Project Status Update

P09310- Automatic Shift Controls for ATV

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Project Status Update

- Project Name
  - **Automatic Shift Controls for ATV**
- Project Number
  - **P09310**
- Project Family
  - **Modular, Scalable, Open Architecture Control Systems**
- Track
  - **Systems and Controls**
- Start Term
  - **2008-1 planned academic quarter for MSD1**
- End Term
  - **2008-2 planned academic quarter for MSD2**
- Faculty Guide
  - **Professor George Slack (EE)**
- Faculty Consultant
  - **Dr. A. Nye (ME)**
- Primary Customer
  - **Polaris Industries**
    - **Joel Notaro, *Performance ATV Project Engineer***

Phase 0: Planning
Mission Statement

Product Description

This product is part of the 3rd generation design for automatic shift controls for an ATV equipped with a manual transmission. Currently, there is a push button control option, but in this generation an automatic option will be designed for both race and general use.

Key Business Goals

The primary business goals of this product is to enhance race controls by developing an automatic shifting system with manual override to give the individual racer the benefit of quick, smooth automatic shifting while racing with optional user input prime for a dynamic race experience.

Primary Market /Project Opportunities

Polaris sponsors race teams

Secondary Market /Project Opportunities

Polaris Industries aftermarket

Stakeholders

Stakeholders in the design of our product include the following:

RIT MSD I&II

Polaris Industries

ATV Race teams

ATV Enthusiasts

RIT FSAE Teams (Baja and Formula)

Other competitors in ATV Industry

Other off-road motor vehicle industries

Phase 1: Concept Development
Identify Customer Needs - Interviews

Primary Customer Interview

Joel Notaro- Polaris Industries

Phone Interview 4/9/08

- Needs and update on last teams progress
- Market needs, race teams TBD
- Weight and shift times
- Cost, able to be manufactured
- Follow guidelines and constraints of previous team, improve on them
- Automatic shift control with manual override, a more agressive race shift mode and general to light race mode
- Would like to have a phone conference with Professor Slack

Phase 1: Concept Development
Identify Customer Needs - Interviews

Stakeholder Interview:

Professor George Slack, EE Dept

Interviewed 4/3/08

- Intelligent automatic up and down shift points for both racing high performance and general ‘paddock’ use
- Investigate power need for shifting, spring force
- Package into ATV with clean and simple appearance
- Investigate alternate shifting activation devices
- Investigate and characterize engine sensors
- Weather and other elemental conditions
- Suggests large allotment of time of SDII to be dedicated to robust testing

Phase 1: Concept Development
Identify Customer Needs - Interviews

Past Senior Design Team Interview

Team Leader: Eric Gambon

Interview: 4/8/08, Machine Shop

- Currently a button shift system has been installed and is in working condition.
- A pneumatic system is used to move a fabricated piece that replaces the shift lever to up and down shift.
- Electronics read from engine sensors to limit up/down shifts based on engine RPM.
- Significantly reduce valve size.
- Eliminate extra battery and mount.
- Weight can be reduced further, currently right at spec or slightly over.
- Plan on large allotment of time for debugging.
- No final design review from Polaris.
- P07310 and P08310 are the previous two generations.

Phase 1: Concept Development
Identify Customer Needs - Interpret

Safety

-Easy and safe to use

-Ergonomically sound

-Retain reverse lockout feature

Durable

-Normal durability

-Exposure to elements

-Designed for race conditions (sand dune, trail ride, etc)

Performance

-Shifts are made within 1/10 second

-Shifting is smooth

-No ‘recharge’ or modification for at least one fuel cycle

Cost

-Easy to manufacture

-Production cost of less than $250

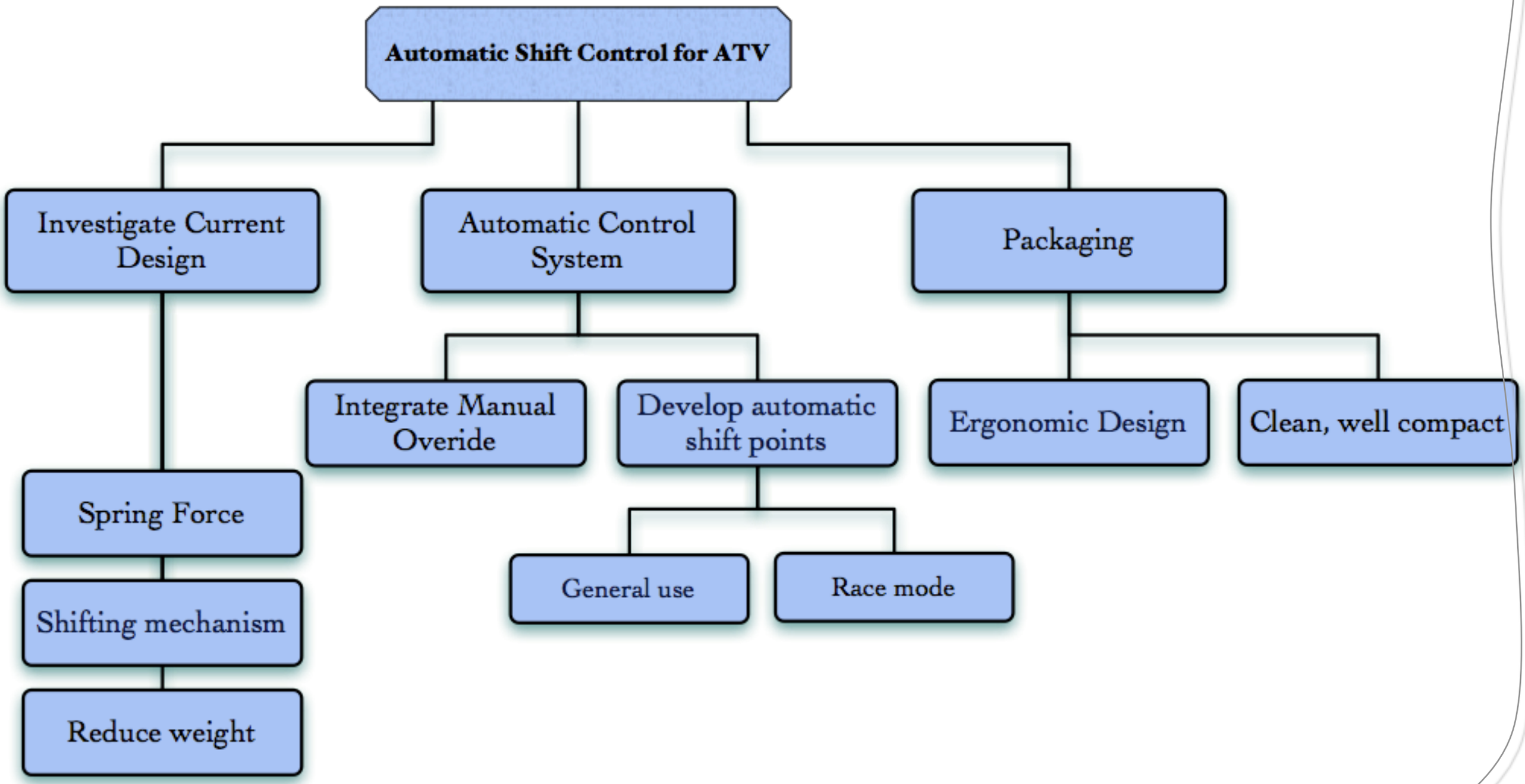
-Individual cost less than $400

Phase 1: Concept Development
Identify Customer Needs - Interpret

Needs Statements:

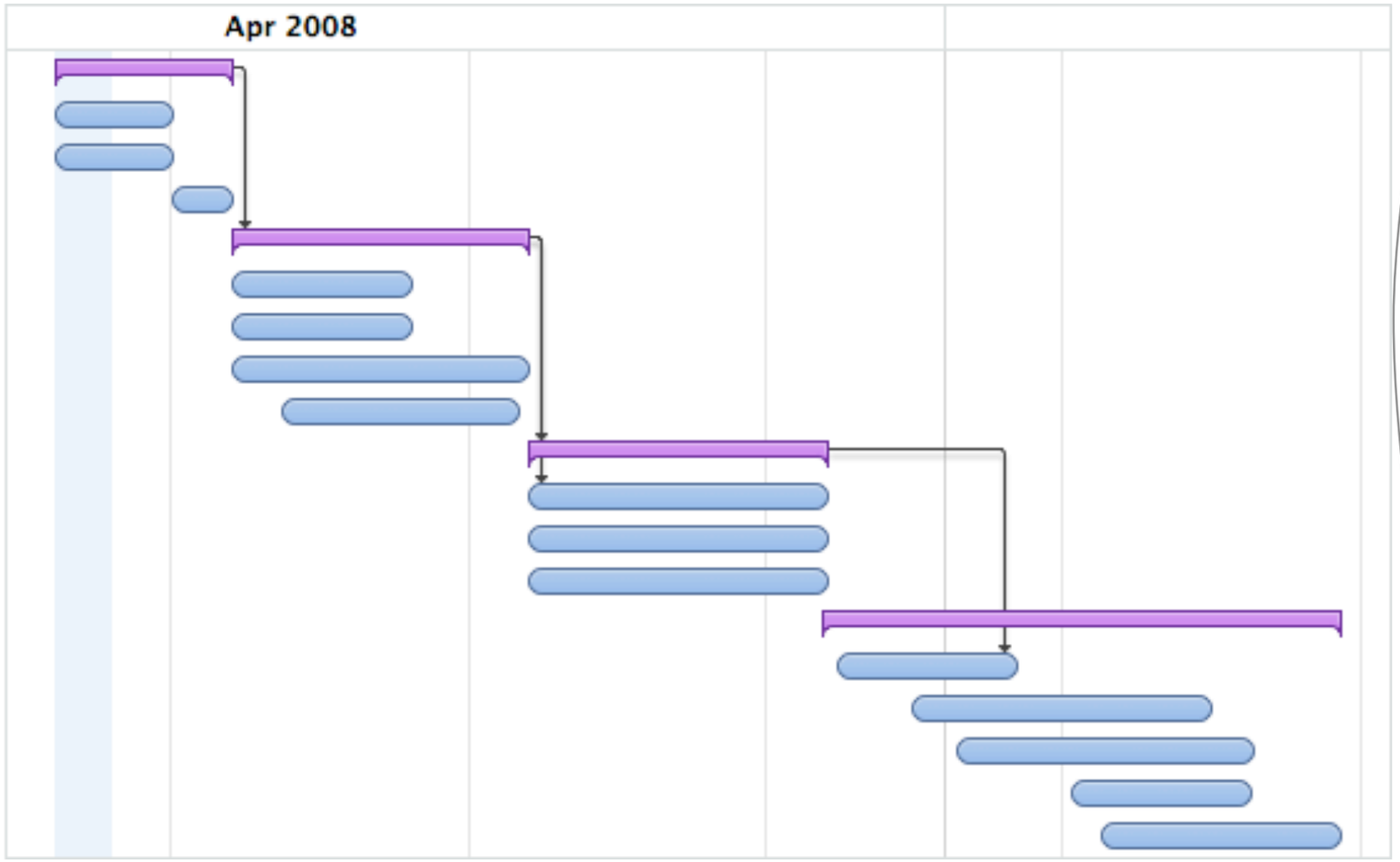
1. The system must be safe and reliable
    1. System is safe and easy to use
    2. System maintains current reverse lockout
    3. System is ergonomically sound
2. The system must be able to maintain high performance
    1. The shifting system must be smooth
    2. Shifting must be done quickly
    3. System must maintain performance for at least one fuel cycle
3. The system must be durable
    1. The system must be able to handle exposure to elements
    2. The system must last the life of the ATV
    3. The system must handle dynamic race conditions
4. The system must be manufactured with specific production costs
    1. The system must be easy to manufacture
    2. The system must be able to be installed without significant cost

Work Breakdown Structure



Preliminary Schedule
MSD I

Task	Effort
• 1) Planning	1w
• 1.1) Evaluate Current Design	2d
• 1.2) Research Previous Projects	2d
• 1.3) Research Background...	1d
• 2) Concept Developement	3w
• 2.1) Customer Needs, Specifications	3d
• 2.2) Needs Assessment	3d
• 2.3) Concept Generation	1w
• 2.4) Concept Evaluation	4d
• 3) System Level Design	3w
• 3.1) Mechanical Design	1w
• 3.2) Electrical Design	1w
• 3.3) Controls Design	1w
• 4) Detail Design	4w
• 4.1) Risk Assessment	3d
• 4.2) Test procedures	1w
• 4.3) CAD Designs	1w
• 4.4) Documentation	3d
• 4.5) Establish BOM	4d



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Future Plan
Where do you go from here?

- **Conference call with Professor Slack and Joel Notaro**
  - **Go over P08310 results and any suggestions for modification from customer**
- **Develop SD II Schedule**
- **Refine Mission Statement and Needs Assessment**
- **Develop Staffing Requirements**
- **Further develop WBC**