

Senior Design Meeting Notes  
Group 1 – Hobie Cat Kayak

January 27, 2009 @ 5:00PM

**Client Meeting**

**Location:** Patriot Products

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Jill Caruso, Chris Beins, Steve Grudzien

**Notes:** Initial meeting with client. Met client, introduced company, background, vision for the Hobie Cat Kayak mechanism, potential market, laid out preliminary client requirements. Took many pictures and many rough measurements of kayak and existing Mirage Drive system, installed/uninstalled and with/without occupant. Client mentioned that we can return to Patriot Products any time during business hours to take measurements or fit test.

February 3, 2009 @ 5:00PM

**Client Advisor Meeting**

**Location:** Ability Center

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Jill Caruso, Chris Beins

**Notes:** First meeting with client advisors. Established next meeting Feb-17, will continue to meet biweekly Tues at 5:00PM at Ability Center. Will invite client (Steve Grudzien) as needed. Jill reminded our group to deliver our product at the end of the semester, gave examples of groups that didn't fully complete their projects. Jill briefly described a typical meeting with our faculty advisors (Dr. Hefzy and Dr. Pourazady). Jill asked that we turn over all of our documents on a CD at the end of the semester. Group decided to ask a patent expert about the patenting process. Group discussed preliminary sketches, all agreed with early concept. Matt will remind client (Steve) to meet in class on Monday Feb-9 for proposal presentation. Group decided that Steve should review house of quality used in proposal presentation. Jill reminded the group to provide at least 24hr notice of cancellation for meetings, said that 1 or 2 cancellations are acceptable. Jill reminded group to sign a letter at the conclusion of the project vouching for Jill's and Chris's involvement in the design process. Jill introduced an upcoming sensitivity training session, said that she would email details and that a response is required; attendance is not required. Chris will email a project planning form that he has used on past projects, as well as his current contact information sheet. Group decided to consult other sources for materials advice.

February 5, 2009 @ 6:00PM

**Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Zach Walker, Dr. Hefzy, Dr. Pourazady

**Notes:** Introduced rocker design and crank design to Dr. Hefzy and Dr. Pourazady. All agreed that client

(Steve) should approve either the rocker or crank design. Dr. Pourazady expressed concern that too much force will be required to propel the kayak. Group explained that the mechanism requires very little input force per stroke, but decided to conduct formal testing to determine minimum and maximum forces involved. Group will conduct a test on the water as soon as a facility is available. Dr. Hefzy approved a budget of approximately \$500. Dr. Hefzy refused to sign patent forms until after the client signature. All agreed not to meet next week unless otherwise notified. Group will bring a video at next meeting to show operation of Mirage Drive. Dr. Pourazady suggesting asking client opinion on dummy movement of legs by using straps on Mirage Drive pedals. Group will ask client at next meeting.

February 9, 2009 @ 1:00PM

### **Group Meeting**

**Location:** North Engineering Computer Lab

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker

**Notes:** Made final preparations for proposal presentation to be given at 3:30PM. Most of presentation was developed by group earlier in the week. Performed three practice presentations and made minor readability changes. Discussed more detailed design, specifically connections between rocker arms and hatch bracket. Group decided some type of bushing would be best (no bearing). For connecting rod to Mirage Drive connection, will use a quick-release tie-rod with semi-permanent clamp. Will use square bar for rocker arms and round bar for connecting rods. Initially decided stainless steel or aluminum would be best materials, but will make a final decision after more research. Noted that tie-rods are not stainless; this may be a concern. Group made several sketches by hand and then in AutoCAD. Gave presentation at 3:45PM. Checked availability of prototyping material with John Jaegly.

February 17, 2009 @ 5:00PM

### **Client Advisor Meeting**

**Location:** Ability Center

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Jill Caruso, Chris Beins, Steve Grudizen

**Notes:** Did not meet with faculty advisors last week (as planned). Steve brought the Mirage Drive System. Group gave Steve a printed copy of the proposal presentation (Steve was unable to attend due to a medical emergency). Steve was surprised at three separate designs, Jill explained that this was to fulfill university requirements. Steve was satisfied. Steve is concerned with large side-to-side forces due to muscle spasms. Group had not considered this, will incorporate into design. Steve emphasized three design requirements: adjustable height of handles, adjustable neutral position of handles, and adjustable mechanical advantage. Suggested using sliding tubes (telescoping) to achieve all three adjustments. Steve suggested using aluminum instead of stainless steel, group still must research more before final decision. Steve will try to get engineering information from Mirage Drive manufacturer. All agreed that the design will not include foot straps on pedals (for dummy leg motion). Steve reiterated

very little force required to propel the kayak (to address Dr. Pourazady's concerns at last faculty meeting). Client suggested UT Rec Center and Urban Active for possible pool usage.

February 19, 2009 @ 6:00PM

#### **Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Brian Back, Dr. Hefzy, Dr. Pourazady

**Notes:** Group introduced idea of lowering entire mechanism in kayak. Dr. Hefzy expressed concerns with loss of mechanical advantage. Group explained that mechanical advantage will remain adjustable. Dr. Hefzy and Dr. Pourazady would like the group to perform stress analysis. Group will perform analysis, present at next meeting. Will not meet with faculty advisors next week. Will begin constructing prototype and perform first round of stress analysis.

March 3, 2009 @ 5:00PM

#### **Client Advisor Meeting**

**Location:** Ability Center

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Chris Beins, Steve Grudizen

**Notes:** Group fabricated most of first prototype using spare material from UT machine shop. Performed initial stress analysis, will present formal analysis to faculty advisors on Thurs March 5. Chris reminded the group about midterm presentations, said he would like to review a rough draft if possible. Group showed Chris an animation of the mechanism created with ProEngineer. Chris was concerned about lack of adjustability in animation, Brian said design still needs to be updated to show adjustability mechanisms. Chris suggested using a factor of safety between 2 or 3 for stress and fatigue calculations. Group would like to measure Mirage Drive flippers to determine max force possible. Matt was able to determine the Mirage Drive uses anodized aluminum box tube with some sort of coating. Steve arrived approx half hour into meeting. Group again discussed large side loads and possible hinge failure due to side impulse loads. Steve again emphasized adjustability required for limited range of motion or one-arm users. Steve would like to use handle attachments from [www.topendwheelchair.com](http://www.topendwheelchair.com). Steve announced Med Trade National Design competition, suggested our design may be eligible. Steve said that we can drill through the kayak for additional strength if needed. Steve suggested adding various implementations of springs for "break-away" ability due to large impulse side loads. Chris suggested this may be an idea for a new project or second generation. Steve will be on vacation from Thurs March 5 until Sat March 21.

March 5, 2009 @ 6:00PM

#### **Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Brian Back, Zach Walker, Dr. Hefzy, Dr. Pourazady

**Notes:** Dr. Pourazady would like Matt to email kinematic animation. Dr. Hefzy and Pourazady stated that they would return the graded proposal paper before the midterm paper is due. Dr. Hefzy would like John Jaegly to approve drawings before ordering any material. Group needs to draw a better force

diagram for the entire mechanism for review at the next faculty meeting. Dr. Pourazady would like the group to complete a kinematic analysis by hand, then perform FEA only on hinges with very rough hand calculations.

March 19, 2009 @ 6:00PM

#### **Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Brian Back, Zach Walker, Dr. Hefzy, Dr. Pourazady

**Notes:** Group showed Dr. Hefzy and Pourazady updated kinematic animation of mechanism model, explained current designs for all hinges. Showed first FEA of hinges on hatch. Dr. Hefzy emphasized that FBDs are required for ALL calculations so that it is clear what we are analyzing. Ryan asked about thread strength, Dr. Hefzy referred to Shigley example 8-1. Dr. Pourazady would like a more accurate FEA showing realistic constraints and deformations. Dr. Hefzy will have proposal paper graded tomorrow. Either faculty will sign for purchasing tomorrow if updated calculations and drawings are provided.

March 26, 2009 @ 6:00PM

#### **Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Brian Back, Zach Walker, Dr. Pourazady

**Notes:** Group showed Dr. Hefzy and Pourazady updated stress calculations. Dr. Pourazady would like to see bending stress analysis for connecting rod. Would also like analysis of bracket B with actual direction of force. Would also like to see updated color FEA for next meeting.

March 31, 2009 @ 5:00PM

#### **Client Advisor Meeting**

**Location:** Ability Center

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Chris Beins, Jill Caruso

**Notes:** Group discussed calculation and ordering progress with Chris and Jill. Group will email Jill when we are ready to order materials. Group showed Jill and Chris the completed midterm report and calculations. Group plans to order material on Thursday (actually ordered on Friday). All would like Steve to be at next client advisor meeting (Steve did not make next meeting).

April 2, 2009 @ 6:00PM

#### **Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Brian Back, Zach Walker, Dr. Pourazady

**Notes:** Dr. Pourazady is concerned that FEA showed a maximum stress of 24ksi on the connecting rod – rocker arm bracket. Would like group to obtain ultimate stress from McMaster-Carr (did not have info, used third party values). Group printed updated stress calculations and showed to Dr. Pourazady; he would like group to perform all analysis using fatigue strength.

April 9, 2009 @ 6:00PM

**Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Brian Back, Zach Walker, Dr. Pourazady

**Notes:** Group will ask John Jaegly to allow group to machine connecting rods on Friday (successfully obtained permission and machined). If John Jaegly will not allow group to machine, then talk to Dr. Pourazady. Dr. Pourazady would like to know when we can demonstrate complete assembly, would like group to show next week. Group cannot meet deadline, all agreed to show in two weeks. Group explained design expo plans, no concerns.

April 14, 2009 @ 5:00PM

**Client Advisor Meeting**

**Location:** Ability Center

**Present:** Matt Ricciardi, Brian Back, Ryan Wackerly, Zach Walker, Chris Beins

**Notes:** Agreed that this will be last client advisor meeting. Group showed Chris pictures and video from prototype testing. Chris offered sawhorses to support kayak if needed. Group will email Jill and Chris final report. Group needs handles from Steve, Chris will pursue. Chris reminded group to provide Jill with CD of all files after design expo.

April 16, 2009 @ 6:00PM

**Faculty Advisor Meeting**

**Location:** Nitschke Hall First Floor

**Present:** Matt Ricciardi, Ryan Wackerly, Zach Walker, Dr. Pourazady

**Notes:** Reviewed graded midterm report. Discussed design expo requirements, all of group's needs should be met. Dr. Pourazady would like to see finished, assembled mechanism by 5:00PM on next Thursday, April 23. Brian is not here to confirm that this is possible. Group may not be able to meet deadline.