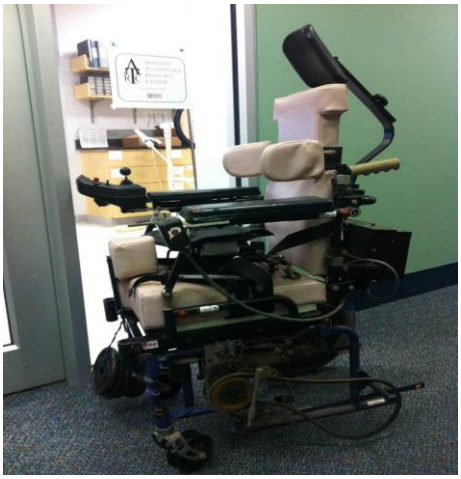


Figure 4- EPICS Wheelchair before Modifications

Figure 5- EPICS Wheelchair after Modifications

The team's primary plan was to publicize the successful wheelchair project and attract underclassmen. Since many underclassmen have not yet been exposed to major projects such as the IQP and the MQP, the team decided that EPICS would offer these students an opportunity to use their design knowledge and creativity in a constructive and meaningful way. The team established three things to increase the organization's publicity. First, the team would publish articles about the accomplishments of EPICS in the ATRC's print media and WPI publications. Second, the team would encourage professors in the design courses affiliated with the ATRC

(Introduction to Engineering, Introduction to Engineering Design, and Rehabilitation Engineering) to inform their students about EPICS in an effort to recruit new members. Students at the beginning of their college careers would be more likely to accept an extra-curricular project since they have yet to start their IQPs or MQPs. Third, the team offered to help table-sit on behalf of EPICS in the Campus Center to increase campus's knowledge about the organization, so that the club's president could complete the registration and voting process with the Student Government Association to make EPICS an official club.

The team also realized that it was important to monitor the progress of EPICS. The organization needs to transform itself into a fully-functional student organization with input from a faculty advisor to ensure that progress is being made. Therefore, the team met with the EPICS officers and urged the officers to purchase an engineering notebook to document their weekly progress.

5. Implementation

After developing the methods, they were carried out to varying degrees of effectiveness to fulfill the project's outreach and operations management goals.

5.1. Outreach

The project resulted in a diverse set of media that were designed to help facilitate outreach on behalf of the ATRC. In addition, the project team also met with several organizations in the Worcester region to further the ATRC's public presence, recognition, and ability to obtain assistive technology projects.

5.1.1. Media

The study produced various media sources for the ATRC to use to conduct outreach both at WPI and with outside organizations. These media sources were a redesigned website, a newsletter, a brochure, an extensive project database, a video, and a Facebook page.

Website

The ATRC website can be accessed at http://www.wpi.edu/academics/me/ATRC/. While the website's style remained the same, changes were made to improve the site's functionality and content. The most important change was that the website was completely finished. The website no longer includes broken links or missing files, which increases the website's professionalism and improves the experience of visitors. In addition, each page features a redesigned header and footer. The header was redesigned to be bolder and include the ATRC logo along with the most recent Worcester Polytechnic Institute logo. Then the footer was condensed from two lines to one to minimize the amount of space that it occupied on each page. The former home page in Figure 6 can be compared to the redesigned home page for the ATRC website in Figure 7. The entire redesigned website can be found in Appendix B.

Figure 6- Website at the Start of the Project

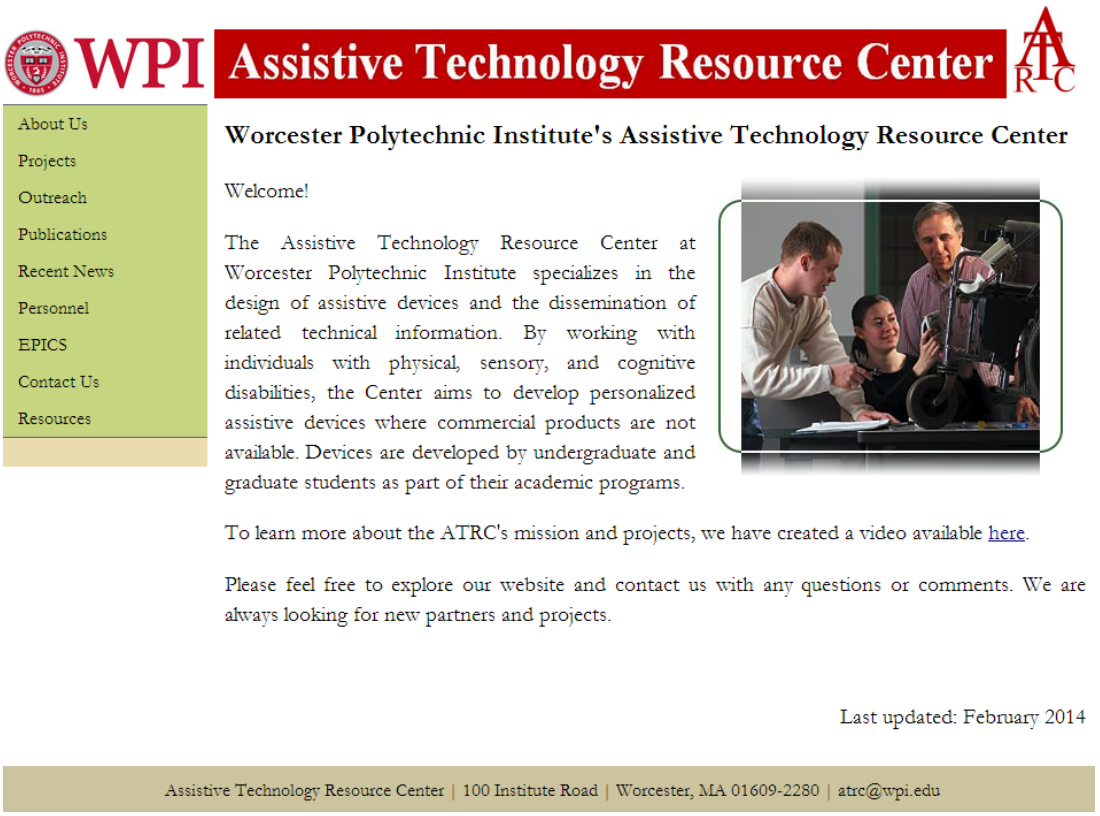


Figure 7- Redesigned Website

The website's content was also updated. Since the previous website had not been updated since February 2012, much of the information was outdated and occasionally incorrect. The projects page was updated with the Center's most recent MQPs and graduate research projects. A link to the Digital Commons online project database was also added as well to offer interested individuals the ability to see the ATRC's full portfolio of past projects. An outreach page was also added to the ATRC website to showcase the Center's informational programs and tours designed to increase the general knowledge about assistive technology devices and attract clients.

Analytic software from GoStats was also added to determine how much viewership the ATRC website is receiving. GoStats offers a complete breakdown of the number of unique and returning visitors, the number of pages opened by visitor, and the average time spent on the website. This information can be further broken down by day, week, month, or year, which will help gauge the effectiveness of the ATRC's media since a spike in website traffic shortly after sending out the newsletter or brochure would indicate that it piqued the interest of the recipient.

The website was also made W3C compliant, which aligns the webpage with one of the key missions of the ATRC to assist persons with disabilities. At the start of the project, the ATRC website received a zero from Sitebeam in terms of its accessibility due to broken links and the absence of alternative text. The redesigned website received a nearly perfect W3C compliance and accessibility score from Sitebeam. The accessibility score was only penalized for the site's complex terminology when describing assistive devices and disabilities, which is necessary to covey the relevant technical information about the ATRC's work. The accessibility score was lowered after analytics software was installed on each page. The analytics software is unidentifiable to Sitebeam's code analyzer, and resulted in the accessibility score being

negatively impacted. Since this analytics code is invisible and unobtrusive to a visitor of the ATRC website, the site remained W3C compliant in all areas except for the complex terminology.

Print Media

New templates for both the brochure and newsletter were created to expedite the creation of print media in future terms. The brochure only received a few design improvements over the version used by the previous IQP teams. First, the ATRC logo was added to the front page to help brand and increase the Center's recognition. Second, the older WPI logo was replaced with the most recent version. The redesigned front page for the brochure can be seen in Figure 8, and the entire brochure can be seen in Appendix B. The brochure template was also transferred from Microsoft Word to Microsoft Publisher to offer future teams more flexibility and convenience editing the ATRC brochure's design and content. Along with these two design improvements, all of the brochure's information was updated for both a fall and spring brochure. These brochures were stationed by the ATRC conference room and rehabilitation engineering laboratory to educate the public about the ATRC and its fundamental goals.

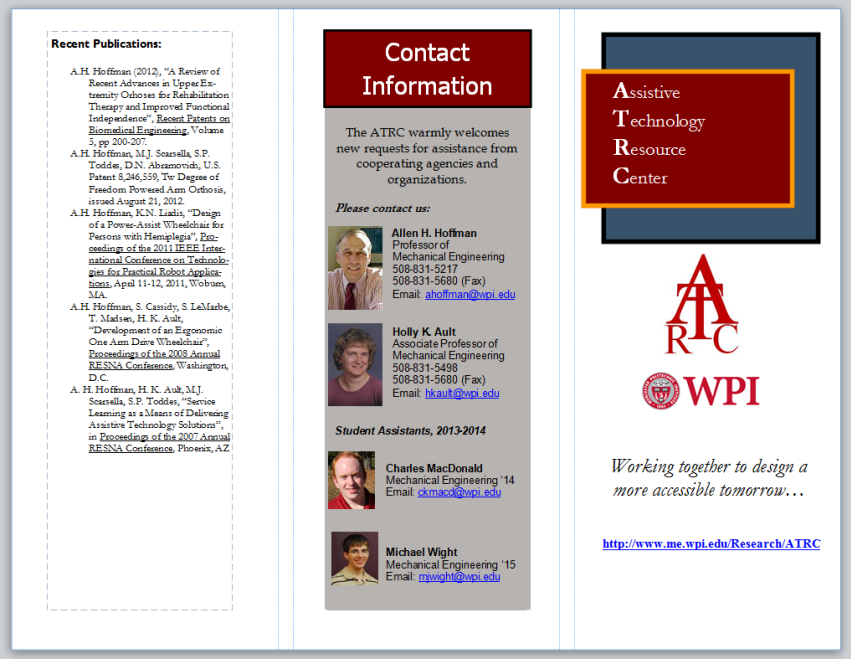


Figure 8- Brochure Redesign

The newsletter received a substantial facelift. A Microsoft Word template, the newsletter was updated to include both the ATRC logo and the newest WPI logo just like the brochure. A bright red skybar was added to the front page to attract readers since the previous version had a plain white background. This background color was carefully selected to ensure that the text would still be very visible and easy to read. Content wise, the redesigned newsletter included more pictures than its predecessor to better showcase the ATRC's projects and accomplishments. Figure 9 shows the front page of the redesigned newsletter, and the 2013 Fall and 2014 Spring ATRC Newsletter can be seen in their entirety in Appendix B.

Figure 9- Newsletter Redesign

The newsletter was used as a marketing tool for the ATRC, as it was sent to 40 new outside organizations, 40 previously contacted (according to the lists provided by previous IQP teams), and 22 WPI organizations. These newsletters rekindled the ATRC's involvement with Worcester's Seven Hills and the Massachusetts Department of Developmental Services. Within WPI's campus, the newsletter was distributed to the presidents of honor societies (Alpha Epsilon Delta, Alpha Eta Mu Beta, Pi Tau Sigma, Tau Beta Pi) and project societies (CollabLab, Engineers Without Borders, Genius Entrepreneurship) hoping to recruit motivated students with an interest in extracurricular projects. News organizations such as *The Daily Herd* (online

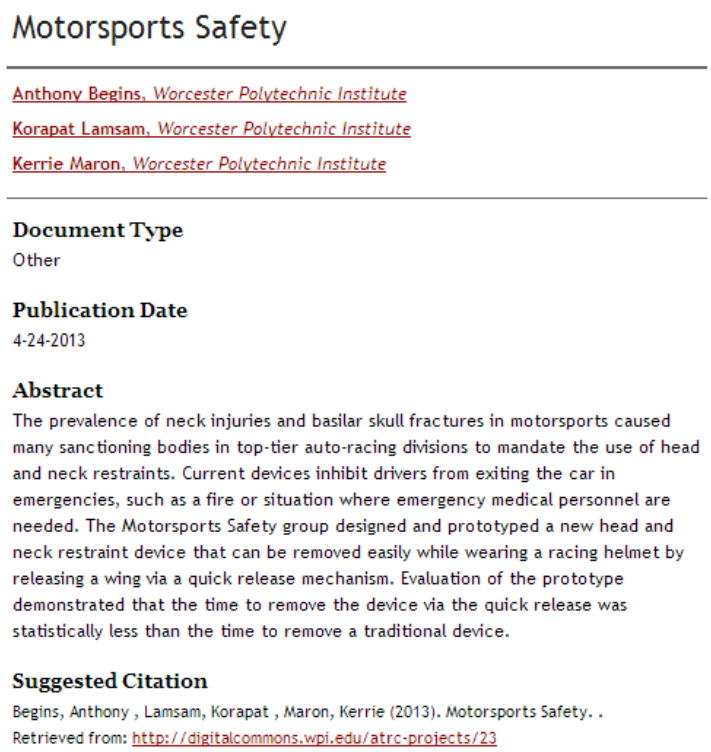
newspaper), *The Peddler* (yearbook), and *The Towers* (student newspaper) also received the newsletter so that the ATRC could possibly have additional media coverage around campus.

Project Database

The ATRC project database on the Gordon Library's Digital Commons can be accessed at http://digitalcommons.wpi.edu/atrc-projects/. This link is also available on the ATRC website on the "Projects" page. This project database includes information on 56 MQPs, IQPs, and graduate theses completed with the ATRC since 1997. While projects were completed before 1997, the Gordon Library has not yet digitally archived these reports and made them available for online viewing.

The entries are sorted by publication date by default as seen in Figure 10, but users can sift through the entries by title or keyword as well. Each individual entry includes the project title, authors, publication date, abstract, and link to the report, as seen in Figure 11. A complete list of projects uploaded into the Digital Commons database can be found in Appendix B.

Figure 10- Project Database Main Page



Motorsports Safety

Anthony Begins, *Worcester Polytechnic Institute*
Korapat Lamsam, *Worcester Polytechnic Institute*
Kerrie Maron, *Worcester Polytechnic Institute*

Document Type
Other

Publication Date
4-24-2013

Abstract
The prevalence of neck injuries and basilar skull fractures in motorsports caused many sanctioning bodies in top-tier auto-racing divisions to mandate the use of head and neck restraints. Current devices inhibit drivers from exiting the car in emergencies, such as a fire or situation where emergency medical personnel are needed. The Motorsports Safety group designed and prototyped a new head and neck restraint device that can be removed easily while wearing a racing helmet by releasing a wing via a quick release mechanism. Evaluation of the prototype demonstrated that the time to remove the device via the quick release was statistically less than the time to remove a traditional device.

Suggested Citation
Begins, Anthony , Lamsam, Korapat , Maron, Kerrie (2013). Motorsports Safety. .
Retrieved from: http://digitalcommons.wpi.edu/atrc-projects/23

Figure 11- Project Database Entry

Video

The team created an eight and a half minute video that provides an overview of the ATRC. The first half focuses on logistical information such as the Center's mission, history, and facilities, and the second half demonstrates the wide range of projects students have completed with the ATRC. Professor Hoffman and Professor Ault provide brief overviews of Introduction to Engineering Design (ES 1020), Introduction to Engineering Design (ME 2300), Rehabilitation Engineering (ME 3506), Interactive Qualifying Projects (IQPs), Major Qualifying Projects (MQPs), and graduate projects while showing corresponding projects for each class.

After discussions with Professor Hoffman, the team also began making videos for individual MQPs. These project videos would be one to two minutes in length. The MQP team provides a brief overview of their project and demonstrates the device operating. The success of these videos depended upon the cooperation of the project teams, so the mobility device by Nick

Algiere `14, Alan Humphrey `14, and Grant Raymond `14 was the only 2013-14 MQP that was recorded. These MQP project videos will be uploaded to the ATRC's YouTube account to provide a visual demonstration of the Center's successful projects for potential clients.

Social Media

The Facebook page was created as a community, and information from the website and other media were adapted to the page. In addition to links to the ATRC website and email, as well as information on the affiliations and name of the ATRC, descriptions of the Center, as well as its mission were included in the Facebook page. The mission and description were taken from those already posted to the website, and adapted to meet the word limits of Facebook. The short description was limited to 155 characters, which was not sufficient for communicating the full scope of the Center's mission or information, so this was left as a simple explanation of the acronym ATRC, with a description of the full scope of work and the history of the Center included in the long description and mission fields of the page. The layout of this information can be seen in Figure 13.

Name	Assistive Technology Resource Center at WPI	Edit
Facebook Web Address	www.facebook.com/WPIATRC	Edit
Category	Other : Community	Edit
Topics	Worcester Polytechnic Institute (WPI)	Edit
Start Info	Joined Facebook	Edit
Short Description	The Assistive Technology Resource Center (ATRC) at WPI	Edit
Long Description	In 1999, the Rehabilitation Engineering Laboratory at Worcester Polytechnic Institute received a grant from the Fairlawn Foundation, in Worcester, Massachu...	Edit
Mission	The mission of the ATRC is to foster the use of assistive technology through collaboration with professionals associated with local and regional clinical, educational, governmental and social service organizations that serve persons with disabilities. The ATRC disseminates technical information regarding the availability and use of assistive devices. When an appropriate commercial device is not available, the ATRC will collaborate with cooperating organizations in developing modifications to existing devices or the design of a custom device. The ATRC focuses on mechanical and electro-mechanical devices.	Edit
Email	atrc@wpi.edu	Edit
Website	http://www.wpi.edu/academics/me/ATRC/index2.htm	Edit
Official Page	Enter the official brand, celebrity or organization your Page is about	Edit
Facebook Page ID	501221983297151	

Figure 12: Facebook Page Information Entry

Figure 13: Facebook Page about Section

In addition to this general information, the ATRC logo (used in the Brochure and Newsletter) was added as the cover picture for the Center's page, and the banner was set as a picture of the past projects located near the window of the Rehabilitation Laboratory (Figure 14). Once these and other pictures were uploaded, the initial set-up of the page was complete. From that point on, focus was put on updating the "timeline" of the page with posts to interesting articles related to news regarding the ATRC, as well as media generally relating to assistive technology (AT) and serving people with disabilities (Figure 15).

Figure 14: Top of ATRC Facebook Page

Figure 15: Sample of Timeline from Facebook Page

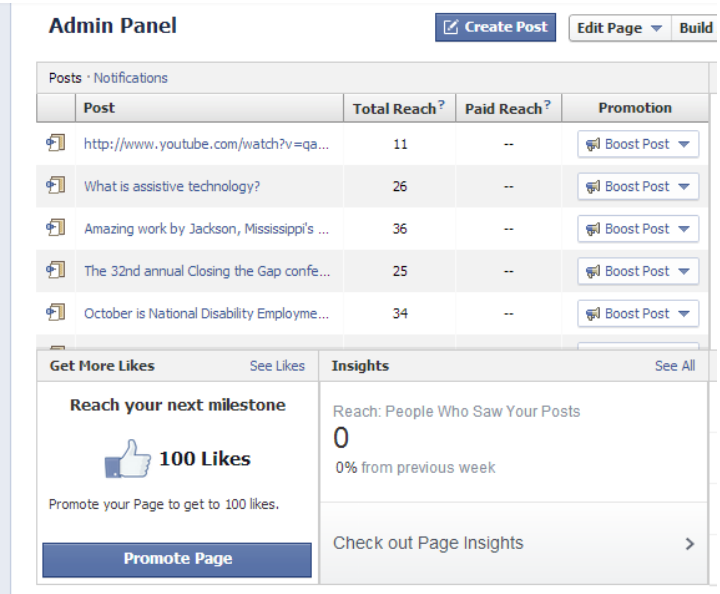


Figure 16: Facebook Built-in Diagnostic Tools

Facebook's diagnostic tools allowed for the "reach" (number of page views or visits) of the page and individual posts to be tracked. While the page is followed by 73 people (who liked the page), the posts to the page generally reach between 25-45 people, with an average reach of a little over 30 people reached per post. As of 3/10, there have been a total of 9 posts. Upon closer examination of the page's followers, it was found that most came from 18-24 year olds enrolled

at WPI; consistent with the fact that the majority were Facebook friends of either Charles or Michael, who saw the page shared when it was initially founded. Beyond the initial bump in likes and page views in the first few weeks of the page's existence there have been little to no new viewers, indicating that very few people have searched for or found the page independent of targeted outreach by the team.

Contacts Database

The contacts database was created in Microsoft Access. The database includes organizations that the team contacted along with organizations from previous IQP teams. Each entry includes important identifying information. This database is an offline reference for future IQP teams and the Center directors to respect the privacy of the organizations.

5.1.2. Client Meetings

In the 2013-2014 academic year, the individuals who met with the ATRC included: members of the Mercy College and Worcester State Enactus programs, an Assumption College Rehabilitation Counseling class, Julia Sorcinelli of the WPI Tech Girls Program, and Sharon Plickert from Worcester Academy.

In the meeting with Curtis Abel, the head of Mercy College's Enactus program, their project work and the structure of the Enactus program were discussed. This not only sparked an interest in the possibility of founding an Enactus program at WPI, but also resulted in significant interest in collaboration on future and ongoing projects. Professor Hoffman and Ault were particularly impressed with projects to establish accessible musical instruments, such as the one-handed trumpet project carried out at WPI, and the drum set that can be played by a person with disabilities that was a result of one of their projects. This meeting helped establish that not only did the Enactus system at Mercy college have a common ground (creating devices for people

with disabilities) with the ATRC, but also that there was a mutual benefit from combining the business background of the students involved at Mercy college with the Engineering one of WPI students.

The meeting with Curtis Abel led to further research into the Enactus program, prompting a meeting with the Worcester State program to be set up. In this meeting, further discussion on the types of projects typical of an Enactus program was had, which led to the realization that the primary focus (entrepreneurship) was not necessarily the best fit for the ATRC, especially considering that there are many other similar organizations centered on engineering and design, rather than business principles.

Meetings with other groups that visited WPI, such as the Assumption graduate class fulfilled the purpose of educating local students and faculty on the goals and project work of the Center, the results of which may or may not be seen in future collaboration with these individuals. The meeting with Julia Sorcinelli helped her and Professors Hoffman and Ault better understand whether or not there was enough common ground to warrant the ATRC's participation in the Tech Girls program.

5.2. Operations Management

The team produced several documents to optimize the ATRC's management and organization. In addition, the team attempted to increase the publicity of EPICS and offer support for the organization.

5.2.1. Best Practices for Operation

As a result of the research conducted on the best practices in running the ATRC, as well as the recommendations and input from past IQPs, a standard operating procedures document was created as a guide for IQP groups and individuals who will run the Center in the future

(Appendix C). This document outlines important tasks and general advice for carrying out all of the different aspects of running the Center, and would serve as a good resource for a group or individual new to running the Center, before they begin doing so.

As a supplement to this document, an operational checklist was developed (Table 11, Appendix C) which will act as a reminder of what needs to be done to keep the ATRC running properly. This was organized into daily, weekly, monthly, and term based tasks related to organization of the laboratory, as well as updates to the media used in outreach.

5.2.2. Organization

The successfulness of the laboratory organization was difficult to quantify. While the signs posted in the laboratory stayed up throughout the year, and no complaints from students using the laboratory were received, there were some things that indicated that there is still room to improve the laboratory's organizational structure. For one, work areas were often left un-cleaned for extended periods of time, with tools left around the laboratory. A second observation was that the laboratory notebook was largely ignored (not used) until Professor Hoffman made an announcement to the Rehabilitation Engineering class in C-term, instructing them to sign in and out. In general, the larger changes to the layout and placement of tools and other items in the laboratory was deemed successful, as these items stayed in the correct areas of the laboratory, and the items removed from the laboratory were not requested by any students.

5.2.3. EPICS

EPICS, in the form of an informal student club, was restarted in C term of the 2012-13 academic school year after a brief hiatus when the organization lacked self-motivated officers and student interest. Recently reborn, the team published an article in WPI's student newspaper, *The Towers*, about the organization's creative electric wheelchair modification. The article not

only detailed the wheelchair, but it also provided an overview of the organization in an attempt to recruit new members.

The team also attempted to monitor the progress of EPICS, both with regards to their projects and application process to become an officially recognized club at WPI. Following a poorly-attended general body meeting in the first few weeks of the school year, the EPICS officers failed to communicate with the team, and ultimately the club disbanded again due to a lack of student interest.

6. Discussion

This section evaluates how well our methods satisfied the project's overall outreach and operations management goals.

6.1. Outreach

The team improved the ATRC's outreach efforts during the 2013-14 school year. After previous teams neglected this component of the project in favor of internal tasks, the team worked to increase the Center's publicity around the Worcester region. The media sources successfully established communications with outside organizations and enabled the ATRC to find potential project sources for future academic years.

6.1.1. Media

The team's media sources were the most important outcome of the project. The redeveloped website served as a valuable informational source after establishing contact with an organization. The brochure and newsletter helped the team initiate contact with organizations both within and outside of WPI, as it was a concise overview of the ATRC that clearly displayed the Center's project and outreach activities. Newly created, the video has the potential to travel with the ATRC directors to conferences and be shown during WPI Open Houses because of its combination of verbal information and visual project demonstrations. Unfortunately while it was designed to help facilitate student interest in the ATRC, the Center's Facebook page has mostly been inactive and has struggled to generate likes and views among the WPI community.

Website

The redesigned ATRC website was the best media source produced by the project. With the immense popularity of the Internet, the ATRC website is an excellent way to keep individuals informed about the ATRC's most recent developments. While a newsletter or brochure requires additional exchanges to occur over email, changes to the website are visible to any individual who logs into the ATRC website. In addition, the website was a great tool for providing supplemental information to any individual or organization who expressed further interest in the ATRC after receiving the newsletter. The website was also how Sharon Plickert was able to contact the ATRC about scheduling a class field trip, which demonstrates its effectiveness as a marketing tool.

In January, the GoStats analytics software was successfully embedded into the ATRC's code and made active. Since then, the ATRC website has received 233 visitors, which amounts to an average of 116.5 visitors per month or 3.9 visitors per day. The average visitor opens 5.1 of the ATRC's 10 pages, which suggests that the redesigned website's home page effectively piques interest and encourages visitors to investigate the ATRC's mission and work more thoroughly. This information can be seen in Table 2.

Table 2- ATRC Website Visitor Statistics (April 2, 2014)

	Today	Estimate	Yesterday	7 Days	Week avg	30 Days	12 Months	Total
Page views	16	25	13	51	5	169	395	395
IP hosts	3	4	3	15	2	44	82	82
Unique visitors	3	4	3	16	2	45	79	79
Unique sessions	4	6	4	20	2	51	113	113
Page views per visitor	5.3	6.2	4.3	3.2	2.2	3.8	5.0	5.0
Sessions per visitor	1.3	1.5	1.3	1.2	1.0	1.1	1.4	1.4
Visitors per IP host	1.0	1.0	1.0	1.1	0.9	1.0	1.0	1.0

The original Sitebeam test results for the ATRC website were discouraging. The website received a score of 2.2 overall. This included a 0 in the accessibility category, which is a function of the site's usage of alternative text, completeness (no broken links or missing files), readability, and W3C compliance. Because the original ATRC website was incomplete, the website featured broken links and missing files that negatively impacted the accessibility score. In additional alternative text was almost completely absent, which would have frustrated individuals using screen readers.

The redesigned ATRC website received an overall score of 6.2, a 4 point increase with a well above-average score of 7.9 in the accessibility category. Fixing the broken links, adding the missing files, and including alternative text in all figures provided these sections with perfect scores. Both the analytics and W3C compliance scores erroneously received scores of 0. In order to be W3C compliant, web pages must have alternative text and a user-friendly layout. The updated website satisfies both of these criteria, but it received the lowest possible score due to the analytics software installed on every page. Sitebeam does not recognize the relatively new Sitebeam website traffic code, which cause the analytics and W3C compliance scores to be equal to zero due to the computation used by Sitebeam. Having a W3C compliant website positively reflects a Center working to alleviate the burdens faced by individuals with disabilities. The website also received an average readability score. While the website is free of typos and grammatically correct, the website was penalized for the complex terminology associated with assistive technological devices and disabilities. Table 3 compares the old and new Sitebeam test scores.

Table 3- Sitebeam Accessibility Test Results

Sitebeam Accessibility Test Results			
Test	**Original Website**	**Redesigned Website**	**Change**
Alternative Text	0.3	10	+ 9.7
Analytics	0	0	0
Broken Links	0	10	+ 10
Headings	5.0	10	+5.0
Missing Files	0	10	+ 10
Readability	4.2	5.5	+ 1.3
W3C Compliance	0	0	0
Overall	**2.2**	**6.2**	**+ 4.0**
Accessibility Summary	**0**	**7.9**	**+ 7.9**
Content Summary	**4.9**	**6.9**	**+ 2.0**
Marketing Summary	**3.4**	**5.6**	**+ 2.2**
Technology Summary	**0.7**	**6.2**	**+ 5.5**

Print Media

The brochure and newsletter had two separate functions, but both were important. The newsletter served as the interface for establishing contact with potential clients and increasing the ATRC's outreach. Nearly 100 newsletters were sent out in the fall, and nearly one-fifth of all recipients requested to be added to the ATRC newsletter mailing list. Of this fifth, seven of these organizations contacted the ATRC on potential collaboration. While the percentage of potential project partners per newsletter was at about 6.9%, diligently distributing the newsletter eventually attracted potential partners and led to face-to-face meetings.

Figure 17 shows tracks the ATRC website's traffic from February 7 to March 7 using the GoStats analytic data. On February 21-22, the team distributed additional ATRC newsletters to assistive technology organizations. February 24 saw a massive spike to nearly 50 visitors. For the previous few weeks, the average number of visitors to the ATRC website had been less than 10.8. Because the recipients of the newsletter presumably visited the website upon receiving and reading the newsletter, the newsletter's effectiveness as a marketing tool is demonstrated. The

ATRC website has received about one or two new visitors per day during periods where the newsletter has not recently been distributed, as seen in Figure 18.

ATRC Website Visitors from February 7, 2014-March 7, 2014

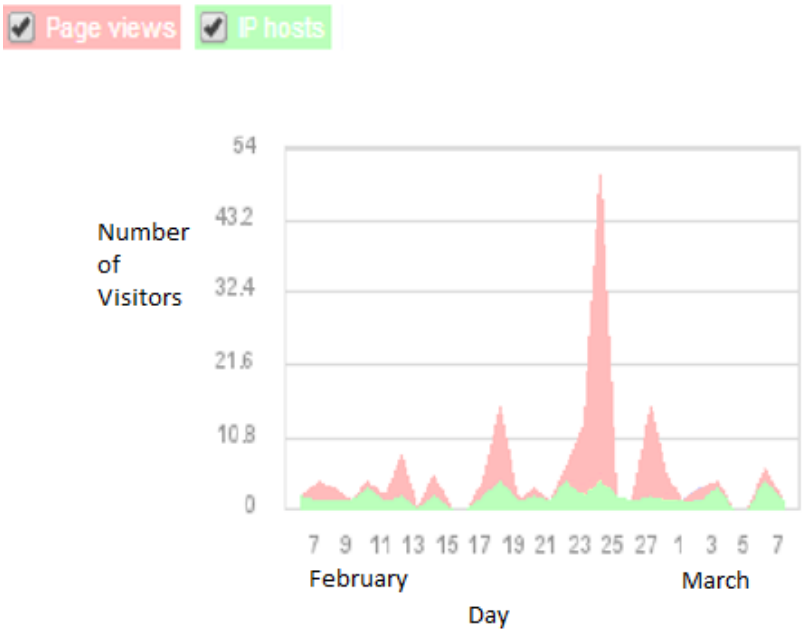


Figure 17- ATRC Website Visitors from February 7, 2014-March 7, 2014

ATRC Unique ATRC Website Visitors from March 5, 2014-April 2, 2014

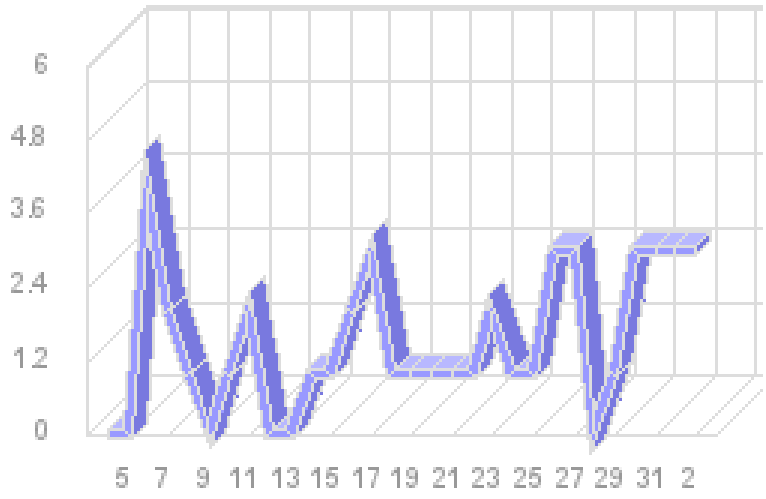


Figure 18- Unique ATRC Website Visitors from March 5, 2014-April 2, 2014

The brochure was primarily used as an internal recruiting tool and supplementary handout for visitors. Stationed inside the Rehabilitation Engineering Laboratory and outside the ATRC Conference Room, the brochures are readily available for passing students and faculty members. Over the course of the academic year, very few brochures were picked up by passing students, so future teams should work to increase the visibility of these brochures. The brochures were useful at face-to-face meetings however. At the beginning or conclusion of a meeting, the brochure was a nice resource to provide to the client since it is a tangible and clear summary of what the ATRC has accomplished and hopes to accomplish.

Project Database

The ATRC Digital Commons project database is the database that future project teams should continue to use when updating the ATRC's record of past projects. Since the database is directly online, it is easily accessible to individuals outside of WPI's campus and can be added to the website as a hyperlink. Previous project databases contained the same information as the Digital Commons database, but they were less user-friendly. The Microsoft Access database had confusing entry fields and could not be uploaded online as a PDF on the website. Then the projects database lacked a search field and was laid out in paragraph form.

Having an up-to-date online project database accomplishes two goals. First, it helps conduct outreach. The database includes information on over fifty, comprehensive projects across several assistive technology fields that have resulted in the creation of prototype devices or the filing of patents. This positively reflects the Center's ability to meet the needs of a client and attract projects. Second, the projects database will improve the ATRC's operations management. Instead of having two separate project forms (Microsoft Access database and the projects document), there is now one complete database.

Video

The ATRC video was the newest media source created by the project team and was designed to serve as a substitute for the mostly text-based website and newsletter. For conferences and tours, having a video is a more engaging and appealing way of sharing information about the ATRC. In the event that Professor Hoffman or Professor Ault are unable to attend an event, the video is a viable substitute since it contains general information about the Center along with past projects. The video is linked to the ATRC website's homepage and available on YouTube (https://www.youtube.com/watch?v=x_VB4j3uPuA). The one and a half minute video for the 2013-14 mobility device MQP can also be accessed on YouTube (https://www.youtube.com/watch?v=imfcXXFpj1o). All of the ATRC videos will have the same title slide featuring the ATRC logo, the WPI logo, and an image of a wheelchair, as seen in Figure 19.

Figure 19- Title Slide for the ATRC Videos

Social Media

The Facebook page was created to be an alternative method of outreach, specifically as a tool to boost the visibility of the existing website. While the page seems to be set up well, with important information about the ATRC contained within the "about" section, and somewhat consistent posts to the wall, the page does not generate many new visits, and had not resulted in any new contacts for the Center at the time of this report. One way to improve the effectiveness of the page would be to continue making consistent posts to the wall, focusing on improving their quality. A general observation was that a concise description or comment to accompany an external link generally increases the number of views or click of that link. Another possible method for improving the quality of posts, would be to increase the number of posts that actually refer to work done by the ATRC; most of the existing posts are simply related to AT and disabilities in general. If posts were about events that the Center were actually be involved in, they might generate more interest for the Center, even if the number of people who view them is unchanged.

More important than the focus of the content posted however, it is important to build a larger following for the page. By making a concerted effort to build the network of people who follow the page, to include a larger number of WPI students; student interest and general awareness of the ATRC could be improved. To do this it would be best to have a large number of students involved in the Center share the page or a post to the page; otherwise the number of people reached will be a narrowed to those who are friends of the managers of the ATRC. Another method of reaching a wider range of individuals would be to have other laboratories or groups within WPI that have a page to share the page in order to reach their followers (people who have "liked" their page). If the focus of the page is to remain on bringing in new contacts

from outside WPI, it is important to increase the number of followers of the page (to make it appear earlier when people search for it). It is also important to provide a link to the page, in more media, to guide more people to the page.

Regardless of the focus of the page, the content posted should be able to be kept neutral enough to cater to both students and outside groups. It is important to keep in mind that even if the page is made to cater towards students, posts and other material on the page are publically available, thus it would be the best course of action to try to build a large audience in both groups of people, and post content that is generally informative (about AT, the Center, and other related topics) and interesting to anyone who might view the page.

Contacts Database

The value of the Contacts database and other newly established tools for outreach proved to be helpful in this year's effort to distribute the newsletter to organizations that would potentially be interested in collaborating with the ATRC. The database provides a single source of contact information for each organization, and allows for any results of correspondence with the organization to be documented. Due to the fact that new contacts may be added to the database after emails containing the newsletter are sent, the fields of the database that indicate whether contact has already been made with the organization or individual will be useful to future groups when performing similar "mass" outreach efforts. The database can be further organized based on the organization's response to outreach such as the newsletter; for instance groups that request that we not send further information can be moved to a separate database, or a separate list, rather than being deleted, to ensure that they are not "found" by future teams performing research for outreach. One issue with the database is that it must be opened independent of the ATRC email, as it was made using Microsoft Access, and the atrc@wpi.edu

email is a Linux account. If the two were both either Microsoft or Linux based, the database would be able to be used to perform mass email to lists that could be organized using the database. Regardless this is a useful tool that can be expanded on by future teams and used to keep better track of organizational contacts (as opposed to personal contacts of Professors Hoffman and Ault).

6.1.2. Client Meetings

As discussed earlier, the meetings throughout this year were productive in improving the ATRC's relationship with other organizations. While email and other forms of correspondence proved useful in setting up meetings, and sending or explaining documents; meetings were much more useful for getting to know potential collaborators better, especially when they were first contacted. Meetings throughout the year were generally very successful in achieving the desired goals, or communicating important information; generally leading to follow up and in some cases the establishment of new contacts, or project partners. One possible improvement to the project could have been made if more meetings were held, especially if this was used more often as a tool in outreach. The lack of meetings of this nature was likely due in part to the fact that the outreach conducted by this year's project primarily focused on making first contact with groups, which meant that not all relationships with outside organizations developed to the point that a meeting was appropriate.

6.2. Operations Management

The team met two of the three operations management goals. Best practices for the Center's operation were produced, which will serve as a guideline for future IQP teams and ensure that they continue to manage the Center's internal and external operations. Then, a wide range of documents to improve the laboratory's organization and the experience of students

using the Rehabilitation Engineering Laboratory were created. Meanwhile the third operations management goal was not met. The team attempted to help EPICS become an official club and complete projects, but the organization disbanded due to a lack of interest amongst students.

6.2.1. Best Practices for Operation

While the standard operating procedure developed (Appendix C) is a valuable resource for future managers of the ATRC to read at the beginning of the year, the operational checklist (Table 11 in Appendix C) will be a much more valuable resource, as it can be referred to throughout the year to keep them on track. Throughout the year, it was noticed that the largest mistakes and problems arose when the team either forgot about a smaller regularly performed task (like checking email or cleaning the laboratory), and these resources should be helpful to future groups or individuals running the laboratory, as long as they are referenced consistently. These documents should guide future IQP teams in their project to ensure that they are properly managing the ATRC.

6.2.2. Organization

In general the organization of the ATRC was improved throughout the course of this year. The laboratory index and cleaning schedule, which built on the efforts of past projects, were found to be extremely useful in keeping the laboratory organized and clean. Some of the signs, and the sign-in binder, intended to be used by students who worked on projects in the rehabilitation laboratory were not as successful. One problem identified was that due to the fact that students come in through different doors (based on whether they have card access or not), they did not necessarily see signs that were originally intended to be seen by people entering from the neighboring laboratory. After students were informed by the professor teaching their class that they should sign in and out, they began using the sign-in binder more regularly. In

addition, moving signs to be more visible to those entering the laboratory from the hallway (rather than the laboratory next door) seemed to increase student's awareness of some of the rules and directions that they communicated. Overall, it seemed as though the signage was most effective when accompanied by some form of verbal communication. The signs are good reminders to students, but are much less effective in communicating guidelines for first time users, as some students will not bother to read them, unless explicitly instructed to do so. Some attempts to further organize the laboratory, especially the project registration, attempted early in the year failed, primarily due to students ignoring them. This can be attributed to some students only using the laboratory a few times, and the fast pace at which term projects are completed.

6.2.3. EPICS

After EPICS held a General Body Meeting during the first week of the academic year, the team published a newspaper article about the modification that they made to an electric wheelchair during the 2012-13 school year. Published in WPI's student newspaper, *The Towers*, the article explained the complexity and importance of the project while also including information about EPICS and how to become involved. A discussion with the club's president, Congji Li, revealed that the article failed to attract any additional members. The organization failed to hold any further meetings during the school year and has become inactive again.

Purdue University founded the EPICS program and has the largest number of students participating in the EPICS program in the nation. Purdue's program has two distinct differences from WPI's program that encourages student participation. First, EPICS has consistent faculty involvement. By receiving input from faculty members, the officers and participating students receive direction in their projects and have an added level of personal responsibility to complete the project. Second, the Purdue EPICS program provides students with class credit. Students

enrolled in EPICS for course credit are expected to spend 7.5 hours per week on activities related to their EPICS project (Purdue University, 2014). The project is a unique alternative to the standard theory-based classes found at Purdue University, and students are interested in applying their engineering knowledge on a real project.

Another obstacle unique to WPI is the university's project-based curriculum. Believing in theory and practice, WPI exposes its students to projects throughout all four years. During the junior and senior year, WPI undergraduate students have extensive projects in the IQP and MQP that span either a full term or almost an entire year. Because of the requirement to complete several real projects over their four years, WPI students are less likely to want to undertake another project for an extracurricular activity where they will not receive any credit.

Last year's project was completed because of the project manager, Sarah Chamberlain; a freshman, Chamberlain modified the wheelchair for her sister. The combination of Chamberlain's academic status as a lower division student and personal connection to the device's user allowed for the project to be completed. Future groups should target freshmen and sophomores to become involved in EPICS, as these students have yet to become fully exposed to WPI's project-based curriculum and could have the desire and time to undertake a real project with EPICS. Project teams should also meet the individual for whom they are creating the device. Not only does this improve the overall design since they can study the ergonomic factors, but will develop an added sense of personal responsibility to drive the project. In addition, a faculty adviser should regularly meet with the club's officers to provide project guidance and be updated on the club's progress.

7. Conclusions

The 2013-14 ATRC management IQP successfully improved the ATRC's ability to satisfy its mission statement. The study satisfied both outreach goals by improving the ATRC's outreach capabilities and recognition in Worcester and the surrounding region. Then the operations management goals were partially satisfied. While the ATRC's internal organization was improved, the team struggled to increase the Center's recognition on the WPI campus and saw the EPICS club dissolve yet again.

The newsletter was the most effective method for establishing contact when initiated by the ATRC. While less than 10% of organizations who received the newsletter responded that they would potentially be interested in working on projects with the ATRC, the organizations that did respond were very passionate and their goals in future projects could be aligned with those of the ATRC. The redesigned format of the newsletter was more visually appealing and therefore more likely to entice recipients to read through the entire publication.

When outside organizations initiated contact with the ATRC, the website was the primary contact tool. The website received a face-lift to eliminate any broken links, which increased the Center's professionalism. The coding was also updated. Alternate tags and stylistic changes were made to make the website W3C compliant and better reflect the ATRC's mission to assist those with disabilities. Descriptors and key words were also embedded into the code to make the ATRC website easier to find in search engines. Then the most recent information on the Center's projects and activities were also included.

The Digital Commons database satisfies the main goal that previous IQP teams identified for a project database, which was serving as a comprehensive and centralized location for previous ATRC projects that could be accessible to outside organizations. Previous efforts failed

to satisfy both conditions simultaneously and ultimately failed. The Digital Commons online project database offers the organization and formatting of the former Microsoft Access database with the accessibility of the previous projects document.

The ATRC's internal operations have been improved. The best practices document serves as a reference for future teams to guide them in their project. Previous IQP teams have had to learn about the responsibilities for managing the laboratory and conducting outreach by reading previous reports. While these reports are useful for establishing general project goals, they fail to detail the necessary day to day activities to manage the ATRC. Therefore, the best practices document will educate future teams by providing detailed task lists about which tasks must be performed, when they should be performed, and how they should be performed. This document will reduce the transition period in between IQP teams since the following team will be able to focus on improving the Center's operations rather than recreating operational procedures themselves.

Laboratory signage has also been improved to enhance the experience of students and faculty using the laboratory. Previous signs such as the clean-up procedure and general welcome signs were updated to include the contact information for the current team. New laboratory signs such as the laboratory index were created to help students find resources in the ATRC. Unfortunately, students have failed to notice or follow the instructions on these signs. Students have consistently failed to return used tools to their correct location or locate the appropriate tool for a job, which suggests that they may not have noticed the clean-up and laboratory index tacked to the ATRC bulletin board.

The Facebook page's impact has been minimal. After asking fellow WPI students to like the Facebook page in its initial week, the page has not received any new likes and the reach has

been limited to fewer than 75 people. The Facebook page was originally designed to be a recruiting tool amongst WPI students, but the page has failed to attract new students who could potentially be interested in assistive technology projects.

The WPI student EPICS club dissolved during the 2013-14 academic school year. While the team attempted to work with the organization's officers to improve their recognition across campus, the officers slowly became less invested in EPICS and the organization dissolved. The absence of faculty involvement has caused the club's officers to have no project accountability outside of their own person interest to develop an assistive device for the individual or individuals.

8. Recommendations

Future IQP teams should continue developing the ATRC's media resources. These resources should be updated annually to reflect any new ATRC projects or activities to ensure any outreach efforts are using the Center's most recent information. Teams should also develop criteria for when each media source should be used, especially the newly created video, so that each media source meaningfully contributes to the ATRC's outreach efforts.

Teams should continue to maintain any pre-existing contacts since these organizations have already demonstrated an interest working with the ATRC. As the ATRC completes projects for the same organization, that organization will gain a better understanding of the ATRC's capabilities and be able to propose suitable projects more regularly. Developing new contacts is difficult since each organization has a different goal and it may not align perfectly with the project-based system for the ATRC. Teams should still contact new organizations as often as possible, but they should recognize that many of these organizations may not be perfect matches for future projects.

Student awareness about the ATRC must be increased. A majority of students are unfamiliar with the ATRC, which restricts the Center's ability to attract qualified and driven students to complete projects. By actively promoting the brochure and Facebook page, more students will become knowledgeable about the ATRC. Future teams could also visit mechanical engineering and biomedical engineering design classes in an effort to attract students.

Awareness of laboratory signage must also be increased. While the team created a myriad of new signs to keep the laboratory more organized, many students appeared to ignore their instructions or notice them on the bulletin board. Future teams should investigate adding a

large, attention-grabbing sign on the laboratory's main doors to notify IQP teams of these documents.

Most importantly, future IQP teams should attempt to re-establish EPICS and ensure the club's continuous operation. Teams should consult with Professor Hoffman and Professor Ault while also studying the EPICS models at other universities such as Purdue to learn why these chapters are successfully and have consistent student involvement. Implementing a faculty adviser for EPICS and establishing mandatory weekly meetings for the club's officers with the adviser could dramatically improve the club's organization. The long term goal would be for EPICS to become a self-sustaining organization with defined officer positions.

9. Summary

Over the past academic year, the team improved the operations of the Assistive Technology Resource Center. After studying the areas that the previous IQP teams were not able to address, the team determined that the Center's outreach methods needed to be improved. The team developed extensive media resources to facilitate contact with outside organizations in order to help the ATRC find assistive technology projects for undergraduate and graduate students to complete as part of their studies at WPI.

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Appendix A- Work by Previous IQP Teams

Martin & Thamilavel (1999)

Goals:

- Determine whether or not the ATRC would benefit WPI

Accomplishments:

- Concluded the ATRC would benefit WPI
- Proposed how WPI the Center's financial and management structure
- Suggested steps the ATRC should undertake to satisfy its mission statement

Proposed Items/Recommendations:

Table 4- Martin & Thamilavel Proposed Items

Martin & Thamilavel Proposed Items	
Proposed Item/Recommendation	**Status**
Center for the collection & dissemination of assistive technology information	Satisfied The Center has released papers and attended conferences. The Center also has a wide range of media resources.
Global assistive technology projects	Partially Satisfied The Center has completed MQPs for clients such as the Massachusetts Hospital School and Seven Hills; however, the Center has not had IQPs outside of Massachusetts.
Integrated with the project system	Satisfied Since the Center's inception, the ATRC has sponsored multiple IQPs, MQPs, and graduate research projects.
Management structure with a director and either faculty or students	Satisfied Professors Hoffman and Ault are the Center's directors and then student IQP teams have managed the internal operation of the Center and offered suggestions for its improvement.
Recruit students across WPI's campus	Partially Satisfied Classes working with the ATRC have generated interest in projects (IQPs, MQPs, etc.) with the ATRC. Many students outside of these classes are unfamiliar with the ATRC.
Website	Mostly Satisfied The website has the ATRC's information, goals, projects, and links. The website's information was out of date.

Lyons & Trimby (2008)

Goals:

- Determine the best practices for the ATRC's internal and external operation.
- Create a Five Year Plan for the Center.

Accomplishments:

- Created a Five Year Plan for the ATRC outlining the best course of action for the Center.
- Designed a brochure for the ATRC.
- Established a list of contacts.
- Sent surveys to various AT organizations and care centers to gather information for the Five Year Plan.
- Updated the website.

Proposed Items/Recommendations:

Table 5- Lyons and Trimby Five Year Plan

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Brochure format update	Not Satisfied The brochure's information was updated, but the brochure's format was not updated.	Satisfied The brochure's format was most recently updated during the Begins/Zeveska study and has been released annually.
Databases for contacts & projects	Satisfied The team created a Microsoft Access database with contacts and past projects	Satisfied The teams have done a good job creating and maintaining a contacts and project database in Microsoft Access.
Newsletter format updated to include recent projects & information on recent sponsors/clients	Satisfied They updated the newsletter's format and added information on clients, sponsors, and recent projects	Satisfied The newsletter's format was most recently updated during the Begins/Zeveska study and has been released annually.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Labels for lab tools & materials	Satisfied The team labeled the cabinets and drawers in the laboratory. They also created a lab schematic describing the locations of items and valuable tools.	Satisfied Labels for tools and supplies in the laboratory have been placed on all of the cabinets and drawers. A detailed schematic detailing the location of tools and supplies has also been created.
Surveys from past year's clients to assess satisfaction	Not Satisfied Report did not mention any surveys.	Not Satisfied After the Lyons and Trimby IQP, no groups sent surveys to previous clients to assess their satisfaction and collect outreach feedback.
Website updated to be easily modifiable & meet W3C guidelines	Satisfied The team updated the website's information and made the files easier to modify using the program WinSCP.	Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.
Year 2: 2009-2010 School Year (George & Kalluri IQP)		
Proposed Item/Recommendation	**2009-2010 School Year Status**	**Overall Status**
Brochure reviewed & updated	Satisfied The team updated the brochure's information and reused the previous year's format.	Satisfied The brochure's format was most recently updated during the Begins/Zeveska study and has been released annually.
Contact list for clinical, educational, governmental, & social service organizations	Not Satisfied The team did not find any new contacts (clients or partners) for the ATRC.	Partially Satisfied The Hristov, Mawhiney, and Wilson IQP continued the previous year's work, but since then no group has added any contacts to the ATRC's list.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Database reviewed & updated	Satisfied The team created a comprehensive Microsoft Word document instead of working on the database directly. This document provided more information on each project than the database.	Satisfied The teams have done a good job creating and maintaining a contacts and project database in Microsoft Access.
Decision whether or not to expand the ATRC (suggested to be handled by faculty members)	Not Satisfied There was no mention of this item in the report.	Unknown
Lab organization continued	Not Satisfied The team did not make any advances in the lab's internal organization.	Satisfied Extensive signage has been placed throughout the laboratory detailing clean-up policies and the location of tools and supplies. The Herzog and Oo IQP also developed a procedure for storing projects and scheduling the ATRC conference room (HL 123).
Newsletter reviewed & updated	Satisfied The team updated the newsletter's information and reused the format from the previous year.	Satisfied The newsletter's format was most recently updated during the Begins/Zeveska study and has been released annually.
Roles of ATRC individuals reviewed (suggested a hired professional should conduct this item)	Not Satisfied The team did not review the roles of the individuals affiliated with the ATRC.	Satisfied Teams developed standard operating procedures and task lists for future student IQP teams.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Surveys from past year's clients to assess satisfaction	Not Satisfied The team did not send out any surveys.	Not Satisfied After the Lyons and Trimby IQP, no groups sent surveys to previous clients to assess their satisfaction and collect outreach feedback.
Website reviewed & updated	Not Satisfied The team did not update the website.	Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.
Year 3: 2010-2011 School Year		
Proposed Item/Recommendation	**2010-2011 School Year Status**	**Overall Status**
Brochure revised and updated	There was no IQP reviewing the operations of the ATRC during the 2010-11 school year.	Satisfied The brochure's format was most recently updated during the Begins/Zeveska study and has been released annually.
Contact list for additional organizations		Partially Satisfied The Hristov, Mawhiney, and Wilson IQP continued the previous year's work, but since then no group has added any contacts to the ATRC's list.
Database reviewed & updated		Satisfied The teams have done a good job creating and maintaining a contacts and project database in Microsoft Access.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Newsletter reviewed & updated		Satisfied The newsletter's format was most recently updated during the Begins/Zeveska study and has been released annually.
Publicize recent projects through WPI media such as the student newspaper		Not Satisfied Project teams have failed to use publicize the ATRC's projects through WPI media. The most recent IQP attempted to recruit students to EPICS by distributing fliers across campus, but they did not directly use any WPI-specific media.
Surveys from past year's clients to assess satisfaction		Not Satisfied After the Lyons and Trimby IQP, no groups sent surveys to previous clients to assess their satisfaction and collect outreach feedback.
Website reviewed & updated		Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.
Year 4: 2011-2012 School Year (Begins & Zeveska IQP)		
Proposed Item/Recommendation	**2011-2012 School Year Status**	**Overall Status**
Analyze operations of university AT centers like Lemelson & UMass Lowell	Not Satisfied The team did not look at other AT centers to develop best practices.	Not Satisfied No teams have looked at other AT centers to develop best practices.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Brochure revised and updated	Satisfied The team redesigned the brochure and updated its information.	Satisfied The brochure's format was most recently updated during the Begins/Zeveska study and has been released annually.
Contact list for additional organizations	Not Satisfied The team suggested re-establishing contact with organizations the ATRC worked with in the past, but they failed to generate a list themselves or add to the pre-existing contact lists	Partially Satisfied The Hristov, Mawhiney, and Wilson IQP continued the previous year's work, but since then no group has added any contacts to the ATRC's list.
Database reviewed & updated	Not Satisfied The team did not update or review the database.	Satisfied The teams have done a good job creating and maintaining a contacts and project database in Microsoft Access.
Financial review of the ATRC (suggested to be completed by hired faculty)	Not Satisfied The team did not conduct a financial review of the ATRC.	Unknown
Grant list developed	Not Satisfied The team did not research grants that the ATRC could apply for.	Not Satisfied No team has created a list of grants that the ATRC could apply for.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Lab organization reviewed	Satisfied The team conducted an inventory of the laboratory and created a schematic listing the location of all tools and supplies.	Satisfied Extensive signage has been placed throughout the laboratory detailing clean-up policies and the location of tools and supplies. The Herzog and Oo IQP also developed a procedure for storing projects and scheduling the ATRC conference room (HL 123).
Media reviewed for effectiveness	Satisfied The team redesigned the brochure, newsletter, and website to be more visually appealing for clients and partners.	Satisfied Teams have redesigned the brochure, newsletter, and website. The George and Kalluri study also developed a marketing document for distribution to potential clients and partners; however, this document has not been updated since then.
Newsletter reviewed & updated	Satisfied The team redesigned the newsletter and updated its information.	Satisfied The newsletter's format was most recently updated during the Begins/Zeveska study and has been released annually.
Publicize the ATRC	Satisfied The team redesigned the ATRC's media sources (brochure, newsletter, & website) and also suggested emailing the brochure and newsletter to the WPI community to increase the ATRC's presence on campus.	Partially Satisfied Teams have done a good job publicizing the ATRC by redesigning and updating media sources such as the brochure, newsletter, and website. Many WPI students are unfamiliar with the ATRC though.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Surveys from past year's clients to assess satisfaction	Not Satisfied The team surveyed current WPI students and not past clients.	Not Satisfied After the Lyons and Trimby IQP, no groups sent surveys to previous clients to assess their satisfaction and collect outreach feedback.
Website reviewed & updated	Satisfied The team designed an all new website for the ATRC using Adobe Dreamweaver and WinSCP.	Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.
Year 5: 2012-2013 School Year		
Proposed Item/Recommendation	**2012-2013 School Year Status**	**Overall Status**
Analyze operations of university AT centers like Lemelson & UMass Lowell	Not Satisfied The team did not look at other AT centers to develop best practices.	Not Satisfied No teams have looked at other AT centers to develop best practices.
Brochure revised and updated	Satisfied The team updated the brochure's information and reused the previous year's design.	Satisfied The brochure's format was most recently updated during the Begins/Zeveska study and has been released annually.
Contact list for additional organizations	Not Satisfied The team did not find any additional contacts.	Partially Satisfied The Hristov, Mawhiney, and Wilson IQP continued the previous year's work, but since then no group has added any contacts to the ATRC's list.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Database reviewed & updated	Satisfied The team updated the database and began the process of making it more accessible via the library's Digital Commons.	Satisfied The teams have done a good job creating and maintaining a contacts and project database in Microsoft Access.
Lab organization reviewed	Satisfied The team created new laboratory signage (clean-up policies, labels, & welcome signs) and various policies to improve the ATRC's organization (project storage bin room reservation form).	Satisfied Extensive signage has been placed throughout the laboratory detailing clean-up policies and the location of tools and supplies. The Herzog and Oo IQP also developed a procedure for storing projects and scheduling the ATRC conference room (HL 123).
Newsletter reviewed & updated	Satisfied The team updated the newsletter's information and reused the previous year's design.	Satisfied The newsletter's format was most recently updated during the Begins/Zeveska study and has been released annually.
Publicize the ATRC	Satisfied The team updated the ATRC's media (brochure, newsletter, and website) and also created fliers to encourage WPI students to become involved with EPICS.	Partially Satisfied Teams have done a good job publicizing the ATRC by redesigning and updating media sources such as the brochure, newsletter, and website. Many WPI students are unfamiliar with the ATRC though.
Review of the ATRC's operations (suggested to be completed by a management major for an IQP or MQP)	Not Satisfied The ATRC's overall operations were not analyzed by a management major for an IQP or a MQP.	Not Satisfied All of the IQPs for the management and operation of the ATRC have been conducted by mechanical engineering majors.

Lyons & Trimby Five Year Plan		
Year 1: 2008-2009 School Year (Hristov, Mawhiney, & Wilson IQP)		
Proposed Item/Recommendation	**2008-2009 School Year Status**	**Overall Status**
Surveys from past year's clients to assess satisfaction	Not Satisfied The team did not conduct any surveys.	Not Satisfied After the Lyons and Trimby IQP, no groups sent surveys to previous clients to assess their satisfaction and collect outreach feedback.
Website reviewed & updated	Partially Satisfied The team updated the website's information, but these changes never went online.	Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.

Hristov, Mawhiney, & Wilson (2009)

Goals:

- Improve the internal organization of the ATRC's facilities.
- Develop a project database.
- Optimize the marketing and management strategy.
- Publish a spring newsletter.
- Update the ATRC website.

Accomplishments:

- Created a Microsoft Access database for the ATRC's contacts and major projects.
- Created a floor plan of the laboratory.
- Found 47 new contacts for AT organizations, AT centers, schools, & businesses.
- Redesigned the newsletter's format and added sections on partners and recent projects.
- Reorganized the lab and labeled the cabinets and drawers.
- Suggested duties for the ATRC lab manager.
- Updated the brochure's information.
- Updated the website and made the files easier to modify using WinSCP.

Proposed Items/Recommendations:

Table 6- Hristov, Mawhiney, & Wilson Progress

Hristov, Mawhiney, & Wilson Progress	
Proposed Item/Recommendation	**Status**
Database maintenance	Satisfied Contacts and project database has been maintained.
Lab signage improved	Satisfied Extensive signage has been placed throughout the lab.
Outreach with suggested local affiliates and local schools	Partially Satisfied No groups have made a list of contacts since this study. The first two operational IQPs found 140 total contacts.
Project organization and storage improvements	Satisfied A procedure for storing projects using large tubs has been implemented.
Sign In/Sign Out sheet	Not Satisfied No groups have added a sign in/sign out sheet to the ATRC.
Website maintenance	Partially Satisfied The website has been updated every two years; however, project teams have struggled to access the website.

George & Kalluri (2010)

Goals:

- Improve the organization of past projects completed within the ATRC.
- Create a comprehensive document of past projects completed within the ATRC.
- Create a marketing document for potential clients & sponsors.

Accomplishments:

- Created a comprehensive Microsoft Word document of past projects completed within the ATRC.
- Created a marketing document explaining the center's mission and highlighting the center's recent projects.
- Updated the information for the brochure and the newsletter.

Proposed Items/Recommendations:

Table 7- George & Kalluri Progress

George & Kalluri Progress	
Proposed Item/Recommendation	**Status**
Distribution of the marketing document and survey clients on its effectiveness	Not Satisfied Future IQP teams failed to use the marketing document and because of this, they were also unable to survey the clients on the document's effectiveness.
Update the project document & upload it to the ATRC website	Not Satisfied The project document was not used by future teams and as a result, it was not uploaded to the ATRC website. Future teams instead added past projects to the Microsoft Access database.
Website maintenance	Partially Satisfied The website has been updated every two years; however, project teams have appeared to struggle gaining access to the website and updating its files.

Begins & Zeveska (2012)

Goals:

- Make the ATRC self-sustainable for regular communications with clients, partners, and the WPI community.
- Create standard operating procedures for the ATRC.
- Improve the management structure of the ATRC.

Accomplishments:

- Began the process of re-establishing the EPICS program.
- Conducted inventory of the lab's tools and supplies.
- Created a lab schematic for the location of tools and supplies.
- Created a new ATRC website using Adobe Dreamweaver to replace the old website.
- Created a new template for the brochure and newsletter.
- Surveyed WPI students about the ATRC with regards to its convenience & visibility.

Proposed Items/Recommendations:

Table 8- Begins & Zeveska Progress

Begins & Zeveska Progress	
Proposed Item/Recommendation	**Status**
Connect with WPI community, clients, & partners by sending the newsletter & brochures out via email	Partially Satisfied The ATRC brochures and newsletters were sent to potential clients, but they were never sent to the WPI community.
Follow the Standard Operating Procedures document for managing & operating the ATRC	Satisfied The standard operating procedures document was satisfied
Future IQP to manage the ATRC & build the presence of EPICS	Satisfied The Begins-Zeveska study began re-establishing EPICS and then the Herzog-Oo study successfully re-established EPICS by increasing the organization's publicity.
Research past organizations that the ATRC worked with & re-establish contacts that have been lost	Not Satisfied No IQP teams since 2008 have established a list of contacts.
Update the Website	Partially Satisfied The website has been updated every two years; however, project teams have struggled to access the website.
Work Study position to maintain the Rehabilitation Laboratory	Not Satisfied IQP teams have instead continued to maintain the Rehabilitation Laboratory.

Herzog & Oo (2013)

Goals:

- Develop an internal organizational structure for the ATRC
- Develop the ATRC's outreach program
- Re-establish WPI's EPICS chapter

Accomplishments:

- Backed up all ATRC files onto a flash drive
- Created lists of tasks future IQP teams should follow each week & at the start of a term
- Created new signage for the laboratory (clean-up policies, labels, & welcome signs)
- Created scheduling procedures for the ATRC Conference Room (HL 123)
- Determined a task list that should be conducted before Open Houses
- Developed an operational contact list
- Developed a project management outline
- Developed a project storage system using a large, storage tubs.
- Re-established WPI's EPICS chapter
- Researched archival software
- Updated the brochure
- Updated the Microsoft Access project database.
- Updated the newsletter
- Updated the website's information, but the changes never went online

Proposed Items/Recommendations:

Table 9- Herzog & Oo Progress

Herzog & Oo Progress	
Proposed Item/Recommendation	**Status**
Continue work on unfinished projects	Not Satisfied EPICS failed to meet during the 2013-14 school year.
Develop weekly task lists	Satisfied Our team added weekly task lists in the progress reports.
Educate future project groups on project organization methods & tools	Satisfied The Herzog-Oo IQP began leaving hand-off materials for future IQP teams to aid the transition between years.
Increase EPICS's collaboration with other clubs & organizations	Not Satisfied EPICS failed to meet during the 2013-14 school year.
Upload the ATRC project database to the Library's Digital Commons database	Not Satisfied This has not been accomplished as we have yet to meet with Jessica Colati of Gordon Library's Archives.

Appendix B- Media

Website

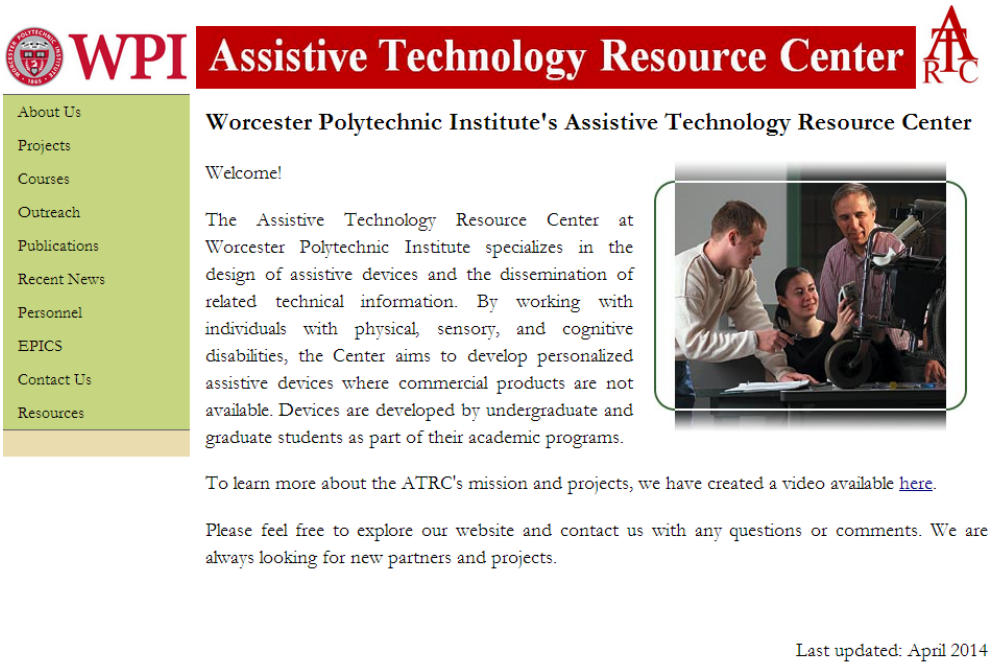


Figure 20- ATRC Website- Index

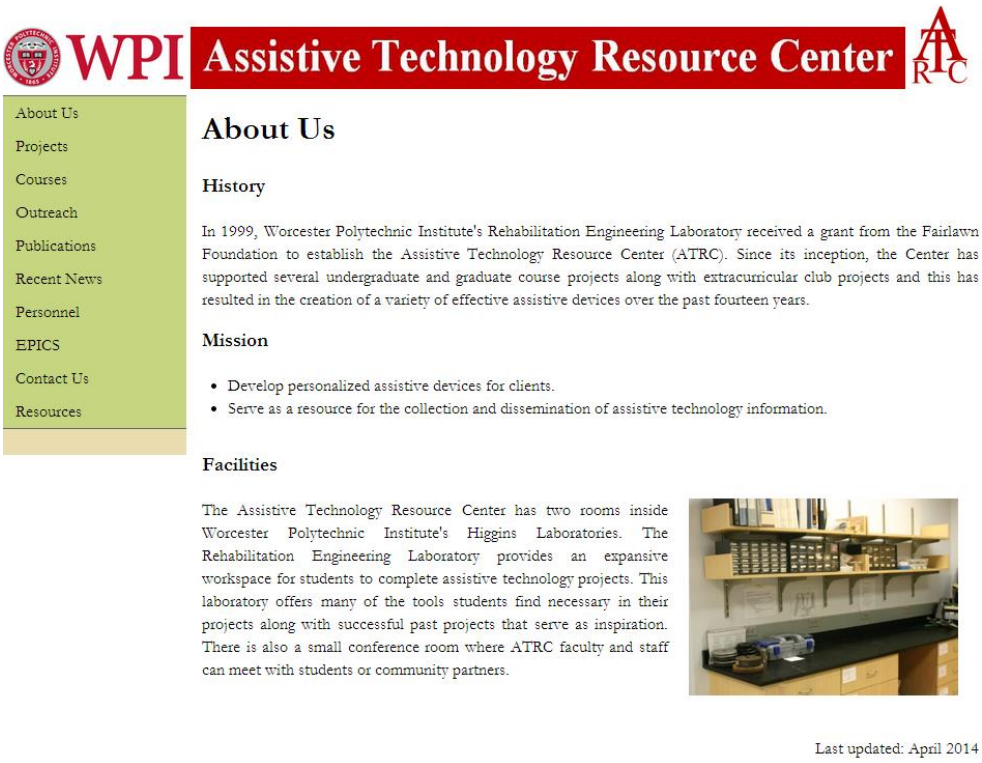


Figure 21- ATRC Website- About Us

WPI Assistive Technology Resource Center ATRC

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

Projects

Students complete assistive technology projects with the ATRC for undergraduate courses and graduate level work. Many projects are major qualifying projects (MQPs), which are complex projects completed during a student's senior year. Students also complete interactive qualifying projects (IQPs) with the ATRC during their junior year, and these projects study the connection between science and society. A majority of the ATRC's IQPs have studied the Center's management and operational structure.

A complete list of projects completed with the ATRC can be found on WPI Gordon Library's Digital Commons site by clicking here.

Custom Mobility Device

Year: 2013-14

Students: Nick Algiere `14, Alan Humphrey `14, Grant Raymond `14

Advisors: A.H. Hoffman (ME), H. K. Ault (ME)

A team of three mechanical engineering students designed a device to allow a fourth grade student with arthrogryposis to navigate his school. The device was built to fit into the areas that a standard wheelchair cannot access, while providing free range of motion of his feet. This was crucial, as he uses his feet to write and perform activities of daily living. A video of the device can be seen on the ATRC YouTube channel by clicking here.

Figure 22- ATRC Website- Projects (Page 1)

Powered Hand Orthosis

Year: 2013-14

Students: Ian Crowe `14, Reed Hebert `14, Brittany Nichols `14

Advisors: A.H. Hoffman (ME), H. K. Ault (ME)

This project group designed a powered hand orthosis to aid those with injuries that limit the dexterity or strength of their hand in rehabilitation and ADL. This externally mounted device builds on a past MQP advised by Professors Hoffman and Ault. The new design aimed to make the device more compact and lightweight in order to make it more user friendly.

Rehabilitation Tricycle

Year: 2013-14

Students: Caroline Allen `14, Audrey Blasius `14, Katelyn Puttre `14

Advisors: A.H. Hoffman (ME), H. K. Ault (ME)

A tricycle was developed to be used by a person who has weakness on one side of his or her body. A tricycle was used to provide the user a stable platform, and modifications were made to allow the pedals on each side to drive the "trike" with different gear ratios. The brakes were connected to a single hand brake on one side. The trike will allow the user to exercise outdoors and use the affected leg as he or she regains strength and range of motion.

Shoulder Mount for a Wearable Arm Orthosis

Year: 2012-13

Students: Richard Downey `13, Nikole Dunn `13, Adam Hoyt `13

Advisors: A.H. Hoffman (ME), H. K. Ault (ME)

Many current methods for mounting orthoses to shoulders are inadequate due to the complex kinematic movements of the human shoulder. Tests determined that this design did not severely limit shoulder motion and enabled the user to easily complete daily tasks such as getting dressed and brushing their teeth. The final prototype was comfortable and lightweight, as it was not cumbersome and weighed less than four pounds.

Last updated: April 2014

Figure 23- ATRC Website- Projects (Page 2)

WPI Assistive Technology Resource Center ATRC

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

Courses

The ATRC is affiliated with four courses at WPI: Introduction to Engineering (ES 1020), Introduction to Engineering Design (ME 2300), Rehabilitation Engineering (ME 3506), and Advanced Engineering Design (ME 4320). All course descriptions are from the WPI Undergraduate Catalog, which can be found here.

ES 1020- Introduction to Engineering

Level: Freshman

Course Description: This course is for first year students with an interest in engineering. The course focuses on the design process. Students are introduced to engineering through case studies and reverse engineering activities. Students will learn the steps in the design process and how engineers use this process to create new devices. Teams of students are then assigned a design project that culminates in building and evaluating a prototype in their design. Results of the design project are presented in both oral and written reports. This course does not require any prior engineering background.

In ES1020 first year students are exposed to engineering and design, culminating in a design project in which they build and test a prototype. One project from this year's class was the design of a device to allow those with sore or injured backs to play golf. This consisted of a three part tool to allow them to place a tee in the ground, place a ball on the tee, retrieve the tee, and then remove the ball from the hole. This tool was mounted on the end of a pole with a grip at the top, to allow all of these actions to be completed from a standing position.

Figure 24- ATRC Website- Courses (Page 1)

ME 2300- Introduction to Engineering Design

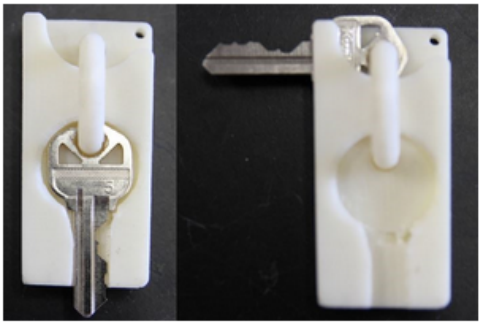
Level: Sophomore

Course Description: Real world engineering design problems usually have more than one correct solution. This course utilizes a realistic design process to introduce students to the methods and techniques for solving engineering problems. Lectures will support the design projects and may cover engineering economics, fluid dynamics, heat transfer, mechanics, statistics, and basic circuits. No prior knowledge of fluids, heat transfer, economics, statistics or electrical circuits is required. Laboratory sessions will be used to build, test and demonstrate various designs. This course is designed for sophomores and juniors to provide a broad overview of engineering design. The course includes a significant writing component and makes extensive use of PCs for word processing, spread sheet calculations and programming.

In ME2300, students focus on the design process, and participate in a term-long design project. One of this year's teams designed a prototype device to allow people with limited grip strength and dexterity to put on their socks without assistance from others. The design consists of a simple platform, handles to provide stability, and a molded plastic component that stretches the sock. The user can place the sock over the plastic component and then simply hold the handles while sliding their foot into the sock.

Figure 25- ATRC Website- Courses (Page 2)

ME 3506- Rehabilitation Engineering



Level: Junior

Course Description: The course exposes the students to the use of technology to design devices to ameliorate the handicaps of individuals with disabilities. This course focuses on the design process for assistive devices including defining the problem, setting design criteria, developing preliminary designs, selecting, analyzing and testing a final design. Human factors are integrated into all phases of the design process. Topics include: ergonomics, physical and cognitive parameters that affect the user interface, safety, economics, reliability and esthetics. Design and analysis of devices used for mobility and in daily activities in residential, educational and vocational settings. Laboratory sessions will be used to develop conceptual designs that solve real problems.

ME3506 is an intermediate design course for junior and senior students about rehabilitation engineering and assistive technology. Students learn about the interface between technology and the user while making a working prototype. One project from this year was the design of a "torque-assist" key-turn device. The key is attached to a small piece of plastic that can easily fit in one's pocket. When one goes to turn a lock, they can snap the key into place. The deployed position allows the user to generate greater torque when unlocking or locking a door.

ME 4320- Advanced Engineering Design

Level: Senior

Course Description: This course integrates students' background in ME in a one-term design project that is usually taken from a local company. Students must organize themselves and the project to successfully realize a product that meets customer needs. Activities include problem definition, design analysis, mathematical modelling, CAD modelling, manufacturing, testing, liaison to vendors, customer relations, marketing, technical management, purchasing, report writing, and oral presentations.

ME4320 is a senior design course. The students are designing a portable manual wheelchair capable of traversing a multitude of surfaces (both indoors and outdoors) and navigating steeper slopes than commercially available chairs. The wheelchair is powered by a lever system to reduce the user input. The frame can be raised or lowered by pneumatic pumps to accommodate indoor or outdoor use. The class is divided into four different divisions: design, manufacturing, marketing, and operations.

Last updated: April 2014

Figure 26- ATRC Website- Courses (Page 3)

WPI Assistive Technology Resource Center ATRC

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

Outreach

Community Outreach

Camp Reach

Since 1997, WPI has offered Camp Reach, a two week summer program for female middle school students to boost their interest in engineering, mathematics, and science. Within this program, the ATRC leads a half day workshop on assistive technology and accessibility.

The workshop raises awareness towards persons with disabilities. Participants don bulky gloves and attempt to assemble a nut and bolt to simulate the difficulties persons with disabilities face with routine tasks. Campers conduct experiments such as collecting ramp measurements to learn how ADA requirements aid people with disabilities. Presentations are also offered on past ATRC projects and computer accessibility for persons with disabilities to educate what technology is already available. More information on Camp Reach can be found at its website.

Touch Tomorrow

Touch Tomorrow is a festival of robots, science, and technology held in June at WPI the past two summers. The event focuses on the NASA Sample Return Robot Centennial Challenge competition, but the campus is transformed into a museum to educate visitors about science and technology. The ATRC has past projects on display such as the reacher-grabber shown with one of the Touch Tomorrow visitors in the photo. More information about Touch Tomorrow can be found at its official website.

Figure 27- ATRC Website- Outreach (Page 1)

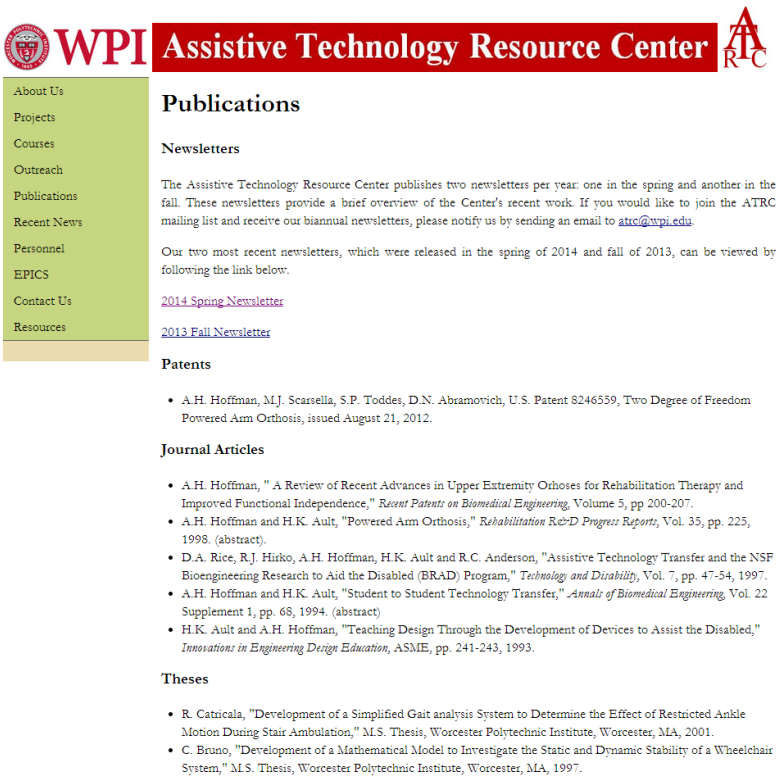
Tours

The ATRC offers tours of its facilities during WPI Open Houses and by appointment. During these tours, the ATRC showcases past projects and the Rehabilitation Laboratory. If you are interested in receiving a tour of the ATRC, please contact the ATRC and we would be happy to schedule a time.

Last updated: April 2014

Assistive Technology Resource Center | 100 Institute Road | Worcester, MA 01609-2280 | atrc@wpi.edu

Figure 28- ATRC Website- Outreach (Page 2)



WPI Assistive Technology Resource Center

About Us
Projects
Courses
Outreach
Publications
Recent News
Personnel
EPICS
Contact Us
Resources

Publications

Newsletters

The Assistive Technology Resource Center publishes two newsletters per year: one in the spring and another in the fall. These newsletters provide a brief overview of the Center's recent work. If you would like to join the ATRC mailing list and receive our biannual newsletters, please notify us by sending an email to atrc@wpi.edu.

Our two most recent newsletters, which were released in the spring of 2014 and fall of 2013, can be viewed by following the link below.

2014 Spring Newsletter

2013 Fall Newsletter

Patents

- A.H. Hoffman, M.J. Scarsella, S.P. Toddes, D.N. Abramovich, U.S. Patent 8246559, Two Degree of Freedom Powered Arm Orthosis, issued August 21, 2012.

Journal Articles

- A.H. Hoffman, " A Review of Recent Advances in Upper Extremity Orhoses for Rehabilitation Therapy and Improved Functional Independence," *Recent Patents on Biomedical Engineering*, Volume 5, pp 200-207.
- A.H. Hoffman and H.K. Ault, "Powered Arm Orthosis," *Rehabilitation R&D Progress Reports*, Vol. 35, pp. 225, 1998. (abstract).
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Figure 29- ATRC Website- Publications (Page 1)

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Last updated: April 2014

Figure 30- ATRC Website- Publications (Page 2)

WPI Assistive Technology Resource Center ATRC

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

Recent News

Patent Granted for Powered Arm Orthosis

A powered arm orthosis developed by the Assistive Technology Resource Center received a patent (US008246559) in 2012.

The patent was originally filed in 2005 after three major qualifying projects in the late 1990s developed and refined the powered arm orthosis.

Last updated: April 2014

Assistive Technology Resource Center | 100 Institute Road | Worcester, MA 01609-2280 | atrc@wpi.edu

Figure 31- ATRC Website- Recent News

WPI Assistive Technology Resource Center ATRC

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

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Last updated: April 2014

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Figure 32- ATRC Website- Personnel

WPI Assistive Technology Resource Center

- About Us
- Projects
- Courses
- Outreach
- Publications
- Recent News
- Personnel
- EPICS
- Contact Us
- Resources

Engineering Projects In Community Service

Engineering Projects in Community Service (EPICS) was founded at Purdue University in 1995. The founders of EPICS saw the program as a way to combine student work with the needs of local community service organizations that could benefit everyone involved. Teams are comprised of multi-discipline, multi-year students who solve engineering and technologically-based problems and create viable solutions for these partnering organizations.

EPICS has two primary goals.

1. Educate undergraduate engineers in the design process and give them real world problem-solving skills.
2. Help individuals and non-profit organizations who may not have the access or necessary resources to hire a professional engineering team.

EPICS at WPI

WPI is one of 20 universities across the globe with an EPICS chapter. At WPI, EPICS students work in collaboration with the Assistive Technology Resource Center to complete projects focused on assistive technology. Last year, EPICS modified an electric wheelchair so that it could successfully operate on the sandy, uneven surface of a beach. This modification was featured in WPI's student newspaper, *The Towers*, and can be read by clicking here.

The Wheelchair Before

The Wheelchair After

Additional information about EPICS and past projects can be found by watching a short video here.

If you are interested in becoming involved with EPICS or have any questions about the organization and its projects, please contact the club at atrc-epics@wpi.edu.

Figure 33- ATRC Website- EPICS (Page 1)

Member Institutions

Since its founding, EPICS has grown to become a national consortium of the following twenty universities:

- Arizona State University
- Butler University
- University of California, Merced
- University of California, San Diego
- Columbia University
- Dartmouth College
- Drexel University
- George Fox University
- Illinois Institute of Technology
- Itasca Community College
- University of Notre Dame
- Ohio Northern University
- Penn State University
- Princeton University
- Purdue University
- San Jose State University
- Texas A&M University
- Université de Sherbrooke
- University of Virginia
- Worcester Polytechnic Institute

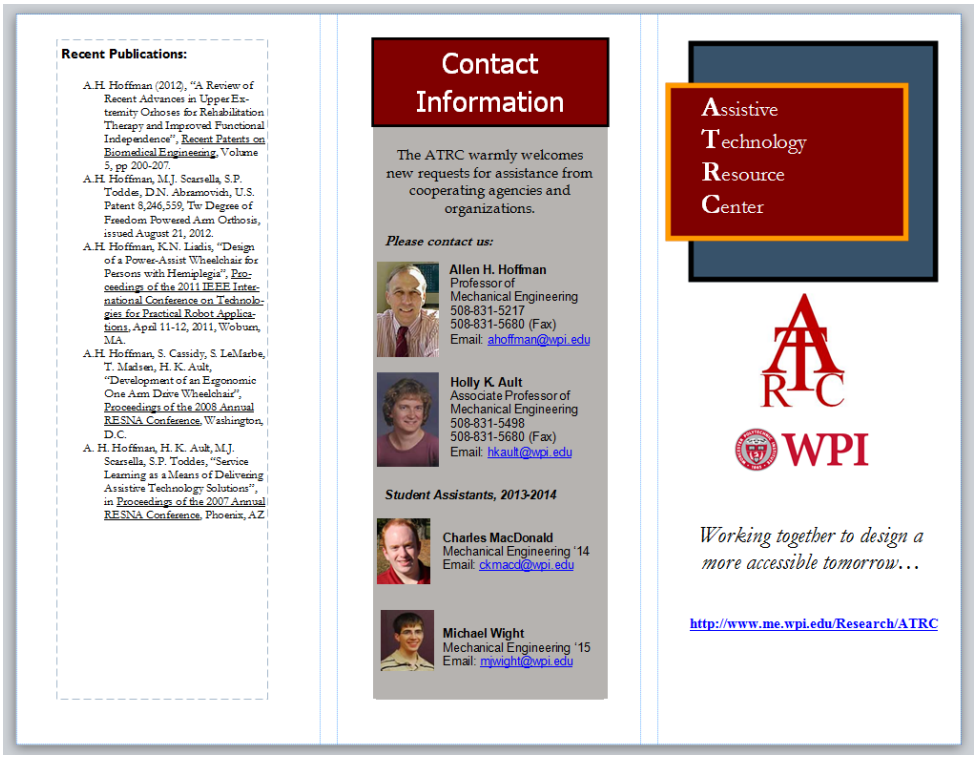
Last updated: April 2014

Figure 34- ATRC Website- EPICS (Page 2)

Figure 35- ATRC Website- Contact Us

Figure 36- ATRC Website- Resources

Brochure



Recent Publications:

A.H. Hoffman (2012), "A Review of Recent Advances in Upper Extremity Orthoses for Rehabilitation Therapy and Improved Functional Independence", Recent Patents on Biomedical Engineering, Volume 5, pp 200-207.

A.H. Hoffman, M.J. Scarsella, S.P. Toddes, D.N. Abramovich, U.S. Patent 8,246,559, Tw Degree of Freedom Powered Arm Orthosis, issued August 21, 2012.

A.H. Hoffman, K.N. Liadis, "Design of a Power-Assist Wheelchair for Persons with Hemiplegia", Proceedings of the 2011 IEEE International Conference on Technologies for Practical Robot Applications, April 11-12, 2011, Woburn, MA.

A.H. Hoffman, S. Cassidy, S. LeMarbe, T. Madsen, H. K. Ault, "Development of an Ergonomic One Arm Drive Wheelchair", Proceedings of the 2008 Annual RESNA Conference, Washington, D.C.

A. H. Hoffman, H. K. Ault, M.J. Scarsella, S.P. Toddes, "Service Learning as a Means of Delivering Assistive Technology Solutions", in Proceedings of the 2007 Annual RESNA Conference, Phoenix, AZ

Contact Information

The ATRC warmly welcomes new requests for assistance from cooperating agencies and organizations.

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Assistive
Technology
Resource
Center

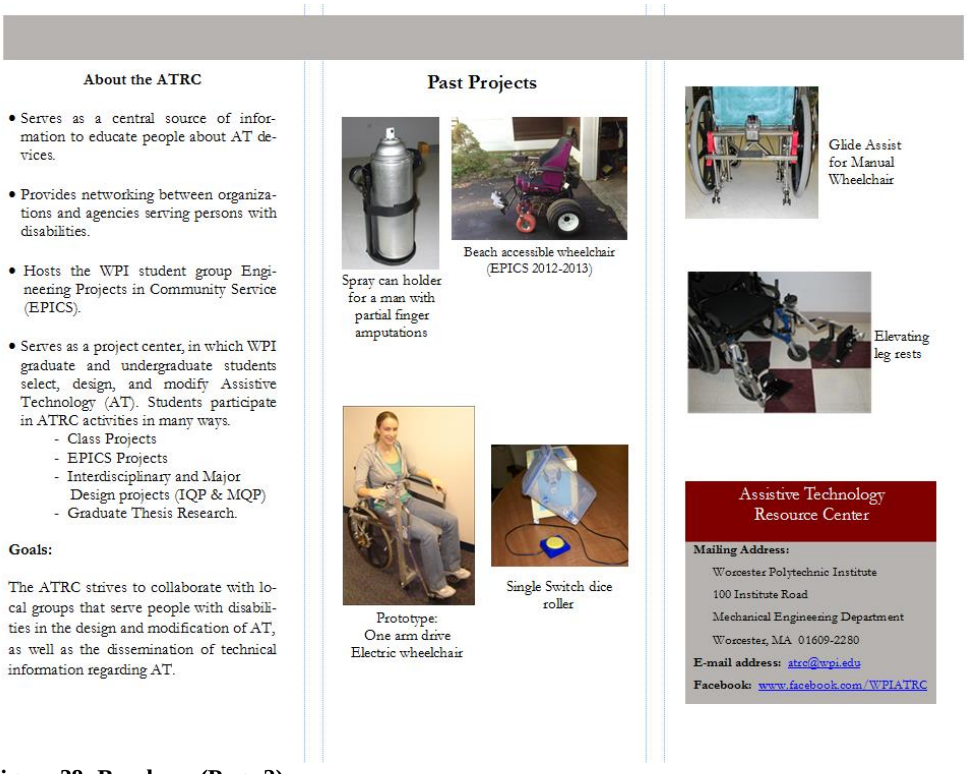
ATRC

WPI

Working together to design a more accessible tomorrow…

http://www.me.wpi.edu/Research/ATRC

Figure 37- Brochure (Page 1)



About the ATRC

- Serves as a central source of information to educate people about AT devices.
- Provides networking between organizations and agencies serving persons with disabilities.
- Hosts the WPI student group Engineering Projects in Community Service (EPICS).
- Serves as a project center, in which WPI graduate and undergraduate students select, design, and modify Assistive Technology (AT). Students participate in ATRC activities in many ways.
  - Class Projects
  - EPICS Projects
  - Interdisciplinary and Major Design projects (IQP & MQP)
  - Graduate Thesis Research.

Goals:

The ATRC strives to collaborate with local groups that serve people with disabilities in the design and modification of AT, as well as the dissemination of technical information regarding AT.

Past Projects

Spray can holder for a man with partial finger amputations

Beach accessible wheelchair (EPICS 2012-2013)

Prototype: One arm drive Electric wheelchair

Single Switch dice roller

Glide Assist for Manual Wheelchair

Elevating leg rests

Assistive Technology Resource Center

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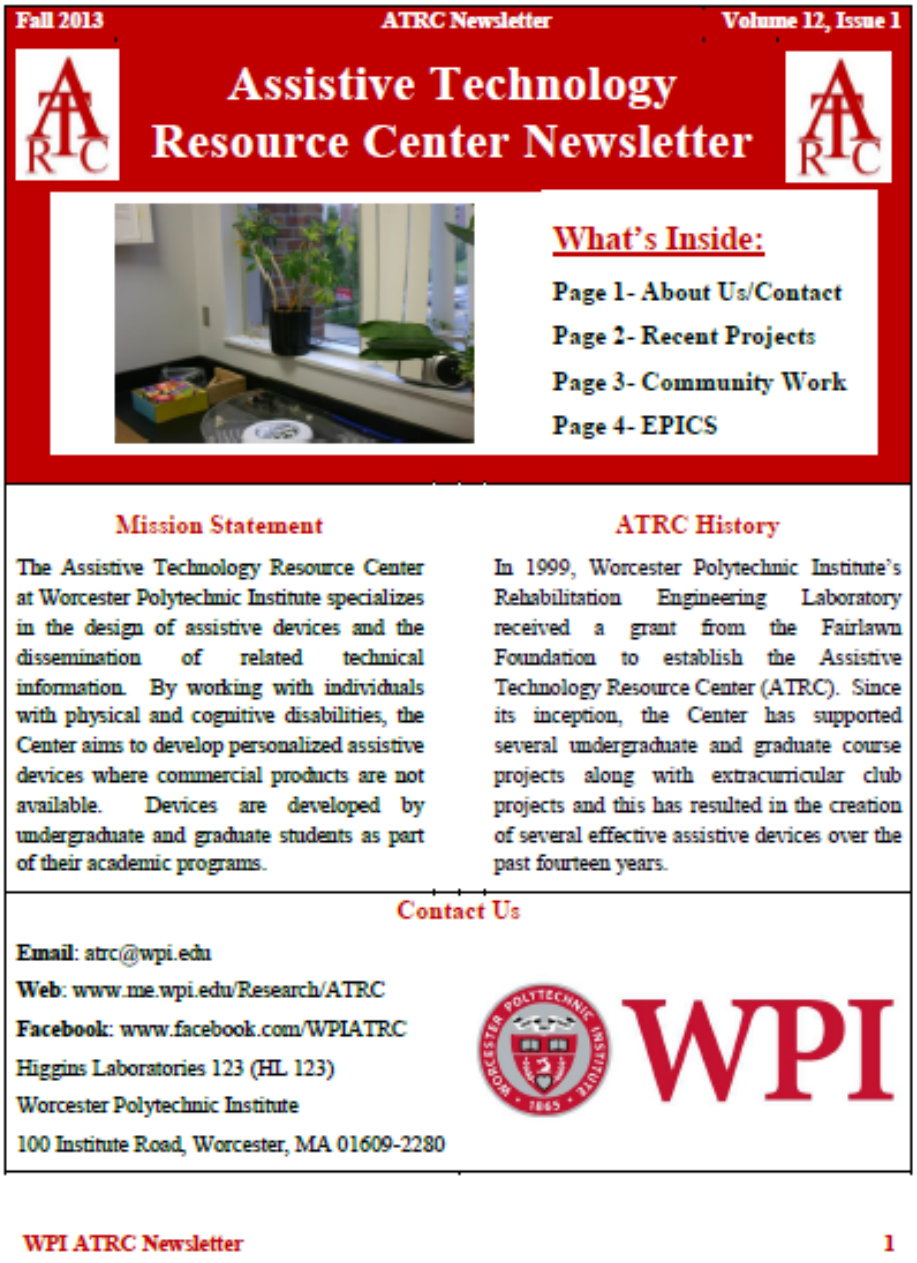
Figure 38- Brochure (Page 2)

Newsletter



Fall 2013 ATRC Newsletter Volume 12, Issue 1

Assistive Technology Resource Center Newsletter

What's Inside:

Mission Statement

The Assistive Technology Resource Center at Worcester Polytechnic Institute specializes in the design of assistive devices and the dissemination of related technical information. By working with individuals with physical and cognitive disabilities, the Center aims to develop personalized assistive devices where commercial products are not available. Devices are developed by undergraduate and graduate students as part of their academic programs.

ATRC History

In 1999, Worcester Polytechnic Institute's Rehabilitation Engineering Laboratory received a grant from the Fairlawn Foundation to establish the Assistive Technology Resource Center (ATRC). Since its inception, the Center has supported several undergraduate and graduate course projects along with extracurricular club projects and this has resulted in the creation of several effective assistive devices over the past fourteen years.

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WPI

WPI ATRC Newsletter 1

Figure 39- 2013 ATRC Fall Newsletter Page 1

Fall 2013 ATRC Newsletter Volume 12, Issue 1

Recent Projects

Design and Manufacturing of a Powered Hand Orthosis

Recently a student major qualifying project (MQP) team under the guidance of Professors Allen Hoffman and Holly Ault developed a powered hand orthosis. Elyssa Dorenfeld, Robert Wolf, and Stephan Zeveska designed the orthosis to be controlled by the contralateral hand. The orthosis replicates the motion of the hand by reducing the twenty-seven degrees of freedom of a healthy hand to six.

Patent Granted for Arm Orthosis

Above- Second generation prototype of the powered arm orthosis (US008246559).

Many diseases, medical conditions, and injuries can result in the loss of upper limb functionality and this affects an individual's ability to perform daily activities. A powered arm orthosis can help restore motion to the upper limb. The ATRC has made great advances in upper limb orthotics over the past decade. In 2005, one of Professor Hoffman's MQP teams developed a two degree of freedom powered orthosis that was patented in 2012.

Shoulder Mount for a Wearable Arm Orthosis

Richard Downey, Nikole Dunn, and Adam Hoyt created a shoulder mount to work in conjunction with a wearable and powered arm orthosis to provide support for a user of the orthotic device. Tests determined that the shoulder mount did not severely limit shoulder motion and enabled the user to easily complete daily tasks. Professors Hoffman and Ault advised the project.

Above- A student wears the shoulder mount that would support the upper limb orthosis.

The light-weight and comfortable shoulder mount offers the user of an arm orthosis more freedom. Early upper arm orthoses were mounted to wheelchairs, which severely restricts the user's motion. Tests showed that the new shoulder mount allows sufficient motion to perform most tasks associated with daily living.

Figure 40- 2013 ATRC Fall Newsletter Page 2

Fall 2013 ATRC Newsletter Volume 12, Issue 1

Community Work

Camp Reach

Since 1997, WPI has offered Camp Reach, a two week summer program for female middle school students to boost their interest in engineering, mathematics, and science. Within this program, the ATRC leads a half day workshop on assistive technology and accessibility.

The workshop raises awareness towards persons with disabilities. Participants don bulky gloves and attempt to assemble a nut and bolt to simulate the difficulties persons with disabilities face with seemingly routine tasks. Campers conduct experiments such as collecting ramp measurements to learn how ADA requirements aid people with disabilities. Presentations are also offered on past ATRC projects and computer accessibility for persons with disabilities to educate the girls what technology is already available.

Left- The campers attempt to assemble a nut and bolt while wearing cumbersome gloves to simulate having a physical disability.

This ATRC workshop has always been well received. The goal of the workshop is to introduce assistive technology and demonstrate the need to advance the field.

Touch Tomorrow

Touch Tomorrow is a festival of robots, science, and technology that was held in June at WPI for the second consecutive summer. The event focuses on the NASA Sample Return Robot Centennial Challenge competition, but the campus is transformed into a museum to educate visitors on the advances in science and engineering fields. The ATRC participates in Touch Tomorrow and has past projects on display.

Above- The Rehabilitation Laboratory was open and visitors could use some projects such as the reacher-grabbers.

Above- Past ATRC project posters were on display to educate visitors on recently-developed assistive technology devices.

Figure 41- 2013 ATRC Fall Newsletter Page 3

Fall 2013 ATRC Newsletter Volume 12, Issue 1

EPICS

Engineering Projects in Community Service (EPICS)

Description

EPICS is a club educating engineers in the design process while also helping individuals and organizations who may not have the access or resources to involve professionals.

Contact Us

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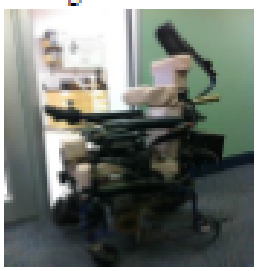
President: Congji Li

Electric Beach Wheelchair

Powered wheelchairs can easily navigate homes and streets, but most are not designed to operate on the sandy surface of a beach. Last year, EPICS modified an electric wheelchair to enable travel on a beach.

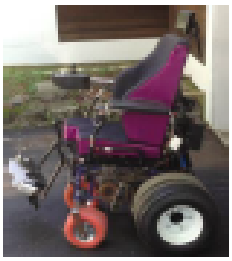
By the end of the school year, EPICS created a wheel design and over the summer, project manager Sarah Chamberlain '16 continued work on the project. Along with adding the modified wheels, EPICS also added a recliner and updated the wheelchair's paneling while maintaining its electrical system.

"The wheelchair project was for my sister," said Chamberlain. "It's just something I've always wanted to do and I figured it was an opportunity to collaborate with others…The project is 99% finished. I worked a lot on it over the summer. The only problem that I ran into was the brackets in the front. We didn't want to do the field testing on it yet until it was absolutely safe."



Left- Wheelchair before EPICS made their modifications.

Right- Wheelchair after EPICS modified it to safely drive on a sandy beach.



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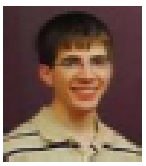

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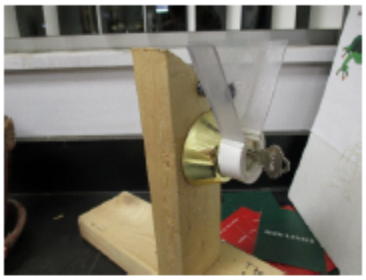
Figure 42- 2013 ATRC Fall Newsletter Page 4

Spring 2014 ATRC Newsletter Volume 12, Issue 2

Assistive Technology Resource Center Newsletter



What's Inside:

Year in Review

In the 2013-2014 academic year the students and faculty of the Assistive Technology Resource Center continued to strive towards the Center's goals of developing assistive devices and serving as a source of information on the topic of assistive technology. This year undergraduate students took part in class projects through the ATRC, in which they design and prototype assistive devices over a seven week term. Nine senior students also completed three capstone design projects advised by the ATRC faculty.

Students developed devices including toys for children with cognitive disabilities and limited sight; rehabilitative and mobility aids for people with limited mobility, strength or dexterity; and assistive devices to enable people with a wide range of disabilities to perform activities of daily living (ADL).

The ATRC staff made educational presentations to local groups on the topic of assistive technology. More information on the activities of the ATRC can be found within the resources listed below.

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WPI

Figure 43- 2014 ATRC Spring Newsletter Page 1

Spring 2014 ATRC Newsletter Volume 12, Issue 2

Senior Design Projects (Major Qualifying Projects)

Custom Mobility Device

A team of three mechanical engineering students designed a device to allow a fourth grade student with arthrogryposis to navigate his school. The device was built to fit into the areas that a standard wheelchair cannot access, while providing free range of motion of his feet. This was crucial, as he uses his feet to write and perform activities of daily living. A video of the device can be seen on the ATRC YouTube channel (http://goo.gl/rhAZdQ).

The chair increased the student's mobility.

Team: Nick Algiere `14, Alan Humphrey `14, Grant Raymond `14

Rehabilitative Tricycle

A tricycle was developed to be used by a person who has weakness on one side of his or her body. A tricycle was used to provide the user a stable platform, and modifications were made to allow the pedals on each side to drive the "trike" with different gear ratios. The brakes were connected to a single hand brake on one side. The trike will allow the user to exercise outdoors and use the affected leg as he or she regains strength and range of motion.

The gear system of the tricycle can be seen.

Team: Caroline Allen `14, Audrey Blasius `14, Katelyn Puttre `14

Powered Hand Orthosis

A third project group designed a powered hand orthosis to aid those with injuries that limit the dexterity or strength of their hand in rehabilitation and ADL. This externally mounted device builds on a past MQP advised by Professors Hoffman and Ault. The new design aimed to make the device more compact and lightweight in order to make it more user friendly.

Left- Isometric View, Right- Back View

Team: Ian Crowe `14, Reed Hebert `14, Brittany Nichols `14

Figure 44- 2014 ATRC Spring Newsletter Page 2

Spring 2014 ATRC Newsletter Volume 12, Issue 2

Class Projects

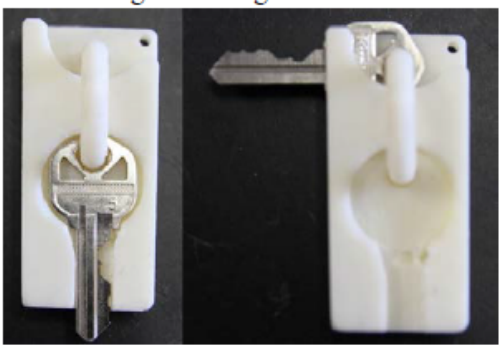
ES1020 – Introduction to Engineering

In ES1020 first year students are exposed to engineering and design, culminating in a design project in which they build and test a prototype. One project from this year's class was the design of a device to allow those with sore or injured backs to play golf. This consisted of a three part tool to allow them to place a tee in the ground, place a ball on the tee, retrieve the tee, and then remove the ball from the hole. This tool was mounted on the end of a pole with a grip at the top, to allow all of these actions to be completed from a standing position.

The ball is currently resting on the end of the tool that helps the user set up the golf tee.

ME3506 – Rehabilitation Engineering

ME3506 is an intermediate design course for junior and senior students about rehabilitation engineering and assistive technology. Students learn about the interface between technology and the user while making a working prototype. One project from this year was the design of a "torque-assist" key-turn device. The key is attached to a small piece of plastic that can easily fit in one's pocket. When one goes to turn a lock, they can snap the key into place. The deployed position allows the user to generate greater torque when unlocking or locking a door.



On the left, the key is in the closed position. On the right, the key is in the deployed position.

ME2300 – Intro. to Engineering Design

In ME2300, students focus on the design process, and participate in a term-long design project. One of this year's teams designed a prototype device to allow people with limited grip strength and dexterity to put on their socks without assistance from others. The design consists of a simple platform, handles to provide stability, and a molded plastic component that stretches the sock. The user can place the sock over the plastic component and then simply hold the handles while sliding their foot into the sock.

The sock device is a simple solution to a complex problem.

Figure 45- 2014 ATRC Spring Newsletter Page 3

Spring 2014 ATRC Newsletter Volume 12, Issue 2

EPICS

Engineering Projects in Community Service

Description

EPICS is a club educating engineers in the design process while also helping individuals and organizations who may not have the access or resources to involve professionals. EPICS is looking for new student members for next year! If you are interested contact Professor Hoffman or Ault.

Website: www.wpi.edu/Academics/EPICS

ME4320 - Advanced Engineering Design

ME4320 is a senior design course. The students are designing a portable manual wheelchair capable of traversing a multitude of surfaces (both indoors and outdoors) and navigating steeper slopes than commercially available chairs. The wheelchair is powered by a lever system to reduce the user input. The frame can be raised or lowered by pneumatic pumps to accommodate indoor or outdoor use. The class is divided into four different divisions: design, manufacturing, marketing, and operations.

The frame can be adjusted by pneumatic pumps to accommodate indoor or outdoor use.

Looking to Next Year

The ATRC will continue to provide customized designs of assistive technology and education in this field. The ATRC will continue their involvement with Camp REACH and Touch Tomorrow while also providing a workshop for the TechGirls program. Professors Hoffman and Ault are currently recruiting teams of senior students to work on design projects beginning next August. Anyone with an idea for a project or otherwise interested in working with the ATRC should contact the faculty and learn more from the website.

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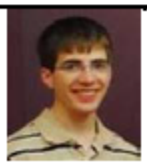

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Figure 46- 2014 ATRC Spring Newsletter Page 4

Digital Commons Project Database

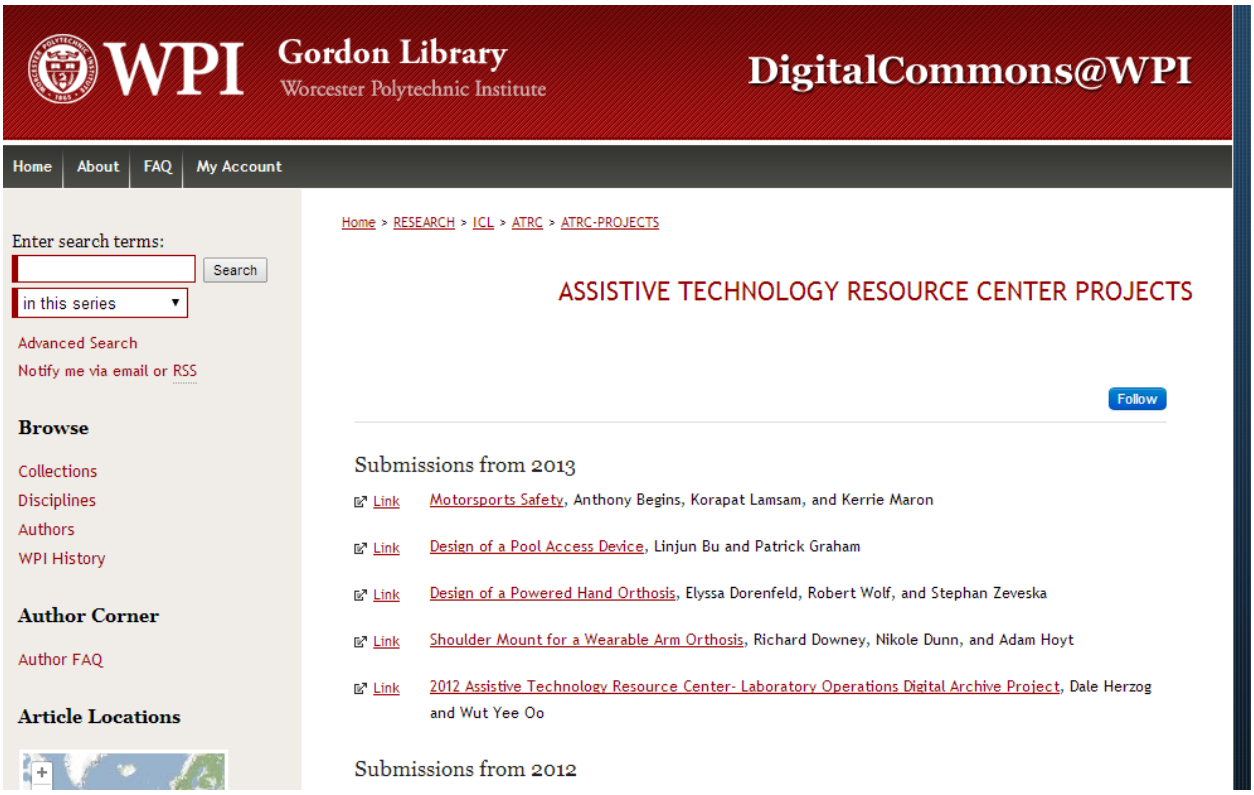

Figure 47- Digital Commons Project Database

Design of a Powered Hand Orthosis

Elyssa Dorenfeld, *Worcester Polytechnic Institute*
Robert Wolf, *Worcester Polytechnic Institute*
Stephan Zeveska, *Worcester Polytechnic Institute*

Link to Full Text

SHARE

Document Type
Other

Publication Date
4-25-2013

Abstract
The goal of this project was to design and manufacture a fully functional powered hand orthosis, controlled and operated by the contralateral hand, and used by people with diminished hand functions. Linear actuators were used to create the movement of the fingers through a six-bar linkage. The design reduces the twenty seven degrees of freedom in a healthy human hand to six and replicates the motions needed to perform the most common grips including the cylindrical, pinch, and key grips. Results showed that a single finger could exert a force of 50N. This correlates to an approximate hand strength of 200N, which was felt to be sufficient for most ADL's. Overall, this orthotic device increases the hand's strength and functionality for the user and increases their quality of life.

Suggested Citation
Dorenfeld, Elyssa , Wolf, Robert , Zeveska, Stephan (2013). Design of a Powered Hand Orthosis. .
Retrieved from: http://digitalcommons.wpi.edu/atrc-projects/22

Figure 48- Individual Entry on the Digital Commons

Table 10- Digitized ATRC Projects

Digitized ATRC Projects			
Project Title	**Project Type**	**Authors**	**Publication Year**
Motorsports Safety	MQP	Anthony Begins Korapat Lamsam Kerrie Maron	2013
Design of a Pool Access Device	MQP	Linjun Bu Patrick Graham	2013
Design of a Powered Arm Orthosis	MQP	Elyssa Dorenfeld Robert Wolf Stephan Zeveska	2013
Shoulder Mount for a Wearable Arm Orthosis	MQP	Richard Downey Nikole Dunn Adam Hoyt	2013
2012 Assistive Technology Resource Center- Laboratory Operations Digital Archive Project	IQP	Dale Herzog Wut Yee Oo	2013
ATRC Communications	IQP	Anthony Begins Stephan Zeveska	2012
Pseudo-Fluid Control Extension System	MQP	John Dunbar Christopher Farren Mari Freitas	2012

Digitized ATRC Projects			
Project Title	**Project Type**	**Authors**	**Publication Year**
Rowing Foot Stretcher Design	MQP	John Madura Daniel Pierson	2012
Design of a New Prosthetic Adaptor with Quantitative Alignment and Height Adjustment	MQP	Olufunmilayo Adebayo Lydia George Mark Marchand Jeffrey Marrion	2011
Design of the Grab-Bot	MQP	Meaghan Busteed Amanda Rinaldi	2011
Front Mounting Bicycle Attachment for Improved Accessibility of Adult Passengers	MQP	Victor Montero Kelly Roberge Brandon Stuczko	2011
Improved Walker Design	MQP	Meagan Foley Kelly Johnson Joseph Kalbach Brittany McNally	2010
History of Future of Rehabilitation Robotics	IQP	Christopher Frumento Ethan Messier Victor Montero	2010
Optimizing the Assistive Technology Resource Center: Marketing and Documentation	IQP	Lydia George Deepti Kalluri	2010
Powered Device for Pushing a Manual Wheelchair	MQP	Kevin Kordosky Lindsay Mullins Katelyn Perkins George von Roth	2010
One-Arm Drive Manual Wheelchair	MQP	Dominic DiGiovanni Valerie Marrion Hamlet Nina	2009
Optimizing the WPI Assistive Technology Resource Center: Operation and Management	IQP	Stoyan Hristov Kelsey Mawhiney Zachary Wilson	2009
Design and Manufacturing of a Portable Single-Switch Activated Bowling Game	MQP	Jeff Prunera Jacob Saffron Jonathan Welch	2009
Manual Wheelchair Handbook Study for the Massachusetts Department of Mental Retardation	IQP	Daniel Asselin Nikolas Ledoux David Willens	2008
Testing and Analysis of Low Cost Prosthetic Feet	MQP	Morgan Carpenter Carolyn Hunter Dean Rheaume	2008

Digitized ATRC Projects			
Project Title	**Project Type**	**Authors**	**Publication Year**
Implementation of Best Practices in the Operation of the WPI Assistive Technology Resource Center	IQP	Christopher Lyons Paul Trimby	2008
Analysis of a Lower Limb Prosthesis	MQP	Victoria Richardson Erin Vozzola	2008
Improving Disabled Access to the Tram System in Melbourne, Victoria	IQP	Alexander Christakis Katie Flynn Jennifer Himottu	2007
Design of Trans-humeral Prosthetic Mounting System for Use in High Load Activities	MQP	Bethany Corliss Dave Giebenhain Richard Gilley	2007
Independent Transfer System for a Person with Limited Strength	MQP	David Curran	2007
Campus Safety for Persons with Disabilities	IQP	Sara Gouveia Eric Wilusz	2007
Environmental Control for Persons with Disabilities	IQP	Kevin Harrington Timothy Loughlin Bryan Mancuso	2007
Electromechanical System Integration for a Powered Upper Extremity Orthosis	Graduate Thesis	Michael Scarsella	2007
Adapting Hands-On Science Programs for Students with Disabilities	IQP	Nicholas Simone Erin Vozzola Lynn Worobey	2007
Optimization for Commercialization of a Two Degree of Freedom Powered Arm Orthosis	Graduate Thesis	Stephen Toddes	2007
Design and Development of a Transhumeral Prosthetic Mounting System	MQP	Michael Bertini Zachary Domínguez Joshua Morin Elizabeth Palumbo	2006
Design of a One-Arm Driven Manual Wheelchair	MQP	Sean Cassidy Shaun LeMarbe Tiffany Madsen	2006
The Design and Manufacture of an Elevating/Articulating Manual Wheelchair Legrest	Graduate Thesis	Eric Couture	2006
Design of a Power-Assist Hemiplegic Wheelchair	Graduate Thesis	Keith Liadis	2006
Design of a One-Arm Driven Manual Wheelchair	MQP	Jennifer Cofske Barrett Franklin Darcy Vought	2005

Digitized ATRC Projects			
Project Title	**Project Type**	**Authors**	**Publication Year**
The Impact of Using an Obstacle Sensing System in the Power Wheelchair Training of Children with Disabilities	Graduate Thesis	Lisette Manrique	2005
Transporting Personal Oxygen Bottles in Vehicles- Is it Safe?	IQP	Jesse Chisholm Sarah Duford Kathryn McGovern	2004
Design of a Linkage Based Articulating Wheelchair Legrest	MQO	Rebecca Duhaime Amy Gray	2004
Evaluating a Wheelchair Maintenance Resource	IQP	Christopher Kopec Joseph Sarcione Adam Trimby	2004
Design of an Elevating Legrest for a Wheelchair	MQP	Johanna Barlow Daniel Reed	2003
Adaptive Saddle for Massachusetts Hospital School	MQP	Michael Landi Lisette Manrique	2003
Design of a Glide Control Mechanism for a Manual Wheelchair	MQP	Bonniejean Boettcher Timothy MacLean Kenneth Sundberg	2002
Development of a Simplified Gait Analysis System to Determine the Effect of Restricted Ankle Motion During Stair Ambulation	Graduate Thesis	Rosanna Catricala	2001
Design of Tuck-Away Wheelchair Brakes	MQP	Todd Clark Christopher Meyer Garret Mier	2001
Dynamic Seating System Design	MQP	Brynn Hart Nathan Smith Melanie Tetreault	2001
Development of an Educational Resource for Preventative Wheelchair Maintenance	IQP	Ethan Holmes Andrew Young	2001
Arm Orthosis Body Mount	MQP	Adam Beckett Kurt Haggstrom	2000
Design and Fabrication of a Retractable Wheelchair Foot Tray	MQP	Kenneth Belliveau Melissa Carreau	2000
Powered Wheelchair Stability Model	MQP	Trevor Martin	2000

Digitized ATRC Projects			
Project Title	**Project Type**	**Authors**	**Publication Year**
Design, Modification, Fabrication, Construction, and Performance Evaluation of a Prototype Body Mounted Upper Extremity Orthosis	Graduate Thesis	Hiroshi Toriumi	2000
The Aquatic Rehabilitation Aid	MQP	Nancy Bedrossian Kristin Carreau Benjamin Nawrath	1999
Development of a Prototype Bumper System for Powered Wheelchairs	MQP	Rosanna Catricala Stefan Kohn Justin Ripley	1999
Powered Arm Orthosis III	MQP	Christopher Felice Sean Smith	1999
Design of a Laptray Easel for Disabled	MQP	Kristofor Hallee Annika Nilson Tamara Samuels	1999
Two Degree of Freedom Automated Prosthetic Wrist	MQP	Theron Johnson Siu Ng Garrett Sutton Eric Wilhelm	1999
Development of a Mathematical Model to Investigate the Static and Dynamic Stability of a Wheelchair System	Graduate Thesis	Christopher Bruno	1997

Facebook Page

Figure 49- ATRC Facebook Main Page (March 8, 2014)

Figure 50- ATRC Facebook about Us Page (March 8, 2014)

Facebook Page Research

Assistive Technology Resource Centers of Hawaii

Website: https://www.facebook.com/assistivetechnology
Description: Awards, General Information, History, List of Activities/Programs, Mission, Overview, Products/Services

Posts: Mix of announcements, articles, memes, & videos about assistive technology
Total Likes: 374

Assistive Technology Services

Website: https://www.facebook.com/ATSTN
Description: General Information, Mission, Overview, Products/Services
Posts: Photos and videos of products that try and link the viewer to their main website
Total Likes: 4,940

Kern Assistive Technology Center

Website: https://www.facebook.com/kernatcenter
Description: General Information, Mission, Overview, Products/Services
Posts: Videos of assisted technology and many links to get people to their main website
Total Likes: 538

Montano Assistive Technology Center

Website: https://www.facebook.com/pages/Montano-Assistive-Technology-Center/157617864292643

Description: General Information, Mission, Overview, Products/Services
Posts: Videos of various assistive technology products
Total Likes: 374

Oklahoma Assistive Technology Center

Website: https://www.facebook.com/pages/Oklahoma-Assistive-Technology-Center/107113056021860

Description: General Information, Mission, Overview, Products/Services
Posts: Fliers for events
Total Likes: 64

Summary

The main goal of the Facebook pages for these five assistive technology websites is to redirect people either to their main website or events sponsored by their organization. By posting daily, the organizations keep their name in the public's mind and offer a variety of articles, photos, and videos that may pique the viewer's interest and get them to either their website or a company event. These centers were not affiliated to a university, so their Facebook pages differ from the pages for a university organization. However, since the ATRC wants to reach potential clientele, a Facebook page along these lines is ideal.

Appendix C- Best Practices for Operation

ATRC Standard Operating Procedure

ATRC Email

- Receive the ATRC username and password from Professor Hoffman.
    - The ATRC email is a UNIX account and cannot be accessed through Exchange. You must use https://webmail.wpi.edu/squirrelmail/src/login.php.
- Monitor the account daily.
    - Notify the professors about any important emails.

Brochure

- Update the brochure in both the fall and the spring.
    - Use the most recent brochure template.
    - Update logos, web addresses, and contact information.
    - Check with the professors about recent projects or resources that should be added.
- Once the brochure is approved, print them through Statia in the ME department.
- Distribute the brochures to ATRC faculty and put some outside the conference room

Contacts Database

- Keep the contacts database up-to-date.
    - Add any new contacts. Include their name, email, phone, organization, organization's specialty, and organization's location.
    - Verify that the information for pre-existing contacts is accurate.

EPICS

- Communicate with EPICS officers weekly (email).
- Meet with EPICS officers monthly.
- Help EPICS recruit members.
    - Provide publicity for EPICS in the school newspaper, newsletter, and website.
    - Promote their general body meeting early in the year.
- Provide reports to Professor Hoffman and Professor Ault on the status of EPICS.

Facebook Page

- Update the Facebook page weekly.
- Provide updates about the both the ATRC and assistive technology in general.

Laboratory Cleaning

- Inspect the lab weekly.
- Store old projects. Consult with Professor Hoffman which projects should be kept.
- Clean the lab. Keep the lab tidy by sweeping floors and washing tables.
- Ensure that the eye-washing station and other safety equipment are easily accessible.

Laboratory Inventory

- Conduct a part inventory at the start of each term and the conclusion of the year.
- Use the lab index to check for missing supplies.
- Verify that any power tools are operational.
- Create a list of supplies that the lab needs and get it approved by advisors.
    - Order parts through the ME department, see Barbara Fuhrman for details
    - P.O. Request will need to be filled out, ask for list of approved suppliers from Barbara/others in the ME office
- Update the lab index to reflect any new supplies or relocations.

Laboratory Signage

- Replace all out-of-date signs in the laboratory (general welcome, clean-up policies, lab policies, registering your project, and drawer labels).
- Email professors who have classes affiliated with the ATRC the laboratory's policies.

Newsletter

- Publish a newsletter in both the spring and the fall.
    - Use the most recent newsletter template.
    - Update logos, web addresses, and contact information.
    - Check with the professors about recent projects or resources that should be added.
- Distribute the newsletter to WPI community members.
    - Update the distribution list with WPI faculty members and organizations.
    - Professor Hoffman will distribute the newsletter to faculty members.
    - Send the newsletter to organizations who may be interested in the ATRC.
        - Address the email to the club's president.
- Distribute the newsletter to external organizations.
    - Contact these organizations using the ATRC email account.
    - Refer to the distribution list to see which organizations we have previously established contact with.
    - Send the email to new organizations affiliated with assistive technology.

Projects Database

- Meet with Jessica Colati (jcolati@wpi.edu) to gain access to the Digital Commons.
- Update the database with any IQPs or MQPs completed with the ATRC.
    - Include the project's title, authors, abstract, keywords, and link to the full text.

Tours

- Dress appropriately and arrive early.
- Ensure that the laboratory is clean and have recent projects on display.
- Encourage tour groups to ask questions.

Track Past IQPs

- Update the ATRC Operations Progress document monthly.
- Focus on improving in areas that recent IQP groups have struggled in or neglected.

Visits

- Dress appropriately and arrive early.
- Prepare for the meeting.
    - Research the visitor's organization and cater the presentation to their interests.
    - Clean the lab if the meeting is at WPI and have recent projects on display.
- Be engaged in the conversation. Look for how the ATRC could work with them.
- Write a short report on the visit.

Website

- Gain access to the ATRC website.
    - Contact Randy Robinson (rhr@wpi.edu) to gain access to modify the website.
    - Map the network drive (\\corvair2@wpi.edu\atrc).
    - Enter your WPI username and password as credentials to access the site. The username field must be in the form "admin\username".
- Update the ATRC website monthly.
    - The webpage is written in HTML and can be edited using a simple text editor such as Notepad or a web design program like Dreamweaver.
    - Ensure that the staff information is correct.
    - Include any recent projects or news about the Center.
    - Verify that there are no broken links or misspellings.
- Contact Siamak Najafi (snajafi@wpi.edu) and he will upload the ATRC website.
- Test the website for its W3C compliance.
    - Set up a Sitebeam account (http://sitebeam.net/website-tests/w3c-compliance/) and test the URL for the ATRC. You will receive quantitative feedback.

ATRC Operational Checklist

Table 11- ATRC Operational Checklist

ATRC Operational Checklist	
Daily Items	
Check the ATRC email	
Update the contacts database.	
Weekly Items	
Communicate with the EPICS officers	
Inspect the laboratory for cleanliness	
Update the Facebook page	
Write a progress report	
Monthly Items	
Meet with EPICS officers	
Update the ATRC Operations Progress document	
Update the website	
Start of the Term Items	
Clean the laboratory thoroughly (sweep the floor, wash tables, etc.)	
Conduct a part inventory	
Ensure there is a clear path to the eye wash station	
Store old projects	
Start of the Year Items	
Contact Jessica Colati to gain access to the Digital Commons database	
Contact Randy Robinson to gain access to the ATRC website	
Update all signage to reflect the new ATRC personnel	
Update the projects database on the Digital Commons	
Update the website to reflect the new ATRC personnel	
End of A Term Items	
Mail the newsletter	
Update the brochure	
Update the newsletter	
Update the projects database on the Digital Commons	
Write a term report	
End of B Term Items	
Create an outline for the final report	
Write a term report	
End of C Term Items	
Mail the newsletter	
Write a rough draft for the final report	
End of the Year Items	
Conduct a part inventory	
Update the brochure	
Update the newsletter	
Update the projects database on the Digital Commons	
Write a final report	

Appendix D- Laboratory Documents

Laboratory Index

Table 12- Lab Index

Laboratory Sections
Section 1- Back Drawers 
Section 2- Side Cabinets and Drawers 

Laboratory Sections

Section 3- Large Toolbox

Section 4- Tool Cabinet

Laboratory Sections
Section 5- Center Table 
Section 6- Side Table 

Laboratory Sections

Section 7- Wheelchair Rack

Section 8- Left Corner Cabinets and Drawers

Laboratory Sections

Section 9- Back Corner Cabinets and Drawers

Section 10- Right Corner Cabinets and Drawers

Item	Location(s)
12 V Power Tool Battery	4
16-Pin Connectors	8D
18 V Ryobi Cordless Drill	4
18 V Ryobi Cordless Drill Battery Charger	4
18 V Skill Cordless Drill	4
18 V Skill Cordless Drill Battery	4
18 V Skill Cordless Drill Battery Charger	4
4-Pin Connectors	8D
9-Pin Connectors	8D
9-Volt Snap Connectors	8C
Adhesives	2B, 2J, 2S, 8D, 10D
Alligator Clips	8D
Aluminum	2T
Angle Rods	2J
Banana Plugs	8D
Basketballs	2U
Batteries	2G, 2H, 4, 10E, 10I
Battery Chargers	4, 10E, 10I
Battery Holders	4, 8C
Battery Pack	4, 10E
Bike	7
Bike Parts	9G
Biomechanics	1A
Blades	2J, 3, 4
Blocks	1F
BNC Sensors	10G
Bolt Gauges	3
Bolts	2J, 8D, 8G, 8J, 8O
Bowling Ball	2U
Bowling Pins	2U
Brackets	8K, 8O
Brakes	9G
Bronze Tubes	2N
Brushes	2B
Bubble Wrap	1G
Bungee Cords	4
Burst Controls	8C
Cabling	8L, 10G
Cane Parts	10F
Capacitors	8C, 8D
Caster Wheels	10L
Catheter Transducer	1C
Caulking Gun	4
Cement	2A

Chains	8P
Children's Toys	1D, 1F
Clamps	8G, 8M, 9H
Cleaning Supplies	2Y, 2Z
Clippers	3
Computer	2I
Computer Cables	10G
Connectors	8C, 8D, 10H
Contact Paper	2S
Containers	9F
Copper Tubes	2N
Corded Table Saw	4
Cordless Drill	4
Cordless Table Saw	4
Cotton Stuffing	2S
Craft Paint	2A
Current Projects	5C
Data Acquisition	2D, 2G, 2H, 8D, 9K, 10B, 10D, 10K
DC Motors	9J
Desoldering Braid	10D
Diodes	8C, 8D
Donut Load Cell	9K
Door Parts	8L
Dowels	2N
Drill Bits	4, 8F
Drills	4
Duct Tape	2B, 2J
Ear Plugs	2K
ECE Kit	8C
Electrical Engineering Kit	8C
Electrical Equipment	8C, 8D, 10H
Empty Tubs	9I
Epoxies	2B
Equipment Case	9K
Eye Wash Station	5B
Fabric	2S
Face Shields	2K
Fasteners	8J, 10D
Faucets	8Q
Feet (Rubber)	10F
Files	3
Film	8I
Fishing Line	10D
Flaring Tool	3
Flashlight	4

Flux Paste	10D
Foam	2S, 6B
Foam Sheets	2S, 6B
Forceps	2J
Four-Pin Connectors	8D
Fourteen-Pin Connectors	8D
Fuji Film	8I
Fuses	8C
Gallon Bags	2B
Galvanized Tubes	2N
Gauges	3
Gear Box Set	10L
Gloves	2K
Glue	2B, 10D
Glue Gun	10D
Goggles	2K
Gorilla Glue	2B
Hammers	2J, 3
Hand Cleaner	2L
Hand Saws	4
Hangers	8L
Head Traction Set	10J
Heat Shrink Tubes	10D
Hex Key Set	3
Hex-Nut Multi-Tools	3
Hex-Nut Sets	3
High Impact Gun	4, 8F
Hinges	8L
Holders	8C
Hooks	8D, 8J, 8K, 8L, 8O
Hose Clamps	8G
Hot Glue Gun	10D
Hubs	10F
Hydraulics	8Q
IFC	8C
Instant Solder	10D
Interlocking Connector	8D
Jigsaw Blades	4
Kid's Toys	1D, 1F
Label Manager	10B
Lap Trays	2M
Leather	2S
Lock Washers	8J
Loose Wiring	9E
Magnetic Relays	8D

Magnifying Glass	10E
Makita Cordless Driver Drill	4
Markers	8B
Mass Balance	9K
Measuring Devices	2D, 2G, 2H, 3, 4, 9K, 10B, 10D, 10K
Measuring Tapes	3
Metal Balls	8K
Metal Clamps	8M, 9H
Motors	9J
Multimeters	10B, 10D
Nails	2J, 8J
Nine Volt Snap Connectors	8D
Nine-Pin Connectors	8D
Nuts	2J, 8D, 8G, 8J, 8O
Nylon Rope	2S
Nylon Threaded Rods	2N
Op-Amps	8C
Optics	9C
Packaging Materials	1G
Paint	2A
Paint Brushes	2B
Paint Thinner	2A
Panel Meter	10H
Pans	2X
Paper	2S
Paper Towels	2L
Past Projects	1E, 2C, 2F, 2O,6A, 7, 8N, 9A, 9B, 10A, 10C
Pencils	8B
Pens	8B
Phone Cord	9E
Phono Jacks	8D
Picture Hangers	8L
Pins	8C, 8D
Pipe Tape	2J
Planimeter	10G
Plaster	2A
Plaster of Paris	2A
Plastic	2U
Plastic Bags	2B
Pleather	2S
Pliers	2J, 3
Plumbing Fixtures	8M
Pneumatics	8R
Power Drills	4
Power Resistors	8C

Power Sander	4
Power Saws	4
Power Source	2G, 2H, 9K
Precision Resistors	8C
Pressure Indicating Films	8I
Pressure X-Ducers	8C
Project Tubs	9I
Prosthetics	1A, 2E
Protective Equipment	2K
Protoboard	10H
Pulleys	8O
Push Bar Set	10L
Putty	2A
PVC	2N, 2P, 11
PVC Primer	2A
Ram Board	9K
Recorder	2H
Rectifiers	8C
Reference Books	8A
Relays	8D
Resistor Arrays	8C
Resistors	8C, 8D
Ring Stand Clamps	9D, 9H
Ring Stand Holders	8M
Ring Stands	8M, 9D
Robotics	10L
Rods	2N, 2J
Rope	1B, 2S
Rubber Bands	8J
Rubber Feet	10F
Rubber Ring	8J
Rulers	2J
Ryobi Battery Charger	4
Sanders	4
Sandpaper	4
Saws	4
Scale	9K
Scissors	3
Scotch Tape	2B, 10D
Screw Gauges	3
Screwdrivers	2J, 3
Screws	2J, 8D, 8G, 8J, 8O
Sensors	10G
Sewing	2D
Sharp Edge	2J, 3

Sharpies	8B
Shower	5A
Shrink Tubing	10D
Silicon Thermal Joint Compound	8D
Silicons	2B, 8D
Skid Brakes	9G
Skill Battery	4
Skill Battery Charger	4
Snap Fasteners	10D
Soap	2L
Sockets	8D
Soldering Flux Paste	10D
Soldering Station	10E
Soldering Tips	8D
Solenoids	9J
Sound Plugs	9K
Sponge	2L
Sporting Equipment	2V
Spray Paint	2A
Springs	8K
Sprockets	8P
Stain Lifter	2L
Staple Gun	3
Staples	8J
Steel Plumbing Fixtures	8M
Steel Threaded Rods	2N
Stepper Motors	9J
Storage Containers	9F
Story Books	1G
Strain Gages	10K
String	1B
Super Glue	2B
Switches	8D
Tape	2B, 2J, 2S, 10D
Tape Measures	3
Teflon Spray Tube	2A
Tempura Paint	2A
Terminal Strips	8D
T-Handled Hex Key Set	3
Thermometers	2D
Therolink	8D
Threaded Rods	2N
Toolbox	2J, 3, 8F
Toys	1D, 1F
Transducers	1C, 8H

Transformers	9J
Transistors	8C
Trays	2M, 2X
Tubing	2N, 2W, 2X, 10D
Tubs	9I
Ultrasound Transducer	8H
Urethane	2A
Vacuum	4
Velcro Heat-Activated Adhesive	10D
Velcro Tape	2S, 10D
Vice Grips	3
Video TV Splitter	8D
Voltage Regulator	8C
Voltmeters	2G, 2H
Walkers	7
Wall Putty	2A
Wash Station	2L
Washers	2J, 8D, 8G, 8J, 8O
Weights	8E
Wheel Hubs	10F
Wheelchair Parts	7, 10F
Wheelchairs	7
Wheels	7B, 10L
Wire Connectors	10H
Wire Nails	8J
Wire Wrap Pins	8C
Wires (Electrical)	8C, 8D, 10H
Wiring	9E, 10D, 10H
Wood	1G, 2Q, 2R, 11
Wood Clamps	9H
Wood Glue	2B
Wood Putty	2A
Wood Screws	8G
Wooden Dowels	2N
Wrenches	2D, 2J, 3
Writing Utensils	8B
Yarn	1B
Zip Lock Bags	2B
Zip Ties	8D

Laboratory Rules

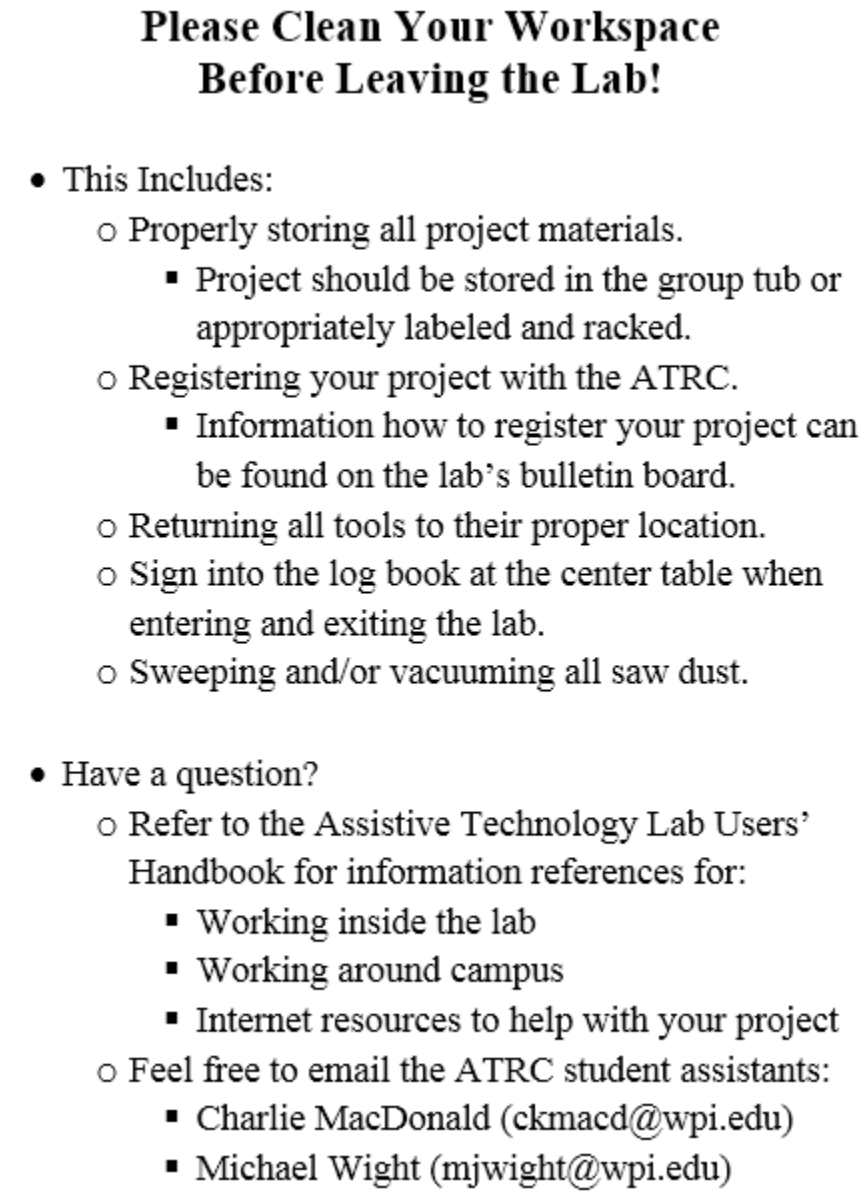

Figure 51- Laboratory Rules

Using the ATRC

For Classes using the Assistive Technology Resource Center (ATRC)

In order to ensure the smooth operation of the ATRC, there are a few policies that students must follow for the 2013-14 school year.

1) All students using the lab for course projects must sign and date the log book located on the center table. This will help the student assistants order supplies during peak times.

2) Register your course project if you plan on keeping it in the lab. This will ensure that the project will not be disposed of and will be safely stored. Further instructions for project registration can be found on the lab's bulletin board.

3) Fill out the equipment form if a particular item's stock has been depleted or if you have a suggestion for an item that would be useful for your project.

4) Refer to the laboratory index document on the bulletin board if you need assistance locating any materials or tools in the laboratory. It is a detailed document alphabetically listing all of the materials within the laboratory and their subsequent locations.

5) Clean up your workspace when you are finished in the lab. This includes properly storing your project, returning all unused tools and materials to their original location, sweeping any dust, and throwing out any garbage. All of the work stations around the laboratory and the bulletin board feature this reference document

If you have any further questions, please do not hesitate to contact the 2013-14 ATRC student assistants, Charles MacDonald (ckmacd@wpi.edu) and Michael Wight (mjwight@wpi.edu). You will receive a response within 24 hours and usually sooner.

Figure 52- Using the ATRC

Welcome to the ATRC

Welcome to the Assistive Technology Resource Center (ATRC)

Welcome to the Assistive Technology Resource Center. For the 2013-14 school year, Charles MacDonald and Michael Wight are the two ATRC student assistants. Both assistants will keep the lab organized and hope to help you on your projects whenever possible. Instructions about registering your project, clean-up procedures, and a myriad of other information can be found throughout the laboratory. If you have any questions, comments, or concerns, do not hesitate to contact the student assistants.

Best regards,

Charles MacDonald (ckmacd@wpi.edu)

Michael Wight (mjwight@wpi.edu)

Figure 53- Welcome to the ATRC

Appendix E- EPICS Newspaper Article

THE TOWERS

Home Current News Features Editorials Sports Entertainment Archive About

Pimp My Wheelchair

EPICS redesigns an electric wheelchair for use on a beach

Michael Wight
Sports Editor

Walking along the beach is one of the most relaxing summer activities out there, but what if you were unable to take part in this hobby? That is the harsh reality for many individuals who rely upon an electric wheelchair to move about. While electric wheelchairs can easily navigate homes, sidewalks, streets and stores, they struggle to operate on the uneven and sandy surface of a beach. However, WPI's Engineering Projects in Community Service (EPICS) club successfully engineered a solution that will allow electric wheelchairs to travel on a beach.

While commercial wheelchairs exist that can function on beaches, they are incredibly rare and very expensive. Therefore, EPICS focused on modifying a standard electric wheelchair with specialized wheels that could safely operate on sand. By the end of the school year, EPICS created a wheel design and over the summer, project manager Sarah Chamberlain '16 continued work on the project.

"The wheelchair project was for my sister," said Chamberlain. "It's just something I've always wanted to do and I figured it was an opportunity to collaborate with others...The project is 99% finished. I worked a lot on it over the summer. The only problem that I ran into was the brackets in the front. We didn't want to do the field testing on it yet until it was absolutely safe."

Along with adding the modified wheels, EPICS also added a recliner and updated the wheelchair's paneling while maintaining its electrical system. Ultimately, the wheelchair will be used by Chamberlain's sister, who is affected by cerebral palsy.

Wanting to build upon last year's momentum, EPICS has begun paneling its members for potential projects for the current school year. Before modifying the wheelchair last year, EPICS' past projects have included a sensory stimulation activity board, a soccer adaptation for a manual wheelchair and a wander monitor for individuals with Alzheimer's disease.

EPICS is a club featured at almost 20 universities across the country. Founded in 1995 at Purdue University, EPICS aims to educate undergraduate engineers in the design process while also helping individuals and non-profit organizations who may not have access or the resources available to hire a professional engineering team.

According to club president David Li, WPI's EPICS has "engineers from multiple majors come in and design projects for people who are handicapped in their daily life." Working with the Assistive Technology Resource Center (ATRC) in Higgins Laboratories, EPICS excels in making assistive devices for physically impaired individuals.

EPICS welcomes any student regardless of major and is always looking for new members who have a passion for design. The project teams rely on a myriad of skills including biomedical engineering, computer science, electrical engineering, mechanical engineering and robotics due to the complexity of the projects that they undertake.

"The problem recognition, the manufacturing and the production of the projects is quite similar to the IQP, except [EPICS] is a club," said Li. "One part that this is different from an IQP is that you get involved in a management system because you will have students working on different things. Sometimes you will need to look for the people you work with and be able to figure out how you can work with them to get the project going."

Last C-Term, WPI's EPICS was restarted after a brief hiatus. Dale Herzog '14 and Wut Yee Oo '14 were conducting their IQP in the ATRC. After discovering that WPI's EPICS program, which had been around since the mid-2000s, stopped due to a lack of interest, Herzog and Oo worked with their advisor and one of the overseers of the ATRC, Professor Allen Hoffman, to restart the program last C-Term.

Currently, EPICS is going through the process of becoming an official on-campus organization and their status will be voted on by the Student Activities Office. In the future, EPICS hopes to collaborate with other clubs and organizations both on- and off-campus to include a wider range of projects possibly outside of rehabilitation engineering to increase the club's appeal to a broader spectrum of majors.

Thanks to its dedicated and passionate members, EPICS will surely continue following the program's mission statement. Anyone interested in joining EPICS should attend their upcoming general body meeting. To receive information about this meeting and the club's activities, contact the club at atrc-epics@wpi.edu.

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Figure 54- EPICS Newspaper Article in The Towers (September 17, 2013)

Appendix F- ATRC Course Descriptions

ES 1020- Introduction to Engineering
This course is for first year students with an interest in engineering. The course focuses on the design process. Students are introduced to engineering through case studies and reverse engineering activities. Students will learn the steps in the design process and how engineers use this process to create new devices. Teams of students are then assigned a design project that culminates in building and evaluating a prototype in their design. Results of the design project are presented in both oral and written reports. This course does not require any prior engineering background.

ME 2300- Introduction to Engineering Design
Real world engineering design problems usually have more than one correct solution. This course utilizes a realistic design process to introduce students to the methods and techniques for solving engineering problems. Lectures will support the design projects and may cover engineering economics, fluid dynamics, heat transfer, mechanics, statistics, and basic circuits. No prior knowledge of fluids, heat transfer, economics, statistics or electrical circuits is required. Laboratory sessions will be used to build, test and demonstrate various designs. This course is designed for sophomores and juniors to provide a broad overview of engineering design. The course includes a significant writing component and makes extensive use of PCs for word processing, spread sheet calculations and programming.

ME 2300- Rehabilitation Engineering
The course exposes the students to the use of technology to design devices to ameliorate the handicaps of individuals with disabilities. This course focuses on the design process for assistive devices including defining the problem, setting design criteria, developing preliminary designs, selecting, analyzing and testing a final design. Human factors are integrated into all phases of the design process. Topics include: ergonomics, physical and cognitive parameters that affect the user interface, safety, economics, reliability and esthetics. Design and analysis of devices used for mobility and in daily activities in residential, educational and vocational settings. Laboratory sessions will be used to develop conceptual designs that solve real problems.

ME 4320- Advanced Engineering Design
This course integrates students' background in ME in a one-term design project that is usually taken from a local company. Students must organize themselves and the project to successfully realize a product that meets customer needs. Activities include problem definition, design analysis, mathematical modelling, CAD modelling, manufacturing, testing, liaison to vendors, customer relations, marketing, technical management, purchasing, report writing, and oral presentations.

All course descriptions are from the WPI Undergraduate Catalog (WPI, WPI Undergraduate Catalog 2013-14, 2013).