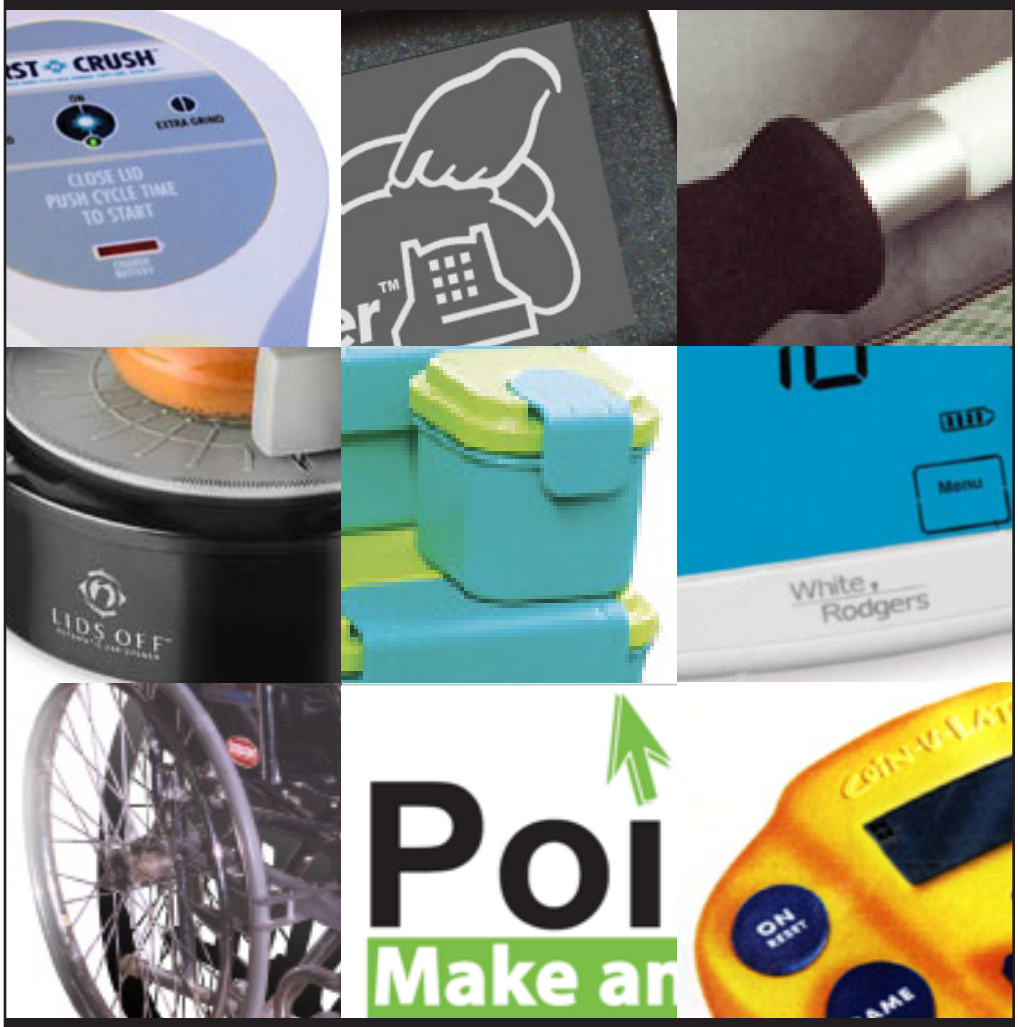
Need to Knowledge (NtK) Model



Case Examples

by

Center on Knowledge Translation
for Technology Transfer

100 Sylvan Parkway, Suite 400 • Amherst, NY 14228
Phone: (716) 204-8606 • Fax: (716) 204-8610
http://sphhp.buffalo.edu/cat/kt4tt

The contents of this publication were developed under a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR grant number 90DP0054-01-00). NIDILRR is a Center within the Administration for Community Living (ACL), Department of Health and Human Services (HHS). The contents of this publication do not necessarily represent the policy of NIDILRR, ACL, HHS, and you should not assume endorsement by the Federal Government.

NtK Model Case Examples

Stage 1  Pill Crusher	Stage 2  Caller Connect	Stage 3  Refrigerator Door Opener
Stage 4  Lids Off Jar Opener	Stage 5  Tupperware Children's Healthy Eating System	Stage 6  White Rodgers Thermostat
Stage 7  UpStop Wheelchair Braking System	Stage 8  Point Smart Software	Stage 9  Coin-U-Lator

The following case examples highlight the way NtK Model steps have been carried out to commercialize actual products. Each case offers information regarding the project background, how we operationalized the NtK steps, and the ultimate results. Where available, links have been included to sites where products can be purchased. Scroll through the cases to see how the Center on KT4TT (formerly the Technology Transfer Rehabilitation Engineering Research Center — T²RERC) has approached each of the NtK Model's steps.

Pill Crusher example

Stage 1: Define Problem and Solution

Step 1.1

Assess Needs: Through interactions with people with disabilities and medical personnel, the manual crushing of pill-based medications for easy ingestion was determined to be problematic.

Step 1.2

Problem Identification: Injuries and the loss of a significant portion of medications were resulting from the manual crushing of pill-based medications.

Audience/Target Market Identification & Context: The aging population would be the primary beneficiary of a solution to this problem. Individuals with dysphagia or difficulty swallowing, those with hand or arm weakness from arthritis, and those who suffer from Multiple Sclerosis, Carpal Tunnel Syndrome, Cerebral Palsy, Post Stroke, and other disabilities would also benefit. A secondary market was also identified, which included nursing homes and hospitals that were experiencing repetitive motion injuries among staff, due to the manual crushing of hundreds of medications per day.

Step 1.3

Plausible Solution: The proposed solution was to develop a countertop based, battery operated, and portable prototype of an automated pill crusher.

Step 1.4

Scope of Project: In-house capabilities were available for prototype design and development, but not for production. Therefore, the project was successfully completed with the development of a prototype invention that was then handed off to partners.

Step 1.5

Path to Market: The functional proof of concept prototype was to be developed in-house, and marketed for licensing to small appliance manufacturers.

Results

The First Crush pill crusher project progressed through the remainder of the NtK model and achieved commercialization. Stage 3 was omitted, as additional research was not needed to move this concept into the marketplace. Information from Stages 1 and 2, and the prototype developed in Stage 4, were used to solicit interest in the device from potential manufacturers. Discussions with the potential licensees, early and often during the development process helped to ensure that the prototype device met the licensee's needs and expectations. The licensee then took the work completed by the Center on KT4TT and moved the project through the remainder of the process to commercialization. The product is currently available for sale through the First Crush website.

Caller Connect example

Stage 2: Project Scoping

Background — Prior Stage

With the growing population of 'Aging in Place' seniors, telephone communication with family members and others is of the paramount importance. It was discovered that many elderly individuals were experiencing breaks in their telephone service due to accidentally leaving a telephone 'off the hook.'

Step 2.1

Innovation Opportunity: An opportunity was identified to develop a unique telephone accessory — the Line Butler. This accessory would need to be an external attachment to a telephone or to the telephone line that enables the telephone to receive incoming calls even when it is off the hook.

Step 2.2

Preliminary Market Assessment: The primary market was identified as the elderly or people with disabilities who are living alone and may accidentally knock or leave the telephone 'off the hook'. These people are in particular need of uninterrupted access to a telephone line in order to ensure their safety. In addition, individuals with children or pets would also find the Line Butler beneficial, as the children or pets may accidentally leave or knock the phone off the hook, causing an inconvenience to the parent/pet owner. These individuals are likely to buy this device for themselves, while the children of elderly parents are likely to buy it for their parents' use. A search of recently introduced and successful products in the telephone accessory marketplace revealed that existing devices did not provide the planned functionality of the proposed device. The competing product analysis also demonstrated that the target price for the Line Butler would have to be in line with telephone caller identification devices and priced under $30.

Preliminary Business Assessment: The device was intended to be sold for profit through the Assistive Technology marketplace. In addition to the extensive product search conducted for the market assessment, the team performed a prior art and patent search on the concept. Patentability was judged possible depending on the design of the mechanism used by the telephone company to alert a consumer that a telephone was "off the hook" — what is known as the howler tone. Feasibility was based on the envisioned device's ability to reconnect the telephone

circuit in response to the howler tone. These findings provided guidelines for the prototype's initial design specifications.

Preliminary Technical Assessment: To complete the technical assessment, initial design criterion were established. The team contacted Verizon to identify the frequency of the howler tone, which would serve as the activation cue for the Line Butler. The team found Verizon to be very receptive to providing technical information needed for the design of the product. As a result of these discussions, as well as an analysis of internal and external capabilities, the design was deemed technically feasible.

Step 2.3

Potential Barriers: At the onset of this project, the increasing use of cell phones was not a major concern. At the time, the elderly segment of the target market tended to resist the use of radically new technology such as cell phones. However, the advent of cell phones and VOIP (Voice over Internet Protocol) technologies acted as disruptive technologies in the mainstream segments of the target market.

Results

During the development phase of this project, the emergence of disruptive technologies (cell phones, VOIP) caused the mainstream marketplace for traditional landline telephones to shrink rapidly. The dwindling target market was people maintaining a landline. Further, the elderly demographic are hesitant to spend discretionary income on what could be considered a non-essential item. In light of these market changes, an extensive marketing campaign to the children of the elderly would have to be mounted to encourage them to purchase the item as a gift for their elderly parents. With a close eye on changing market conditions, the project was continued through Stage 7, where a small number of units were produced in an initial trial run. Upon reaching Gate 7, the team carefully evaluated the new market conditions and determined that large-scale production would no longer be feasible. Even with a successful targeted marketing campaign, the loss of the larger secondary market (parents with children or pets) created a situation where manufacturers would not be able to recoup the high-dollar investments needed to continue through the production phase. With potential revenues declining as cell phone usage increased, the project was terminated at Gate 7, and the initial run of manufactured units were sold through Dynamic Living, an assistive technology distributor.

Refrigerator Door Opener example

Stage 3: Research

Background — Prior Stages

Results from in-home assessments by occupational therapists showed that seniors and people with disabilities who were living alone had great difficulty with many recurrent daily living activities, including the opening of their refrigerator's doors. Early refrigerators had latch mechanism that opened by activating handles or levers. They were replaced with a magnetic gasket that sealed the door to the frame. However, the cooling process reduces internal air pressure which creates an internal vacuum. The longer the refrigerator sits unopened, the greater the internal vacuum, and the greater the force needed to open the door. Thus, refrigerators are most difficult to open early in the morning, when people have not reached full strength or attentiveness. The scope of this project was to quantify the force required to open the door of various makes and models of refrigerators; design a prototype after-market device to effortlessly open the door; and offer a low cost version of the product to assistive technology catalog companies to prove the existence of a market for the product. The proof of existence of a market for the device would ultimately lead to licensing the device to an appliance parts manufacturer, perhaps prompt a redesign of refrigerator doors, or at least build in a mechanism to minimize the internal vacuum.

Step 3.1

Identify Expertise Needs and Assemble Team: A team was assembled, and comprised of marketing experts, engineers/ fabricators, an occupational therapist, and student interns from marketing and engineering programs.

Step 3.2

Identify Specific Knowledge Gap/What is the Research Question: The primary research questions included the following: How much force is needed to open a refrigerator door? Does the amount of force needed vary by make/model, or time of day? Can a non intrusive device be developed to provide a person with a mechanical advantage — use less strength — to open the refrigerator door?

Step 3.3

Select Appropriate Research Design: Action research was selected as the most appropriate research design. Action research is a trial and error process of learning by doing. Identify a problem, and develop something to resolve the problem. See

how successful the problem resolution was, and if not satisfied with the results, try a variation or different resolution.

Step 3.4

Secure Funding: Funding from the National Institute on Disability and Rehabilitation Research (NIDRR) Rehabilitation Engineering Research Center (RERC) on Aging was secured to perform the research. Funding was also available from the same organization to apply the research results to develop a viable prototype device to address the problem.

Steps 3.5, 3.6, 3.7

Conduct Research/Collect and Analyze Data: Consumers with arthritis, or low strength, who were living alone had noted that they had a great deal of trouble opening their refrigerator doors, particularly in the morning. Engineering staff set to work to solve this problem by first taking pressure measurements of the magnetic seal for approximately 150 refrigerators.

Step 3.8

Compile Results: It was discovered that it took anywhere between 6 to 26 pounds of pressure to break the magnetic seal on the refrigerator door. It takes 20% more pressure to release the seal for the first time in the morning. Given the need to pull rather than push, this level of force was deemed excessive for persons who are elderly, disabled or very young.

Step 3.9

Conclusion: There was a need to design a device that reduced the pounds of pressure required to break the seal of the refrigerator door down to below 1 pound of force. Doing so would make the opening of a refrigerator door effortless for anyone regardless of his or her strength level.

Results

Upon reaching Stage 7, a small initial fabrication shop production run showcased there was a limited market for the device. However, during the Gate 7 review, the team determined that the tooling, marketing and distribution costs for a formal production run were prohibitive for a product with such a small market. Therefore, no manufacturing company would undertake licensing the product and bringing it to the marketplace. However, in follow-on work with a major appliance manufacturer interested in usability and accessibility features to appliances, we noted the problem and suggested an ease of opening option. Our prototype device was forwarded to the company product designers for examination and they are considering such a feature in their next generation of refrigerators.

Lids Off Jar Opener example

Stage 4: Begin Development Effort

Background — Prior Stages

Historically, one of the most troublesome tasks of preparing food has been the daunting task of opening vacuum-sealed jars. From pickles, to mayonnaise, to sauces of all kinds, a large variety of prepared foods and condiments in today's supermarkets are packaged in jars. People of all ages and ability levels have struggled with this task. Multiple devices have been conceived to assist with opening jars, yet all these devices still require the consumer to provide resistance and a great deal of force and effort to operate and open a jar. Initial scope of this project included performing a preliminary market assessment including conducting a consumer panel to verify the need for the device; a preliminary business assessment including searching for competing products and technologies; a initial technical assessment accomplished searching the internet and patent databases for a feasible, low cost fully automated device for opening jars with minimal or no consumer effort; and lastly planning to assist in its commercialization in the general consumer marketplace. Formal research (Stage 3) was not required as suitable inventions had already been developed.

Step 4.1

Seek Key Co-development Partners: Located a BF Goodrich Collegiate Inventor Competition winner on the topic of jar opener — found research was funded by and assigned to Black and Decker (B&D). Contacted B&D to inquire about their plans, if any, for the device. B&D reported that they were not satisfied with the current device design. B&D had a hesitant attitude towards acceptance of the product and believed that there was an undefined and "unclear" market for it. From a consumer standpoint and an overall market perspective, questions and concerns arose as to whether there was actually a genuine need for such a product, whom would they sell to, and would people really use it. We conducted a consumer focus group on the concept to verify the need for the device, and assist in defining the market and the price point for the device. With this information, we were able to provide a convincing argument to B&D to take on the project.

Step 4.2

Propose Draft Solution: By October 2000, B&D had agreed to take on the Automated Jar Opener project and had assigned company employees to begin working with us on the concept. At that time, B&D made an internal corporate decision to pursue their own prototype device concept instead of using prototypes submitted by others.

Step 4.3

Outline Preliminary Business Case: The primary market was for the general population who has difficulty opening jars, and the secondary market included the elderly and/or those individuals with a physical disability, and possibly children. Individuals with arthritis, cerebral palsy, multiple sclerosis, Parkinson's disease, orthopedic impairments, and carpal tunnel syndrome, as well as people who are only able to use one hand, would find this device useful, as it allows the jar opening process to be more automated. In addition to the general population of the United States, it is estimated in the 1992 Disability Statistics Report that 5,840,000 people in the United States need assistance in the instrumental activities of daily living. Using a conservative estimate of potential purchasers in a given year, 1% (58,400) of people who need assistance with activities of daily living and 1% (77,040) of the general population who annually purchase an electric can opener, at a price of $40 per jar opener potential annual sales would be $5,417,600.

Step 4.4

Implement IP Strategy in Collaboration with Technology Transfer Office or Patent Attorney: As we were only supplying device concept functions and features, all intellectual property rights would belong to B&D who was designing the device based on input we obtained from consumers.

Step 4.5

Assess Regulatory, and Reimbursement Requirements: We were approaching the device as a mainstream product for consumers rather than marketing the device as an 'assistive technology'; therefore there were no reimbursement issues to address. Regulatory issues, such as UL approval, were to be handled by B&D.

Step 4.6

Initiate Key Co-development Practices: A formal agreement was reached with B&D on the level of involvement of our staff in the project plan. We would be responsible for providing a commercialization package detailing potential market size and segments, primary market research in the form of alpha and beta focus groups and would assist in identifying market outlets.

Step 4.7

Assess Resource Needs and Availability: Determined that the project would require support from B&D engineering, product design, model making, and marketing staff.

Step 4.8

Develop Implementation Plan: Distribution would first be through an Internet product launch as a preliminary 'testing of the waters' on consumer purchase intent and price point. Even though our consumer testing had shown a consumer price point of $40, B&D elected to go with a retail price of $49.99 at its Internet product launch. Follow up distribution would be through mainstream retailers (Wal-Mart, Target and others) currently selling B&D products.

Step 4.9

Secure Resources for Development: Internal corporate resources from B&D were secured for implementation of this project.

Step 4.10

Allocate Adequate Resources: Internal corporate resources form B&D were secured for implementation of the majority of this project. In addition, T^2RERC resources including staff time and funding for consumer testing activities were assigned and made available to B&D throughout the product development process.

Step 4.11

Gather, Analyze and Prioritize Customer Needs: Three in depth alpha (concept generation) consumer focus groups were run on the jar opener topic, with B&D engineers and product designers remotely watching the groups in real time from their corporate headquarters. 29 key design functions and features were identified by consumers in the groups for incorporation into the final product.

A key fact found in the focus groups was that the target user market would not be the target purchaser market of the product. While the elderly clearly wanted and needed the device, they were not willing to spend any money on purchasing the device. However, they were very willing to receive it as a gift. The true sales target market for the product became the adult children of the elderly, and it was decided that it would be marketed as a gift item during the December holidays and at Mother's Day.

Step 4.12

Identify Device/Service Features and Specifications in Light of Production Capabilities and Component Costs: As B&D had an abundance of prefabricated can opener motors in dormant inventory, the initial product design would have to incorporate the use of these can opener motors. Unfortunately, due to the size and configuration of this motor it had to be placed in the top assembly portion of the jar opener unit. This forced the consumer to lift the motor each time the appliance was used. Once this inventory of can opener motors was exhausted, subsequent designs placed a smaller motor in the base of the unit negating this problem.

Step 4.13

Complete Business Case: B&D incorporated 27 of the 29 recommended features into their beta prototype, which they provided to us for further refinement. We ran two beta focus groups on their prototype and from foam models provided by B&D product designers, the beta focus group participants selected the final handle placement and configuration, and the size and placement of the device's activation button. Resulting design recommendations were paired with market information, price point and purchase intent data in the form of a final report presented to B&D. B&D then used this information to complete their business case and move into full production.

Results

The B&D Lids Off Jar Opener had its formal debut at a marketing/press event called Christmas in June in New York City in June 2003. The device was first sold exclusively through the internet at a retail price of $49.99. Initial internet sales were slow. After a month or so, B&D lowered their retail price to $39.99 (price point identified in our consumer focus groups) and sales of the new jar opener took off. Sales were so robust that B&D sold out of initial product run in November 2003 and had to withdraw its December holiday advertisements for the appliance, as it no longer had product to sell. When inventories were replenished in February 2004, sales continued at a very rapid pace. B&D sold over 1 million Lids off Jar Opener in the first year. Later subsequent production variations of the appliance included a professional model (stainless steel appearance), an all in one opener combining the jar opener with a can opener and bottle opener, and some slimmed down designs which had the motor in the base of the unit and enhanced features such as one touch activation anywhere on the top of the unit (elimination of activation button). The jar opener is no longer being produced. However, units can be purchased through various retailers on Amazon.

Tupperware Children's Healthy Eating System example

Stage 5: Build and Test Prototype

Background — Prior Stages

From our dealings with aging consumers, we found there was growing dissatisfaction and frustration when it came to food storage containers. As people were aging and acquiring functional limitations, they were having more and more difficulty with opening and closing plastic food storage containers.

In 2007 we partnered with Tupperware to design the next generation Ideal Food Storage Container. It was to be Transgenerationally designed (a design would span the ages from children to the elderly). We initially ran three alpha (concept generation) consumer focus groups in May 2007 on the topic. Focus group participants confirmed our initial findings of dissatisfaction with existing containers, and shared that they were not pleased with having to employ novel methods to open them. Many of the group participants stated that not only were the methods they employed not always reliable, but they also provided safety concerns, including possible spillage, damage to the container, and injury to the consumer. Participants in those focus groups went on to identify 24 key functions and features for the new product.

Step 5.1

Build Alpha Prototype Models: Tupperware was to produce molds for the prototype and then produce sample prototypes based on our primary market research findings.

Step 5.2

Monitor Development Process: We were in periodic contact with the Tupperware designers, but did not see any preliminary drawings. The designers were aware of the consumer driven design criteria that needed to be incorporated into the prototype.

Step 5.3

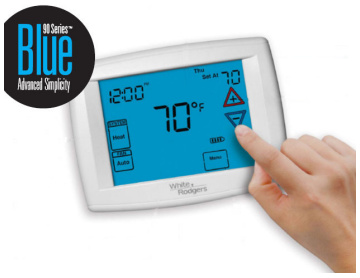
Test Alpha Prototype Models: Upon completion of the prototype, Tupperware sent in the prototype to our fabrication facility for bench testing. The prototype failed our tests, as it did not address key design element criteria. We presented our findings to the Tupperware product designers who redesigned the alpha prototype based on our feedback. Key features that needed to be included were: a latch mechanism for opening and closing the container that would not require the need for finger strength (arthritis sufferers); and the lid needed to possess a locking mechanism that would be activated by the push of a button or bar. In addition, the seal (lid) for closing the container needed to remain attached to the container via a hinge, and the mating of the seal (lid) and container needed to be accomplished by pressing a button or bar on the container.

Step 5.4

Refine Models: Based on our feedback, Tupperware redesigned the container and incorporated a large bar on the seal (lid) for easy opening and closing of the container. The large bar design could be opened and closed easily by using one's fingers, the palm, or the side of one's hand (for arthritis sufferers). The lid was also hinged to the container, yet removable for easy cleaning.

Results

Tupperware test marketed the design by introducing a variety of food storage containers in Australia and New Zealand targeted for children. The product is called Tupperware's Children's Healthy Eating System (CHES). Tupperware anticipates product introduction shortly in the United States and in addition also anticipates re-coloring the range and positioning it for the mature consumer in the near future.



White Rodgers Thermostat example

Stage 6: Beta Testing

Background — Prior Stages

In 1998, our preliminary research in working with Ron Mace's Accessible Thermostat (see Stage 8 example of Kelvin thermostat for more background information), revealed great need for a mainstream thermostat that possessed both increased usability and accessibility features. As the baby boomer population ages into or acquires functional limitations or disabilities the market for such a thermostat was rapidly expanding. In addition we knew there existed a sizable secondary market of early adopters of new electronic technology. In 2002 we contacted and entered into a product development collaboration with White Rodgers on developing a thermostat for this market segment. Late in 2002 we ran four alpha (concept definition) focus groups. Three included aging individuals, while one group was comprised solely of individuals identified as early adopters of technology. The purpose of these focus groups was to identify key device features and functions that needed to be incorporated into a thermostat for these market segments.

Step 6.1

Test Prototype in Lab: In 1998, our preliminary research in working with Ron Mace's Accessible Thermostat (see Stage 8 example of Kelvin thermostat for more background information), revealed great need for a mainstream thermostat that possessed both increased usability and accessibility features. As the baby boomer population ages into or acquires functional limitations or disabilities the market for such a thermostat was rapidly expanding. In addition we knew there existed a sizable secondary market of early adopters of new electronic technology. In 2002 we contacted and entered into a product development collaboration with White Rodgers on developing a thermostat for this market segment. Late in 2002 we ran four alpha (concept definition) focus groups. Three included aging individuals, while one group was comprised solely of individuals identified as early adopters of technology. The purpose of these focus groups was to identify key device features and functions that needed to be incorporated into a thermostat for these market segments.

Step 6.2

Refine Beta Prototype Models: The pre-production prototypes were returned to White Rodgers for refinement of the devices' design function and features based on the consumer evaluation of the two pre-production prototypes at the beta focus groups. The beta focus groups' findings were documented and provided in a detailed report to White Rodgers for incorporation of these recommended device modifications.

Step 6.3

Test Refined Beta Prototype with Consumers in Field: White Rodgers incorporated fifteen different design functions and features from our alpha and beta focus groups into the final product. White Rodgers field tested several units with contractors prior to initiating their production run.

Step 6.4

Refine Beta Prototype Models: No modifications or changes were recommended by the contractors.

Results

In 2006, White Rodgers introduced the 90 Series Blue thermostat, a programmable thermostat with easy to see characters on a 12 square inch touch screen display. The thermostat is easy to install, easy to adjust, possesses intuitive and precise controls and has a signature Blue backlight display that is activated by touching anywhere on the screen.

This successful launch resulted in thousands of unit sales. In addition in January 2011, White Rodgers announced a new addition to its Blue Thermostat line, Emerson Blue Easy Set thermostats. The new non programmable thermostats feature easy to use "Home", "Sleep" and "Away" pre-set buttons and are again targeted to address the key concerns of the growing baby boomer generation. Information about the Blue Thermostat line can be found on Emerson Climate Technologies' website.

UpStop Wheelchair Braking System example

Stage 7: Production Planning and Preparation

Background — Prior Stages

One of the most difficult tasks facing aging manual wheelchair users is the difficulty engaging or keeping engaged the wheel locks on their wheelchairs. Having a stable, non moving, wheelchair during the transfer process is of the utmost importance to all wheelchair users. The UpStop Wheelchair Braking System is designed to reduce the occurrence of falls among manual wheelchair users when they are transferring to and from their wheelchair.

The UpStop automatically engages a set of brakes separate from the wheelchair's standard wheel locks when the occupant begins to exit, thus preventing the wheelchair from rolling forwards or backwards. When entering the wheelchair, the occupant's weight is applied to a release arm located just under the wheelchair seat causing the braking system to disengage. This allows the wheelchair to move freely. When the occupant begins to exit the wheelchair, the weight is relieved from the release arm, causing the brake arm to engage. The brake arm provides a frictional force to the wheelchair tire that resists forward and backward motion. There is also a brake release mechanism, that when engaged by an attendant, disengages the braking system allowing an unoccupied wheelchair to be pushed by an attendant or caregiver.

Upon receiving a **patented** prototype from an inventor, our Initial scope of this project included performing a preliminary market assessment including conducting a consumer panel to verify the need for the device; a preliminary business assessment including searching for competing products and technologies; an initial technical assessment of the inventors prototype; and lastly planning on how to assist in its commercialization. Through Alpha or concept generation focus groups, consumers identified the functions and features of an ideal manual wheelchair braking system. These features were used to create the Beta prototype which was then tested by wheelchair users. Therefore a complete redesign of the inventors prototype was performed prior to introducing the prototype to potential licensing entities.

Step 7.1

Draft preliminary bill of materials (BOM): A bill of materials must be developed by the organization intending to manufacture a product in order to detail each part and subassembly and the costs associated with them. They will assign part numbers and put an inventory control system into place. As this product was to be licensed to an outside party, the RERC did not generate a fully exploded bill of materials. However, because we were shipping partial assemblies to potential licensing entities for their evaluation, our engineers drafted detailed parts and assembly instructions along with pictures and placement arrows for the various components.

Click here to view UpStop Wheelchair Braking System for Manual Wheelchairs Assembly & Installation Instructions

Step 7.2

Develop materials plan: We provided a materials/component list for the licensing entity. All company part numbers and assembly steps were to be added by the licensing entity.

Step 7.3

Estimate market needs and costs for production: Previously, in Steps 2.2 (scoping assessments), 4.3 (building business case), and 4.11 (alpha focus groups), we estimated the market size, developed a competing product matrix and defined the true market's needs by having consumers identify the functions and features needed for their 'ideal' automatic manual wheelchair braking system.

Steps 7.4 — 7.11

Develop production and capacity plan through Develop post-launch evaluation plan: Seeing how the UPStop Braking system fit into their production and capacity plans, these activities were the responsibility of the licensing entity.

Step 7.12

Initiate trial or limited production runs: For the UpStop Wheelchair Braking System, we fabricated a limited production run of 25 units for Sunrise Medical. The UpStop kits, as they were called, were shipped to Sunrise where they were given a Sunrise part number, and added into Sunrise's inventory control system. These 25 units were to be used as trial or test units for Sunrise's clients.

Step 7.13

Test market or trial sell: We determined the product should sell to individuals in manual wheelchairs, institutions, and retail establishments/amusement parks etc. where wheelchairs are provided as a courtesy. Sunrise Medical test marketed the

device, but opted not to license. Alimed, the eventual licensee, also test marketed the device at Medtrade, a large medical device show.

Results

As mentioned above, we produced 25 UpStop units for test marketing by Sunrise Medical. To our knowledge, Sunrise made no concerted effort to try and sell these units. In the interim, as there are three primary manual wheelchair manufacturers and distributors in the United States (Sunrise Medical, Invacare, and Drive Medical), we elected to have our fabrication shop develop UpStop kits for all three wheelchair brands.

After we had designed and fabricated UpStop kits that could be used in conjunction with the major manual wheelchair brands, Alimed, a medical device manufacturer and distributor, expressed interest in the concept. Alimed licensed the patent and device and attempted to have their engineering department combine all three UpStop kits (Sunrise Medical, Invacare and Drive Medical) into one universal kit that could be used on all manual wheelchairs. As part of our licensing agreement, the inventor received guaranteed annual minimum payments as well as any additional royalties accrued for each unit sold.

After 2 years, Alimed's engineering group determined that they were unable to design a suitable universal UpStop kit and terminated the license agreement. As shown by this case example, due to funding constraints, federally funded research and development entities cannot do everything on their own. Many steps in the production process must be undertaken by the licensing manufacturer. For purposes of licensing an invention, work completed in earlier product development stages can be leveraged downstream to justify market need, market size and desired functionality of the product.

Point Smart Software example

Stage 8: Launch Product Innovation

Background - Proir Stages

Edmund LoPresti was a student working for the Rehabilitation Engineering Research Center (RERC) on Wheeled Mobility when he came to the RERC on Technology Transfer (T^2RERC) for assistance in commercializing his software invention. The software was designed based upon consumer needs to enable individuals who had difficulty controlling a mouse to more easily navigate their computer's functionality. It offered hand stabilization, button gravity, and cursor wrapping features, among other options.

Having completed work on the first three stages of activity, Mr. LoPresti was ready to move into Stage 4 activities such that his invention could be propelled to the innovation state where production could occur. Discussions with the Technology Transfer Office at the University at Pittsburgh, where the RERC on wheeled mobility was based resulted in an agreement for the T^2RERC to act as a transfer agent for Mr. LoPresti's invention (Tip 4.2). The T^2RERC identified a manufacturer (Step 4.6), Infogrip, who saw promise in the software and agreed to further development and commercialization. An outside software developer was hired (Step 4.6) to redesign the program's interface, with the T^2RERC and Infogrip splitting the costs (Step 4.10). The redesigned product was tested (Stage 5, 6), while Infogrip prepared for production activities (Stage 7).

Step 8.1

Initiate Production and Launch Device/Service: Following the redesign, a few relatively minor functional flaws were discovered in the final product. However, Infogrip elected to introduce the product at that time (2005) to satisfy customer demand. In doing so they would also gain additional feedback that could be integrated into a second generation product.

Step 8.2

Monitor Performance: Infogrip tracked consumer queries, complaints, and comments related to Point Smart. Additionally, the T^2RERC conducted an efficacy study on Pointsmart to gather consumer feedback. User trials were held onsite with Pointsmart and a competing product- Microsoft's standard accessibility features. Consumers were also asked to take Pointsmart home for a longer term (4 month) evaluation.

Step 8.3

Provide Device/Service Support: Infogrip regularly responded to consumer inquiries for assistance from study participants as well as general consumers. Service and support inquiries were tracked to ensure that bugs would be worked out prior to development of the second generation product.

Step 8.4

Troubleshoot and Correct Problems: The second generation product was released in 2008 with many technical improvements.

Results

Pointsmart was successfully sold through multiple vendors for many years. However, as technology has evolved, the product has been discontinued. Product information is still available on EnableMart's website.

Coin-U-Lator example

Stage 9: Post-Launch Review

Background — Prior Stages

An inventor and special education teacher found that his students needed an easy method of counting coins in everyday living situations and he addressed the problem by designing the Coin-u-lator. Instead of standard numbers, as on a regular calculator, the Coin-u-lator uses buttons that resemble pennies, nickels, dimes, quarters and dollar bills. The device also has an "oops" button which would subtract out the last entry if an error was made. Each push of a "monetary" button is automatically added to the total. In performing addition, fewer steps are required with the Coin-u-lator than with a regular calculator. The Coin-u-lator is primarily for individuals with special learning needs or cognitive challenges to assist them with counting change. The Coin-u-lator also has two learning games that teach money values as players match random money amounts that have been programmed into the Coin-u-lator. Working with an engineer, the inventor built a prototype to show manufacturers.

The inventor applied for and received a patent for his invention. However, after researching manufacturing costs for the calculator, he found the costs to be too high to pursue this option on his own. After two years of 'shopping' the invention directly to manufacturers with no success, the inventor learned of the T^{2}RERC project from a colleague and decided to submit his invention to the T^{2}RERC for evaluation and assistance in licensing to a manufacturer.

Upon receipt of the inventor's submission, the T^{2}RERC, as the inventor had already defined a problem and solution, began its involvement at Stage 2 of the NtK model, Scoping, and performed a competitive product and patent search via the internet to ascertain uniqueness of the invention. From there the T^{2}RERC involvement focused on due diligence in the invention phase verifying, analyzing, and prioritizing customer needs and performing a detailed technical assessment of the prototype. In our research/fact finding efforts the T^{2}RERC also identified a significant secondary market for the invention which we felt would greatly assist in enticing a company to license the invention. The T^{2}RERC then authored a Commercialization Package compiling all the intellectual property, marketing, technical, and consumer information on the invention that had been generated by the T^{2}RERC and the inventor. This Commercialization Package was then 'shopped' to educational product companies and PCI Educational Publishing licensed the invention.

Upon licensing the Coin-u-lator, PCI finalized the business case started by the T²RERC, generated a development plan, tested the Coin-u-lator with real users and sent several samples to schools for additional longer term testing, ascertained how the Coin-u-lator fit into their production and capacity plans, and completed Stage 7: Production Planning and Preparation and launched the product. From a promotion strategy standpoint, PCI first contacted several Internet E-commerce web sites, such as Yahoo Shopping and Precision Web for selling of the Coin-u-lator. Through the Internet, the Coin-u-lator was first introduced as an educational toy for children. PCI then added the Coin-u-lator to its catalogs which are widely distributed to educators nationwide and sales took off.

Step 9.1

Continue production, monitoring, and support: The Coin-u-lator is a very successful product selling over 100,000 units in the first few years. Now over a decade later it is still being sold by PCI to educators and consumers nationwide.

Step 9.2

Troubleshoot and correct problems: This is the ongoing responsibility of the licensing entity, PCI, who is manufacturing the product in China for distribution in the United States.

Step 9.3

Review performance against expectations: The ongoing sales success of the Coin-u-lator has spawned ancillary products such as Coin-u-lator worksheets, Coin-u-lator activity cards and other electronic and non electronic money counting devices being sold by PRO-ED Inc, a company who acquired PCI Education in 2012. The Coin-u-lator can be purchased through numerous retailers, including PRO-ED Inc, Amazon, and EnableMart.