

Print me a new trigger, Scottie!

COULD FORESTRY JOIN OTHER INDUSTRIES IN USING 3D PRINTING TO SAVE TIME AND RESOURCES?

A few weeks ago I flicked through a farming magazine and saw a brief article about a new 3D printing service presented at the LAMMA machinery show (see Q&A, facing page). This made me think: is this something that might have a future relevance for the forestry and timber sector as well?

“3D printing of spare parts for failing machinery is one of the main drivers that got me interested in learning about 3D printers in the first place. In the context of climate change and economic hard times, an entire machine falling out of use and requiring replacement due to the failure of one small part seems particularly criminal”, says Andy Moore, a very early adopter of 3D printing and founder of the start-up Ten Thousand Things Fabrication Ltd.

Forbes magazine (08 June 2016) summarised the findings of the report State of 3D Printing 2016 for which 1000 people from different sectors and countries where surveyed on their use of additive manufacturing technologies. The study found that some of the priorities for 3D printing are not only for improved product development (26% of answers), but also for users to reduce tooling investment, co-create equipment and devices with the manufacturers or improve spare parts management. The fastest growing application of 3D printing for the next four years will be to increase production flexibility.

The opportunity is there and up for grabs, in particular for a sector like ours, where machinery of all sizes and types are part of our everyday business – from small chainsaws to automated sawmill production lines. But will it be worth the effort of changing our mindset and embrace a radically new approach to take advantage of the potential benefits this new technology might bring?

What is 3D printing and should we care? The Forest-based sector technology platform explains: “Additive manufacturing is an innovative industrial production process of joining materials to make objects from 3D model data, usually layer upon layer. It requires dedicated 3D modelling software to design the product in connection to adequate 3D hardware capable of reading the data and mould a solid shape by using a variety of materials (polymers, metals, glass, biochemical materials and,

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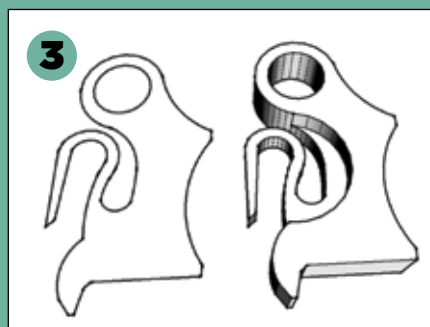


3D PRINTING KEY OPPORTUNITIES

- Increase the efficiency of equipment and reducing running costs.
- Reduce the time required for production of one-off and repetitive parts.
- Extend the usable life of machines that may be deemed no longer fit for purpose or for which the parts are obsolete.

(James Hudson)

HOW IT'S DONE



Q&A

James Hudson, JF Hudson

FTN: In general, is 3D printing of spare parts a feasible option in the UK?

3D printing has become far more accessible to business and the general public over the last five years, although the technology has been around for 20 years and has been used by multi-national businesses to help with prototyping and product development. There are now companies who specialize in 3D printing and it is all they do. Being as it is possible to print steel as well as more commonly known plastics, it is feasible that in a situation where the part is difficult to get or obsolete, 3D printing could be a possible alternative solution. As with multi-national companies, 3D printing enables anyone to prototype a part, so if there is a complex shape that would have previously been difficult and expensive to be molded or cast using traditional methods, most of which require a minimum order quantity to justify the time and effort, 3D printing enables a small number of parts to be produced with relatively little effort when compared to the old ways.

FTN: How can someone get a failing spare part printed? Can they send the failing part to a company? How can companies overcome the difficult part of modelling a part to be printed?

Companies exist that will produce a computer model that will then be used by the 3D printer to

produce the part, although this may take time and a machine may be out of action if the part that has been removed is critical to the operation. Once the first part is produced it is relatively simple to reproduce the same part as and when required. Also, if it is a part that repeatedly fails, it would be easier to make alterations as required to ensure that part doesn't fail as often.

FTN: Under which circumstances could the forestry (or farming) sector benefit from this technology? Imagine a client - forestry or farming company of any size - that has a vehicle and needs a spare part quickly. What is the advantage of 3D printing and how will it be important in the future?

The capabilities of 3D printing and the application with in all sectors of industry are still being learnt and will continue to develop at an ever increasing rate. The biggest restriction on the use of 3D in any sector is the acceptance of the technology as a viable alternative by those in the industry, as with all technology the cost of the equipment and process will become more accessible as time goes on. Alongside 3D printing is an emerging technology call 3D scanning; this allows the user to scan anything and the software generates a 3D model in the computer. This can then be used to create the file required by the 3D printer. 3D scanners are also becoming more accessible and more mobile. In the future, if a customer has failing part to replace, he could use his smart phone to 3D scan the part, send the file to the 3D printer, who could then manipulate the file as required, print the part and send it out. This would reduce the time and necessity of sending failed parts for a company to create the 3D model.



Images showing the process of replacing a missing chainsaw trigger.

- [1] Aside from your 3D printing setup, a few simply tools will make fitting a prototype template quick and easy.
- [2] Taking precise measurements from the template and the part environment is the key to getting good results. (Photo by author)
- [3] and [4] Drawing a 2D shape using the measurements taken from the cardboard template and handle, the part is then "extruded" up to make a 3D prism of the desired shape. Details such as the partial extrusion of the spring shown here can then be added prior to finalizing the design.
- [5] Test fitting and function testing of the new trigger.
- [6] A few minutes and a 3D printer turned this chainsaw from a pile of parts into a useful tool. (Photo by author)

Taken from <http://3dprintingforbeginners.com/3d-printed-replacement-parts>, which is an excerpt taken from the book "The Zombie Apocalypse Guide to 3D printing" by Cliff Smyth (Chapter 2: Prototyping and printing replacement parts, from knobs to triggers).

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more recently, wood-based composites) and various methods of layer printing.

“There are indeed exciting opportunities and ideas that challenge the forest-based sector to investigate the potential of additive manufacturing, both from the point of view of manufacturers and consumers.”

In the future, an increased availability of 3D models for parts to be printed could facilitate a wider adoption of this technology.

Opportunity: spare part management

“I am sure you have been there: you owned a product or device that you ended up throwing away since some small, insignificant looking plastic part had broken. You took your gadget to the shop for repair only to be told that it is cheaper to buy a new one rather than having it repaired. Anybody environmentally conscious will cringe at this point: you have to throw away an item of which 99% of the parts still work but that tiny broken part that you can't replace forces you to dispose of the gadget”. This is how James Hudson of JF Hudson introduces his CAD N CUT service to his clients (see Q&A, p37).

But there is more to it: the reason for wanting to print a machinery part can be due to difficulties in obtaining spare parts for vintage models, or the need to actually improve a spare part that causes problems repeatedly. Replacement parts can even be designed if the original part is missing (see p36).



<http://jfHUDSON.co.uk/services/cad-n-cut/>

3D Printing for beginners:
<http://3dprintingforbeginners.com>

A future market for digital parts

Before a part can be printed, a 3D model needs to be created. In the future, developments in 3D scanning will facilitate this process. For now, clients who wish to look into 3D printing are best off getting professional help to get started with 3D printing and modelling. In the future, ready-to-print files will be available for more and more parts of machinery or other equipment, making the process more straightforward.

Andy Moore explains the implications of creating a model of a spare part: “Replacement of failed parts for proprietary machines whose design files are not available to the public must be done by reverse engineering of that part by someone with the necessary skill set. To do this you would have to dismantle the machine, remove the pieces of the broken part, create a digital model of that part, and recreate the part from the model.

“There are a range of software modelling options with a wide price range. 3D scanning tools will only

capture the visible surface of a part and so the captured model will require at least a little design ability to make sure that it is reproducible by a 3D printer. There is also the approach of sitting with a set of digital callipers and measuring by hand all of the part dimensions as you input them into the modelling software - a very flexible approach depending on the part (see panel, p36).

“The difficulty of modelling is largely avoided in the small but growing world of open source hardware where designs for all the parts are made freely available on sites like github, thingiverse, GrabCAD or 3D Warehouse amongst others.

“In both cases the modeller/maker has the opportunity to improve the design of the part, perhaps to add strength to it in the place that it failed, making a further failure less likely. Having that improvement feed back into the community to allow other users of the same product access to it is vastly more likely in the open source world.”

The State of 3D Printing report can be downloaded from www.confor.org.uk (Resources - Publications - Reference Publications)



Compliance with PUWER for tree work winching operations

Differing opinions currently exist within the forest industry about the application of PUWER (Provision and Use of Work Equipment) and LOLER (Lifting Operations and Lifting Equipment Regulations) to winching operations in tree work, for example: skidding and directional felling. As a result, queries are regularly raised particularly in respect to the inspection and thorough examination of winching equipment. These queries often stem from how the term 'lifting' is interpreted in respect of loads being winched. The HSE have issued a paper to clarify the application of health and safety legislation to the use of winches in tree work - in particular in relation to the requirement for thorough examination and inspection. This paper is available on the FISA website.

Cable cranes lift as part of their function therefore the requirements of LOLER apply. For winching, where the load does not leave the ground, if the work equipment does not have as its principal function a use for lifting and lowering, then LOLER does not apply; but PUWER does.

It is important to recognise that LOLER and PUWER require much the same thing for work equipment that they apply to: that the equipment is suitable for the task undertaken; that it is properly maintained, and that it is operated correctly by competent people.

FISA will shortly add a machine inspection check sheet to the FISA website, enabling you to download a check sheet to complete for your machines.

www.ukfisa.com

Forwarder at work in the forest
(Photo: Tilhill Forestry Ltd)