

# Susan Long

Born c.1987. Humanitarian engineer.  
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# 1. Growing up in Newcastle



*Susan Long next to the Syria Airbag Kit and Makerspace equipment.*

Susan Long (Robinson 2005) has always championed the social benefits of manufacturing. Throughout her career, she has brought revolutionary manufacturing technologies to some of the world's most challenging environments. But wherever she works, Susan's guiding principles remain the same. She says: "Having people make the things they need, where they need them. It's still a brilliant idea."

Growing up in Newcastle, Susan saw the impact of de-industrialisation firsthand. Later, Susan would see other societies across the world, each with a complicated relationship to industry. Countries like Kenya and Vietnam did not go through the same process of industrialisation, and missed out on the opportunities it created. In the Middle East, a mixture of state policy and constant conflict made it difficult to reap the benefits of industry. A common problem between these very different societies was what happened in the absence of industry, where a flood of social problems arose instead. To try and solve some of these problems, and explore the benefits of local manufacturing, Susan would need extensive training and hands-on experience in engineering.

Susan was first encouraged to apply to Cambridge by a family friend. He was already enrolled at the University, and when he came back home during the summer holidays Susan would catch up with him in her local pub. He told her how Cambridge was a fascinating place to be. Susan was initially put off the idea of applying, as she was worried she wouldn't fit in. Eventually though, she decided: "You'll be better to try it then to regret having not done so." After her application was successful, Susan went to Robinson College to study Engineering.

## 2. Arriving at Cambridge



*First Makerspace team in Iraq; set-up team in Iraq featuring Susan. (c) Field Ready.*

When Susan arrived at Cambridge, she found a place “big enough to build your own tribe”, where “everyone you study with has so much energy for other things”. Her next-door neighbour brought a show to the Edinburgh Fringe in the summer. Another fellow student was an Olympic sailor. At Robinson, Susan soon adapted to college life, even designing decorations for a few May Balls.

It was at Robinson that Susan found Engineers without Borders, a group that supported engineering students in developing projects overseas. Susan eventually became one of the society’s most prominent committee members. Through her involvement with the group, Susan attended regular speaker sessions and training weekends at Clare Farm and Newmarket.

As part of the Engineers without Borders group, Susan travelled to Ecuador to make ceramic water filters using local techniques. While the trip was insightful, Susan felt that the engineering solutions she could offer were a sticking plaster for the local people’s problems; the fundamental economic issues that governed their lives were not going away, and these issues had the most pervasive effect on people’s lives.

Partly because of these frustrations, Susan moved away from engineering after university. Seeking to understand the bigger drivers of international economies, she became a management consultant and worked in Kenya and Vietnam. But when one of her fellow committee members from Cambridge’s Engineers without Borders recommended a new opportunity with Field Ready, Susan was drawn into engineering once more.

### 3. Technology Changes the Game



*Susan on a plastic recycling pile; installing 3D-printed part to baby warmer in Mosul. (c) Field Ready.*

By this point, rapid advances in technology meant that engineering projects in developing countries were no longer a sticking plaster: they could fundamentally change these societies and their economies. These new developments could now revolutionise production in some of the world’s poorest areas – most strikingly via distributed and local manufacturing.

These revolutionary technologies focus on digital fabrication – a group of technologies that includes 3D printing – and have dramatically reduced the space needed for complex manufacturing equipment. As a result, Susan explains, “you don’t have to have a big factory to produce essential goods anymore. You can set something up in your living room, or a garage in Syria powered by a solar panel.”

Susan’s time at Cambridge proved useful when she started working for Field Ready in the Middle East. She needed to know how factories run from start to finish. Cambridge’s manufacturing engineering course provided a holistic understanding of the entire production process. In her second year, Susan did placements in factories, where she and her fellow students were given specific tasks to do – for example, reducing waste in a given process.

“One of the biggest things I learned on these placements was the importance of HR in a factory. The happiness of your staff has a huge impact on productivity, even if large parts of the production line are automated.” From these placements on different factory floors, Susan could see which ones worked better. “It often came down to the divide between the factory floor and the management: when that gulf was bigger, there were more problems with equipment, more stoppages on the line. Going in



as students, we heard directly what the workers complained about. We were worried about whether the workers would mind us coming into their environment, but they were happy to have someone listen to them. It became obvious what needed fixing and what processes weren't working.”



*Making airbags in the workshop; 3D-printed soap toys. (c) Field Ready.*

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## 4. Makerspaces in the Middle East



*Syria airbag kit; airbag testing under collapsed building. (c) Field Ready.*

Susan is currently using the knowledge she gained at Cambridge to create Makerspaces in the Middle East, initially focusing on Iraq. Makerspaces are co-working spaces with in-built engineering equipment. Their staff provide expert training and encourage collaboration between different local groups. These Makerspaces allow members to design and manufacture a huge variety of things. Susan now gets to work with passionate, young people in the Middle East who want to master the latest technologies and fix the problems they experience in their communities.

“We give people training and access to 3D printers, laser cutters, and computer numerical control (CNC) machines. We’ve also fitted the Makerspaces with a lot of electronics: now, people can put electronic circuits together, and engrave whatever circuit board they want to have in whatever device they’re making.”

The possibilities for what someone can make with equipment like this is staggering. Entrepreneurs can craft supplies or artistic items. Educational groups can make items for people with disabilities – one group recently created a customised sensory environment for children with cerebral palsy. And when it comes to medical supplies, the opportunities for improvements can be drastic.

These became apparent when Susan first worked with Field Ready in Syria. “We made replacement springs for broken bone drills. We made hinges for incubator doors – small, simple parts: but if these break, the whole incubator is out of service.”

Once a community has trained engineers that can troubleshoot and diagnose medical equipment, these fixes are made possible. Distributed

manufacturing makes this process far cheaper, more reliable, and less dependent on turbulent factors. “If the borders are closed, you can still make spare parts in your garage,” Susan says.

These benefits become international when ideas are shared. “A lot of our designs are hosted on online platforms that are open source. These could be designs for anything from an incubator handle to oxygen concentrators for COVID-19 response. People from across the world can download these designs, take them to their local Makerspace, and 3D print the components.”

In one of her most successful projects for Field Ready, Susan helped to research low-cost airbags for search and rescue in Syria. They are designed to inflate under the rubble of bombed-out buildings and enable trapped persons to escape. The airbags were then used in Nepal, after devastating earthquakes necessitated search and rescue. Soon, people in Mexico were using the same airbag design for their earthquake search and rescue teams.

Beyond the technical solutions made possible by these technologies, their decentralised nature grants local economies a tremendous amount of power and independence. Instead of being reliant on international aid, these communities can now take their problems into their own hands. By giving state-of-the-art technology to intelligent, energetic local people, they can be the ones to make the difference. So, while Field Ready began as a way of providing humanitarian relief, it has become a way to allow communities to generate and keep wealth, by supporting local business and entrepreneurs.

Susan’s dream of using manufacturing for social good – an idea born in Newcastle and nurtured by her time at Cambridge – has come to fruition.

“This technology is a massive equalizer. You don’t need an expensive lab. You don’t need to rely on parts being flown in from overseas, you don’t need to pay other countries for the parts you need. You get to keep the money in the local economy. You’re empowered to fix problems you see around you, and can learn from those in similar positions across the world.”

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## 5. Interview

*The following interview with Susan Long was archived in 2021, with acknowledgement and thanks, from the website of the Cambridge University Department of Engineering:*

*Susan Long, Manufacturing Engineering graduate (2005) from the Institute for Manufacturing (IfM), is based in the Middle East and now works for non-profit organisation Field Ready.*

*The organisation meets humanitarian need by providing solutions in health, water and sanitation using new technologies such as 3D printers and laser cutters as well as conventional manufacturing techniques.*

*Susan, Innovation Advisor (Turkey and Syria), is working on Field Ready's Syria response programme to assist with the humanitarian crisis. She is part of the team that has developed a locally made 'lifting airbag', which rescue workers use to reach people trapped under rubble following shelling. Rescue teams were unable to get enough of the standard airbag kits for their needs and none at all in besieged areas. The locally made airbag kit costs roughly \$450 compared to imported standard units, which cost around \$5,000.*

*We caught up with her to find out more.*

*Field Ready is not your average engineering organisation, how did you hear about them?*

I heard about this innovative organisation doing something interesting and with real impact through networks that dated back to my time as an engineering student. After reaching out to hear more, I took what was meant to be just a month-long break from my previous employment to volunteer and ended up not going back.

*What does your work mainly involve?*

A great deal of my time is spent meeting with current and potential partners to understand their work and the challenges they face. Field Ready isn't about a specific product or technology, but rather seeks ways to use innovation to make things when and where they are needed, and to see this become the normal way to do things. This approach means every programme is individual. I spend a lot of time talking to people internally and externally to try and work out what this should be.

*What sort of impact are you making?*

Within the very short time I have been involved with Field Ready's Syria response, I have seen a 'lifting airbag' move from an idea to now being used to rescue civilians in the field. The airbag functions as a jack and



allows rescue workers to access those trapped under rubble following shelling.



*Susan Long (centre) with Syrian engineers and Field Ready staff who had participated in a 3D printing and innovation training workshop. Credit: Field Ready.*

Standard kits cost around \$5,000 and rescue teams in Syria were unable to get nearly enough for their needs and none at all within besieged areas. An engineer in the UK supported our engineers in Syria to design, prototype and test an airbag system, which can be made entirely from readily available tools and materials for roughly \$450 (more than a 90% reduction in cost).



*Field Ready Rescue Airbag Kit: regulator, valves, compressed gas tanks and set of two airbags. Credit: Field Ready.*

*What's next?*

Growing Field Ready's impact across the Middle East region and working with the team that is responding to the Syria crisis; allowing more people to make the things they need to move forward with their lives.

*What was the driving force behind your manufacturing engineering career and have your views changed since working in the field?*

For quite some time I have been concerned about the loss of jobs in various industrial sectors and the impact that this has on communities that have been built around them, like the deindustrialised part of the country I grew up in. I have been troubled by the thought that many young people living in these communities may never receive the benefit of jobs that industrialisation previously created.

Distributed manufacturing seemed to me a way technology could help to alleviate this. Field Ready has given me an insight into how it can do this and more by dramatically reducing the costs and delays in providing needed items to humanitarian crises, but also providing mechanisms for global networks to support those in extreme situations to make their own economy out of making things.



*Inflated Field Ready Rescue Airbag in action. Credit: Field Ready.*

*Why did you decide to study Manufacturing Engineering?*

The breadth and diversity of the course. The fact that you learn how to develop products, and how global supply chains function, which was immensely useful when I worked in trade and investment in Asia and Africa. As a hands-on person, I was also attracted by the time spent in industry, and as an avid traveller, completing my final placement overseas was a huge bonus.



*What is the most useful advice you could offer to a secondary school student trying to decide on a career path?*

Develop skills in what you are passionate about, put in the groundwork to get good at it and don't get stuck on the idea that there is a specific path. I have met lawyers, filmmakers, retail experts, teachers, even an abattoir expert, who have used their professional experience in different ways.

*What do you like to do outside of work?*

I've made a couple of fashion collections and furniture for friends and myself. I like combining fabrics from different places I've lived and reusing everyday and industrial items.



*An example of Susan Long's fashion design.*

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