

# Lockheed Martin

## Additive Manufacturing

### Introduction to Engineering Design EDGSN 100 Section 002

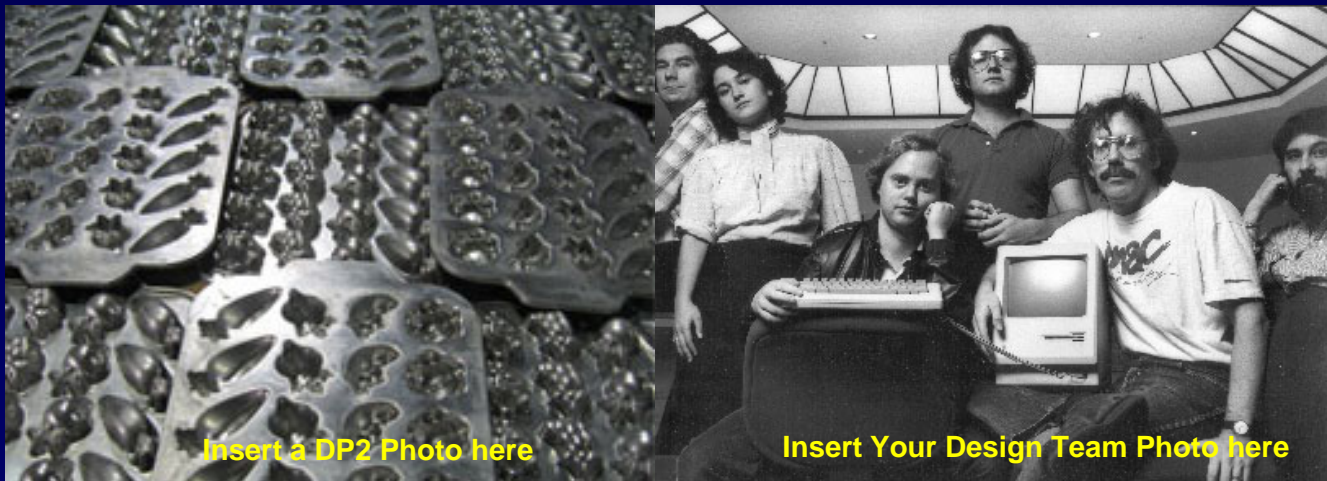
#### (Team) / (Design Team 3)

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# Purpose

- To improve the design of current technologies in terms of the reduction of weight, cost, and assembly time.
- The improved designs will go through the process of rapid prototyping by using the desktop additive machinery (i.e. MakerBot).
- To cover the problems faced by the users with the Anker USB 3.0 7-Port Hub and discuss only the new features added to the original design in order to make the USB Hub more efficient.

# Background

- Objective is to redesign a USB Hub Mounting Bracket used as a debug and auxiliary mounting device for a custom avionics mission system.
- The new USB mounting brackets will provide greater capability for the avionics technician through an increased capacity of connections and allow for installation in various areas on the platform.
- Primary goals:
  - To reduce the total number of parts for this assembly
  - To provide a vertical installation configuration.
- A mounting bracket will be designed that consists of brackets that can be connected via joints and each bracket will be a single additively constructed piece that can stand alone on a base, also connected via a sliding joint.
- Ideally this type of design will allow for the utmost simplicity by utilizing the fewest parts.



# Sponsor

## Lockheed Martin

- Bethesda, Maryland
- Global security and aerospace company
- 126,000 employees
- Principally engaged in the research, design, development, manufacture, integration and sustainment of advanced technology systems, products and services.



# Project Description

- 5 Projects options
- What we were looking for:
  - The Project most resembling a real-life situation, something we could relate to
  - The Project we felt we could excel at most
- Project #1 & Project #3 did not ignite any sparks
- Project #4 clicked

## Project #4

- Redesigning a USB Hub mounting bracket
- Consisted of designing a bracket for a 7-port USB Hub, designing a bracket for vertical mounting, and designing new cable retention for USB and Power cables.
- Goaled to provide greater capability, reduce parts, and provide vertical installation configuration.



# Procedures (1 of 2)

## Identifying the problem

- **Anker USB 3.0 7-Port Hub**
- **limited capacity of connections and installation in various areas on the USB Hub**

## Defining the criteria needed

- **The existing bracket for quantity 2**
- **7-port USB Hubs with cable retention for USB and Power cables and minimal part count**
- **Maintain 4-point, screw mounting for base bracket**
- **Minimize any additional screw or mounting holes required in platform structure**
- **A bracket for vertical hub mounting**
- **Design a bracket for stacking three Hubs together (horizontal and vertical)**



## Procedures (2 of 2)

### Researching on the relevant data and information

- Dimension of 4.3x1.7x0.9in and weight of 2.9oz
- Lightweight and portability

### Planning and developing solutions

- The mounting bracket was designed within 5 hours while the modeling process using Solidworks software took another 5 hours.
- Model designed based on 5 different structures; a stand, a pair of brackets (left and right), a stopper plate, and a container.
- Model is examined to ensure the dimensioning and tolerance of the bracket suits the Anker USB 3.0 7-Port Hub.

### Additive Manufacturing

- Model of the docking station is converted to a real life size prototype by using additive manufacturing.



# Results and Discussion

- T-shaped joints and main brackets fit well
- Can be manipulated into its different functionality options in only seconds
- Requires only four screws maximum for either vertical or horizontal mounting unlike the original design
- The interlocking t-joints allow several USB hubs to be stacked on top of one another
- The base designed for vertical mounting has no way to be secured to the table (bothersome to utilize a USB hub that does not remain in one place)
- The prototype is rather bulky.



# Conclusions and Recommendations

To correct the base designed for vertical mounting, one screw hole could be placed on either side of the base to allow the assembly to be mounted to table. If less material is used, the bracket assembly could be much more space efficient on a desktop.

This design is well suited for the jobs that were part of the design criteria because of its versatility in being able to string as many of the hubs together as desired and it is strong enough to be mounted with only four screws because of the trapezoidal joints.

This group feels that the appropriate measures were taken to ensure the high quality of the design as well as keeping the vision of the company in mind. It was a great honor to cooperate with Lockheed Martin on this project and this group would be willing to lend a hand in other projects as well, should the need arise.



# Closing

If there are any questions about the design, please contact Logan Fries at

[lvf5173@psu.edu](mailto:lvf5173@psu.edu). He plans to devote years of his life to perfect the design of the

USB Hub mounting bracket. He will be quite willing to help in any way that he

can.

Thank you.