HI at a glance:

COUNTRIES WHERE WE WORK*

58 COUNTRIES

*April 2020

DIRECT BENEFICIARIES IN 2019

2 871 722

PEOPLE,

(people receiving goods or services from a project implemented by HI or its operational partners in 2019)

STAFF MEMBERS** WORLDWIDE IN 2019

4 237

EMPLOYEES,

** Expressed as annual full-time equivalents.

OF WHICH:

3 401 national staff members in the field

347 international staff members in the field

"TESTIMONIAL"

Tabita, 11 years old
South Sudan

Tabita, eleven, was born in South Sudan. She now lives with her family in the Omugo refugee camp in Uganda. She developed well until the age of three, but the polio virus seriously affected her legs which became so weak she could neither walk nor stand.
HI's team provided her with crutches so she could continue going to school. She is now one of the beneficiaries of the TeReFA project. HI's prosthetics and orthotics technical advisor scanned Tabita's lower limbs before 3D-printing knee and ankle orthoses to support her lower limbs.

Innovating with TeReFa: telerehabilitation for all

"TESTIMONIAL"

Geraldo, 6 years old
Lomé, Togo

Geraldo has a bone deformity that will cause him serious mobility problems and pain as he grows unless it is corrected with a repositioning splint. He is one of a hundred people taking part in a large-scale clinical trial implemented by HI in West Africa. In 2017 and 2018, HI and its partners used state-of-the-art digital modeling and 3D printing technology to trial custom-made orthopaedic devices including splints on children and adults in Togo, Mali, and Niger.

"One of the biggest challenges in any humanitarian crisis is to provide the most vulnerable and isolated people with access to care. Thanks to digital technologies combined with the added value of 3D printing, we can care for people with physical disabilities, together with our partners, in complex and remote environments, and produce and supply quality prostheses and orthoses for less."

Isabelle Urseau, Director of Rehabilitation

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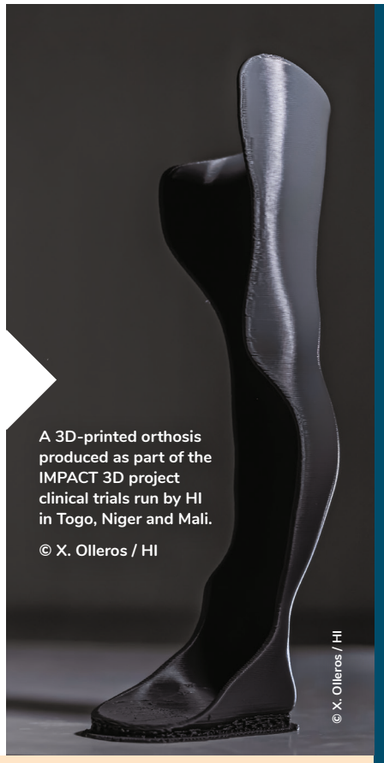
Since 1982, HI has improved access to orthopaedic devices and rehabilitation services worldwide. It started by providing bamboo prostheses to Cambodian people living in refugee camps in Thailand, and has always taken a pragmatic and innovative approach, using existing materials and expertise while pursuing a policy of continuous research, testing, and the adaptation of its activities to reach the vulnerable and and needy isolated people.

New digital technologies have become more accessible and affordable in recent years and HI aims to unlock their potential to improve access to rehabilitation services.



A 3D-printed orthosis produced as part of the IMPACT 3D project clinical trials run by HI in Togo, Niger and Mali.

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WHAT IS TELEREHABILITATION AND 3D PRINTING?

/ Telerehabilitation is the use of digital technology to facilitate remote access to rehabilitation services.

/ HI has developed and tested a process using a portable 3D scanner to digitally mold patients for orthoses or prostheses. Health workers receive basic training from HI experts to operate scanners in remote areas.

/ We then use computer-aided design technology and a 3D printer to produce custom-made devices from lightweight filament. The devices can be produced at a separate location without the presence of the patient.

/ This process requires fewer resources – health facilities, human input, equipment – and produces devices quickly.

/ We use digital innovation to interact with beneficiaries using video communication technology. HI's teams and partners communicate with beneficiaries before producing the device. The next step might to be help them learn to walk again with their new prosthesis or orthosis. Professionals can also use this technology to follow up beneficiaries, assess improvements in mobility and autonomy, and answer any questions or resolve any technical problems they may have.

THE INNOVATION CYCLE

/ HI takes a pragmatic and continuous-learning approach to innovation. Since 2016, we have conducted four scientific studies into the potential of telerehabilitation and 3D technology. We also work with leading universities, private companies, and civil society to benefit from and contribute to the latest technological, clinical, and social expertise.

/ We run clinical trials and pilot projects in six different countries, including Uganda, Togo and Madagascar, to confirm our hypothesis that digital technologies can be used to produce affordable, quality prostheses and orthoses, including in challenging environments.

EXAMPLE OF A HEALTH CARE PATHWAY FOR A PATIENT IN NEED OF A PROSTHESIS:

- Arrival of the patient at the healthcare centre
- Individualized clinical examination*
- Fitting indication (type of orthopaedic device required) according to fitting standards*
- A mobile device is used to scan a residual limb (3D image is created)
- The socket is produced with a 3D printer**
- The prosthesis or orthosis is assembled and delivered to the patient
- Prothesis fitting is carried out to make any necessary modifications*
- Patient receives rehabilitation services*

* Steps performed using telemedicine with the support of a local health worker
** Steps performed remotely

Prosthetics and orthotics are still produced today in the same way as they were 20 years ago. They remain inaccessible to most patients. According to figures from the World Health Organization, 80 percent of people with disabilities live in developing countries while only 5 to 15 percent have access to mobility aids, devices, and assistive technologies.

Millions of people therefore live with a physical disability that could be mitigated or treated with an appropriate orthosis or prosthesis. Mobility and autonomy can be restored to a surprising degree. A person equipped with adapted prostheses may no longer need a wheelchair or even crutches, and a child with polio-related leg deformities could learn to run again, helping prevent the psychological, social, and economic stigma he or she might otherwise suffer.

MAIN RESULTS AND ADDED VALUE OF TELEREHABILITATION AND 3D PRINTING

/ 3D-printed prostheses and orthoses meet structural and mechanical requirements (ISO standards)

/ The 3D process has a positive impact on patients; it takes less time to personalise, and patients are satisfied with 3D-printed orthoses and prostheses

/ 3D solutions do not require the same health infrastructure, human resources or equipment needed to produce conventional prostheses and orthoses

/ Cost-effectiveness: there is a limited difference between the cost of producing conventional prostheses and 3D printing in a humanitarian context

/ Telerehabilitation to clinically assess, measure and adjust prostheses remotely with the support of a technician has achieved positive results

/ Telerehabilitation makes up for a shortage of professionals, brings experts closer to patients, and improves information and communication on rehabilitation solutions

/ Access to rehabilitation services and prosthetic and orthotic solutions increases functional autonomy, reduces vulnerability, minimises the risk of exclusion and improves quality of life for the target population.

5 PROJECTS IN...
humanitarian and development contexts and refugee camps.

HI's prosthetist and orthotist examines the scan of a four-year-old boy's legs.
Lomé, Togo.

© X. Olleros / HI

5 COUNTRIES
Togo, Madagascar, Mali, Niger, and Uganda

An orthotist prepares to 3D-print an orthosis.
Lomé, Togo.

© X. Olleros / HI

234 PATIENTS TREATED

OF WHICH:
150 patients provided with **orthoses** and rehabilitation services
84 patients provided with **prostheses** and rehabilitation services

An orthotist and a printing technician supervise the printing of an orthosis.
Lomé, Togo.

@ X. Olleros / HI

Odyssey 2025: drones to accelerate humanitarian demining

"We can now confirm we are able to locate mines buried in the desert using drones equipped with infrared cameras. It is quite remarkable! It now takes us minutes - rather than sometimes weeks using conventional methods - to collect visual information of a hazardous area and search for signs of explosive devices. A sound grasp of these new methods will accelerate demining operations and ultimately land release for local populations."

Emmanuel Sauvage, Director of Armed Violence Reduction at HI

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ODYSSEY 2025: DRONES AT THE SERVICE OF DEMINING PROJECTS

Between September 2018 and March 2020, HI and its partner Mobility Robotics studied and tested the application of drones to its demining operations within the framework of the Odyssey 2025 project[1]. The tests were carried out as part of a vast demining programme in northern Chad[2].

[1] Project funded by the Belgian Directorate-General for Development Cooperation and Humanitarian Aid (DGD).

[2] HI implements demining operations, supervised by the National High Commission for Demining (HCND) as part of the "Support for the demining, development, and social protection of vulnerable people" project (PRODECO) funded by the European Union and supported by the Chadian government.

A SUSTAINABLE AND REPLICABLE APPROACH

The challenge of that project is intended to help achieve a mine-free world by 2025. HI develops sustainable solutions adaptable to developing countries and countries in conflict. Our teams adjust their activities to local conditions and challenges (weather, regulations, and acceptance of technology) and meet real-field needs. For example, how does drone technology apply to operations in practice?

This agile approach will enable HI to export Odyssey2025 to any country or context.


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FRUGAL AND EFFICIENT

DEMINING IS A TWO-STAGE PROCESS:

1 / **The first phase is to precise identification of areas to clear of contamination (non-technical surveys).** The types of explosive devices likely to be encountered are also identified shortly after this stage.

2 / The second is metre-by-metre explosive ordnance clearance with extreme caution.

DRONES ARE A MAJOR ASSET FOR THE NON-TECHNICAL SURVEYS

Drones provide additional visual information and save on the deployment of deminers for non-technical surveys. They also significantly reduce the number of clearance days.

ENHANCED SECURITY FOR DEMINERS

Using drones equipped with different categories of sensors, deminers obtain aerial images and maps of suspected hazardous areas without even setting foot in them.

Eye in the sky

Deminers use these images to:

- Understand the topography of a site, vital for planning clearance operations, especially those involving demining machines;
- Detect potentially hazardous objects (e.g. a bomb);
- Spot indicators of potential contamination: a burnt-out military vehicle suggests there was an explosion which may have scattered explosive remnants around a site; the wreck of a tank or car, ammunition, or a crater may indicate an explosive impact, etc.

Deminers use information from drones to better plan clearance operations and prepare for their deployment in the field.

Disruptive technology

More sophisticated cameras can be attached to drones and tested in hazardous areas. We used an infrared sensor to locate hundreds of mines buried in an actual minefield. This discovery is a world-first and could lead to radical changes in humanitarian demining methods.

AN INNOVATIVE TECHNOLOGICAL SOLUTION ADAPTED TO HUMANITARIAN CONTEXTS

Low-cost and accessible to local teams in mine-affected countries, drones are a solution adapted to humanitarian contexts.

Frugal technology

Drones do not have to be expensive or complex. Commercial off-the-shelf devices can already produce highly accurate images and thermal analyses of extensive areas. This is sufficient to help locate suspicious explosive devices, establish more precise security zones, and better plan demining operations.

Skills transferred to local actors

The drones used are widely available and easy to operate, even by inexperienced pilots. In Chad, HI transferred drone skills to staff from the National High Commission for Demining (HCND). HI's deminers - all seconded from HCND for its operations in northern Chad - were trained to operate the drones. HI also trained two employees from HCND headquarters.

Project gradually adapted to the situation in the field

At the test stage, HI regularly adapted and readjusted the project to the local context - particularly the climate (regular sandstorms, extremely high temperatures, etc.).

For example, pilots initially controlled the drones by using a digital tablet for real-time viewing of in-flight images taken by a drone-mounted camera. However, temperatures can exceed 50 degrees in Chad, making it impossible to use tablets. They were replaced by more robust remote-control devices.

The drones used are classic models.

Drone piloting session in the Chadian desert.

HI KEY FIGURES:

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Explosive remnants of war caused more than 8,000 casualties in 2019.

A threat to 60 million civilians in more than 60 countries and territories.

HUMANITARIAN IMPACT

Emmanuel Sauvage

Director of Armed Violence Reduction at HI

"By making demining operations easier, we hope the use of drones will help humanitarian demining organisations fulfil their promise of a mine-free world by 2025, as stated by members of the Mine Ban Treaty,"

"TESTIMONIAL"

Kheira Djouhri

Head of the Chad innovation project at HI.

"HI faced two challenges in northern Chad. A large number of dromedaries had been killed by explosive devices, which suggested the region was heavily contaminated, and we needed to investigate a very wide area. To understand why so many dromedaries had died at the same time, we used a drone to gather information on the circumstances surrounding the accidents. The superzoom of the drone-mounted camera revealed the presence of **bounding mine**[3]. A single dromedary can activate a bounding mines which projects fragments over a range of up to 100 metres. This explained the death of an entire herd of dromedaries. It is vital the head of operations knows about this type of mine so we can adjust our security measures."

[3]Bounding mine: when tripped, a small propelling charge launches the body of the mine into the air and spreads the white-hot fragments horizontally in all directions at waist height.

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