Fasteners for the Digital Future

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- # TJ Smith
  - ## Background: Software development, testing, and deployment
  - ## Education: M.S. in Systems Engineering
  - ## Hobbies: Fishing, Gaming, & Running

- # Cassey Kinman
  - ## Background: CAD Process Development, Software Development
  - ## Education: B.S. Mechanical Engineering
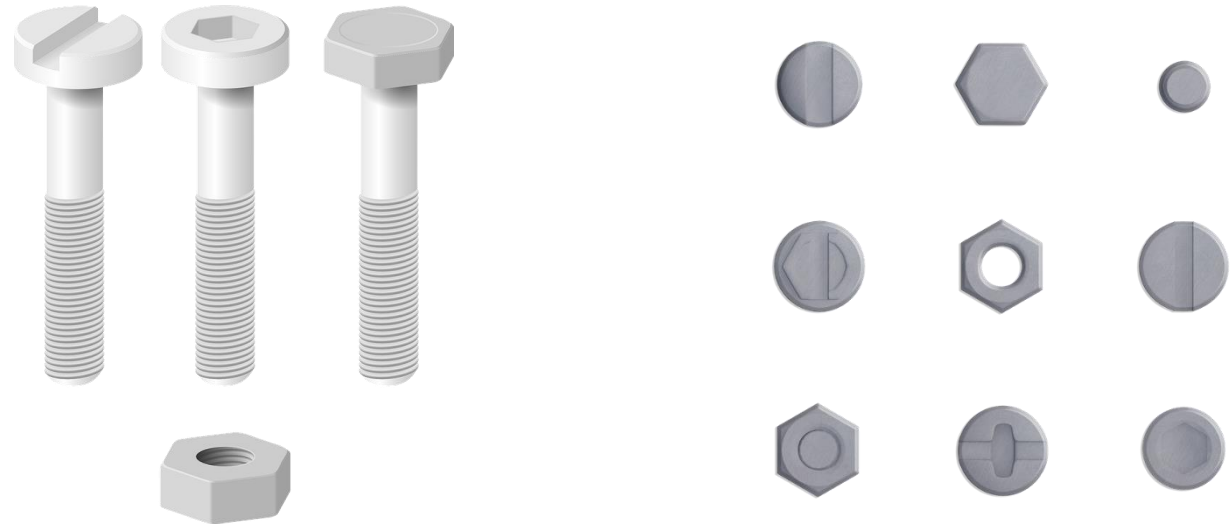 - ## Hobbies: Gaming, Movies, & Music (Piano & Mandolin)

Agenda / Roadmap

- **Mechanical Fastener Object Components**

- **Challenges of Fastener Object Creation**

- **How Have Fastener Been Defined in Model?**

- **Why Try to use Mechanical Fastener Objects?**

- **Challenges of Mechanical Fastener Objects in Model Based Definition**

- **Possibilities of Fasteners**

- **Mechanical fastener objects are composed of individual components (e.g. nuts, bolts, washers, rivets, etc.)**
  - **Fastener objects are also referred to as assemblies, stack ups, references, etc.**
- **Consider a standard BOLT**
  - **One standard BOLT can have hundreds of thousands of possible part number combinations**
    - **Multiple lengths**
    - **Multiple grip lengths**
    - **Multiple sizes**
    - **Multiple material**
    - **Multiple finishes**
    - **Multiple head types**

- **When additional standards are required (e.g. washer(s), nut-plates, etc.), the number of possible combinations grows exponentially**
  - **It is not scalable or viable to define every single possible combinations of fastener objects**
- **Do not need to have every single possible combination defined or created**
  - **Not all combinations are valid**
    - **Some combinations may try to combine dissimilar metals**
    - **Different fasteners have different usage requirements (inside vs. outside)**
    - **Federal, Industry, Military (FIM) standards vs. company specific standards**
- **How can fastener objects that are needed by supplied to downstream consumers in a timely manner?**

# Challenges of Fastener Object Creation

- **Current Processes**
  - **Standard part models are derived parametrically from a geometric master model**
  - **Fastener combinations are defined by program Subject Matter Experts (SMEs)**
- **Current Tools**
  - **Programs created custom tools to take the parametrically derived models and put them in stack ups**
- **Future Tools & Processes**
  - **Ability to generate fastener objects on demand**
  - **Standard & re-usable fastener object**

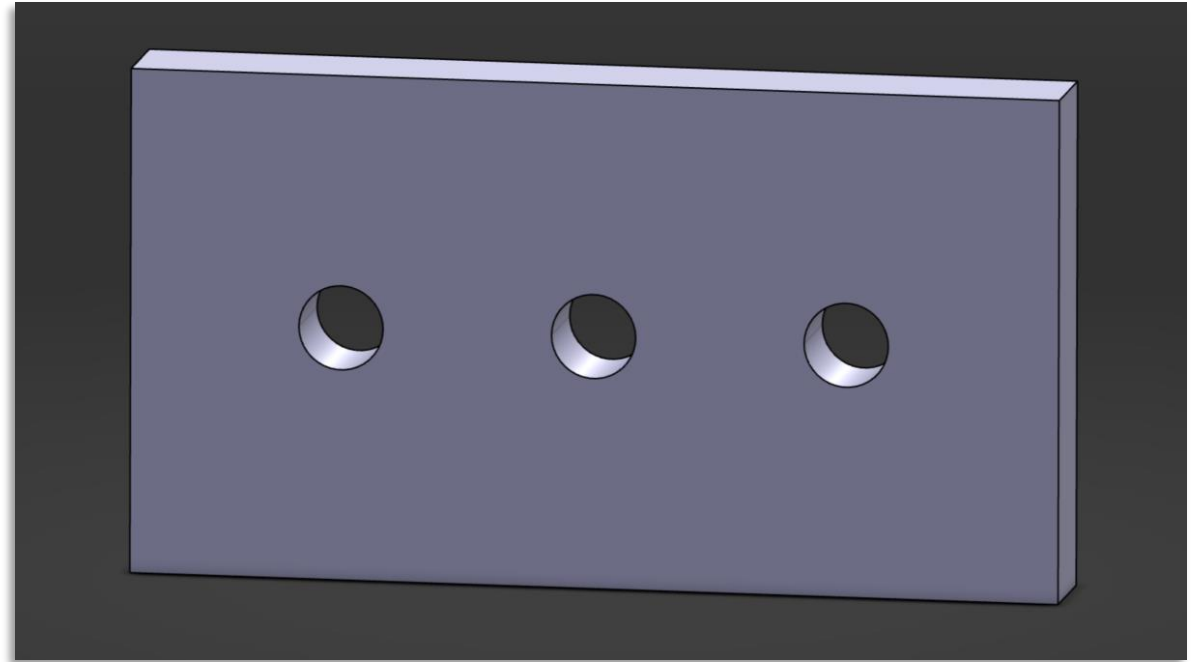# How Have Fasteners Been Define in Models?

- **Fasteners have been depicted in model in various ways:**

  - **Point, Line, and Annotation**

  - **National Aerospace Standard 523: Fastener Codes - Drawing Method**

  - **Placing Standard Parts into the model**
    - **Actual Parts**
    - **Volumetric Solids**
    - **Mechanical Fasten Object**

  - **And so many other ways…**
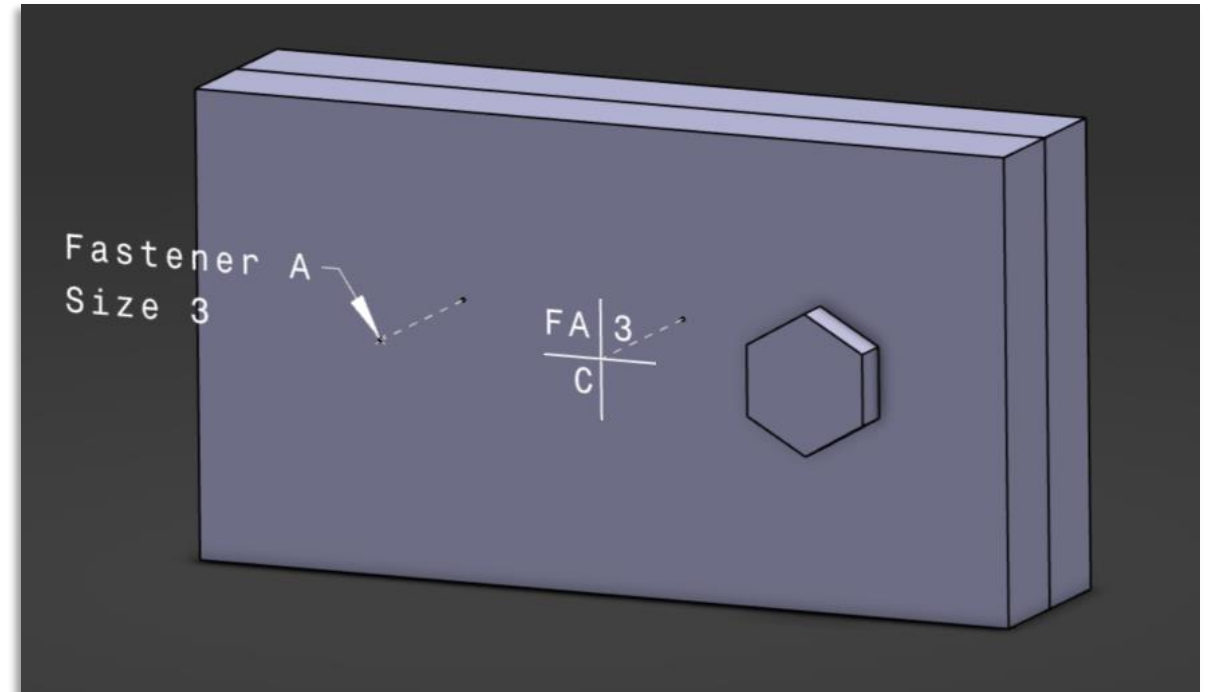
What is the difference between these 3 Holes?

Trick Question: Visually Nothing

These Holes where created 3 different ways:

- **By using a Split**
- **By using a Pocket**
- **Hole Wizard**

Only ONE of these is recognized by the software is as a hole
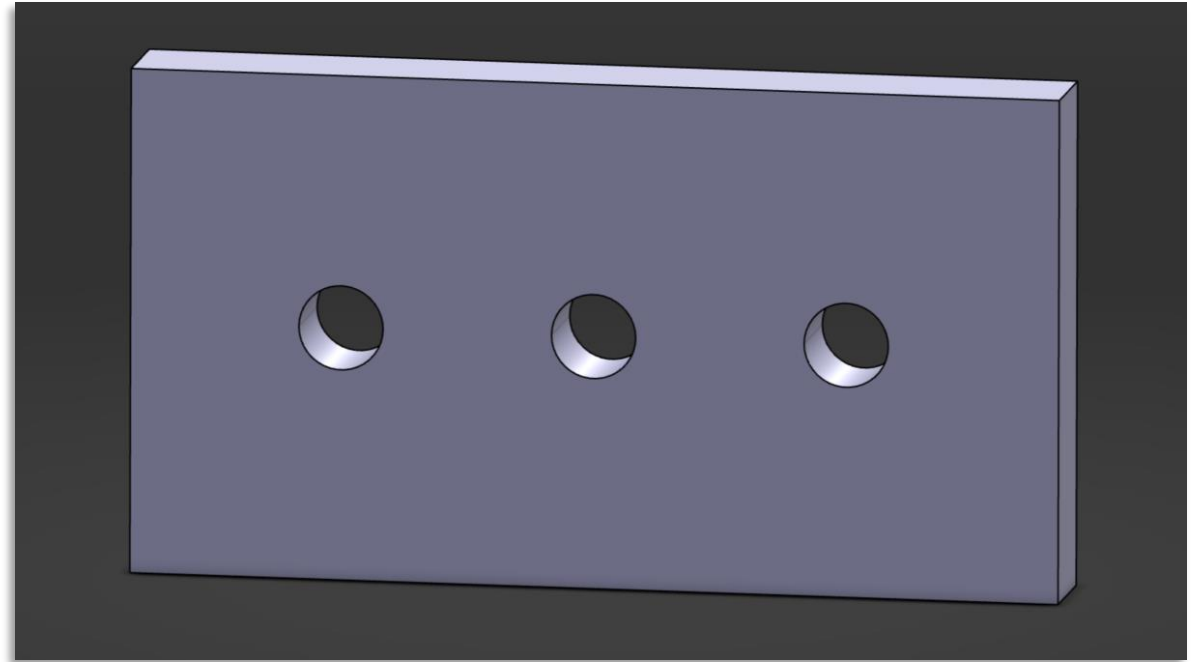
- **Repeat: Mechanical fastener objects are composed of individual components (e.g. nuts, bolts, washers, rivets, etc.)**

- **When applying Mechanical Fastener Objects to a model more information is available. We start to build more intelligence models. The software knows this is a Fastener.**

- **As many industries tries to support more information being used throughout the Digital Thread, the way we define fasteners requires us to change how and what data is applied to our Definition of the Fastener.**

- **Ideally we would want to be able to use/reuse the same information defined by the Design Engineering Process in the Manufacturing Planning and down to the Shop Floor.**

- # Information is not free
  - ## Older processes rely on old documentation
  - ## The more connections that are created in a model the more complicated the model gets
  - ## Managing connections through change of models is not easy

- # Balancing
  - ## Data that goes into defining a Fastener needs to have a value
  - ## We need to be able to maintain efficiency as we add information.

Future Possibilities of Fasteners

- **<u>IF</u> we can get through the challenges of facing Fasteners:**

  - **Better understanding of Reality, Supports Digital Twin Concepts**

  - **Decreases mistakes made by relying on human inputs**

  - **More opportunities for Developing Analysis Tools**

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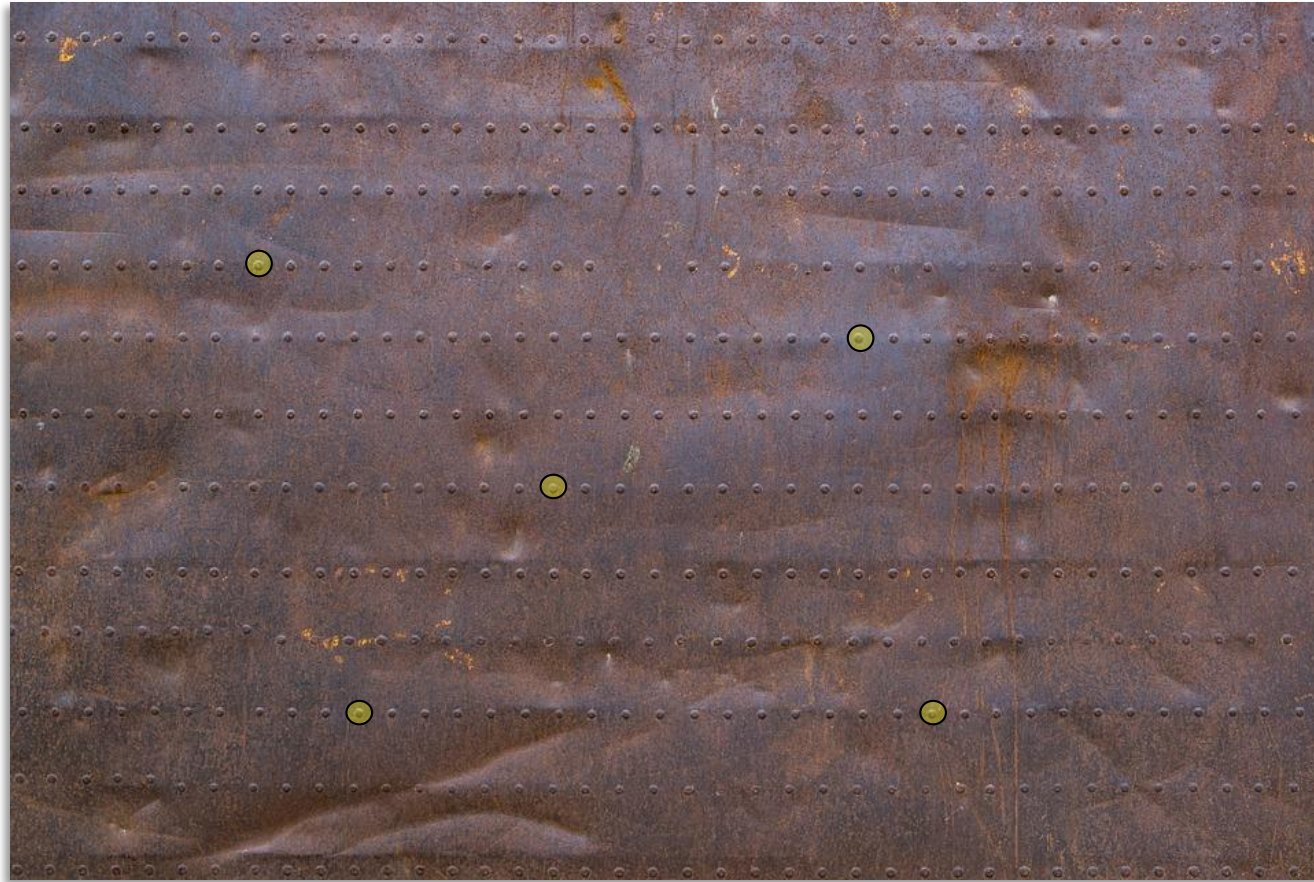
Possibilities of Fasteners

- # Image Citations
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