Northrop Grumman is a leading producer of deployable space systems such as deployable booms, solar arrays, and antennas. In order to accurately test the deployment of these systems, the zero-gravity environment of space needs to be simulated on Earth. This requires a testing platform that can provide a frictionless environment and be able to endure a range of high and low temperatures.

**Overview**

- An all-purpose off-loader test kit that utilizes air bearings was created to simulate deployment sequences with negligible friction
- Surface finish and flatness of the floor are vital to air bearing performance
- An epoxy substrate is used as the air bearing floor to create a flat, self-leveling, and frictionless surface
- A modular sub-frame which holds the epoxy substrate is scalable and portable for large scale testing

**Exploded View**

Off-Loader Design Concept

**Key Design Features**

**Actuating Pedestals**
- Provides rough leveling capability
- Supports weight of assembly

**Modular Subfloor Assembly**
- Allows testing area to be scaled
- Can disassemble for portability

**Epoxy Substrate**
- Creates smooth surface
- Enhances leveling properties of floor

**Quantifying Friction Coefficient**

To determine if the cured epoxy substrate can float an air bearing, a friction test rig was designed and built. Using the inclined plane method, a micrometer gradually raised one end of the platform until the air bearing displaced.

<table>
<thead>
<tr>
<th>Epoxy</th>
<th>Angle</th>
<th>Friction Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro Marine Epoxy</td>
<td>0.03528°</td>
<td>0.0006</td>
</tr>
</tbody>
</table>

**Conclusion**

- Modular design allows for scalability and fast assembly
- Components were chosen to operate from -60°C to 60°C
- More epoxy substrates that can consistently produce a desirable flatness tolerance and surface finish must be tested in the future

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