Draper Overview, our Global Challenges Initiative, and Selected Projects
Draper — not-for-profit highly advanced engineering

- Began as MIT Instrumentation Lab (1934)
- Independent & not-for-profit since 1973
- $623M in fiscal 2017 in federally and commercially funded R&D revenue
  - 10% of revenue into internal research
  - Commercialization via external partnerships
- 1,700 employees, 1200 tech staff
- Facilities
  - 135,000 sq.ft. of lab space
  - New 12,000 sq.ft. BSL-2 Bioengineering Lab
  - R&D MEMS & Microfluidics Fabrication
- Rapid prototyping
- Extensive characterization

Draper’s Mission

Applied research and development
Technology transition into usefulness
Advanced technical education
Bridging the Technology Gap

ACADEMIA

RESEARCH

APPLIED RESEARCH

ENGINEERING & DEVELOPMENT

DRAPER

COMMERCIAL COMPANIES

CONTRACT MFRS.

MFG
What We Do

~35%

ideas

research

concept

prototyping

design

transition

support

~20% ~20% ~20% ~25%
Draper’s engineering capabilities

• Pinpointing the location & time of measurements.

• Measuring carefully and accurately.

• Enabling any modality of sensors required, and making them small and out of novel materials/ingredients when necessary.

• Measurements around life and biodiversity.
Draper’s engineering capabilities

• Miniaturized, automated, and highly instrumented platforms for drug development, cell movement and sorting, vector delivery, synthetic biology platforms …
Draper’s engineering capabilities

• Failure- & tamper-resistance.
• Full automation in monitoring and reporting.
• Extracting meaning from all available data and information.
• Pulling it all together in modeling, analysis, and decision systems that are easy to use and guarantee maximum effectiveness.

And we can build anything
From Space to Neural Stimulation

1934: Draper was founded as M.I.T. instrumentation laboratory

1969: Apollo 11 made the historic first manned moon landing using Draper’s navigation & control systems

1981: First launch of NASA Space Shuttle using Draper-designed guidance, navigation & control & backup flight system

1987: First MEMS gyroscope with a silicon, double-gimbal gyro

1998-2015: Micro-machined Differential Mobility Spectrometry (DMS) system

2006: Intra-cochlear Drug Delivery (ICDD) system combining miniaturization and fluidics

2011: An artificial lung combining synthetic biology, micro-fabrication, instrumentation and human organ on chip technologies

2016: EVATAR, mimics the female reproductive system by combining microfluidics, human tissue and multi-organ-on-a-chip technologies

2017: Stim Particle Inductively powered, wireless Neural Stimulator device combining miniaturization and radio-frequency

2019: Devices to manufacture personalized therapies for cancer treatment

2021: Devices to manufacture personalized therapies for cancer treatment
Draper’s *Global Challenges Initiative*

Our *Global Challenges initiative* is the application of Draper’s engineering & technology expertise to *challenges for humankind and the planet*

- that align with Draper's capabilities
- that the for-profit sector is not addressing
- that are jointly supported by Draper and outside partners & funders

*Partnership for Impact* — all of our projects are partner-driven, by organizations working actively in the area and on the ground. We work collaboratively for impact. *We believe that an entire community must be engaged in a solution to maximize the probability of success.*
Our philosophy on the successful application of technology both inside and outside of Draper

*Technology on its own rarely solves the right problem. Close collaboration is key to providing a solution with impact.*

- Draper’s teams are deeply interdisciplinary, providing innovation with a very short design cycle time.
- Draper works to identify, develop, and execute projects in conjunction with partners working in specific challenge domains.
- Draper and its partners work together from project ideation through implementation and release to ensure that the ultimate *solution* will be both *deployable* and *sustainable*. 
Global Challenges Demonstration Projects:  *Healthcare for All*

- **Smart devices for improving cancer detection**
  - CANARY FOUNDATION

- **Maternal ultrasound in low-resource environments**
  - Bill & Melinda Gates Foundation

- **Pediatric heart valves with growth potential**
  - Seattle Children’s Hospital
  - Boston Children’s Hospital

- **Low-cost pediatric diagnostics for the developing world**
  - HealthCube
Global Challenges Demonstration Projects: Environment & Energy

- Identifying & Quantifying Plastic Particle Pollution in the World’s Waterways and Oceans
- Coral Restoration Pilot Program in the Florida Keys — Emerging opportunity
- Data-driven Comprehensive Road Safety & Congestion Reduction
Draper’s Low force Expandable/Adaptable Pediatric (LEAP) Pediatric Heart Valve

Vision
- Addresses the *most critical unmet need* for children under 6 years old
- Adapts to child’s growth up to a *doubling in valve diameter*
- *Eliminates at least 1 major open heart surgery or other invasive procedures* required for valve expansion or replacement

Status
- *First working prototypes* manufactured and tested on the bench
- *Winner of award* at Children’s National 6th Annual Pediatric Device Symposium in September 2018 as an "innovative medical device that addresses significant unmet needs in pediatric health care"
- *Boston Children's Hospital* and *Seattle Children's Hospital* on the team
- FDA has strongly encouraged our pursuit of this solution in ongoing communications

Next step
- Seattle Children’s Hospital will perform animal studies
Plastic Particle Pollution Index: Identifying & Quantifying Plastic Particle Pollution in the World’s Waterways and Oceans

1. Microplastic sensor to measure density & type

2. Deployment with partners in rivers & coasts, on commercial ships, + others

3. Open-source design & platform for int’l adoption

- 3-year project from sensor design to working with first adopters
- Primary technical partner: US EPA Microplastics Experts Team
- Outreach partners to date: Mystic Aquarium, New England Aquarium, Shedd Aquarium, Clean Ocean Access (Newport)
- Deployment partners to date: Common Seas, World Bank Environment & Natural Resources Global Practice
**Plastic Particle Pollution Index:** Identifying & Quantifying Plastic Particle Pollution in the World’s Waterways and Oceans

- Gen-1 design & field testing at Tern Island in August 2018
- Plastic lifecycle system modeling, to support decision-makers for resource allocation in the Philippines & Indonesia (Development Innovation Group/USAID, and World Bank Environment & Natural Resources group)

- Funded to date by the Wallace Research Foundation, Patagonia, 11th Hour Racing, and Draper.
Outreach

Draper-designed microplastic exhibit was displayed at Draper and is now part of the permanent exhibit at Mystic Aquarium in Mystic, CT.

We have made the exhibit design freely available to zoos and aquariums worldwide (next launches: Newport, RI; Shedd Aquarium in Chicago; New England Aquarium in Boston).

October 2018 Microplastics: A Path Forward to Action event is available as a video FAQ on microplastics designed for the general public and policy-makers.
Data-driven Comprehensive Road Safety & Congestion Reduction

Making the roads safer for pedestrians & bicyclists provably increases the use of sustainable transportation.

Cambridge & Somerville have the highest percentage of bicycle commuters in the US.

- Provide cities with real-time, actionable safety metrics on intersections, with an emphasis on pedestrians & bicycles.
- Transportation departments will be able to assess the impact of intersection changes in days rather than months or years, and continually adapt to maximize safety.
Coral Restoration Pilot Program in the Florida Keys — Emerging project

Challenge: Disease, climate change, and environmental stresses are afflicting the Florida reef system. Current restoration efforts require 3-6 minutes of touch labor by a skilled diver to plant a single coral.

NOAA has asked for Draper’s assistance in increasing the speed of coral outplanting by a factor of 10.
Our philosophy on the successful application of technology both inside and outside of Draper

Technology on its own rarely solves the right problem. Close collaboration is key to providing a solution with impact.

- Draper’s teams are deeply interdisciplinary, providing innovation with a very short design cycle time.
- Draper works to identify, develop, and execute projects in conjunction with partners working in specific challenge domains.
- Draper and its partners work together from project ideation through implementation and release to ensure that the ultimate solution will be both deployable and sustainable.