



# Design that Matters

## 2016 Programs Report

---

Dear Friends,

One of the secret benefits to working to create a better world is the total absence of boredom. You might find yourself watching beetles crawl on the seat cushions while waiting for your flight to board in Haiti, tapping nervously while watching the newborn warmer control software compile, laughing in frustration as Skype drops yet another call with your partners in Vietnam—but it’s never routine. The days are long but the years are short.

In this short year, our focus has been to scale Firefly, to develop three radically new global health technologies, and to inspire the minds and the courage of students and professional volunteers who have so much to offer the sick and the poor. In the last twelve months, Firefly phototherapy devices have treated another thirty thousand newborns in Africa and Asia. In total, products we have helped design and launch have reached more than 300,000 people.

We have lots of exciting news to share, including stories from our summer building a revolutionary new infant warmer for rural hospitals. With your support, together we’re designing a better future for the most vulnerable, one day at a time.



Sincerely,  
**Timothy Prestero**  
Design that Matters, Inc.



Table of Contents

Firefly ..... 4  
Otter ..... 8  
Echo ..... 10  
Pelican ..... 12  
Opportunity Exploration ..... 14  
Partnership News ..... 16  
Team ..... 17  
Press and awards ..... 18

Last year we refined our program strategy to focus on the following objectives:

- 1 Exponentially scale Firefly’s impact with complementary innovations
  - Otter is a durable, washable warming bassinet that will save newborn lives by reducing hypothermia and newborn infection
  - Echo is a real-time remote-monitoring device that will increase the impact of medical device donations in developing countries.
- 2 Apply Firefly human-centered design model to another priority newborn health problem
  - Pelican is a portable pulse oximeter and respiratory rate timer to diagnose and assist treatment of newborn pneumonia

# Firefly

newborn phototherapy device designed specifically to allow rural hospitals with limited resources and inexperienced staff to successfully treat otherwise healthy newborns for jaundice

**2016 Goals for Firefly:** Support the ongoing international distribution and social impact monitoring and evaluation of the Firefly Phototherapy device. We expect to assist MTTS and Thrive Health in a design consulting role as they reach seven new countries in the next two years, and scale to 1,000 units implemented by end of 2017.

**Firefly Update:** Since last fall, DtM and partners have implemented Firefly in two new countries (Afghanistan, Zimbabwe). Firefly devices have now treated more than 60,000 newborns.

Firefly units are now in 21 countries. We are on track to reach our goal of 22 countries in 2016. Currently, 492 units have been shipped, of which 466 are already in use. We anticipate that 550 units will be in use by end of 2016. In summary, Firefly distribution growth is steady and sustainable but we want to explore options to increase distribution volume. We have a meeting in Hong Kong scheduled for Q4 with our manufacturing and distribution partners to discuss opportunities to scale Firefly marketing and sales efforts, particularly targeting government tenders in Southeast Asia.

We are on track to exceed our 2016 projections for a cumulative total of 75,000 newborns treated by Firefly in 22 countries. As of July 2016, DtM partners East Meets West Foundation and Vietnamese manufacturing partner MTTS have installed Firefly in 21 developing countries across Asia (Cambodia, East Timor, Laos, Malaysia, Mongolia, Myanmar, Nepal, Philippines, Singapore, Thailand, Vietnam), sub-Saharan Africa (Benin, Burundi, Ghana, Nigeria, Somaliland, Tanzania, Uganda, Zimbabwe) and the Caribbean (Haiti). These devices have already treated nearly 60,000 newborns and will treat at least 220,000 over their lifetime. DtM and our partners expect to distribute at least 1,000 Firefly devices, reaching over 500,000 newborns.



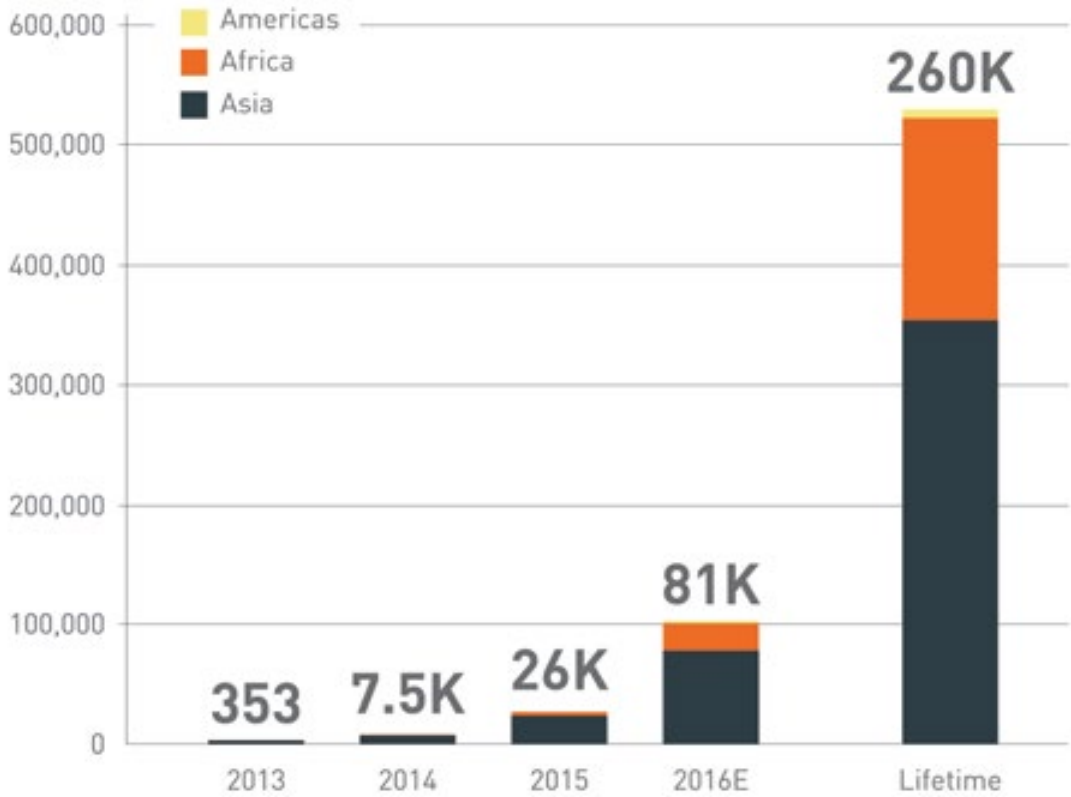
*Firefly arrives at Cao Bang, Vietnam. Photo courtesy of Luciano Moccia and the Breath of Life program.*

2016 goal

**81,000**  
Newborns  
Treated

**22**  
Countries with  
Firefly

Firefly Newborns Treated by Region



2016E (year end estimate) and Lifetime Impact estimate reflects only the Firefly units delivered to date. We will continue to revise these figures as we continue to ship and install new Firefly units around the world.

| Impact Outcomes               | 2013   | 2014    | 2015    | 2016 Goal |
|-------------------------------|--------|---------|---------|-----------|
| DtM beneficiaries: cumulative | 97,000 | 180,000 | 224,000 | 330,000   |

Firefly Program Cost

| Program Stage  | Budget      |
|--|-------------|
| User & Market Research                                 | \$100,000   |
| Product Design, Engineering & Testing                  | \$900,000   |
| Tooling, Initial Production & Distribution (260 units) | \$1,300,000 |
| Volume Production & Distribution (800 units)           | \$1,300,000 |
| TOTAL  | \$3,600,000 |

Firefly Cost = \$8.20/DALY

Compare to EPI vaccine at \$7/DALY (World Bank DCP 2006 est.)

- Key assumptions:
- 530K newborns treated by 1,060 Firefly units over 5 years
  - \$1,700/unit for Firefly manufacture, delivery, training
  - \$34/newborn for health system cost of treatment
  - 10% kernicterus rate for untreated jaundice

Firefly vs Conventional Overhead PT

| Benefit                         | Weekly Savings |
|---------------------------------|----------------|
| Early patient release           | \$7.50         |
| Reduced newborn cross-infection | \$11.25        |
| Averted exchange transfusion    | \$23.08        |
| TOTAL HEALTH SYSTEM SAVINGS     | \$41.83        |

Firefly Break-Even = 9 months

Firefly Lifetime ROI = 6.4x

- Key assumptions:
- Firefly double-sided PT reduces treatment time 25%
  - Typical hospital-acquired infection rate of 25%
  - Infected newborns extend hospital stay 10 days @ \$15/day
  - Firefly newborn isolation reduces cross-infection by 50%
  - Typical hospital: 30 exchange transfusion/yr @ \$200/ea
  - Firefly averts 90% of transfusion vs 70% with conventional PT

# Otter

newborn conductive warmer designed specifically to allow rural hospitals with limited resources and inexperienced staff to successfully treat premature newborns who are especially vulnerable to hypothermia

## 2016 R&D Goals for Project Otter:

Market and field research through Q2 will include interviews and observations with local domain experts and potential users among target markets. We will use this design feedback to generate detailed product requirements and specifications, and complete an alpha prototype for testing. Market research in Q2-Q4 will include a product bill of materials review and manufacturing study in Vietnam with MTTS, our preferred manufacturing partner.

**Otter Update:** With support from the Autodesk Foundation, we recruited a team to advance work on Project Otter this summer. The design sprint started with a couple weeks of orientation at the DtM studio in Salem. This included a review of the project context and background, the product requirements and specifications and the existing CAD models and physical design concepts. The team then hit the road for a series of expert interviews, both at local neonatal intensive care units and with local manufacturers. The team then dove into concept brainstorming, some hand-sketching and lots of CAD modeling. In July, the team moved to the new Autodesk BUILD Space in South Boston for alpha prototype fabrication and testing. The Autodesk BUILD Space team were superlative hosts.

After a series of late nights and endless hours sawing, sanding and soldering, the team finished the Otter alpha prototype, a major step forward for our newborn warmer program.

Challenges ahead of Otter include iterating on the user interface and temperature control system, ensuring that both are “hard to use wrong” and in compliance with international medical and regulatory standards. We will also examine the “bill of materials,” or the components that make Otter, to identify the best vendors and the most cost-effective manufacturing processes.



*Completed Otter alpha prototype.*

**NEXT STEPS:** We’re excited to continue Otter development this fall with a student design-for-manufacture team at Olin College, and to begin field-testing the device overseas later this year. DtM will continue the momentum on our Otter Newborn Warmer project through a new partnership with students and faculty from Olin, Babson, and Wellesley Colleges on the widespread problem of premature infant death in developing countries. A team of engineers and business students will focus on pushing Otter Warmer alpha prototype towards volume manufacture and scale. The Olin and Babson team will visit Vietnam in January to interview both potential users in rural hospitals and the team at DtM’s manufacturing partner MTTS. The course is led by long-time DtM friend and Olin Mechanical Engineering professor Benjamin Linder; DtM superstar alumni and former Firefly product manager Elizabeth Johansen will be the team’s lead mentor.

## 2016 Otter Team includes:

Malory Johnson, Team Lead  
Karan Chaitanya Mudgal, Industrial Design Fellow  
Kristine Chen, Mechanical Engineering Design Fellow  
Kristen Moulton, Clinical Fellow  
Elizabeth Johansen

# Echo

remote-monitoring technology that provides equipment-use data to identify when and which rural hospitals need additional medical devices, additional training or product maintenance.

## 2016 R&D Goals for Project Echo:

Market and field research through Q2 will include interviews and observations with local domain experts and potential users among target markets. We will use this design feedback to generate detailed product requirements and specifications. Market research in Q2-Q4 will include a product bill of materials review and manufacturing study in Vietnam with MTTs, our preferred manufacturing partner.

**Echo Update:** For the Echo project, the DtM team collaborated with Harvard computer science Professor Krzysztof Gajos's course CS179, "Design of Useful and Usable Interactive Systems." The students tackled the user interface for Project Echo, DtM's tool for the remote monitoring of medical device donations. At the highest level, this year's CS179 project was about determining which device data, and what formats of data-presentation, were the most likely to lead to our desired social impact outcomes: hospitals with high rates of device use receiving more equipment, those with low use rates receiving more training, and those with broken devices receiving service calls.

The Harvard students also considered the hospital's point of view, and the tough question: "What's in it for me?" In other words, we understand why international donors and programs that implement medical device donations might want to track the use and status of hospital equipment, but what obvious incentives do the hospitals have for agreeing to be remotely monitored? The Harvard design introduced the concept of local resource-sharing: facilities operating at capacity could use the Echo website to search for local hospitals with available machines.

**NEXT STEPS:** We expect to continue work on the hardware data collection and transmission side of Project Echo with new student teams this Fall.

## 2016 Echo Team includes:

Krzysztof Gajos  
Wilder Wohms  
Amy Huang  
Maria McLaughlin  
Ariana Siegel



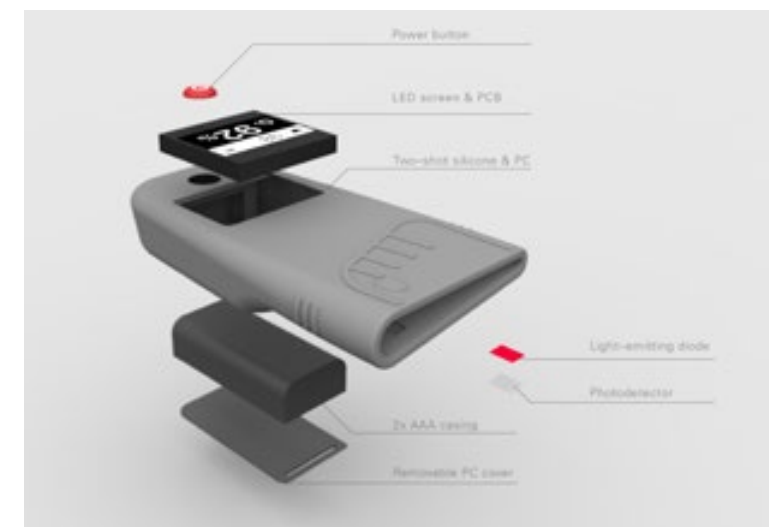
# Pelican

portable pulse oximeter that allows community health workers (CHWs) to quickly identify newborn pneumonia during home visits.

**2016 Goal:** Revise Pelican point-of-view to focus on low-skilled community health workers. Iterate on form factor and complete alpha prototype of Pelican. Market research in Q2-Q4 will include a product bill of materials review and manufacturing study in Vietnam with MTTS, our preferred manufacturing partner.

**Pelican Update:** In February, DtM recruited a new Pelican design team through MIT Sloan Professor Steven Eppinger's course "Product Design and Development" taught with MIT Mechanical Engineering Professor Maria Yang and instructor Jerome Arul from the Rhode Island School of Design (RISD). This was our lucky seventh product design collaboration with Prof. Eppinger's course.

Design efforts before this team focused on a pulse-oximeter device specifically for newborns. Since then, our field research has identified the device user--rather than the patient--as the diagnostic bottleneck. This year's design challenge focused on low-skilled community health workers (CHWs), the first line of diagnosis for newborns with pneumonia in rural communities. CHWs cannot afford a newborn-specific device, and many lack the clinical expertise to make sense of all of the health statistics provided by a traditional pulse oximeter. The new design concept illustrates this change in product positioning.



*Exploded-view rendering of the MIT-RISD Pelican concept, nicknamed "ROO."*

**NEXT STEPS:** The Pelican project now awaits funding to support field-testing of this new design concept with CHWs overseas, and for the development of a production-ready prototype. DtM will continue to explore joint funding opportunities with manufacturing partner MTTS.

**2016 Pelican Team includes:**

Malory Johnson  
Adam Chao  
Leslie Martin  
Andrea Schneider  
Christopher Sommerfeld  
Deepa Fernandes Prabhu  
Maria Yang  
Young Hun Chung



# Opportunity Exploration

## Exploring Opportunities to Tackle Zika

Although we have one great product in distribution and three others in development, DtM continues to invest in new opportunity research.

In April, DtM joined the Consortium for Affordable Medical Technologies (CAMTech) and Global Disaster Response at Mass General Global Health to host a Zika Innovation Hackathon at Massachusetts General Hospital. We packed our Makerbots and some hacking gear to help teams with rapid prototyping, and we mentored teams on product design and strategy. The event kickoff featured experts from USAID, the US National Security Counsel, the Panamanian CDC and a maternal hospital in Brazil.

Zika may feel like the crisis of the moment, but climate change means we will only see an increase in the incidence and spread of vector-borne illness. Any solution that addresses Zika would likely also apply to other flaviviruses, including dengue, West Nile and yellow fever and other diseases carried by the *aedes aegypti* mosquito, including chikungunya. Dengue cases have increased 200% in the last year, and the disease has a much more severe burden of morbidity and mortality. Meanwhile, the crashing pregnancy rates in countries like Colombia and Brazil from prospective parents anxious about birth defects means that the region will see lots of empty kindergarten classrooms in five years.



*Tim Prestero, CEO at MGH with Dr. Claudia Osorio, Professor, Sergio Arouca National School of Public Health in Brazil.*

Partnership News



Autodesk, BUILD Space

This summer we had the opportunity to work as residents of the Autodesk BUILD Space, making great use of the scores of start-of-the-art prototyping equipment housed in the space. In prototyping, we spend a lot of time worrying about “nuisance distance”: how time-consuming and how expensive will it be to test this idea? Having our own laser-cutter and 3D printer has meant we could very quickly and cheaply generate dozens of prototypes for certain classes of product. Having access to the BUILD Space, particularly tools like the large-format CNC mill and the vacuum-former, mean we can suddenly make entire medical devices on our own. The secret to great product ideas is having lots of ideas, so we’re thrilled to be able to generate loads of physical Otter concepts this summer.



Dell, Lenovo

DtM’s partnership with the Autodesk Foundation led to new partnerships with Dell and Lenovo. Each has provided significant in-kind donations of computers, monitors, and additional equipment and supplies. Beyond the equipment donations, Lenovo has launched a webpage showcasing DtM’s work on the company’s ThinkRevolution platform, and they continue to promote our work through social media and other channels. By fostering partnerships like these, the Autodesk Foundation can leverage its relationships and extend the impact of its grantmaking, to the benefit of grantees like our organization.



National Endowment for the Arts

The National Endowment for the Arts has provided funding support to DtM for the development of Otter, a durable, portable, cost-effective newborn warmer. The NEA’s flagship grant category, Art Works funds projects designed to achieve one of four outcomes; creation of art, public engagement with art, lifelong learning in the arts, and the strengthening of communities through the arts.



“The arts are all around us, enhancing our lives in ways both subtle and obvious, expected and unexpected,” said NEA Chairman Jane Chu. “Supporting projects like the one from Design that Matters offers more opportunities to engage in the arts every day.”

“DtM is honored to be a grantee of the National Endowment for the Arts,” said DtM CEO Tim Prestero. “Design--the translation of user needs into context-appropriate products--is our core competency, and we are applying this expertise to create a newborn conductive warmer designed specifically to allow rural hospitals with limited resources and inexperienced staff to successfully treat premature newborns who are especially vulnerable to hypothermia. It’s fantastic to have the NEA as a partner in this project.”

The Design that Matters Team



Timothy Prestero  
Founder and CEO



Kelly Murphy  
Strategic Partnerships Director



Malory Johnson  
Industrial Design Fellow



Karan Mudgal  
Industrial Design Fellow



Kristen Moulten  
Clinical Fellow



Kristine Chen  
Mechanical Engineering  
Design Fellow

AWARDS AND HONORS



Winner

DtM was one of 10 Classy Awards winners selected from among more than 1200 applications.

*Video*



Notable

Firefly was recognized as a Notable Design by the Core77 Design Awards 2016.

*Video*



Finalist

Otter was a finalist for the ASME iSHOW competition in Washington DC.

SPEAKING ENGAGEMENTS



Cambridge Consultants

Keynote speaker at a leadership workshop called “Emerging Markets: transforming surgical care globally by 2030.”



Classy

Panelist at the 2016 Classy Awards Collaborative in Boston, MA

Pneumonia Innovations Summit

Presenter at the Inaugural Pneumonia Innovations Summit in New York Foundation this year.

Rethinking Global Health at MIT

Presenter at MIT’s Global Health poster session

RESEARCH PAPERS

- A position paper from the 2015 Don Ostrow Trieste Yellow Retreat (Greco et al., Neonatology, 2016) finds that tools for the cost-effective diagnosis and treatment of jaundiced newborns are not always readily available in low- and middle-income countries (LMICs).
- A recently published study (Arnolda et al., BMC Pediatrics, 2015) demonstrates the impact of high-intensity phototherapy in averting the need for costly and dangerous exchange transfusions among at-risk newborn patients in low-resource settings.
- An earlier 2015 study (Arnolda et al, Maternal Health, Neonatology and Perinatology, 2015) validated DtM partner Thrive Networks’ experience with high incidence of severe newborn jaundice in Myanmar and other countries.
- Another paper (Olusanya et al., Archives of Disease In Childhood, 2014) explains why delays in the diagnosis of jaundice and the start of treatment are common in developing countries, and how as a consequence these settings experience a much higher incidence of severe jaundice than industrialized countries.
- Tim Prestero co-authored a paper entitled “Global Surgery 2030: a roadmap for high income country actors,” in BMJ Global Health (link). He participated as a panelist at the Global Surgery 2030 event chaired by Paul Farmer (video).

THOUGHT LEADERSHIP



Micro-Documentaries

The Micro-Documentary film sponsored by the Autodesk Foundation led to new media opportunities including a piece for CNN.



NYC Field Day

DtM hosted our second annual Field Day at Chelsea Piers in New York City in June, a cultivation event for DtM donors and their networks. Forty families and 75 kids spent a sunny afternoon launching rockets, building a giant geodesic dome, and learning about Design that Matters.



Every Women Every Child

DtM worked with the United Nations Foundation to complete a written commitment with Every Women Every Child, proposing to reach 500,000 beneficiaries through our portfolio of global health products by 2020.

iSHOW

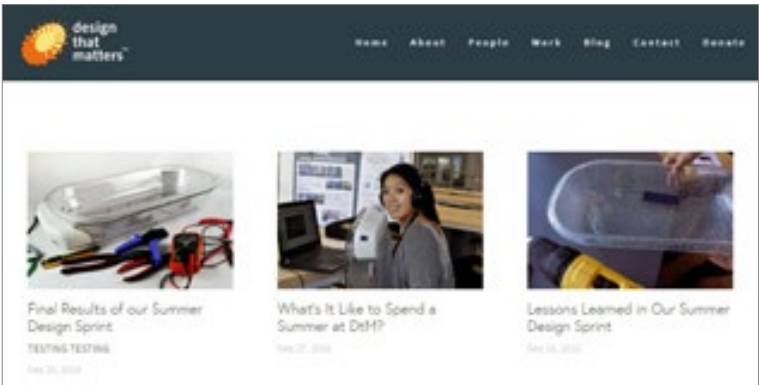
Design Fellow Malory Johnson presented DtM’s Otter project at the ASME iShow, where DtM was a finalist for its Otter Newborn Warmer project.

Boston Design Week

We also hosted several Open Studio “friendraiser” events in March and April 2016, including an event in conjunction with Boston Design Week and one with NewCo.

Xploration Earth 2050

A segment on DtM will air on Earth 2050, an Emmy-nominated educational TV program for high school students that appears nationally on the Fox network.



Check out our newly designed blog for an archive of HOWTO guides, book reviews, prototyping tips, and stories from the field.