Transforming Productivity and Ergonomics in Manufacturing Using 3D Printed Accommodations

George Allman
Manufacturing Engineering-Supervisor, Liberty Electronics, Inc.
Company Overview

- Incorporated in 1985
- ISO 9001, AS9100D, Nadcap Registered Quality Systems
- ITAR Compliant
- Registered Small Business
- 375 Employees - Non-Union Workforce
- 34% Employee Owned
- 150,000 Sq Ft Total
- Profit Sharing System
- Lean Manufacturing Processes
- www.libertyelectronics.com
Liberty Electronics provides electrical cable assemblies, wire harnesses, and box builds for demanding defense and commercial OEMs looking to grow their business by teaming with a competent outsourcing partner committed to success.
A growing number of manufacturers are implementing the use of 3D printed tools and fixtures into the workplace environment, and are seeing great improvements in productivity and efficiency. However, serving the needs of the individual operator or team member may not always be fully considered.

Although it is becoming more recognized in industry to utilize additive manufacturing methodologies to improve process efficiencies, the reward can be far more significant when an accommodation for an operator with, or without, a disability can be designed, developed, and placed into production within a few short hours.

Not only does this help the operator in performing their job task, it also gives them a more personal sense that engineering and management care for them on a deeper, more individual level, by addressing their specific needs and offering some degree of relief and support in performing their assigned work or task.
The ‘question’:

“I’m always seeing Engineering design all of these really creative tools and fixtures.

I suffer from Rheumatoid Arthritis and really have a problem holding my work.

At the end of the day, my hands and wrists hurt really bad, and I’m having difficulty meeting my standard (quota).

Is there any way that you can design something to help me?”

“Of course we can!”
The Solution:

Part: L2xxx - 125-J9-Holder

Within 3 hours, a custom sized fixture was Designed, Printed, Fitted, and Placed into service on the production floor.

The operator was inspired that someone (from Engineering) took the individual time to listen intently, and work to provide a custom solution to ‘her’ problem.

This is Empathy in Engineering at work.

She now can work more effective and efficiently, without pain, and is now better able to meet and exceed her daily quota.
Something to consider

• Manufacturing accounts for 8.5% of all jobs in the United States. *

• Productivity continues to improve as factories have implemented new technologies and production processes.

• As a result, industry demands more skilled and better trained workers.

• For workers with disabilities or limitations entering the workforce, and as our working population ages, it is imperative for businesses to consider providing *reasonable accommodations* to enhance the quality of life and productivity of these valued individuals.

Top Benefits of providing an accommodation

Direct Benefits –
(1) The accommodation allowed the company to retain a valued employee.
(2) The accommodation increased the employee’s productivity.
(3) The accommodation eliminated the costs of training a new employee.

Indirect Benefits –
(1) The accommodation ultimately improved interactions with co-workers.
(2) The accommodation increased overall company morale.
(3) The accommodation increased overall company productivity.

According to U.S. Department of Labor’s Office of Disability Employment Policy, employers experience multiple direct and indirect benefits after making accommodations.
### Accommodation Key Benefits – by percentage

**Direct**

- Retained a valued employee: 89%
- Increased the employees productivity: 72%
- Eliminated costs associated with training a new employee: 61%
- Increased the employee's attendance: 56%
- Increased diversity of the company: 41%
- Saved workers' compensation or other insurance costs: 38%
- Hired a qualified person with a disability: 15%
- Promoted an employee: 11%

**Indirect**

- Improved interactions with co-workers: 63%
- Increased overall company morale: 62%
- Increased overall company productivity: 56%
- Increased safety: 46%
- Improved interactions with customers: 46%
- Increased overall company attendance: 41%
- Increased profitability: 29%
- Increased customer base: 18%

---

As prepared and reported for the U.S. Department of Labor (DOL), Office of Disability Employment Policy by the Job Accommodation Network, under contract number 1605DC-17-C-0038. The views expressed are those of the authors and should not be attributed to DOL, nor does mention of trade names, commercial products, or organizations imply endorsement of same by the U.S. Government.

Percentages based on 2,387 employers surveyed who reported experiencing direct and indirect benefits as a result of having made an accommodation.
‘Employers who have made accommodations for employees with disabilities or limitations, reported multiple benefits as a result.’

With the advent of 3D modeling and printing, supporting the tooling and accommodation needs of production personnel, has never been more accessible.

A well trained and observant support person, whether it be an Engineer, Quality Assurance team member, Human Resource staff member, or Production Supervisor, can help to provide a solution.

One of the best ways to provide a solution to the need of an assembly operator or production team member, is to simply listen, gain understanding of the issue, then respond with genuine concern.
Making a change

Due to a condition from birth, Karen was limited to the jobs that she could perform on the production floor. By developing a custom fitted sleeve that incorporates a 3/8” drive adapter, Karen is now able to perform job functions that she could never have done before.

Time to Design: 3 hrs.
Time to Process: 2 hours

Personal satisfaction: Immeasurable
Opportunities in Manufacturing for Utilizing 3D Printed Technology
Prototype and Production-type Printer Systems

Stratasys - uPrint SE, Prototype FDM System

Stratasys - Fortus 380mc and 450mc 3D Production FDM Systems

Stratasys – Objet 30 Prime – PolyJet System
Application: Connector Assembly

Process: Connector Handling and Interface Engagement.

Considerations: Damage to product. Operator Fatigue and Strain
Application: Connector Assembly

Process: Connector Handling and Interface Engagement.

Solution: 3D Printed Torque Collar
No Damage to product.
Reduce/Eliminate Operator Fatigue and Strain
Application: Final Assembly
          Final Inspection

Process: 5 in./lb.
          Torque Verification

Process Time: 32 Seconds

Process Risk: Damage to Product
              Injury to Operator
<table>
<thead>
<tr>
<th>Application</th>
<th>Final Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Final Inspection</td>
</tr>
<tr>
<td>Process</td>
<td>5 in./lb.</td>
</tr>
<tr>
<td></td>
<td>Torque Verification</td>
</tr>
<tr>
<td></td>
<td>Using 3D Printed</td>
</tr>
<tr>
<td></td>
<td>Holding fixture</td>
</tr>
<tr>
<td>Process Time</td>
<td>12 Seconds</td>
</tr>
<tr>
<td></td>
<td>(62.5% reduction in process time)</td>
</tr>
<tr>
<td>Process Risk</td>
<td>Reduced or</td>
</tr>
<tr>
<td></td>
<td>Eliminated</td>
</tr>
</tbody>
</table>
Application: Terminal Crimp


Considerations: The Assembly Components cannot be safely held in place by the operator during the Crimping Cycle.

Solution: 3D Designed and Printed Tooling Holder to accommodate the operator's limitations and process requirements.
Application: Pin Retention -

Process: 2# Force Test
Typ. 4-80 per connector

Considerations: Operator Fatigue.
Standard handle size is relatively small and difficult to hold.
Application: Pin Retention -

Process: 2# Force Test
Typ. 4-80 per connector

Solution: 3D Designed and Printed
Custom tool handle.
Applying ‘Empathy in Engineering’

When communicating on a design concept for an accommodation, don’t hesitate to ask questions in order to gain understanding of the problem from the perspective of the operator. Value and acknowledge their input. Never try to simply ‘fix’ the problem. Provide a solution.

Remember that everyone seeks to be valued personally.

It’s important that team members are acknowledged for their service to an organization, and encouraged that what they bring to the organization makes a significant difference. Constructive input is key.

Team Members need to be assured that they are supported by management, and are provided the ‘tools’ and accommodations they may need in order to accomplish the task that is set before them.

If we, as Managers, Supervisors, and Team Leaders can respond timely and effectively with an accommodation when needed, we will surely reap the rewards of our efforts. Not only financially, but personally as well.

“People don’t care how much you know, until they know how much you care.”

John C. Maxwell
Utilizing AM to Support the Workplace & the STEM Community

By incorporating Additive Manufacturing initiatives throughout the company, Liberty Electronics stands out as a recognized innovator not only in the Aerospace Industry, but in our local community as well.

The ‘Innovation Mindset’ within Liberty Electronics, has provided opportunities for local students and educators to partner with Liberty in learning valuable STEM skills through Project-Based Learning externships, Mentorships, and State Level STEM competitions.