General Need for Product
The current method for aligning the front wheel of a bicycle with its handlebars is inaccurate and time-consuming.

Perceived Market
- 165+ bicycle retailers in DC-Metro area
- 18 million new bicycles sold yearly in the US (NBDA)

Customer Requirements
- Intuitive Process
- High Accuracy
- Bicycle Compatibility
- Fast to Use
- Easily Stored
- Long Lifetime
- Lightweight
- One-time Process

Objective

Engineering Characteristics
- No. of Adjustments
- Material
- No. of Moving Parts
- Angles of Contact
- Physical Dimensions
- Weight
- Adjustment Force
- Angular Accuracy
- Time to Align

Concept Generation

Stand Concept
- Pro: Non-circular rod
- Con: Floor mounted

Wall Mounted Concept
- Pro: Extending claws
- Con: Discrete heights

Adjustable Tool Concept
- Pro: Mobile tool
- Pro: Dropout attachment
- Pro: Equalizing slides
- Con: Multiple DOFs

<table>
<thead>
<tr>
<th>Concept</th>
<th>Stand</th>
<th>Wall Mount</th>
<th>Adjustable</th>
</tr>
</thead>
<tbody>
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<td>AHP Weight</td>
<td>0.2967</td>
<td>0.2402</td>
<td>0.4131</td>
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Design

1. Geometry of the tool aligns the handlebars with wheel
2. Axle mounts in bicycle dropouts while claws grasp handlebars.
3. Equalizing slides accommodate different handlebar geometries
4. Non-rotating telescoping tube adjusts for different bicycle sizes
5. Tapered claws accommodate different handlebar diameters

Prototype and Testing

Customer Quality Ranking
- Ease of use, speed, accuracy

Mechanical Measurements
- Align time, angular accuracy

End-user suggestions
- Quick-release bolts on axle
- Decrease slider assembly size

Alignment Results
- Avg. angular offset: 2.11°
- Avg. time to align: 71 sec
- Avg. ease of use rating: 4.67/5

Test Results and Future Work

Morphological study and end-user interviews provided focus for concept

Finite element and failure mode effect analyses identified design weaknesses

Prototype testing and end-user reviews confirmed usefulness of tool

Future Plan of Action
- Modify design for aluminum construction
- Incorporate end-user suggestions into design
- Calculate production and marketing costs
- Determine design patentability