



Rehabilitative  
Medicine



# The Accelovate Design Challenge: Innovative Postural Support Solutions for Wheelchair Users in Low-Resource Settings



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# Acknowledgments

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## Accelovate—a Partnership in Accelerated Global Health Innovation

Accelovate is a global program dedicated to increasing the availability and use of lifesaving innovations for low-resource settings. Led by Jhpiego, the Accelovate program began in 2011 as a five-year, United States Agency for International Development (USAID)-funded program under the Technologies for Health (T4H) grant.

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Pre-eclampsia  
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Male  
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**Design Challenges** promote the development of innovative solutions where appropriate technology is lacking

**Solution Landscapes** assess what solutions exist

**Value Propositions** assess the benefits and drawbacks of an array of solutions for our context

**Business Cases** assess manufacturability and commercial potential

**Market Readiness Assessments** evaluate a selected technology/solution for market-level readiness factors

**Briefs** describe technology access and utilization challenges in a topical area and outline Accelovate's approach

**Excel Tools** present raw data that implementers may develop for programming and advocacy purposes

**Literature Reviews** review secondary data, usually to understand a bottleneck

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Jhpiego is an international, nonprofit health organization affiliated with Johns Hopkins University. For more than 40 years, Jhpiego has empowered frontline health workers by designing and implementing effective, low-cost, hands-on solutions to strengthen the delivery of health care services for women and their families. By putting evidence-based health innovations into everyday practice, Jhpiego works to break down barriers to high-quality health care for the world's most vulnerable populations.

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# List of Abbreviations

<b>CLASP</b>	Consolidating Logistics for Assistive Technology Supply and Provision
<b>DDO</b>	Diversability Development Organization
<b>ISWP</b>	International Society of Wheelchair Professionals
<b>LMG</b>	Leadership, Management, and Governance project of Management Sciences for Health
<b>MSH</b>	Management Sciences for Health
<b>NICRA</b>	Negotiated indirect cost rate agreement
<b>PSD</b>	Postural support device
<b>RFA</b>	Request for applications
<b>TRC</b>	Technical review committee
<b>UK</b>	United Kingdom
<b>USAID</b>	United States Agency for International Development
<b>WHO</b>	World Health Organization

# Executive Summary

In October 2015, Accelovate—a partnership between Jhpiego and the United States Agency for International Development (USAID)—concluded its first Design Challenge to address the lack of appropriate postural support devices (PSDs) for wheelchair users in low-resource settings. The Design Challenge consisted of three phases that saw sub-awardees progress from concept to initial prototype to final prototype.

Studies suggest that more than half of wheelchair users—most of them children—require postural support to sit upright. PSDs prevent spinal deviations and pressure sores, increase function, and lessen the risk of malnutrition, aspiration, and death. In low-resource settings, appropriate PSDs are complex, prohibitively expensive, or unavailable. There is a need for PSDs that are rugged, modular, and functional on a variety of wheelchairs. Such PSDs would increase access for and significantly improve the health and functioning of wheelchair users.

Phase 1 of the Design Challenge saw 12 concepts submitted, representing six countries and four continents. Accelovate's technical review committee (TRC)—made up of product designers, engineers, public health professionals, business experts, and clinicians with expertise in wheelchair service provision—awarded six of these innovations with grants up to \$5,000 to develop initial prototypes.

During Phase 2 of the Design Challenge, the six innovators brought their early prototypes to Design Challenge Showcase in Baltimore and Washington, D.C., to compete for three awards of up to \$120,000 to develop final prototypes. Awarded prototypes included a complete modular postural support system using simple materials, a set of adjustable side supports with quick-release bracket clamps, and a boxed kit to offer startup capacity and inventory tracking for wheelchair seating workshops.

As the final sub-awardees developed their final prototypes during Phase 3, they received additional support through structured mentorship, targeted webinars, and collaborative interaction with other sub-awardees and the TRC. Testing and user feedback

activities in numerous locations were utilized to develop final prototypes that more appropriately meet the needs of different stakeholders.

Armed with their final prototypes from the Design Challenge and a plan for success that incorporates input from the many different individuals who were part of the Design Challenge, sub-awardees are prepared to move on to the next steps necessary to commercialize their products. These steps vary for each product, but include activities such as clinical trials, additional safety testing, and finalization of manufacturing processes. It is Accelovate's hope that the sub-awardees' participation in the Design Challenge, along with the connections facilitated throughout, have prepared them for successful implementation and scale-up of their products.



# Background

Using funding provided by the United States Agency for International Development (USAID) Empowerment and Inclusion Program, which is within the agency's Center of Excellence on Democracy, Human Rights and Governance, Accelovate undertook research and design efforts to improve the wellbeing of populations affected by mobility challenges, particularly with regard to the use of wheelchairs.

The World Health Organization's (WHO) 2008 Guidelines For Provision of Manual Wheelchairs in Less-Resourced Settings (Wheelchair Guidelines) provide a definition of an "appropriate wheelchair for less-resourced settings" and distinguish between the needs of three classifications of wheelchair users: basic-level, intermediate-level, and advanced-level. The Wheelchair Guidelines estimate that 65% of all wheelchair users require intermediate-level services and products.

Intermediate-level wheelchair users often require different wheelchair seating products that provide improved body support and injury prevention. These seating products are generally described as postural support devices (PSD) and include:

- Solid padded seats and back supports
- Various pelvic control devices (straps, lateral supports, etc.)
- Head supports
- Tray tables for added arm support and activities

Through appropriate use of PSDs, wheelchair users can benefit in a number of important ways, including:

- Reduced risk of aspiration, the leading mortality factor for people with developmental disabilities
- Avoided or forestalled development of secondary disabilities and postural deformities
- Improved functional movement of the extremities
- Achieved developmental milestones
- Improved respiration, circulation, and digestion
- Improved ability to communicate (verbally or nonverbally)
- Reduced burden to family and caregivers, which often affects family income

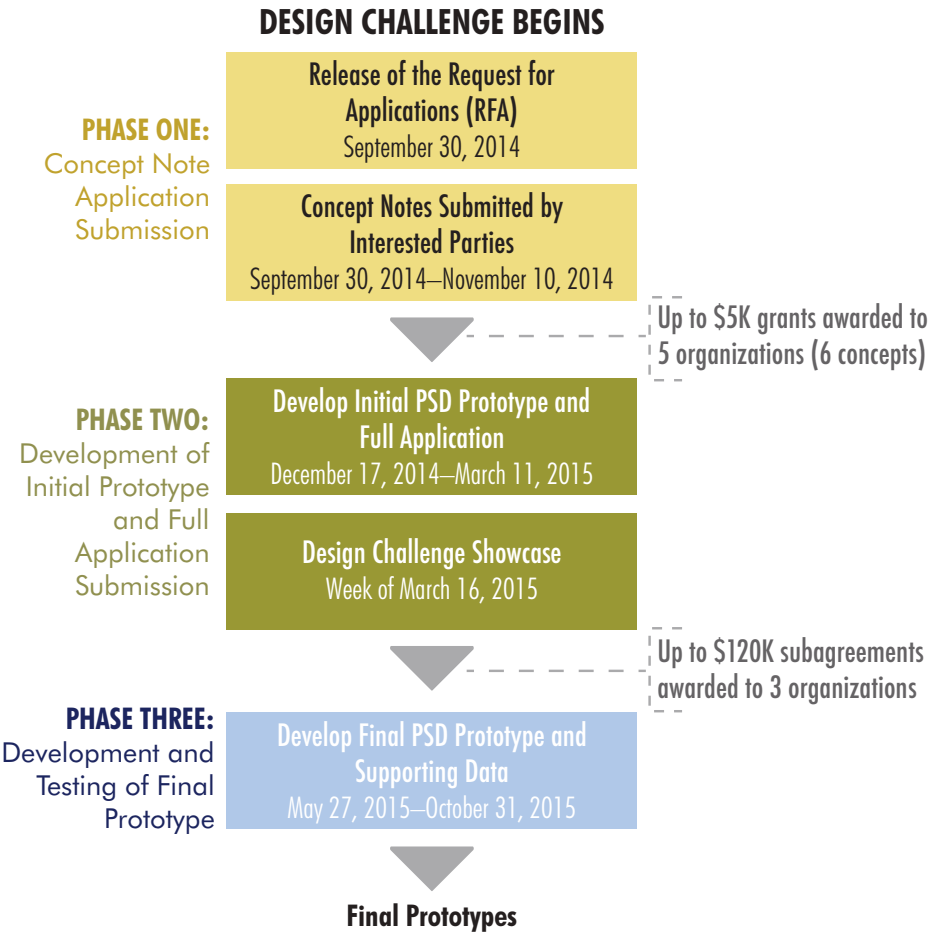
Despite this clear need, there are few appropriate PSDs available in low-resource settings. Part of this issue lies with the current design of PSDs, which is not standardized and can vary widely from chair to chair. Existing seating solutions are manufacturer- or wheelchair-specific and may be as expensive as the wheelchair itself. In addition, these support systems are not modular and cannot be effectively interchanged with other wheelchairs, which increases the cost even further. As a result, current wheelchairs are often either abandoned or underutilized. A well-designed system of PSDs that is appropriate for low-resource settings and functional on a variety of manual wheelchairs would increase access to and uptake of these devices.

Despite a clear need, there are few appropriate PSDs available in low-resource settings.

# Design Challenge Process

Through the issuance of a request for applications (RFA), Jhpiego implemented a three-phase Design Challenge to develop final prototypes of wheelchair PSDs that have the potential to be commercialized and brought to scale in lower- and middle-income countries. A visual summary of the three phases of the Design Challenge process is below (Figure 1).

Figure 1. Design challenge’s three-phase implementation



Applicants based in low-resource settings where the PSDs will be used were particularly encouraged to submit applications. US and non-US universities, nongovernmental organizations, faith-based organizations, and for-profit businesses were also eligible to apply for these awards. Preference was given to applicants engaged in developing innovative solutions for low-resource settings, especially solutions for mobility support.

Further, applicants were charged to adhere to Accelovate's principles including: 1) extreme affordability such that technology is widely accessible and scalable; 2) simplicity such that technology can be deployed closest to communities and people in need; 3) robustness to withstand use outside of hospitals and health facilities and in diverse and adverse conditions; 4) suitability for rapid development using reengineering principles, or suitability for repurposing at peripheral levels of health care systems; and 5) demonstrable application of frugal engineering concepts.

Applicants were charged to adhere to Accelovate's principles including extreme affordability, simplicity, robustness, suitability for rapid development using reengineering principles, and application of frugal engineering concepts.

# Technical Review Committee

An important element of the Design Challenge was identifying a technical review committee (TRC) with a broad range of expertise who could evaluate submissions, provide input into the Design Challenge process, and provide mentorship and guidance to sub-awardees. A six-member TRC was assembled for each phase to reflect expertise in: technical and clinical aspects of wheelchair design and fitting; product design for low-resource settings; engineering; project management in the innovation space; business; and donor priorities in the wheelchair space. These varied perspectives were important because they prompted innovators to consider all elements of product development and introduction. They were able to provide support in areas where innovators may lack expertise, such as business development and clinical practice. The TRC members for each phase were as follows:

- Kristy Peterson (Phase 1): Product Development Manager with Jhpiego who has over fifteen years of experience innovating within the medical device industry
- Cyndi Hiner (Phase 1): Senior Program Officer with Jhpiego with a range of experience in technical program development, monitoring and evaluation, and program and operations management
- Sue Eitel (Phases 1–3): Senior Rehabilitation Adviser with USAID
- Jamie Noon (Phases 1–3): Independent rehabilitation designer and trainer
- Matt McCambridge (Phases 1–3): Independent wheelchair product development specialist
- Elsje Scheffler (Phases 1–3): South African Physiotherapist and independent wheelchair seating/disability consultant

Youseph Yazdi (Phases 2–3): Executive Director of the Center for Bioengineering and Design at The Johns Hopkins University who has spent nearly twenty years innovating in the medical device industry at the research/development and executive levels

Chad Schneider (Phases 2–3): President of Root3 Labs with a broad array of engineering experience on many types of products in the medical device, commercial, and industrial industries

Identifying a technical review committee with varied perspectives was important to prompt innovators to consider all elements of product development and introduction.

# Phase One: Concept Note

Jhpiego issued an RFA on September 30, 2014, and the concept notes were due on November 10, 2014. Significant efforts were made to disseminate the RFA to ensure that innovators around the world had the opportunity to participate. Email blasts, social media posts, and posters at multiple conferences reached an audience of over 100,000 potential innovators.

Submitted applications were required to include:

- Concept note technical package
- Resumé of technical/program director
- Budget, in US dollars, and budget narrative
- Negotiated indirect cost rate agreement (NICRA) (and/or other documents, as applicable)
- Signed certifications and assurances

The Design Challenge's website was viewed by visitors from 32 countries while the RFA was open. Ultimately, 12 concepts were submitted, representing six countries and four continents. All applications were reviewed for eligibility and 11 of the 12 submissions were determined to be eligible. The eligible applications were reviewed by the TRC and evaluated according to the following:

- Context (30%)—Understanding of the problem; identification of competitive landscape; and targeted to users in low-resource settings
- Technical viability (60%)—Proposed solution fully meets the needs of intermediate-level wheelchair users in low-resource settings; design provides clear differentiation from existing solutions; identification of potential technical risks and mitigation strategies; and intellectual property landscape
- Expertise of applicant/personnel (10%)—General organizational capability; mobility sector experience; experience in innovative design solutions for low- and middle-income country markets/environments

The Design Challenge's website was viewed by visitors from 32 countries while the RFA was open. Ultimately, 12 concepts were submitted, representing six countries and four continents.

Six concepts were awarded up to \$5,000 to develop initial prototypes:

#### Shonaquip Concept 1

The concept proposed a modification to standard wheelchairs that would allow the angle of the backrest to be easily changed to help balance the trunk of users who cannot sit upright.

#### Shonaquip Concept 2

The concept consisted of a full seating system with a variety of modular components that could be adapted to a wide variety of users with a simple attachment mechanism that works with all components.

#### Motivation United Kingdom (UK)

The concept proposed a modular “kit in a box” intended to support clinicians by providing a range of modular components that can be applied to unique postural needs.

#### Diversability Development Organization (DDO)

The concept proposed a modular seating unit that would fit a variety of chairs and allow for PSD attachment in many configurations, which allows providers to customize the fit to different users.

#### Motivation Australia

The concept proposed a headrest that was intended to accommodate a number of mounting systems and allow for streamlined manufacturing at varying scales.

#### Hope Initiative

The concept identified a means to quickly manufacture a customized, contoured surface to support varying postural support needs—in particular, cushions.

# Phase Two: Initial Prototypes

During Phase two of the Design Challenge, sub-awardees from Phase one developed initial prototypes. To compete for follow-on awards to further develop and test their prototypes, the sub-awardees submitted full technical applications and presented their initial prototypes at the Design Challenge Showcase in Baltimore and Washington, D.C.

The Design Challenge Showcase was held from March 16–18, 2015. Sub-awardees were given 20 minutes to present/demonstrate their prototypes to the TRC, followed by a 40-minute question and answer session. Additionally, the sub-awardees participated in an open forum, which also occurred in Baltimore and Washington, D.C., to pitch their prototypes to other competitors and interested stakeholders. This forum created a unique opportunity for collaboration and sharing of ideas, struggles, and successes among competitors.

The TRC evaluated the initial prototypes and full technical applications as follows:

- Full technical application (30%)—Understanding of the problem; product value; final prototype development plan; commercial viability; personnel; and experience
- Quality of initial prototype (30%)—Demonstrates critical functionality; prototype is full scale; demonstrates universality; demonstrates adjustability; and demonstrates modularity
- Presentation (40%)—Prototype description; value proposition; development history; prototype demonstration; and question and answer session

Additionally, upon completion of these evaluations, the TRC members individually ranked the competitors in order based on their confidence in moving the product forward. Using the evaluation scores and rankings, the following prototypes were awarded follow-on funding for testing and refinement:

## Shonaquip Concept 1—Modular Postural Support System

The TRC elected to fund development of an adjustable trunk support with a quick-release attachment mechanism. The prototype meets the need for a width-adjustable side support

The Design Challenge Showcase created a unique opportunity for collaboration and sharing of ideas, struggles, and successes among competitors.



that is simple, inexpensive, and can be fitted to a wide variety of wheelchairs.

#### Motivation UK—Kit in a Box

The kit contains all materials and components necessary to build the full range of PSDs recommended by WHO. Additionally, an associated inventory tracking system is being developed to improve the efficiency of re-ordering components. The items in the box are intended to provide rapid startup capabilities to intermediate service practitioners and designed to be easily replicated locally.

#### DDO—Wheelchair Seating Unit

The seating unit is designed to accommodate any wheelchair and is equipped with adjustable clamps/connectors that enable fitting to a wide variety of users. The design of the base of the unit allows for modularity via mixing and matching of components chosen by the service provider.

### Showcase Feedback

Upon completion of the Design Challenge Showcase, surveys were developed and administered to competitors and the TRC to solicit feedback on the format/structure of the event. In general, all responders had been provided with the necessary information to be adequately prepared for the showcase and appreciated the built-in time for competitors to interact with each other during their open forum pitches. All competitors indicated significant benefits from presenting their innovations to the other competitors and responding to other presentations. Finally, the competitors indicated the value in being able to interact with the diverse range of experts on the TRC. However, there are areas for improvement. The key areas are stated below:

#### Collaboration and idea sharing

Responses were nearly unanimous in requesting additional time for collaboration and idea sharing. Several competitors and TRC members suggested an extra working day for brainstorming/idea generation among competitors and the TRC, or even completing a hackathon related to a separate problem.

Responses were nearly unanimous in requesting additional time for collaboration and idea sharing.

### Second open forum pitch

Several competitors did not see the value in the open forum pitch being presented twice. There was a significant reduction in discussion during the second forum.

### Location of future showcase

Feedback indicated potential value in hosting future showcases in environments where the products will actually be used, and including additional stakeholder perspectives (e.g., device user, manufacturer).

# Phase Three: Final Prototypes

The intent of Phase three of the Design Challenge was to support sub-awardees as they tested and finalized their initial prototypes, while preparing for commercialization and market entry. During Phase three, sub-awardees were asked to focus on three key areas:

1. Technical improvement  
Define and test key performance parameters to demonstrate that prototype functionality meets product-specific requirements. Use testing data to develop a more complete prototype and demonstrate technical viability.
2. User feedback trials  
Complete user feedback activities with wheelchair users and service providers, at a minimum. Use this feedback to improve the prototype to ensure it meets defined stakeholder needs. Sub-awardees were encouraged to engage their users early and often while creating final prototypes to develop a safer, easier to use product.
3. Implementation strategy  
Focus on initial target market and entry strategy, potential manufacturing partners, final pricing model, sustainability strategy, additional target markets for scale-up, potential distributors (commercial and non-profit), existing programs where the product may be implemented, and training strategy.

Throughout Phase 3, Accelovate provided support to the sub-awardees via focused webinars, mentorship from TRC members, and virtual collaboration sessions.

## Webinars

At the beginning of the phase, Accelovate provided a questionnaire (Appendix 1) to the three final sub-awardees to aid in defining webinar topics that would help promote their success. Using these questionnaires and input from the TRC, Accelovate hosted two separate webinars.

The first webinar was conducted on August 6, 2015, by Accelovate's Director, Deepti Tanuku, and focused on: 1) assessing a customer's willingness to pay, 2) how to undertake effective customer and market research, and 3) demand forecasting for modular products. Feedback from the sub-awardees indicated the webinar topics were

The intent of Phase three of the Design Challenge was to support sub-awardees as they tested and finalized their initial prototypes, while preparing for commercialization and market entry.

very useful in helping to create surveys to assess various aspects of a proposed business model and performing market research to identify new target markets.

The second webinar was conducted on September 21, 2015. The first portion of the webinar featured a presentation by Michael Allen and Keoke King, representing the Consolidating Logistics for Assistive Technology Supply and Provision (CLASP) project, which is a USAID initiative to create a centralized distribution hub for wheelchair products. CLASP presents a potentially valuable distribution channel for the sub-awardees once their products have been commercialized.

Sub-awardees had the opportunity to participate in a detailed question and answer session with the CLASP team regarding logistics of the program. Upon completion of the webinar, all sub-awardees reported that this was a highly valuable presentation. The second element of the webinar was an open forum regarding manufacturing challenges, facilitated by TRC members Jamie Noon and Matt McCambridge. Sub-awardees were given an opportunity to present manufacturing challenges they foresee and solicit input from their colleagues and the TRC members. For example, one team expressed a challenge in manufacturing their own fasteners for their product. They received input from the group that this would likely be an expensive solution and were directed by another competitor to fasteners they have successfully used in the past.

## Mentorship

Accelovate offered to provide mentorship to sub-awardees in areas where they needed support. A Mentorship Request Form (Appendix 2) was created at the beginning of Phase 3 to allow sub-awardees to request mentorship in areas such as technical/engineering, clinical, and business. All three sub-awardees requested and received mentoring for various aspects of their projects. Requests ranged from clinical input on user feedback activities, to business input on financial sustainability, to technical input for developing a testing fixture in support of safety testing. In total, approximately 40 hours of mentoring were provided by

Sub-awardees were invited to request mentorship in areas such as technical/engineering, clinical, and business. All three sub-awardees requested and received mentoring for various aspects of their projects.

members of the TRC. All sub-awardees stated that mentorship activities met their expectations. An example of specific feedback regarding these activities is below:

“We were extremely happy with the clinical mentorship we received. The mentors worked with our team to develop realistic solutions for questions and concerns we had. Their suggestions for improvement were confirmed by the findings following user feedback activities. The clinical mentors clearly understood the setup of our organization and the context in which we work and offered realistic solutions to match both the above. All in all excellent support received and we are very thankful for that.”

### Virtual Collaboration Sessions

Phase 3 included three virtual collaboration sessions held on July 8, 2015, August 17, 2015, and October 29, 2015. The intent of the sessions was for sub-awardees to provide an update on their progress, but also to solicit input from other sub-awardees and TRC members regarding challenges/barriers they were facing. During the first two sessions, sub-awardees were asked to present the following, with a focus on 2–4:

1. Progress compared to submitted work plans
2. Challenges/barriers and risks to project
3. Requests for input
4. Product introduction strategy
5. Path forward over the next 30–45 days

These sessions provided an opportunity for sub-awardees to seek guidance from an objective audience on challenges and their strategies moving forward, and several useful outputs emerged from these sessions. As an example, offline discussions occurred among sub-awardees who offered to share resources they were aware of for performing product safety testing.

The third virtual collaboration session, while also intended to facilitate discussion, requested slightly different content from the sub-awardees because it was their closing presentation. Sub-awardees were asked to present the following:

1. Current stage of development
2. Next steps required to commercialize their product
3. Product introduction plan
4. Risk management plan
5. Drawings/pictures of final prototype

In addition to the sub-awardees and TRC, the final session was attended by the USAID Global Development Lab; the Management Sciences for Health (MSH) Leadership, Management, and Governance project (LMG); the International Society of Wheelchair Professionals (ISWP); the Nova Scotia Health Authority; Google; and CLASP. One notable output from the final session, which is a reflection of the collaborative focus of the Accelovate Design Challenge, is that Motivation UK and DDO are discussing the potential of combining elements of their products. In particular, Motivation UK plans to include DDO's headrest as a component in their kit. This may lead to inclusion of other components as well.

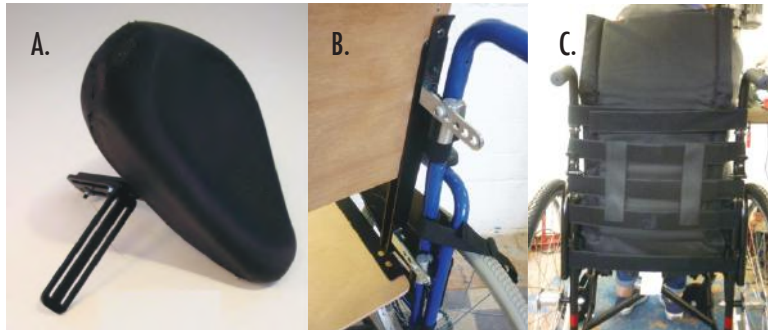
## Final Prototypes

Prototypes are described below. For information on how to reach sub-awardees to learn more about the prototypes, please contact Accelovate.

### Motivation UK

Accelovate Design Challenge funding, the team from Motivation UK evaluated its prototypes with stakeholders in Tanzania, Samoa, and the UK. As a result of these evaluations, they were able to finalize the kit components, quantities and configuration, as well as to improve the design of many components within the kit, including the headrest, tension adjustable backrest, and seat/backrest mounting system (Figure 2).

Figure 2. Example kit components



Notes: A (headrest); B (seat/backrest mounting system); C (backrest)

The final kit has five separate components:

1. Soft component box  
This box includes a wide variety of soft components used by service providers, such as backrests, lap straps, cushions, and pelvis pads.
2. Hard component box  
This box includes a wide variety of hard components used by service providers, such as mounting posts, armrest tubes, and headrests.
3. Materials Boxes  
These boxes include materials commonly used by service providers to customize PSDs, such as ethylene vinyl acetate and chip foam in varying thicknesses.
4. Mountings box  
This box includes a wide variety of mounting options for different PSDs, such as brake clamps, brakes, screws, and hook and loop fasteners.
5. Tools box  
This box includes the tools a service provider would require when creating PSDs to fit a user, such as screwdrivers, various cutting tools, and pliers.

Below is an example of a children's chair that was modified to include several PSDs using Motivation UK's kit.

Figure 3. Before and after pictures showing modified wheelchair using postural support device kit



Service providers will now have the option to order this kit, which will provide them with all of the materials, components, and tools necessary to create a wide range of PSDs for a wide range of users during clinical practice.

## DDO

DDO conducted its user feedback activities in the Republic of Georgia and Argentina. As a result of these trials, several changes were incorporated into the final prototype. Examples include adding a stabilizer on the back panel and seat panel to improve performance on rough terrain, including an extra foam layer in the seat pad to minimize the risk of the user feeling discomfort or pressure from the rigid seat panel beneath the pad, increasing the backrest height for taller patients, and reducing the number of straps so the product is easier to use. As a result of these changes, DDO has produced a final prototype deemed ready for the next stages of the commercialization pathway. The final prototype can be seen in Figure 4 below.



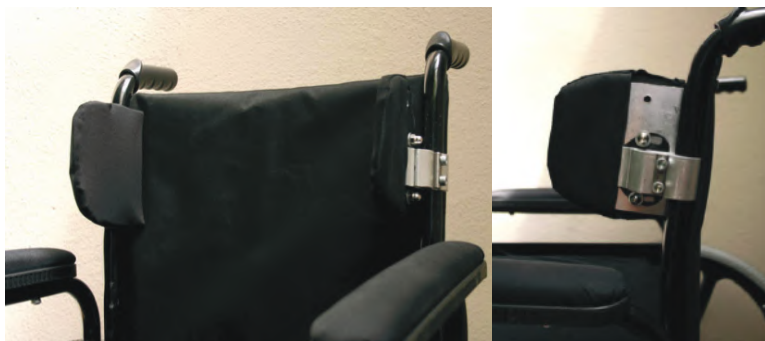
Figure 4. Diversability Development Organization (DDO) D-Seat Final Prototype



### Shonaquip—Concept One

Shonaquip utilized information gathered from user feedback activities in South Africa and Uganda to finalize their prototype for a clamp-on side support. The activities allowed Shonaquip to finalize recommendations for sizing options for the prototype, confirm compatibility with a variety of wheelchair models and sizes, and identify an area of improvement with the design that will decrease the possibility for interference between the patient's upper arm and the side support. As a result of these activities, Shonaquip developed a final prototype, which can be seen in Figure 5 below, and which is ready for additional design modifications prior to commercializing.

Figure 5. Shonaquip final prototype



# Lessons Learned and Value Provided for Sub-Awardees

## Lessons Learned

As this was Accelovate's first Design Challenge, it provided a great learning experience for future design challenges and the innovation process, in general. The main takeaways follow:

### Understand stakeholders

Interview stakeholders before launching the challenge and provide a robust list of stakeholder needs to participants. This will provide a baseline for a successful solution.

### Craft a clear challenge

Develop a clear problem statement and solution parameters to bring innovators together to confront the toughest aspects of a challenge.

### Frame an alluring problem

Innovators want to solve challenging problems with real global impact. Entice them with an exciting problem statement and a solution's potential for improving lives.

### Incorporate fresh perspectives

Invite competitors who are unfamiliar with the problem. Fresh opinions can spur new ideas. Think beyond the usual dissemination channels to reach potential innovators from all walks of life. In launching its challenge, Accelovate emailed, posted on Facebook, and tweeted with abandon. Word of the challenge reached over 100,000 people; we took care to focus our messaging to innovators beyond the wheelchair sector.

### Bring in the experts

Identify subject matter experts from multiple disciplines who can evaluate designs and provide guidance and mentorship for participants. Our expert panel included experts in business, engineering, clinical practice, and public health—some with sector expertise, and some without. With the right experts on board and a process to support innovators in the development of a product introduction strategy, we believe that we can address not only the gap between need and product, but also the lag from

introduction to scale that so disparately affects low- and middle-income countries.

### Balance competition and collaboration

Find opportunities for competitors to collaborate with each other and subject matter experts. Cross-pollination often brings out the best innovations.

### Immerse and iterate

Encourage innovators to seek ongoing stakeholder feedback from environments where the end product will be used. Embracing an iterative process is critical to the success of new solutions.

### Know your endpoints

Prior to the challenge, define your organizational objectives. Is your desired output an idea or concept, a functional prototype, a market-ready product? This will help you guide participants down the best path.

## Value Provided to Sub-Awardees

All sub-awardees have stated they received significant value from participating in the Design Challenge. Several of the participants were smaller organizations, and the PSD market is typically an under-funded one. In addition to the funding provided, sub-awardees received value through the following elements of the Design Challenge:

### Targeted, objective feedback from experts

The TRC essentially served as a pro-bono advisory board for all sub-awardees. Through mentorship and collaboration sessions, the TRC provided guidance and asked critical questions that helped the sub-awardees make key decisions and course-correct, if necessary. It is unlikely the sub-awardees would have access to individuals with this array of expertise (technical, clinical, business, etc.) outside of the Design Challenge.

Through mentorship and collaboration sessions, the TRC provided guidance and asked critical questions that helped the sub-awardees make key decisions and course-correct, if necessary.

### Collaboration with competitors

The sub-awardees were able to solicit input and feedback from other competitors within their sector. Although they are industry competitors, the Design Challenge framework encouraged them to support each other and share potential solutions to problems/barriers they may have previously encountered.

### Product synergies

Potential synergies and partnerships between competitors arose and were discussed throughout the challenge. For example, the sub-awardee developing the kit suggested including in their kit components from other sub-awardees. This would improve the value of their kit while also creating a new distribution channel for the components' owner.

### Structure for product development

The Design Challenge's format and deliverables encouraged the sub-awardees to follow good design principles/processes while developing their products. This is important to developing a product with the best chance for success. Absent the Design Challenge, sub-awardees may have rushed to market or into clinical trials with a product that was not ready for use.

### Early consideration of business elements

Often in product innovation, business/commercialization/introduction of elements of a product are neglected early in product development. The Design Challenge structure required sub-awardees to consider their commercialization/implementation strategy and business plan early and often, including the definition of non-product-related risks and possible mitigations. It is Accelovate's hope that this will better position the sub-awardees and their products for successful commercialization and implementation upon completion of the Design Challenge.

Potential synergies and partnerships between competitors arose and were discussed throughout the challenge.

# Next Steps for Sub-Awardees

## Making Connections

To better prepare candidates for success after the Design Challenge, Accelovate attempted to create connections between the sub-awardees and important stakeholders in the wheelchair sector. In addition to connections with each other and the TRC, several notable connections were made:

### CLASP

In addition to presenting during a webinar, the CLASP team was present at the final presentations. Upon conclusion of the presentation, CLASP reached out to the Accelovate team with additional interest in the sub-awardees' products. Contact between the sub-awardees and CLASP team was facilitated to allow for additional discussion.

### ISWP

A USAID and WHO partner, ISWP supports efforts to bring the best technology with the best service to wheelchair users. Representatives were present at the Design Challenge Showcase and the final presentations. The ISWP reached out to the Accelovate team after the final presentations with additional interest in the sub-awardees' products. Contact between the sub-awardees and ISWP team was facilitated to allow for additional discussion.

### LMG

MSH's LMG project provides training on developed wheelchair service packages. MSH was present at the Design Challenge Showcase and the final presentations and may be a potential training partner for sub-awardees.

### Potential funders

Accelovate invited interested donors, including Google and USAID's Global Development Lab, to the final presentations to allow the sub-awardees an opportunity to demonstrate value to them.

## Motivation UK

Motivation UK's PSD kit has entered the "production rollout" phase in anticipation of an April 2016 launch. In order to successfully hit the target launch date, Motivation UK has to complete the following activities:

- Finalize product instructions, including materials needed for training and maintenance.
- Complete price negotiation with the kit manufacturer and place the first order.
- Develop final production tooling for components of the kit and re-test all applicable components to verify safety per International Organization for Standardization (ISO) 16840.
- Produce a "gold sample" using final production tooling to ensure that all components meet desired specifications.
- Produce the first batch of products in March 2016.

Completion of all of these activities will allow the first batch to be distributed to customers in April 2016. Motivation UK appears to have all of the resources necessary to complete these commercialization activities.

## DDO

DDO is simultaneously pursuing multiple paths in anticipation of having the D-Seat production ready by the beginning of 2016. The paths are as follows:

- Clinical trials are being planned in the Republic of Georgia and Argentina using the final prototype to assess the clinical efficacy of the D-Seat. DDO is currently identifying potential funding sources to cover the cost of the trials.
- Possible manufacturing partners are being considered and evaluated according to factors such as pricing, quality, and location. DDO has engaged Motivation UK to discuss their recommendations for manufacturing facilities and/or licensing options.
- Upon partnering with a manufacturer, manufacturing processes and production tooling will be developed.

- A “gold sample” will be produced using production tooling and evaluated to ensure all design specifications are met.

DDO appears to have the contacts and resources necessary to pursue manufacturing, but their lack of funding for clinical trials may prove to be a barrier to their completion. However, DDO has stated that clinical trials, although preferred, are not a requirement for commercialization.

### **Shonaquip—Concept One**

Shonaquip’s side support has the potential to be a versatile and affordable solution for wheelchair users requiring side support. However, their user feedback activities identified an issue that needs to be addressed prior to commercialization. The clamp on the side support can interfere with the user’s upper limbs, particularly in smaller users with shorter trunks. This may interfere with functional positioning of the upper limb and increase the risk of pressure. A potential solution includes adjusting the angle of the clamp to lower its profile and decrease interference. Shonaquip needs to evaluate different modes for achieving the angle adjustment. Upon finalizing the solution, ISO 16840 safety testing will be repeated and manufacturing preparation can occur.

Final production tooling will need to be developed. However, Shonaquip already has the capability to locally manufacture and distribute this component to South Africa, Namibia, and Botswana. In the longer term, Shonaquip will engage with a more global manufacturing partner to aid in scale-up.

# Conclusions

The Accelovate Design Challenge model offered considerable value to sub-awarded innovators. This was achieved through the provision of funding; a structured approach; informational content in webinar format; close mentorship in areas of need; feedback from a broad array of experts; a network of possible future partners; and a community of collaborators.

Each of the resulting designs is promising, though hurdles remain for each on the path to market, as noted above. While Motivation UK has an existing sales platform, other sub-awardees will need to chart a new course. The broadest possible access to these products is the objective of all Accelovate's Design Challenge innovators. Models for the sale and distribution of PSDs are limitless. With additional funding, there is opportunity for innovation and experimentation at this next phase.

Innovation at the level of distribution model is under-resourced. This investment would have the potential to bring life-saving PSDs to many people, and successes may impart important lessons across sectors.

Models for the sale and distribution of PSDs are limitless. With additional funding, there is opportunity for innovation and experimentation at this next phase.



# Appendix 1: Webinar Content Questionnaire

Please respond by COB Friday, June 5. Please complete just one questionnaire per organization.

Accelovate will sponsor three collaborative virtual meetings in which sub-awardees will share updates and offer one another feedback. Accelovate will also offer one-on-one mentoring upon request (see Mentorship Request Form).

In addition, Accelovate will offer two webinars to help promote your success. Please respond to the proposed content, answering the questions below:

**1. Will the following content add value as you develop your final prototype? What should we be sure to cover here?**

Evaluating Market Feasibility and Potential for Scale

(Proposed presenter: Deepti Tanuku, Proposed Date: Week of August 3)

Cost of goods sold (COGS) analysis for modular prototypes

Demand forecasting for modular prototypes

Assessing willingness to pay

**2. Will the following content add value as you develop your final prototype? What should we be sure to cover here?**

Developing and Executing an Operational Launch Plan (Proposed presenters: Michael Allen, CLASP; Jamie Noon; Proposed Date: Week of September 7)

Understanding how products are being ordered, inventory tracking

Distribution and Supply Chain—CLASP

Partnership opportunities

**3. What other content would add value as you develop your final prototype? Do you have recommendations as to who would best present that information?**

**4. Is there any content you would like to deliver to your peers to add value as they develop their final prototypes?**

# Appendix 2: Mentorship Request Form

## Accelovate Design Challenge: Mentorship Request Form

To request mentoring on a certain aspect of your project, please complete the top half of this form and submit it to Nate Moller (Nathaniel.Moller@jhpiego.org).

**Name:**

**Date:**

**Organization:**

**Area(s) Requesting Mentorship:**

Technical/Engineering  
Business

Clinical  
Other (List):

**Anticipated Number of Hours Required:**

**Desired Dates:**

**Briefly describe what you are requesting mentorship for:**

**Briefly describe your expected/desired outputs from mentorship related to this issue:**

Upon completion of mentorship, please complete the section below and resubmit the form to Nate Moller

**Did the mentorship activities meet your needs? Yes No**

**Please explain:**

**Briefly describe the outputs/action items from your mentorship activities:**

