FINAL PROJECT PRESENTATION

PROJECT

P09310: AUTOMATIC SHIFT CONTROL FOR ATV

DATE	PREPARED BY
MAY 12 2008	ASHLEY SHOUM

Project Information

- 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*

Planning

Mission Statement

PRODUCT DESCRIPTION

An automatic shift control system with manual override designed for race as well as general use

BENEFITS

- Automatically shifts a manual transmission which is traditionally more efficient for race conditions
- Shift control does not require user input for shifting, manual override integration gives user the option to input shift change

KEY BUSINESS GOALS

- To provide an upgrade to factory manual transmission
- To offer an automatic control system while maintaining manual transmission efficiency
- To provide a system that can be used for both race and general applications
- To provide a system that can withstand all track and weather conditions
- Maintain quick, smooth shifting of standard ATV

Mission Statement

PRIMARY CUSTOMER

- Polaris sponsored race teams

SECONDARY MARKET

- Polaris aftermarket

STAKEHOLDERS

- Polaris Industries
- RIT MSD I&II
- Students/Faculty
- ATV Race Teams
- ATV Enthusiasts
- RIT FSAE Teams
- Other ATV industry competitors
- Other off-road motor vehicle industries

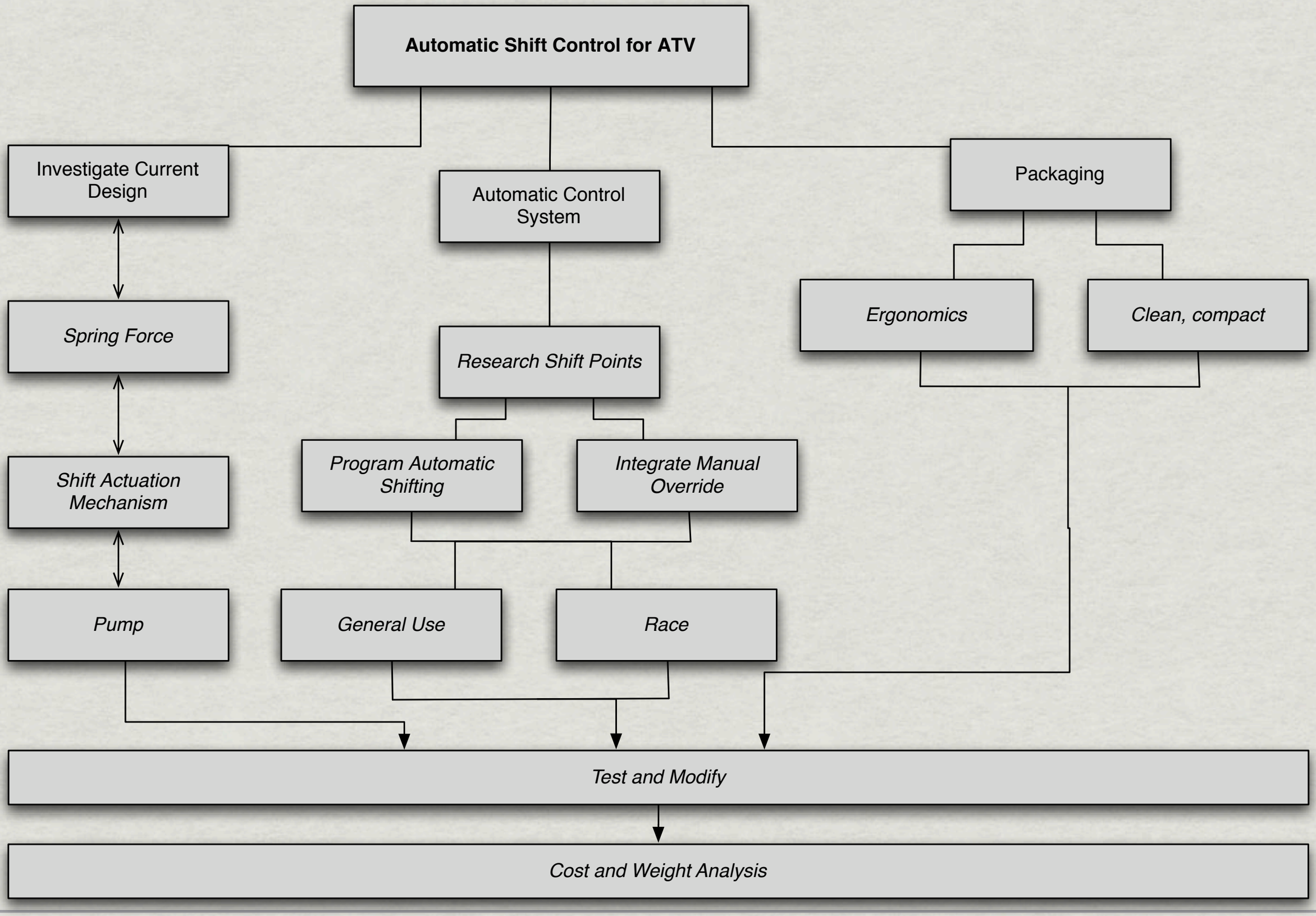
Staffing Requirements

Specialty	Quantity	Required Skills
Electrical	3	Students will integrate intelligent shift program into existing hardware micro-controller or newly developed concept hardware. Students will in assist in research, design, build, test and debug process of new product.
Mechanical	2	Student will work with team to research transmission shift points and to test new programs. Student will research engine load and road speed relationships to develop intelligent shifting concept. In an attempt to lower size and cost of components students will research additional pump options to eliminate electric motor, design stronger bracket for air cylinder to increase durability and evaluate spring force required to shift gears.
Industrial	1	Student will asses feasibility and manufacturability as well as ergonomics, ease of use and safety. Student will verify experimental design and testing is efficient in gathering accurate results. Assist in developing an understanding of operational scenarios to apply to intelligent shifting programs.
Industrial Design	1	Student will design an ergonomic and manufacturable packaging solution for all added components and features to make the product attractive and fully functional.

Intellectual Property Considerations

All intellectual property will be the property of Polaris Industries. Polaris Industries must be consulted for permission to release any data to the public domain. Data includes but is not limited to all design drawings, prototypes and data analysis.

Work Breakdown Structure



Team Values and Norms

Team-worker	Each team member will work in conjunction with other teams members, including members of another discipline. Each team member will communicate ideas, testing results, concept generation, and all other issues pertaining to the project.
Reliable	Each team member is expected to complete assigned tasks efficiently, and on time. Each member is required to be available during scheduled times and meetings and is expected to keep all team members up to date with recent activity.
Consistent	Each team member is to work consistently on the project for both terms giving an equal contribution throughout. Member must remain on one project and have input for all stages of the project.

Team Values and Norms

Punctual	Each team member will be prompt and arrive at the team meetings on time. If an unexpected conflict comes up, the absent team member will notify at least one team-mate prior to the expected absence. An absent team-member should confirm that a team-mate has received their message (in person, voice mail, email, etc).
Thorough	Each team member will complete their tasks thoroughly and completely, so that the work does not have to be re-done by a peer on the team. If a member does not know how to complete a task, feels overwhelmed, or needs assistance then the member notifies peers, and seeks assistance either from a peer, the faculty guide, a faculty consultant, or another person.
Accurate	Each team member completes their work accurately and in a way that can be easily checked for accuracy by peers and the faculty guide. All work is fully documented and easy to follow
Professional and Ethical	Each team member gives credit where credit is due. All work completed includes citations to appropriate literature, or sources of assistance. If a team member has gotten assistance from a publication or individual, then that assistance or guidance is fully documented in the reports prepared. Each team member is honest and trustworthy in their dealings with their peers.

Grading and Assessment Scheme

Senior Design I

A	Concept design meets all customer needs and specifications. Design reviews and concept selection process is fully documented on EDGE site. Proof of concept completed including high-risk assessment. Test plan developed and documented.
B	Concept meets expectations of high customer needs. Concept selection and design review is fully documented. Test plan in development. Risk assessment in development.
C	Concept meets some needs. Concept selected and all major documents and prototype information is documented on EDGE.
D	Customer needs not met. No documents on EDGE website. Concept no approved, design review unsatisfactory.

Grading and Assessment Scheme

Senior Design II

A	Product is fully functional, robust, and has undergone all testing. All design reviews and performance results have been documented on EDGE website. Technical paper and poster are completed and submitted, all action items closed out. Results relayed to customer.
B	Product is constructed and has undergone testing. Documents are submitted to EDGE website. All presentation materials are complete and design reviews complete, all action items closed out.
C	Product constructed. Documents available on EDGE website. Document outline of remaining action items to be addressed. Design reviews and presentations complete.
D	Product construction not complete. No documentation. Design reviews incomplete, presentations incomplete.

Required Resources

Enviroment

Item	Source	Description	Available
Computer Labs	KGCOE	CAD, Programming, ETC	Yes
Machine Shop	ME 09-2360	Parts Fabrication	Students with Materials Process Experience
EE Lab	EE Dept	Programming, Circuit Analysis	Yes
CNC Lab	ME Dept	Parts Fabrication	With proper documents
TBD	TBD	ATV Storage	TBD

Required Resources

Equipment

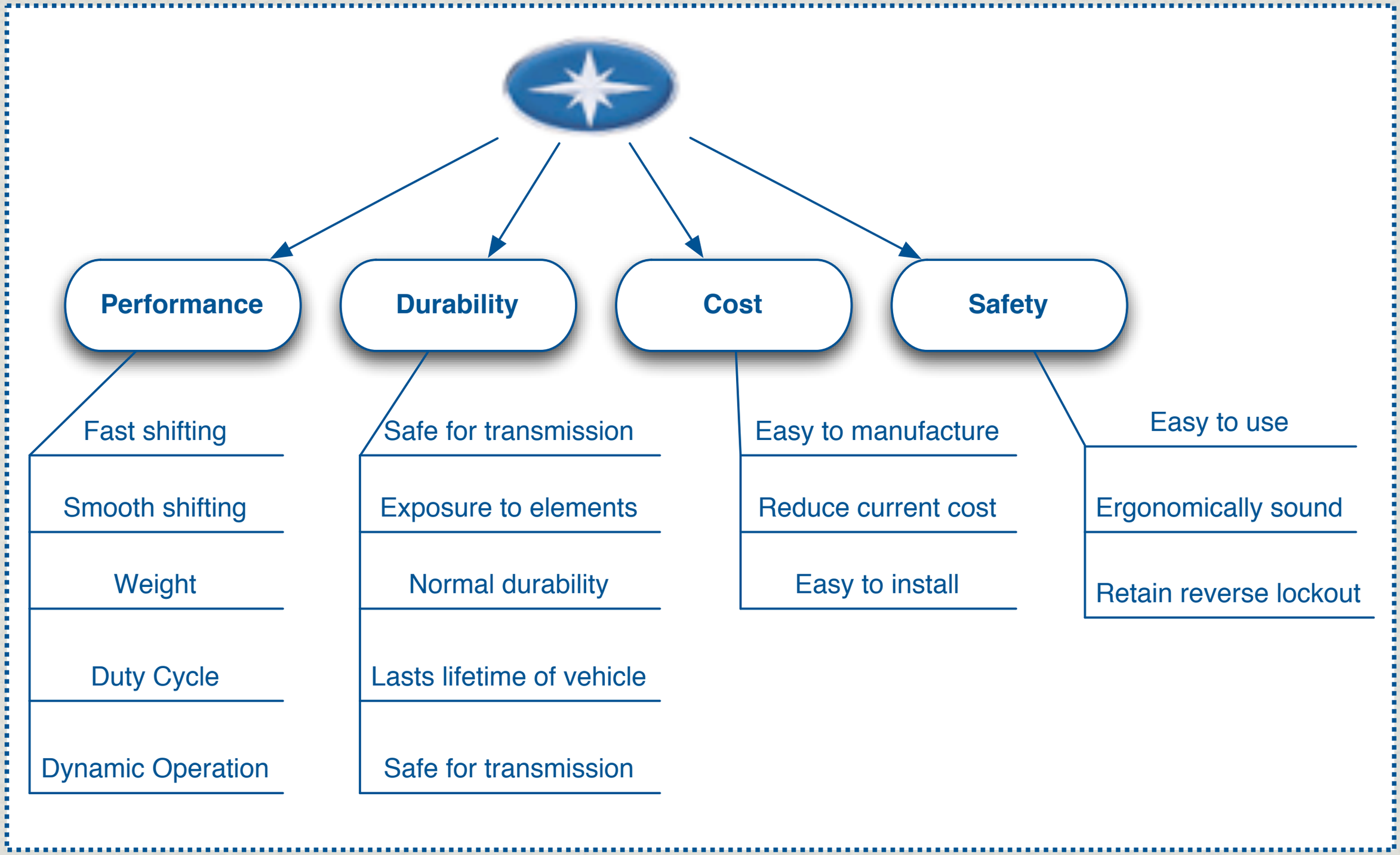
Item	Source	Description	Available
Desktop PC	KGCOE	CAD, Programming, Circuit Analysis	Yes
Function Generator	EE/Systems Lab	Circuit Analysis	Yes
Oscilloscope	EE/Systems Lab	Circuit Analysis	Yes
Voltmeter	EE/Systems Lab	Circuit Analysis	Yes
Power Supply	EE/Systems Lab	Circuit Analysis	Yes

CONCEPT DEVELOPMENT

Identify Customer Needs

1. Easy to use: User can easily operate with beginner ATV knowledge
2. Safe to use: Proper design to prevent unsafe user operation
3. Retain reverse lockout: Keep feature integrated
4. Ergonomically Sound: User can operate safely
5. Normal use durability: Normal ATV durability maintained
6. Exposure to elements: Operates in all weather and off-road application normal to ATV use
7. Race conditions: Can withstand racing operations, rough terrain, high speeds and long duration
8. Lasts lifetime of vehicle: Components will last normal lifetime of ATV with little maintenance
9. No negative effects on transmission life: Shifts within proper RPM limits, computer overrides any improper user input
10. Fast shifting: Shifts are made within one-tenth of a second
11. Smooth Shifting: Shifts are comparable to normal operation
12. Duty Cycle: Cycle of component operation will last at least one full fuel cycle
13. Dynamic operation: Applicable and operational for both race and general usage
14. Manufacturable: Easy to reproduce, No modification to model production process
15. Cost analysis: Reduce cost further (compared to P08310)
16. Easy to install: Integration will not require professional installation
17. Weight: All added components weigh less than 7lbs

Customer Needs- Objective Tree



Establish Target Specifications

Needs Metrics Matrix

	Time to add components	Total added mass	Afforable unit price	Tools	Time between shifts	Comfortable for user	Time to learn new system	Lifetime cycle of product	Ease of shifting	Use in dynamic elements
1. Easy to use							X			
2. Safe to use							X			
3. Retain reverse lockout										
4. Ergonomically Sound						X				
5. Normal use durability								X		
6. Exposure to elements										X
7. Race conditions										X
8. Lasts lifetime of vehicle								X		X
9. Safe for transmission								X		
10. Fast shifting					X					
11. Smooth Shifting									X	
12. Duty Cycle										
13. Dynamic operation										X
14. Manufacturable										
15. Cost analysis			X							
16. Easy to install	X			X						
17. Weight		X								

Issues & Risks

Description of Risk	Possible Consequences	Prob. of Risk	Severity of Risk	Overall Risk	Contingency Plan
In investigating the current design, it is determined that too many components must be redesigned	Lack of funding, time, adjustment in schedule	M	M	M	Re-evaluate project deliverables and schedule
ATV does not have room for adding needed hardware components	Need for designing bracket or other device that will add to weight and cost	L	M	M	Fabricate parts that do not hinder rider ability
Software integration fails or is not compatible to meet deliverables	Automatic shift control not attainable with selected software	L	H	H	Re-evaluate concept design
Allocated budget is not sufficient for product fabrication	Component costs do not fit into projected budget	H	M	H	Cost reduction analysis, narrow scope

Outstanding Items

- Finish updating EDGE website
- Finalize budget allocation
- Find storage location for ATV
- Create commercial
- Find potential team members
- Send information and receive feedback from customer

Questions?