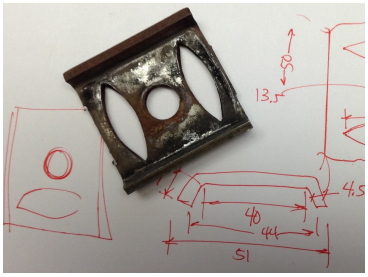
CASE STUDY 5: AGRICULTURAL REPAIR & REPLACEMENTS USING LOW COST ADDITIVE MANUFACTURING, HAY TEDDER PART

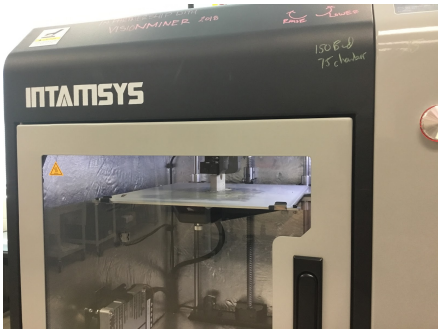
For those involved in the agricultural production industries, profit margins are often narrow and can easily be impacted by market shifts, weather, and equipment issues. For beef, straw, and grain farmers, the latter two are especially significant. The harvesting of hay for optimum winter feedstock is especially stressful for farmers as it often depends on having several sequential days of dry weather in the late weeks of May and early weeks of June. The harvesting process involves a series of procedures referred to as cutting, tedderring, raking and baling. Each of these processes relies on unique, large, and fairly complex pieces of mechanical equipment to accomplish the necessary tasks to prepare the hay for each processing step. And for many small to medium sized producers, this equipment may often only be used once or perhaps twice a year. But during the small window for optimum crop yield, the successful operation of this equipment is incredibly crucial. Likewise, because of this small amount of equipment operating time, owners typically will attempt to extend an implement's lifespan as much as possible. This results in a large of number hay harvesting implements being many decades old but still be in use. Obviously with such aged equipment, issues of deterioration, breakdowns, and the like are commonplace, and finding even the most simple of replacement parts for equipment 30 years old can be a challenge. Even worse, if a breakdown occurs in the middle of the harvesting weather window, with replacement parts nowhere to be found, it can compound the stressfulness of the situation to a near-panic experience.

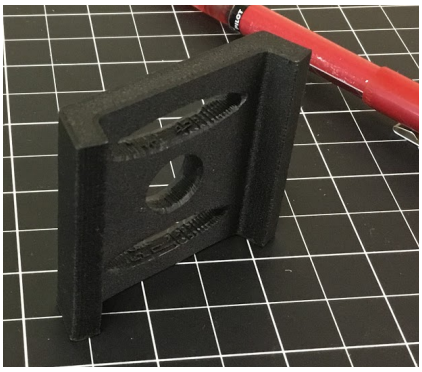
However, Somerset Community College's (SCC) Additive Manufacturing (AM) department, in conjunction with the National Science Foundation's Advanced Technological Education and USDA Rural Development grant program recently demonstrated a new solution to this common problem. Utilizing low cost AM equipment, also known as desktop 3D printers, producers have an option to address these types of situations in a way that can almost seem to be science fiction.

Recently, such a stressful breakdown situation occurred to a regional beef farmer in during the middle of ideal hay harvesting operations. While aerating the cut hay using a hay tedder machine, a bolt came loose and a metal spacer (referred to as a Tedder Tooth Support) component fell off which is used to hold the spinning forks of the device. The forks were eventually found in the field but the spacer was not, as the centrifugal force of the tedder arms likely slung the spacer part a great distance.



With rain in the near forecast and no replacement spacers available, SCC was able to quickly duplicate the model and fabricate a spacer replacement. The computer model was generated in less than 7 minutes and the fabrication time to create the replacement part was less than 3 hours when using the lab's Intamsys Funmat HT from Vision Miner. The replacement part was 3D printed in XSTRAND GF30-PP a carbon fiber reinforced filament made by Owens Corning, and the part cost less than $4 in material. The replacement spacer was then quickly installed and the tedder operated smoothly the rest of the harvest.





Additionally, now that the part is digitally stored, not only can spare part versions be fabricated in preparation for next year's harvest cycle, but improvements can be made to update the design as needed. And as new 3D printing materials become available, the parts can be further improved upon and allow for low cost preventative maintenance.

The potential application of low cost additive manufacturing on farming operations and opportunities such as this is limitless. Being able to 3D print on-demand replacement parts from a desktop based device is revolutionary. This technology offers producers an opportunity for significant time and cost savings on everything from replacement parts for aging equipment to making their own plastic standoffs for electric fence wire.

Spacer replacement part cost (online):
Part + overnight shipping = $71.00
3D printed spacer replacement part cost: $3.75
Time savings: 21 hours

For more information visit: https://www.facebook.com/cadd.lab
Or SCC's 3D printing program webpage:
https://somerset.kctcs.edu/education-training/program-finder/digital-printing-technology-3d-printing.aspx

Information in this document is based upon research supported by the National Science Foundation under Grant No. 1600081. Any opinions, findings, and conclusions or recommendations are those of the author(s) and do not reflect the views of the National Science Foundation.

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