

Reusable Cryogenic Connector

Juan Valencia | Josh Leary | Jackson Herrod | Mika Kuschnitzky



Marshall Space
Flight Center



FAMU-FSU
College of Engineering

Team 513



Joshua Leary
Systems
Engineer



Juan Valencia
Thermal Fluids &
Design Engineer



Jackson Herrod
Test
Engineer



Mika Kuschnitzky
Materials/Manufacturin
g
Engineer

Sponsor and Advisor



Rachel McCauley

*NASA Marshall Space
Flight Center*



Shawn E.
Brechbill

*NASA Marshall Space
Flight Center*



Dr. Mark
Vanderlaan

*FAMU-FSU
College of Engineering*

Juan Valencia

Objective



To design, build, and test a cryogenic connector interface and conduct life cycle testing with a focus on the seal/joint design.

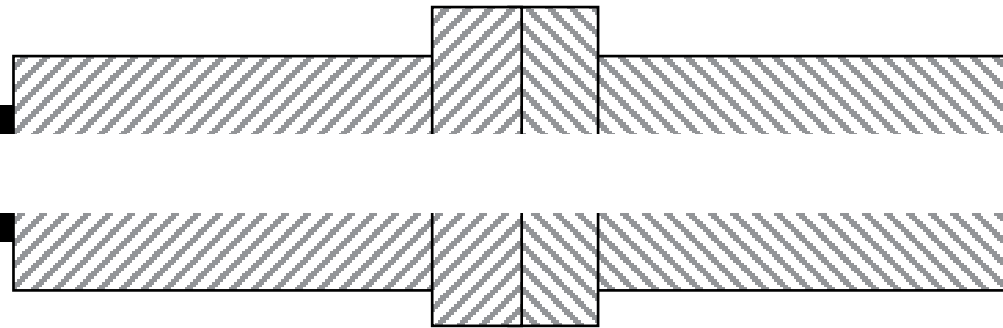
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Project Background

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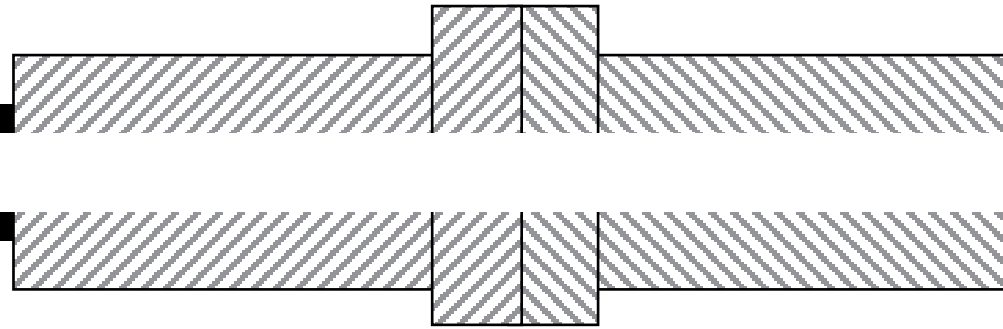
Project Background



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Project Background

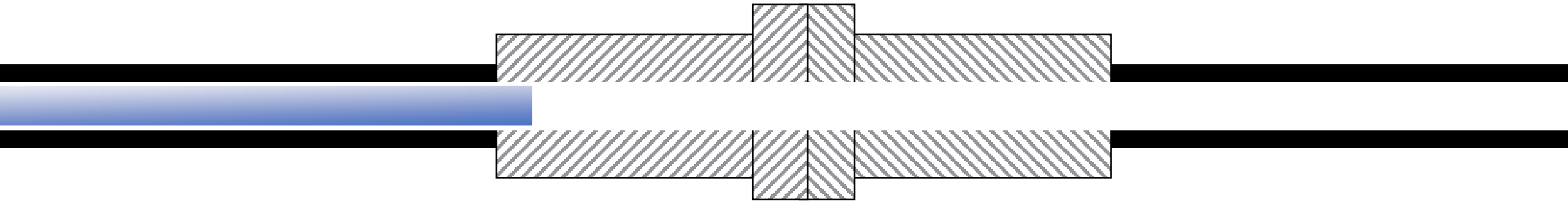
Project Scope



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Project Background

Project Scope



Customer Needs

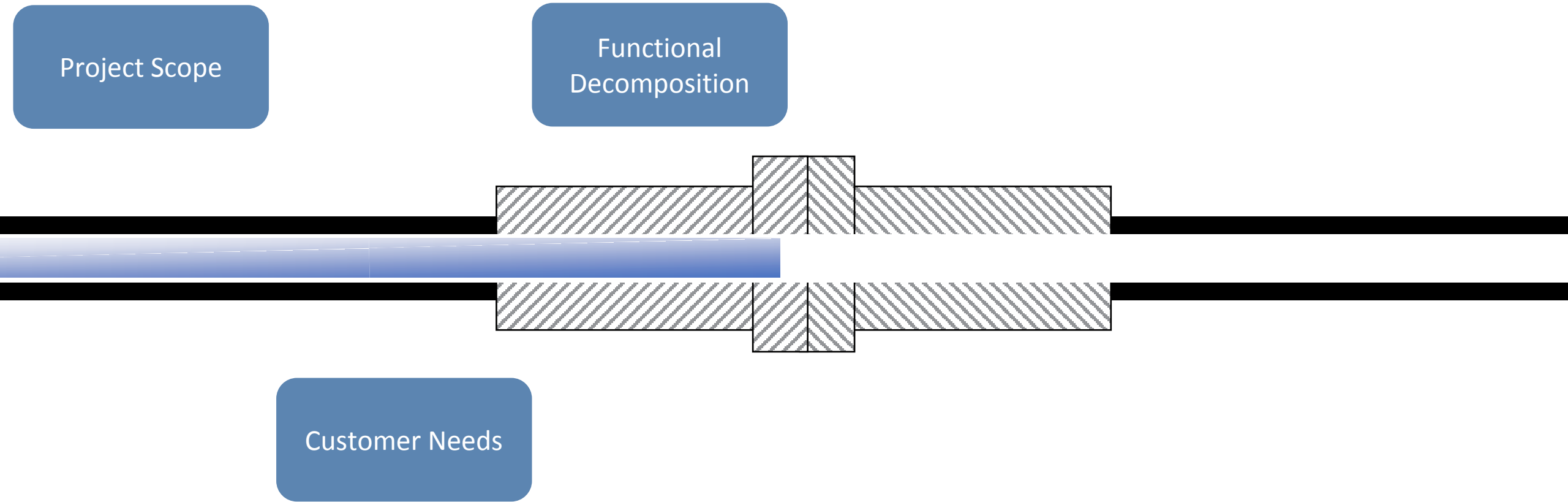
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Project Background

Project Scope

Functional
Decomposition

Customer Needs



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Project Background

Project Scope

Functional
Decomposition

Customer Needs

Targets

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Project Background

Project Scope

Functional
Decomposition

Concept
Generation

Customer Needs

Targets

Juan Valencia

Project Background

Project Scope

Functional
Decomposition

Concept
Generation

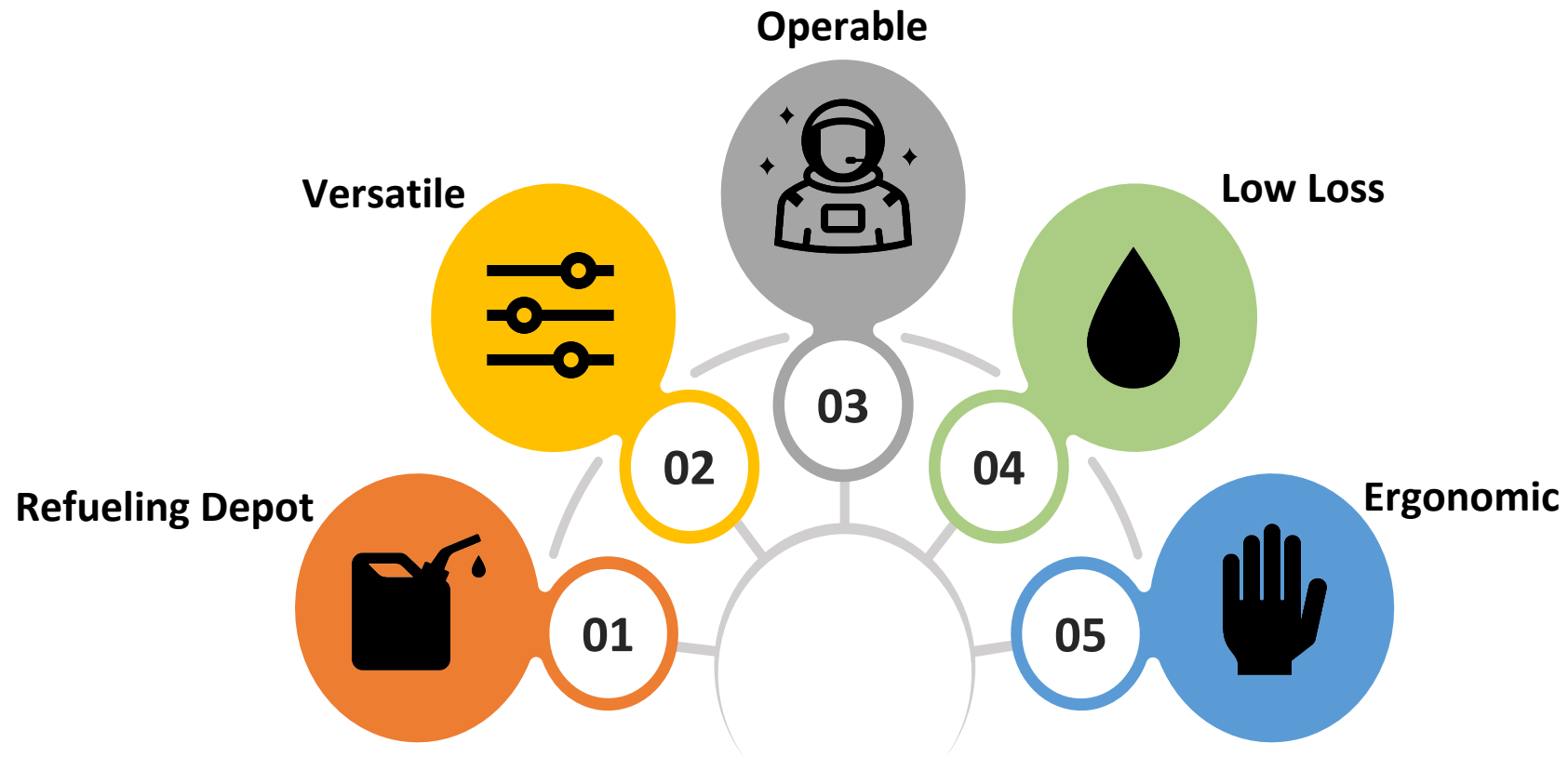
Customer Needs

Targets

Concept Selection

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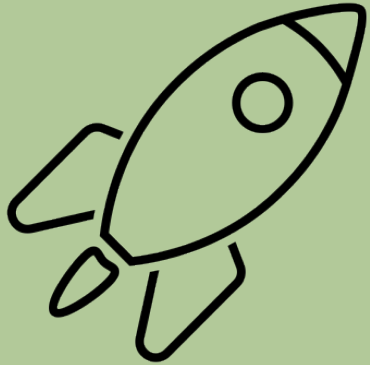
Key Goals



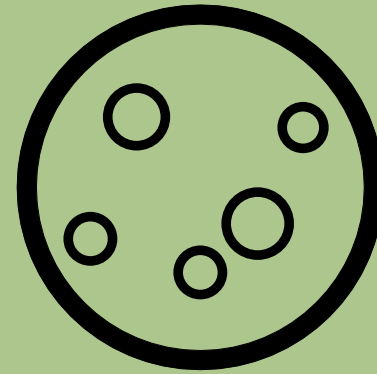
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Targets and Metrics

Critical Targets

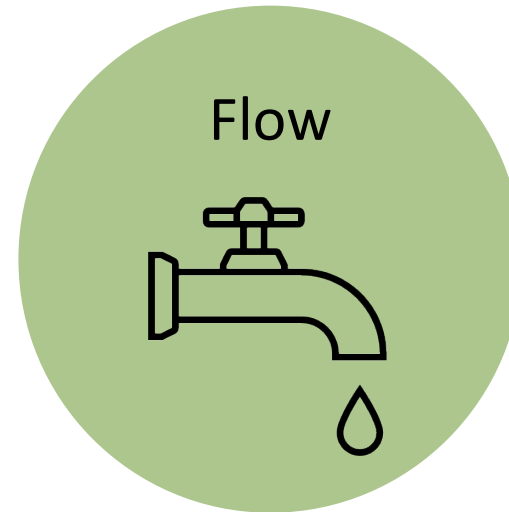
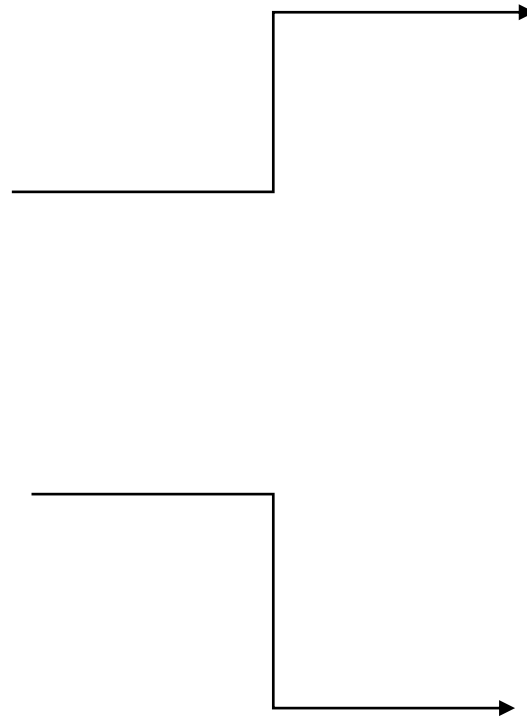


Secondary Targets



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Targets and Metrics



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Targets and Metrics



2.57 cm – 3 cm



< 48 N



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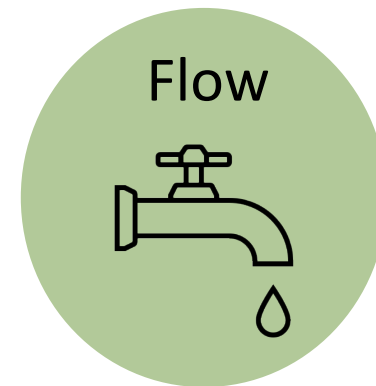
Targets and Metrics



0.1 SCIM

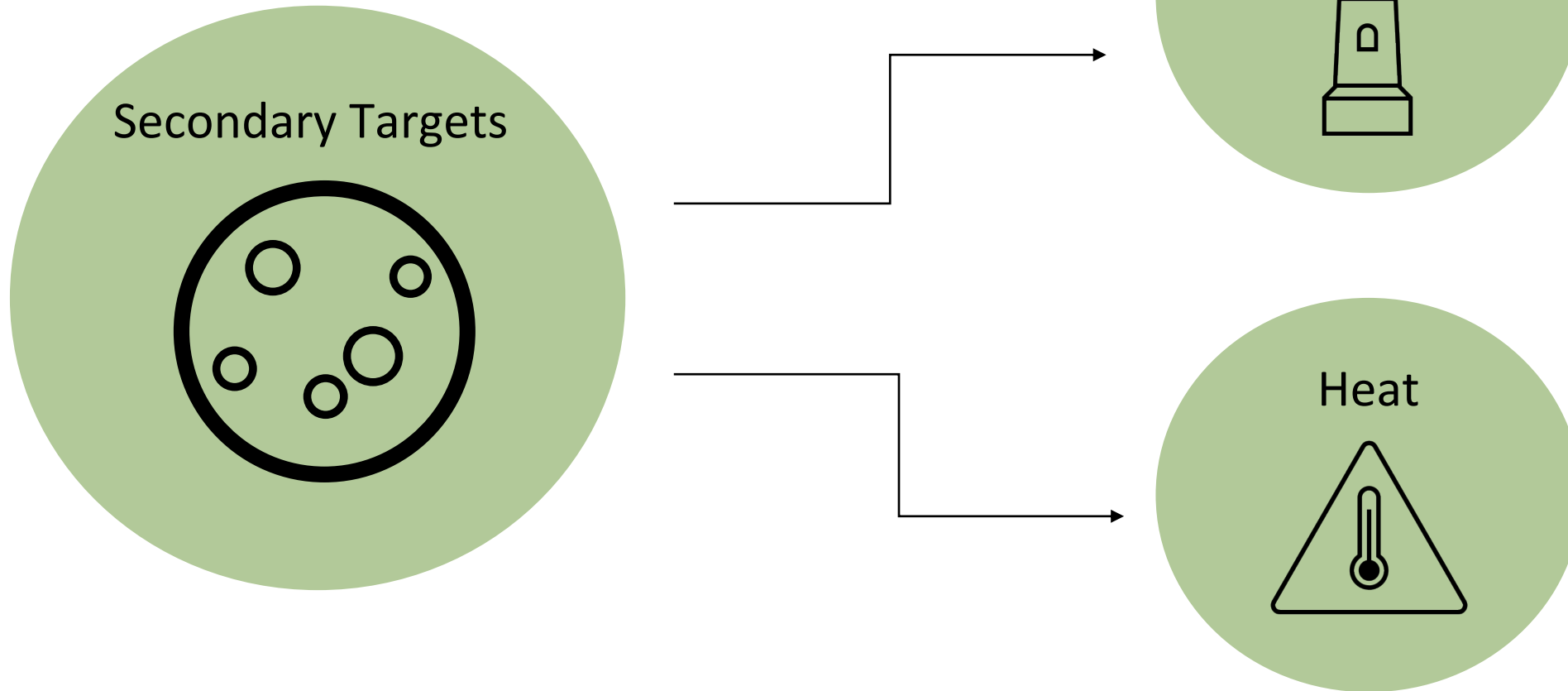


0.001 SCIM



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Targets and Metrics

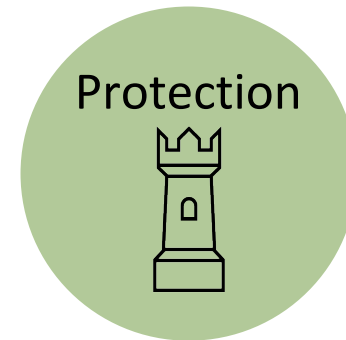


Juan Valencia

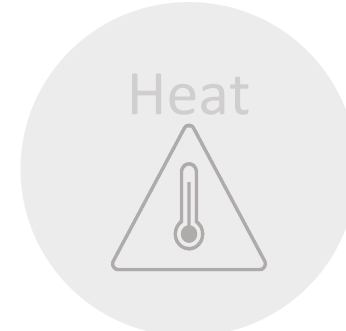
Targets and Metrics



IP64



500 MPa



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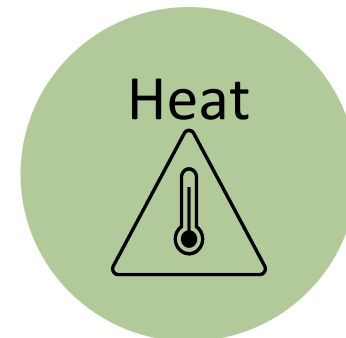
Targets and Metrics



0 mm

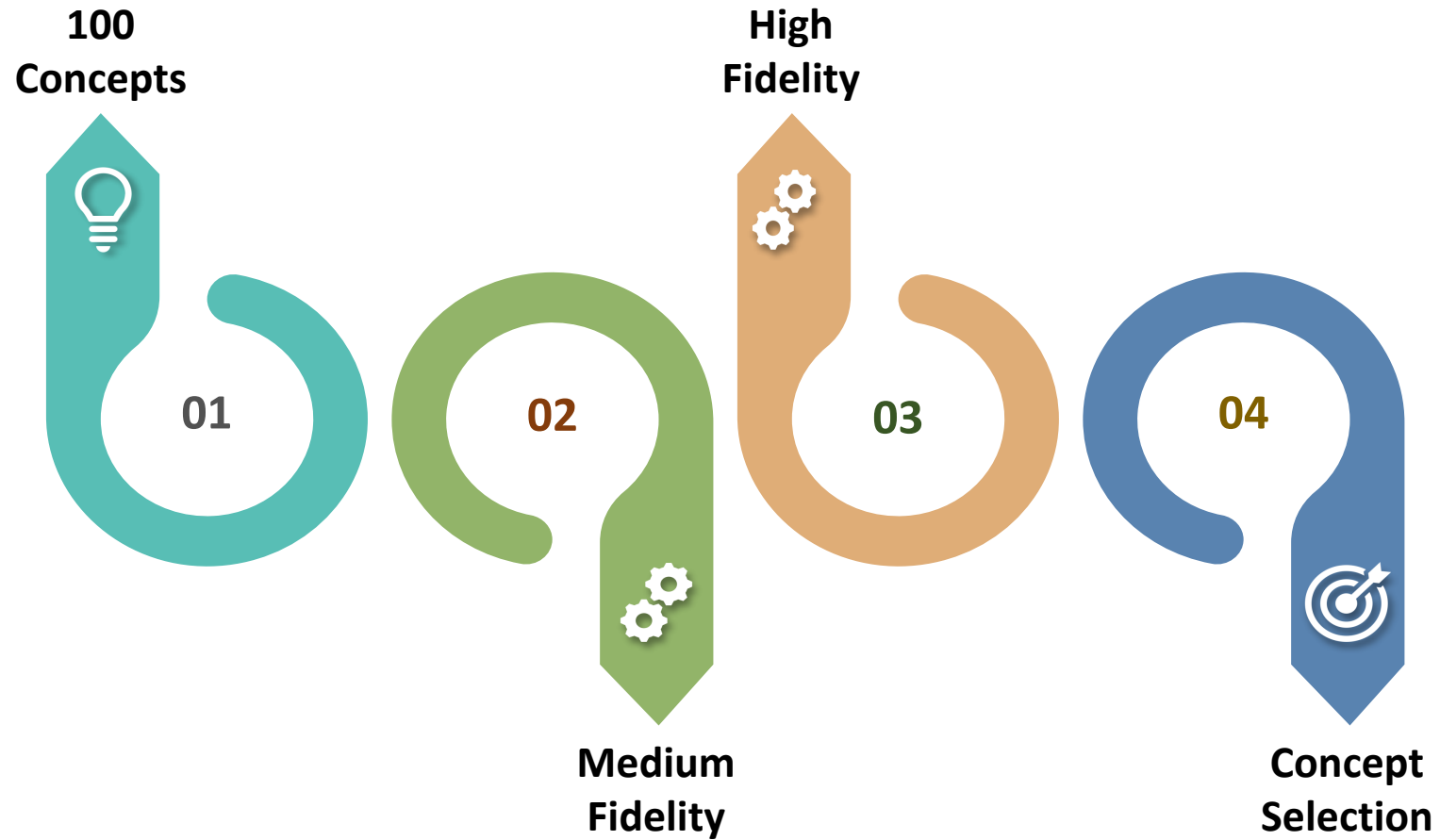


0.0023 SCIM



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Concept Generation



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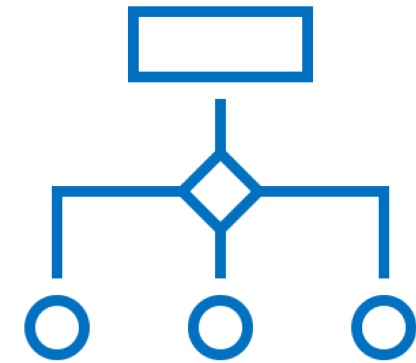
Concept Generation: 100 Concepts



Ideation



Biomimicry

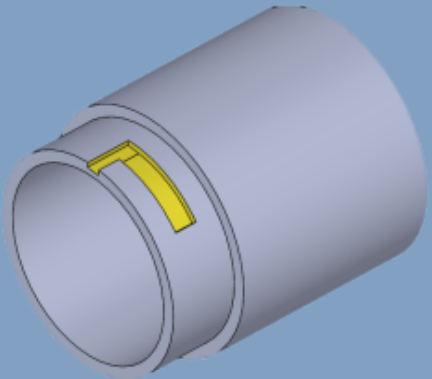


Morphological
Chart

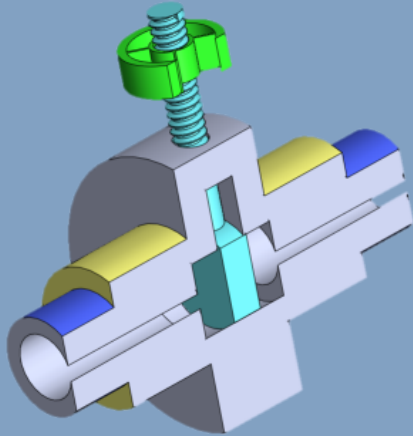
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Concept Generation: Medium Fidelity

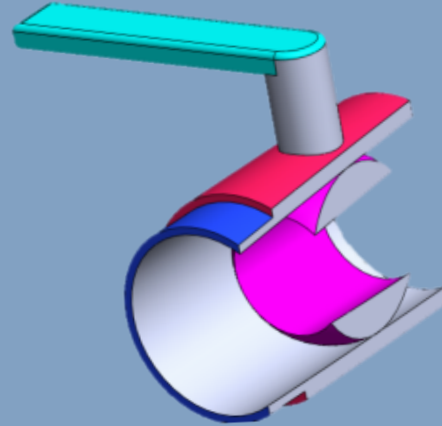
The Key



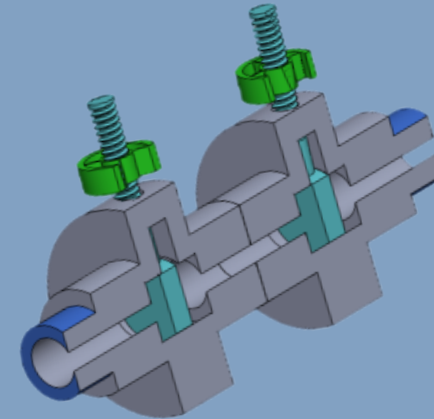
MLI Gate Valve



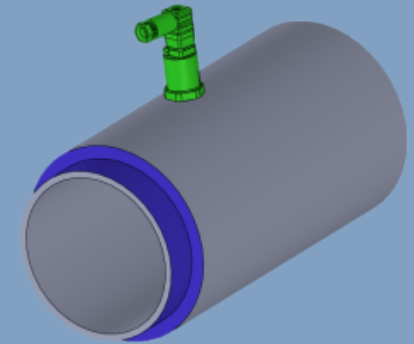
Fiber Glass Ball Valve



Non-insulate Double Gate

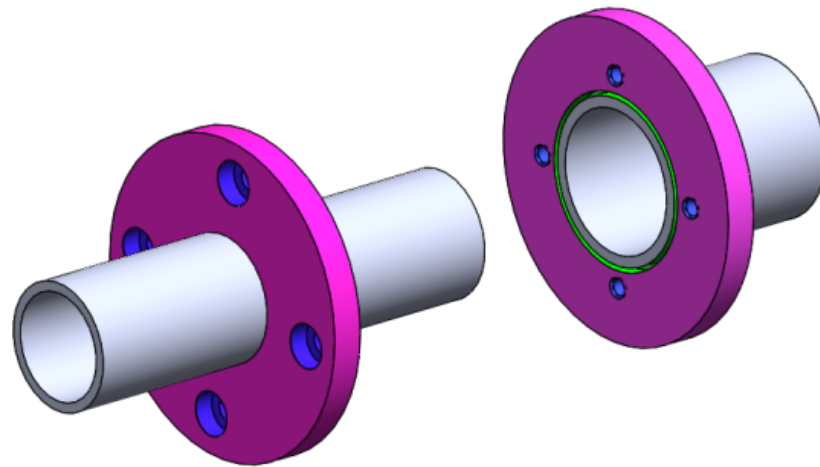


The Sensor



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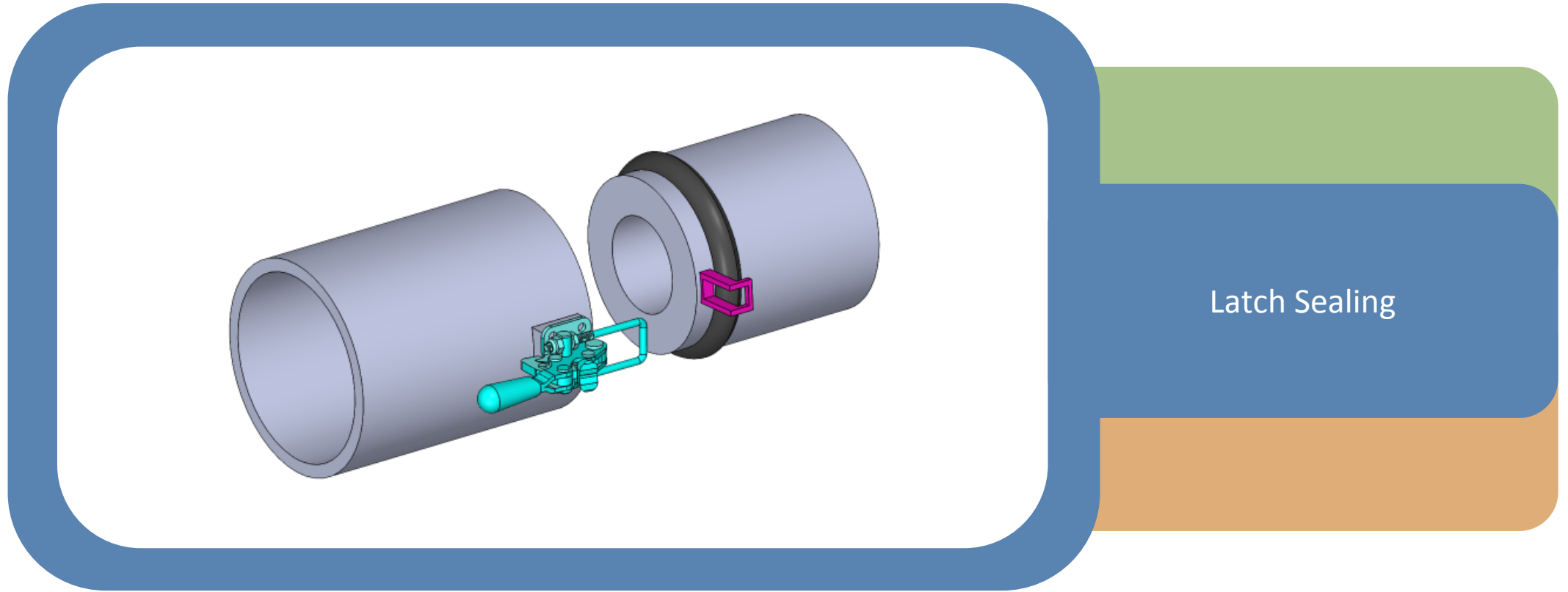
Concept Generation: High Fidelity



Cryogenic Bayonet

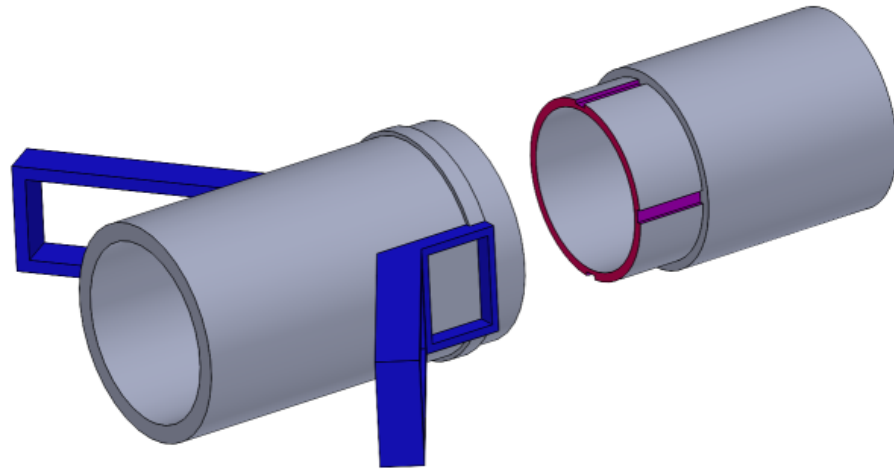
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Concept Generation: High Fidelity



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Concept Generation: High Fidelity



Cryogenic Dry Connect

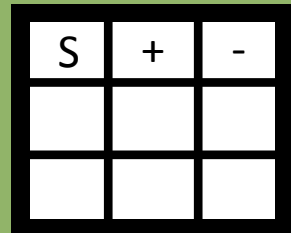
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Concept Selection

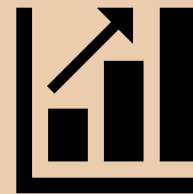
HOQ



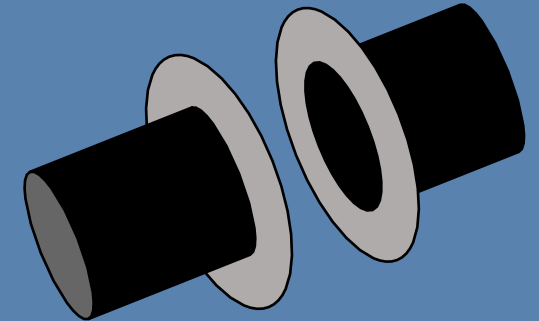
Pugh



AHP

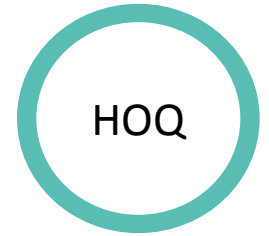


Selection



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Concept Selection



Jackson Herrod

Concept Selection

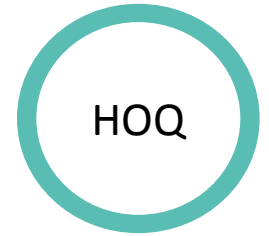
Customer Needs

- Fluid Loss
- Cryogenic Temp.
- Withstand Flow
- Ergonomic
- Fit to Existing Pipe
- Below \$1400
- Reusable
- Reliable**
- Flow Control



Targets

- Diameter
- Fluid Temp.
- Force
- Tensile Strength
- Leakage
- Ingress
- Flow Rate
- Boil Off
- Price



Jackson Herrod

Concept Selection

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Targets

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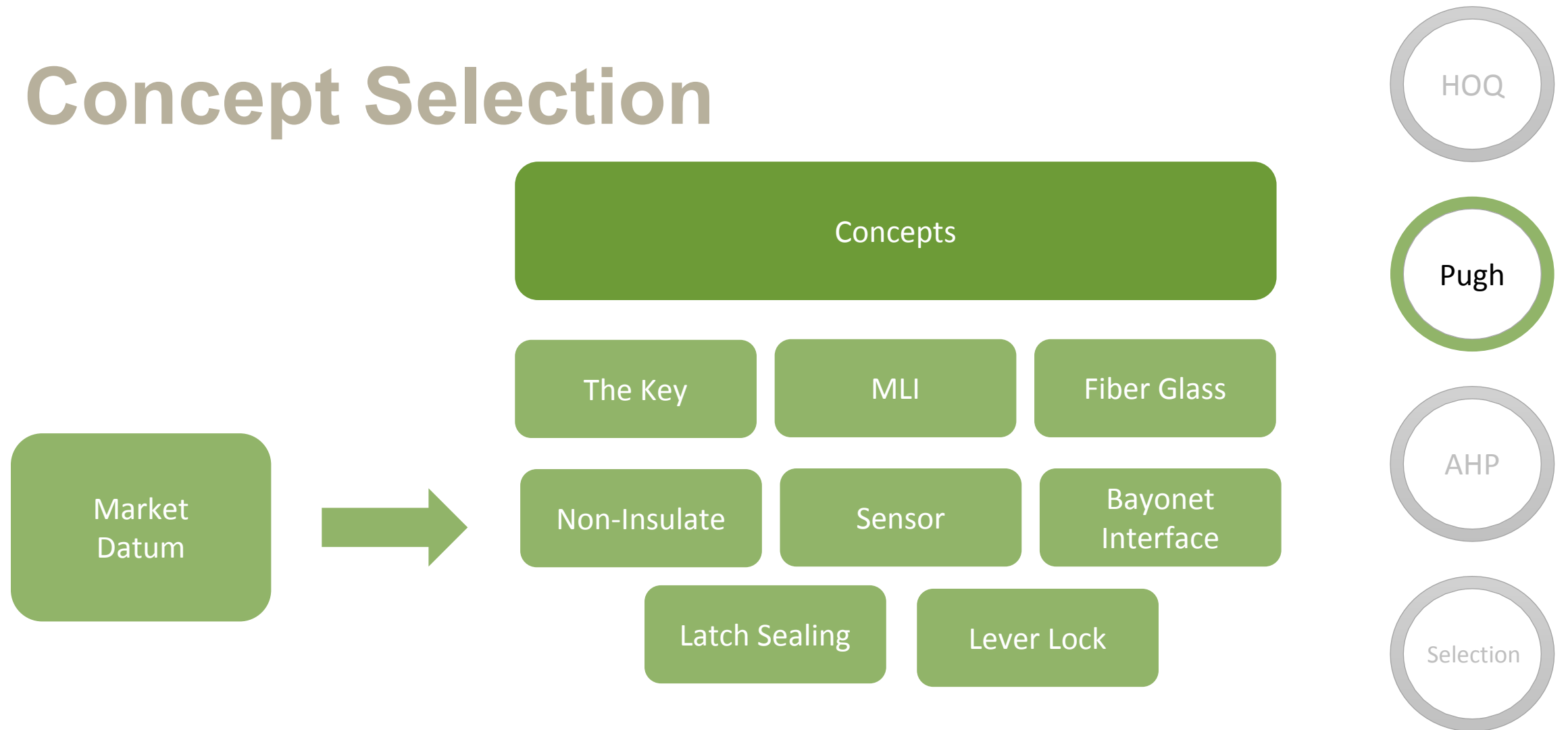
Jackson Herrod

Concept Selection



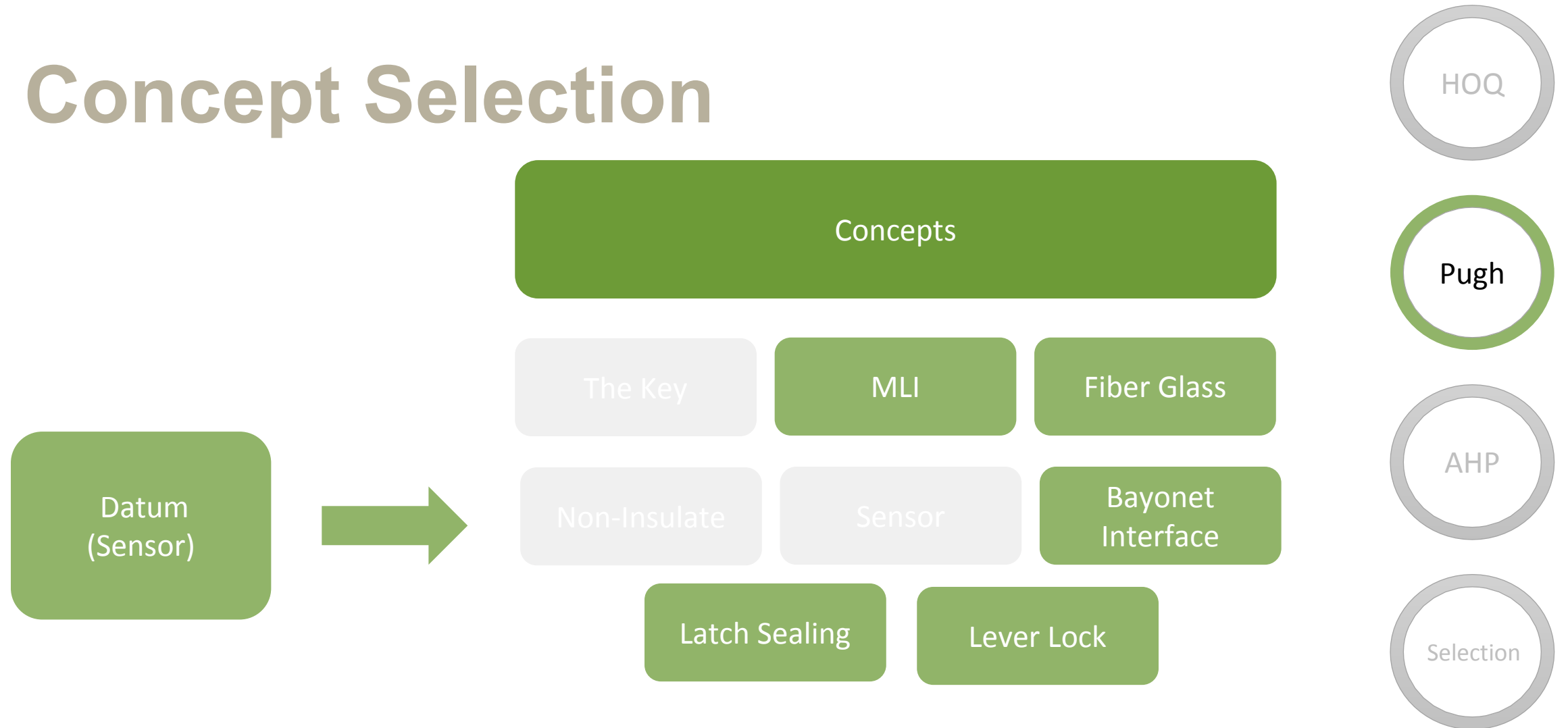
Jackson Herrod

Concept Selection



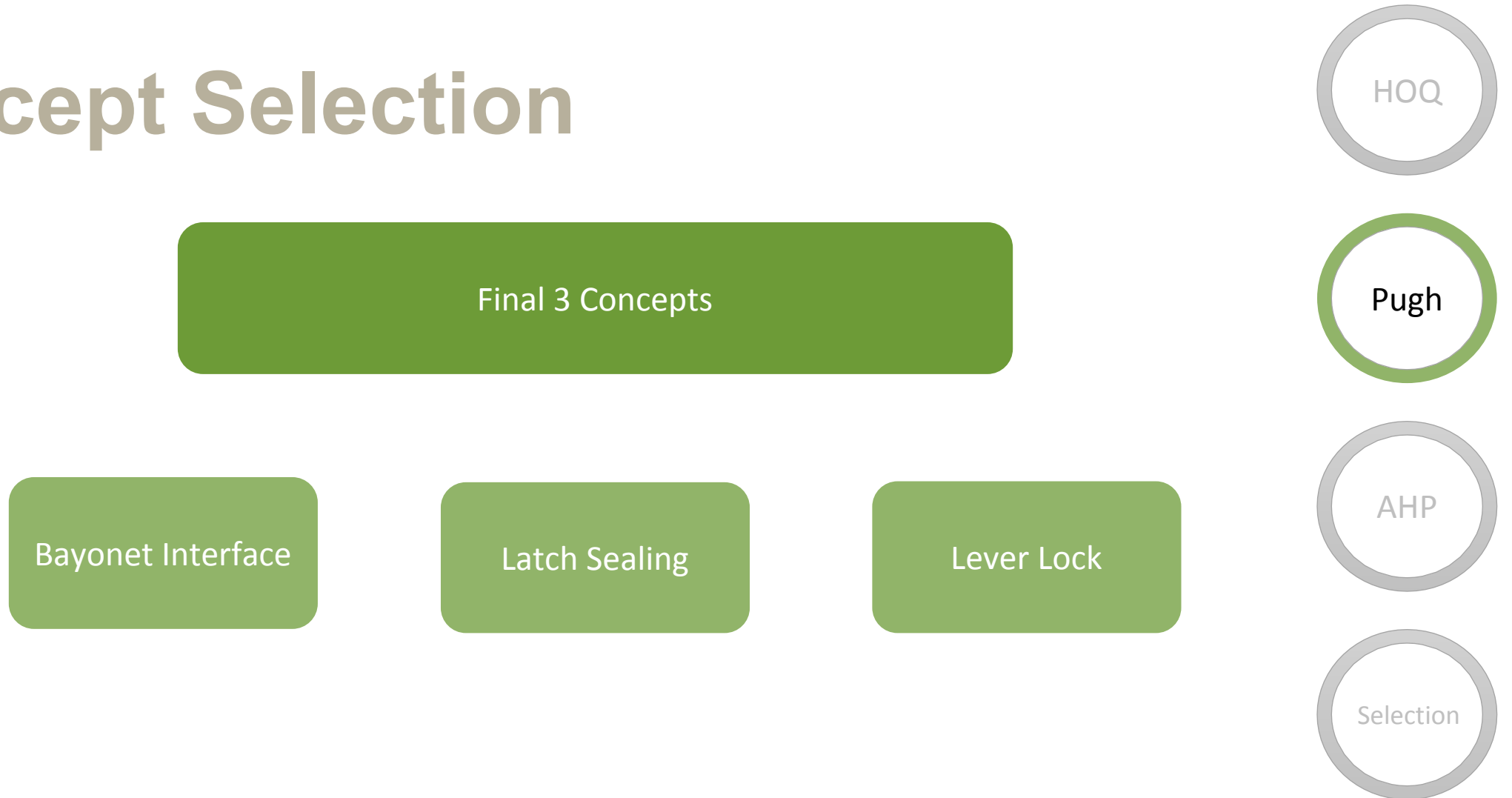
Jackson Herrod

Concept Selection



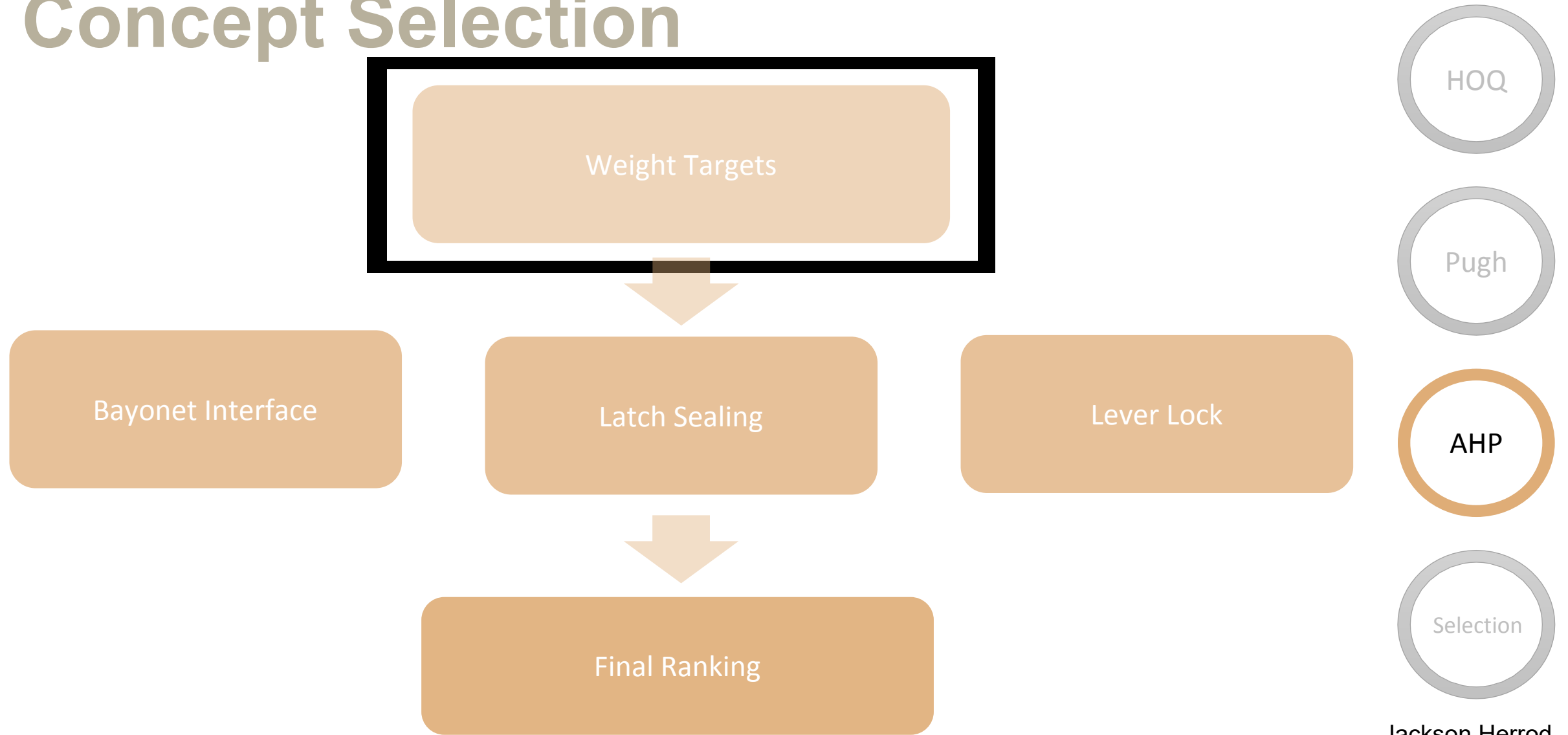
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Concept Selection



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Concept Selection



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Concept Selection

Weight Targets



Bayonet Interface

Latch Sealing

Lever Lock



Final Ranking

HOQ

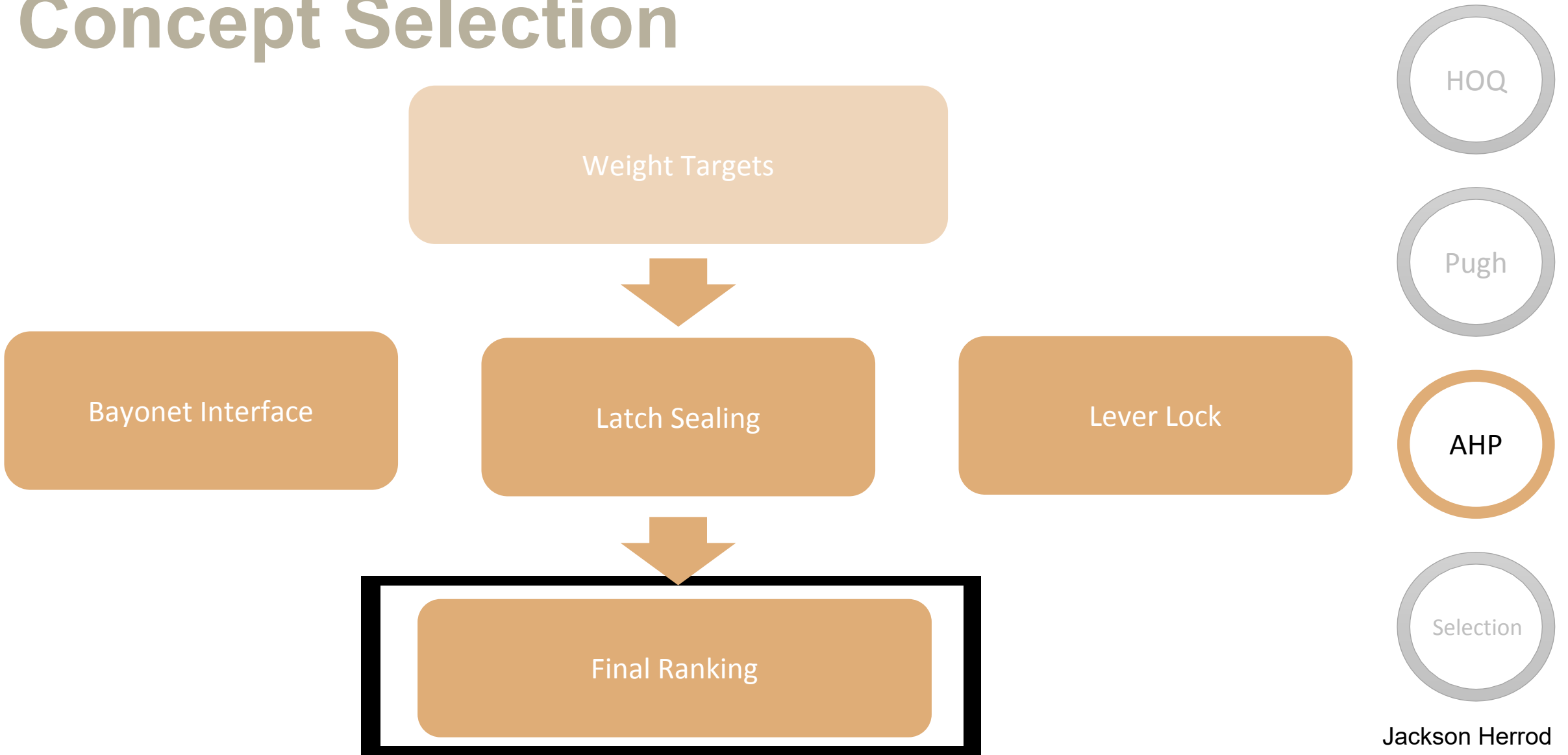
Pugh

AHP

Selection

Jackson Herrod

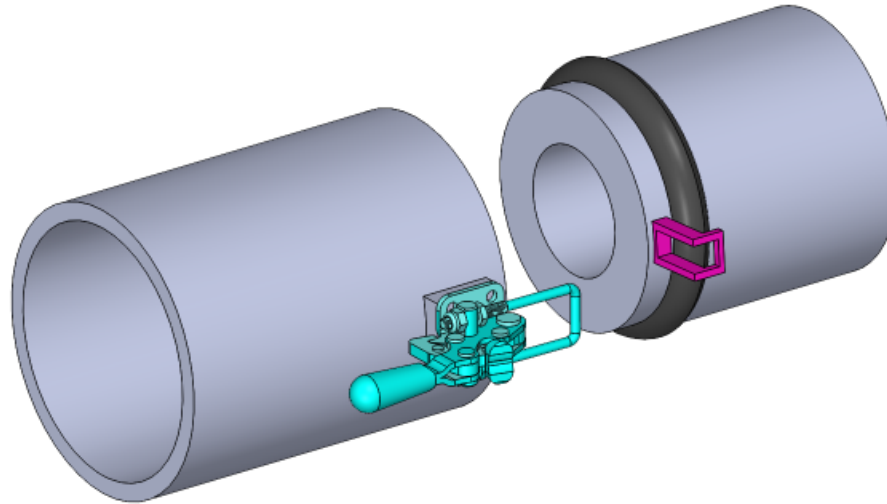
Concept Selection



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Concept Selection

Latch Sealing



HOQ

Pugh

AHP

Selection

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Future Work



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