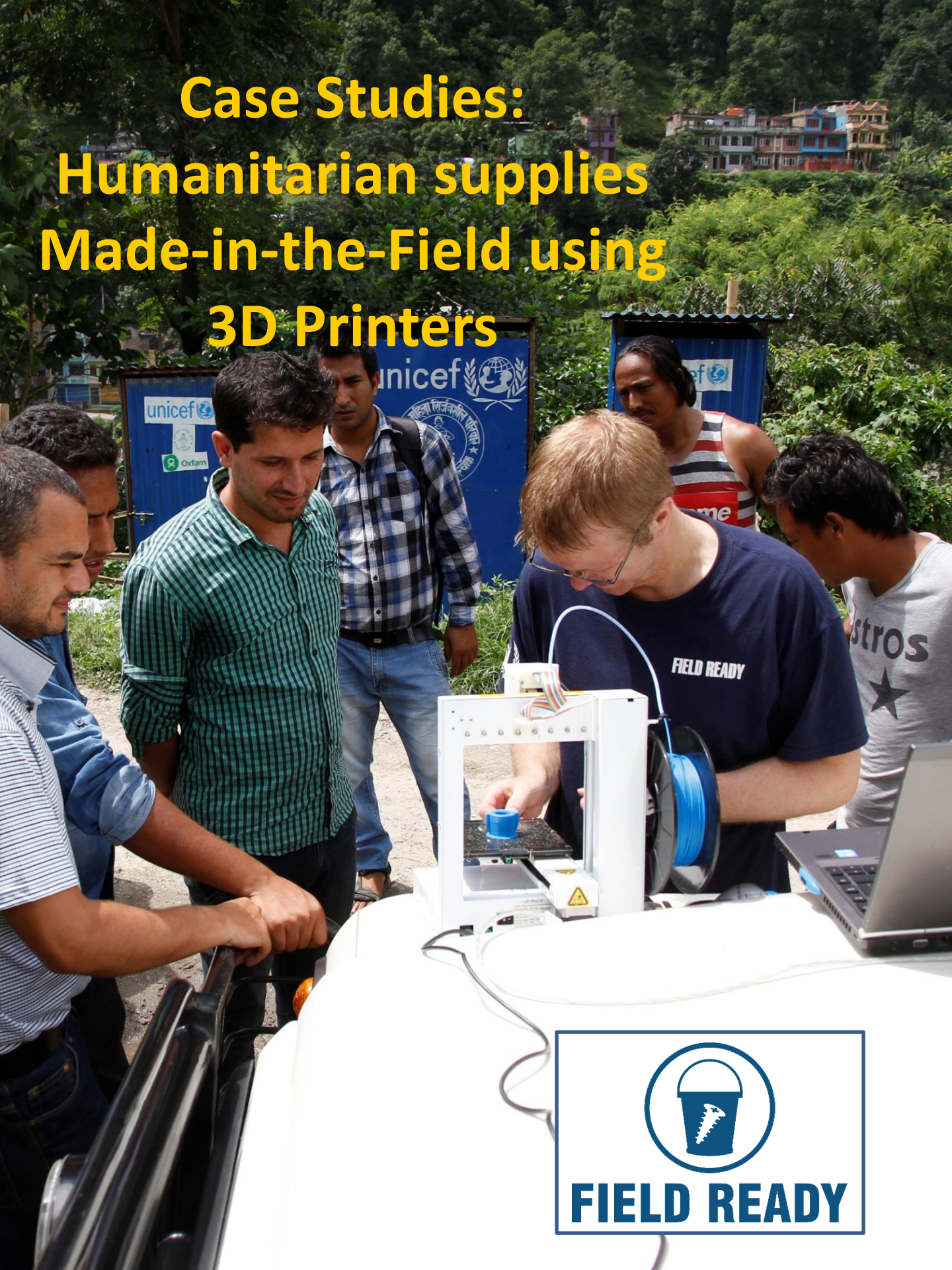
Case Studies: Humanitarian supplies Made-in-the-Field using 3D Printers

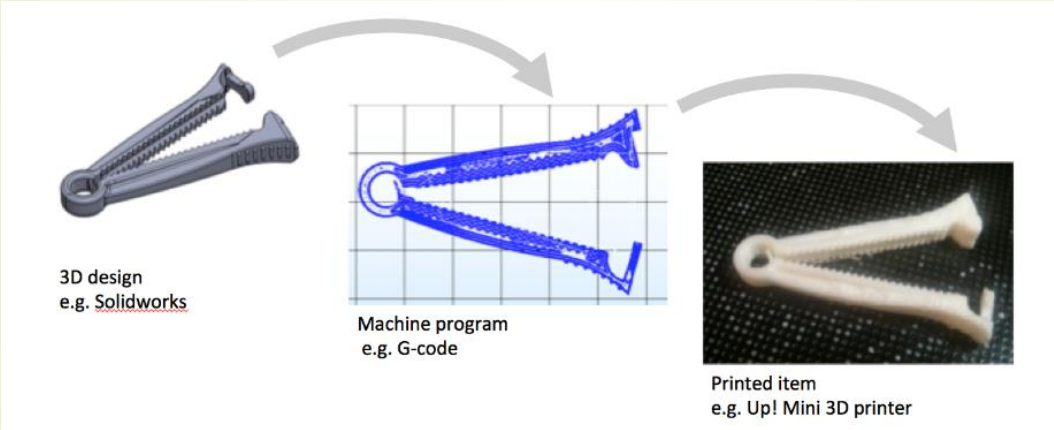


FIELD READY

Field Ready: Approach

Field Ready is pioneering the use of technology to improve humanitarian practice. Our primary ability is to place and sustain specialists in a number of technical areas in humanitarian crises and areas that lack stability. We work closely with other humanitarian organizations and employ the latest in design and technology while maintaining humanitarian principles. In doing so, we have a number of capacities including:

- CAD design & scanning
- Rapid tooling & CNC
- Injection molding
- Repair of goods, materials & accessories
- Training and capacity-building
- Dozens of items can be made in the field including locally identified solutions
- Work in all "program sectors"
- Global reach in both disasters and development



Field Ready: Overview

Field Ready's goal to develop, implement and advance accelerating **technologies for humanitarian** purposes. We seek to dramatically improve logistical supply chains in the most difficult places on earth.

Our vision is guided by a **radical transformation** in the way that needs are met in disasters, developing countries and other low resource areas. This is based on years of collective experience in the field, combined with an appreciation of the idea of exponential technology – that advances will be taking place tomorrow that may be hard to imagine today.

Our approach embraces a respect for others, an openness to learning and experimentation and a **readiness to work** with a broad range of stakeholders. We depend on our partners and are diligent in contributing to the humanitarian community's efforts worldwide.

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Case Study: Umbilical Cord Clamps

Problem: Neonatal umbilical sepsis which accounts for as much as 5% of newborn fatalities in Haiti. A typical clinic needs 50 or more umbilical cord clamps a month.

Current remedies: Rich country donations of clamps are relied on which means that the supply is costly and can be easily disrupted; local string (shoelaces) are also used but this increases the likelihood of sepsis and of the cord not being closed properly.

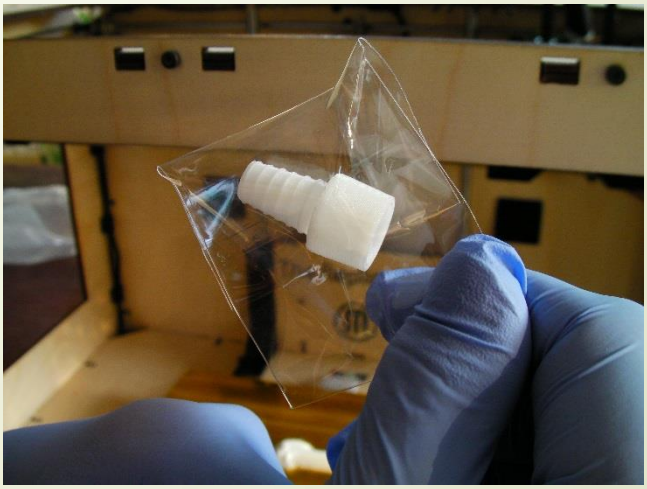
Field Ready solution: Onsite manufacturing of clean umbilical cord clamps. Using a basic design that is tailored to meet local preferences, dozens of clamps can be printed in a day. These clamps are hygienic and inexpensive.

This photo (below, right) shows the iterative process followed in producing a final clamp design. In the main photo, a delivery is made to a clinic in Haiti.

Case Study: Splitters/IV Hooks

Problem: Emergency rooms can be crowded with lots of hardware which can lead to inefficiencies and the potential for equipment breakages. Oxygen tube connectors need regular replacement which is difficult to do when supply chains are compromised.

Field Ready solution: Using a human-centered design approach, Field Ready identified this issue and designed a workable solution (the white 'S' hook shown in these pictures) that did away with the need for a separate stand for IV bags. O2 splitters (bottom) were also printed using iterative design and testing. These are kept clean basic sterile precautions and packaging. Using the same process, many different connectors and other devices can be made directly in the field for immediate use.



Case Study: Prosthetic Hands

Problem: During disasters, the number of amputees can be shockingly high. In developing countries, people lack the resources to pay for prosthetics which can cost thousands of dollars per unit. In longer term situations, children need regular replacements as they grow.
Current remedies: In a limited number of situations, prosthetics are available at specialist clinics and hospitals. These require significant external support and resources.
Field Ready solution: Using the latest designs and standard 3D printers, basic prosthetic hands can be made virtually anywhere. Field Ready carried out pilot testing in Haiti using this design (below).

Standard models, like this one (left), are prohibitively expensive and hard to come by. Sizing and replacement are also major issues.

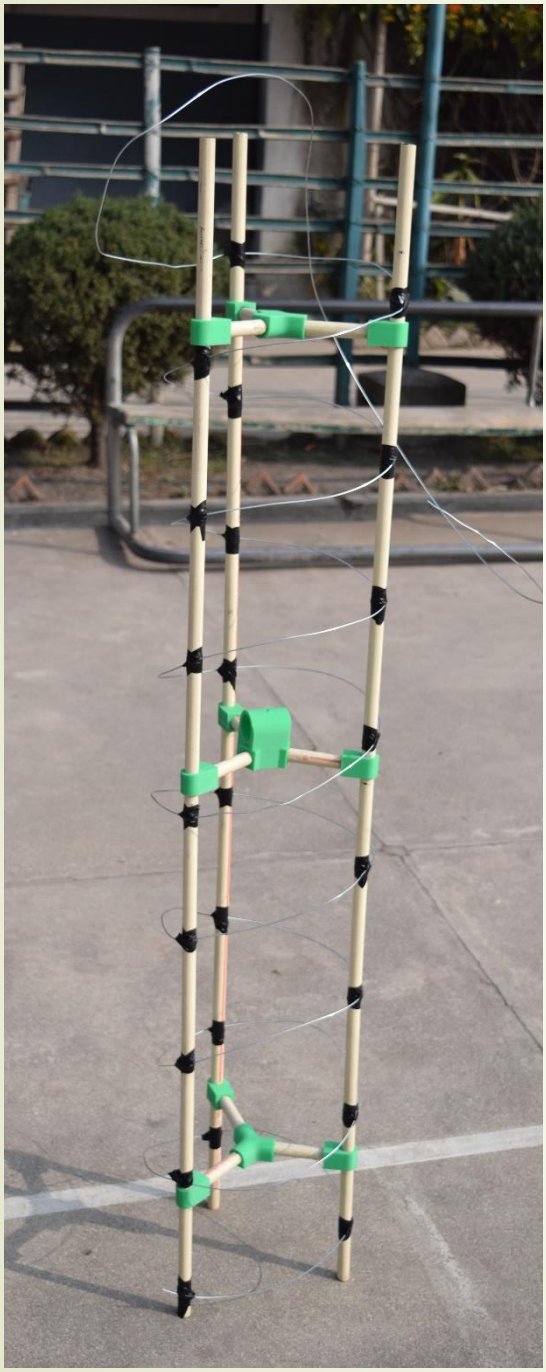
This prosthetic hand (right) fits an adult. Field Ready is the first NGO to make this model using 100% printed parts.

Case Study: WASH Fixtures

Problem: Water, Sanitation and Hygiene promotion (WASH) relies heavily on hardware such as pipes, spigots and connector joints. These often break in the field which ultimately means that public health in compromised. In other words, without replacement parts, clean water will not flow. New parts can be hard to find and the ordering process can be time consuming.

Field Ready solution: In the village of Sindhupalchowk, Nepal, an earthquake affected area, Field Ready identified broken water piping that served displaced families (one water point served about 80 people). Using a the 3D printer powered by the motor of a Land Rover, a replacement part was made and fitted within hours. To the right (above), a water spigot with automatic shut valve made with a 3D printer is shown, and (below) a manufactured part is in place and ready to use (lower right).

Case Study: Communications



Problem: In the immediate aftermath of an earthquake or other disaster, telecommunications (usually provided by cellular phone service) is non-functional. Even in normal circumstances, radio equipment can be expensive and the parts can be difficult to find obtain. This means that aid operations are impaired and that families can not easily reunify.

Field Ready solution: In Nepal, Field Ready worked with a local partner to design and make a helical antenna (pictured left) using local materials and a 3D printer. This antenna allows for people to communicate between remote locations, linking families and solving problems that would not otherwise be possible. Field Ready is investigating other designs, such as the yagi and mesh antennas, and making techniques to extend this work into other challenging environments. In the future, new ways of communicating will be possible when disasters strike.

Case Study: Filament Recycling

Problem: Lack of regular re-supply poses a challenge. The plastic filament comes in a variety of types including PLA, ABS and PET, each of which have different advantages and disadvantages.
Current remedies: Plastic filament is available on spools that are made in special factories and sold in developed markets.
Field Ready solution: We are using recyclers and following the guidelines set by the Ethical Filament Foundation to reuse plastic filament several times. This is a cost savings and further addresses supply chain issues.

Here's how we recycle plastic in the field

Step 1: Collect left over and disused filament (white bowl, left). Put them into the top of the grinder (red box, center) and crank the silver handle until ground plastic pellets are fall into (red) bowl.

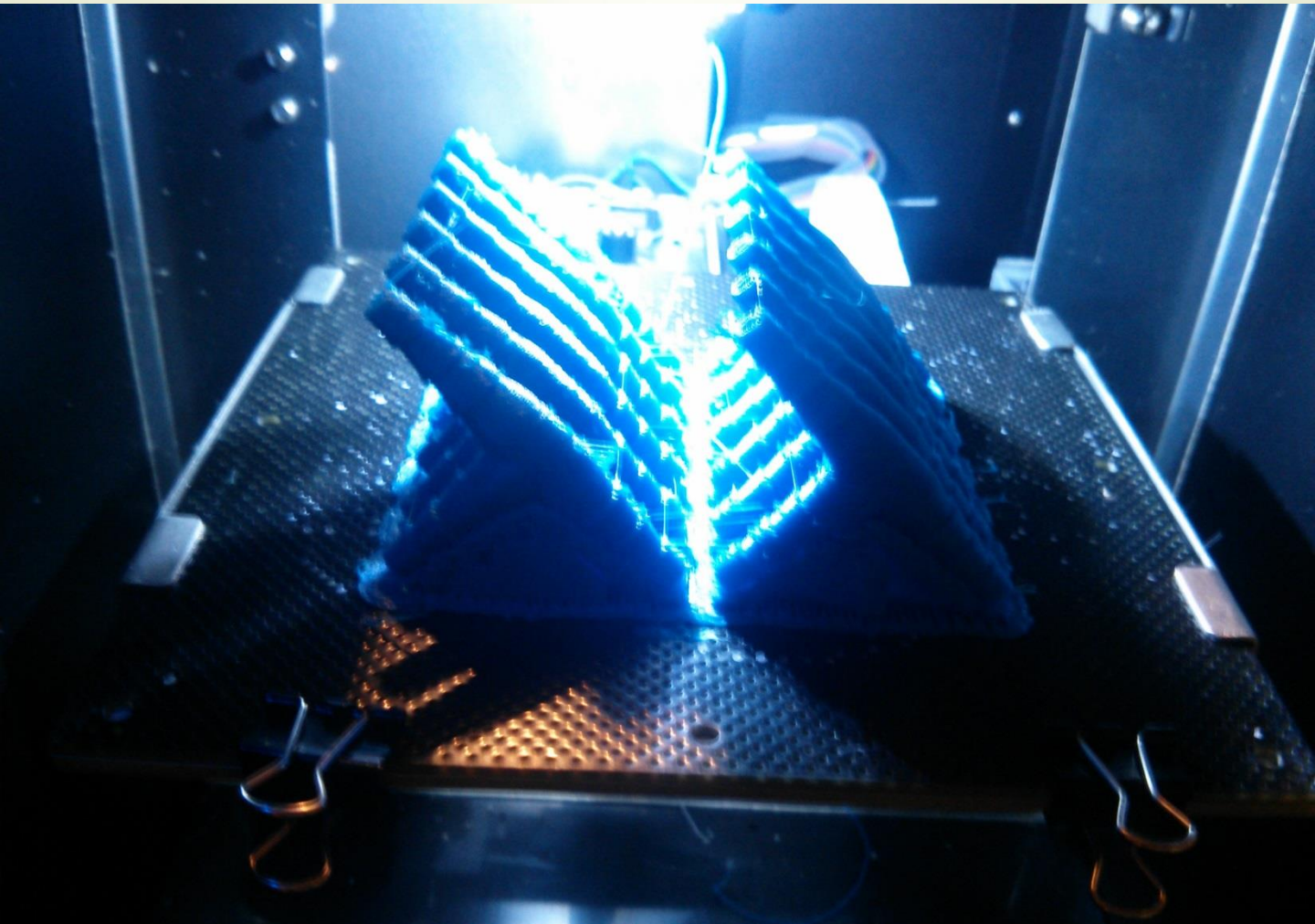
Step 2: Pre-heat electric extruder for 5 minutes. Place the parts from Step 1, into the black hopper (on right). Turn on extruder and the plastic parts will be formed into new filament. The process takes several minutes.

Case Study: Rapid Manufacturing

Problem: Logistics can be time consuming. Shipping new plastic parts can take weeks or longer to reach remote places where humanitarian supplies are needed. Many steps in the logistical chain must be passed from manufacturing to distribution.

Field Ready solution: Onsite manufacturing of needed items. When applied right, the flexibility afforded means that many challenges can be addressed using 3D printers. In Haiti, we manufactured dozens of products a day with just a few printers.

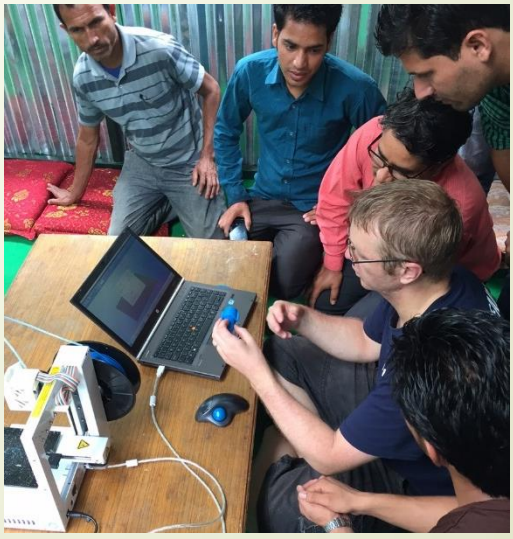
This photo shows a dozen newly printed medical tube connectors. These took about an hour to make.



Case Study: Capacity-Building

Problem: Simply donating equipment and keeping knowledge in the hands of the few runs against the basic tenants of good development practice. 3D Printers and the associated equipment such as CAD software are relatively new technologies and not easily mastered especially when good teaching is absent. Even more difficult to grasp are design and problem-solving skills which requires expert knowledge and close mentoring. These combined ideas are new to international development and humanitarian aid without good resources, guidelines and materials to ensure effectiveness.

Field Ready solution: We first devised a four-level training framework which follows standards of good curriculum design. We next developed interactive training materials that can be delivered in multi-cultural environments and with people of different levels of education. We then provided this training in Haiti, to locals and expatriates alike (right). This approach is being refined and can be delivered worldwide.



Field Ready is seeking partners and various types of support to continue to make our vision of transforming humanitarian aid a reality.

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For more information, visit: www.fieldready.org
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Field Ready is a registered charity (501c3)