

4 September 2018  
Project Announcements

**Meeting Notes:**

- Nightforce Optics: Automated Thread Burnishings
  - Team name: The Longshots
  - Team members: Tom White, Morgan Kerby, Jake Elliott
    - Emails: [thomaswhiteid@gmail.com](mailto:thomaswhiteid@gmail.com) ; [kerbstomp10@gmail.com](mailto:kerbstomp10@gmail.com) ; [jake4173@vandals.uidaho.edu](mailto:jake4173@vandals.uidaho.edu) (respectively; emails used in coordination with Google Drive)
  - Team Contract: To follow later, continuing updating from Morgan
    - \*NOTE: Team Roles/Responsibilities will be held within the Team Contract
  - Project Instructor: Dan Cordon -- [dcordon@uidaho.edu](mailto:dcordon@uidaho.edu)
  - Project Mentor: Sarah Willis -- [will9753@vandals.uidaho.edu](mailto:will9753@vandals.uidaho.edu)

**To Do:**

- Look into meeting locations
  - Morgan suggested looking at reserving a room in the IRIC, will update as the situation plays out
- Send out agenda prior to Tuesday's meeting
  - This "should be emailed as part of a meeting reminder that goes out to your team members, mentor, and lead instructor", as according to the Capstone Team Formation sheet; Tom is designated "Progress Supervisor"
    - \*NOTE: This is only required for the first meeting, and is not to be confused with Documentation/Meeting Minutes

**Additional Notes:**

- The handouts from today's class will be sent in an email to all team members for reference

11 September 2018

## Meeting 1

### Meeting Notes:

- Constructing our project portfolio
  - We should begin thinking about the information and items we will compile for our portfolio
- Scope of the project:
  - Should be pretty self-explanatory, not too much design we can construct before factory visit/client interview.
  - Previous project prototype did not work; we should review the wiki page and other material we can find for the previous project (wiki: thread burnishing, from around 2016-2017)
  - Currently, threads are hand-burnished by several individuals; time and manpower is wasted.
    - Some ideas to start with: improving the control scheme, increase burnishing capacity to 4 turrets at a time
- Dates for the factory visit:
  - Consensus is for 18 September (Tuesday), leaving around 8:00am (travel time is roughly 1 hour one-way).
    - The factory runs MTWR starting at 6:00am
  - We will need to rent a University vehicle to carpool
  - The visitor center should be aware of our visit (pending email sent to Pietro)
  - We need to start developing Client interview Questions for visit, document is already set up in the Drive folder
- Small Team Meetings:
  - Consensus is to hold small team meetings (without Dr. Dan and Sarah) Thursdays during class time (3:30pm-4:45pm)
- Budget:
  - \$8500 will not be our total for the project; expect "\$5000 or less" due to university cut, payment for instructors, etc.

### To Do:

- Research previous Nightforce project (wiki, poster in hall, etc.), gather as much as we can to build off of.
- Begin template for Budget, does not need to be finalized
- Look into renting university vehicle for 18 September, from around 7:00am to afternoon-

18 September 2018

## Meeting 2

### Meeting Notes:

- Budget:
  - The budget for our project is on the Drive, it will continue to be updated as the project progresses
- Factory visit/client interview:
  - We cannot show any earlier to the factory due to commitments/factory visitation hours
  - Dr. Cordon is necessary to be there, Sarah would like to but not necessary component to the visit
    - Dr. Cordon has an 11:30am class he needs to be in attendance for
  - The ongoing plan is to visit Tuesday (25 September)*
  - Molly will take care of the CNR rental, must follow up for progress later
    - Meet at the orange lot north of the steam plant for transport
- Previous prototype:
  - The torque sensor:
    - The sensor calculates the torque in real time, as the screw is fed through the sensor by a hole where the screw goes through
      - The scheme for control is not ideal, consider rehauling the whole system
- Portfolio:
  - the plan is to buy a 3-ring binder or a folder to compile all of our work into, will continue to work with that

### To Dos:

- Reserve a van for the factory visit, contact Molly for CNR reservations
  - Continue developing client interview questions
  - Refine email coordination*
  - Finalize research on previous prototype
  - Develop class excusals before next week
- 

2 October 2018

## Meeting 3

### Meeting Notes:

- Project Portfolio:
  - We have found a binder for use with the portfolio,
  - Dr. Dan will let us know when we need to have our portfolio ready for review; we are held to a more lax time table as our project is partly dependent on the client.
- Snapshot Review:
  - We will have our snapshot day one on 9 October, which will be the next session on Tuesday
    - We will be meeting in the Design Suite, Gauss-Johnson Laboratory room 108, according to the Mindworks page*
  - This is a set time hack, and will not be adjusted from this due date.
- Design Suite Table:
  - Sarah notified us Friday (28 September) that there were 2 tables left unreserved in the Design Suite
    - Morgan went in this morning (2 October) to reserve a table
- Concept Design:
  - Tom presented a design with a gravity-actuated magazine for the lead screws, that would fall into the system to be burnished/tested for backlash; the design would let the then-finished screws fall to the ground, while loading the next materials
    - The idea of a “magazine” was agreeable among all present members, could prove useful for future design
  - David presented a design with a burnishing station and a backlash station as two separate systems, with a circular “turntable” set up to move the screws from one system to the other.
    - The idea of having two separate systems was deemed a realistic approach, will most likely continue forward this way

### To Do:

- Continue research with prototype, other materials related to previous prototype design
- Prepare for Snapshot day one and logbook/portfolio turn in

9 October 2018  
Meeting 4

**Meeting Notes:**

-Backlash Measurements:

-This process will most likely take longer than the burnishing process, we need to take this difference in time into account when constructing the system.

-It may be harder to track pass/fail with bulk/batches of turrets being put into the system at a time

-Developing a rotary system may eliminate this setback, as it will allow for each individual turret to be analyzed while loading the system with multiple turrets

-Logbook Turn-in:

-Dr. Cordon has asked us to turn in our logbooks tomorrow (Wednesday, 10 OCT) to his office; hand-in preferably in the morning, which is more convenient for him.

-Torque Sensor:

-There is a possibility to use the current/voltage applied to the stepper motor to determine the torque used in burnishing the threads; this would eliminate the need for an external sensor

-David will research this topic to see if this is a feasible idea, more to follow for the next meeting

-Delegation of Tasks:

-We need to set up research tasks as we start to move into making our concept design. Tasks will be rotated each meeting, and notes will be compared upon completion.

-Jake will look into the backlash process, Tom will look into how to transfer items from burnishing to backlash testing, Morgan will look into the burnishing process, and David will look into torque sensing and control systems

**To Do:**

-Prepare final notes for logbook turn-in, Wednesday, 10 OCT

-Complete research roles before next meeting (see above)

16 October 2018  
Meeting 5

**Meeting Notes:**

-Research Roles:

-Jake -- Backlash:

-Using linear actuators to test backlash in the threads seems to be the best idea going forward, it would push on the lead screw and apply just enough force to avoid damaging the screw.

-Some laser sensors may work as well, although we are still waiting to hear a quote back from the company

-There is a ~\$1100 dollar actuator that will be well under specifications for what we need (calculates in the  $\mu\text{m}$  range)

-Tom -- Transport system:

-Linear Track ("Racetrack") and Turntable:

-Both ideas use a clamping mechanism to secure the turrets to the track

-Clamping mechanism should not interfere with the other stations

-The turntable idea has four slots for the turrets

-Consider making more slots for more loading at one time

-Need to be aware of the ratio where the more slots we add, the larger/heavier the turntable will get; need to find that happy medium.

-Will develop separate turntables for each different turret, which will allow for loading of one turntable while another is being run through the system.

-Morgan -- Burnishing:

-Best idea going forward is to use direct drive with the stepper motor, to burnish the threads

-If we can calculate the axial force being applied during the burnishing process, we can track the linear displacement during the burnishing which will help with calculations for the backlash testing later.

-It would be best to keep everything in a vertical orientation for burnishing, would ensure everything is applied consistently

23 October 2018

Meeting 6:

**Meeting Notes:**

- Look into using a dial indicator for backlash testing (as a backup option)
  - There is a \$300-\$400 dollar option that might be viable
  
- The final design for our concept is in the Engineering Shared Drive->Senior Design->senior design->2018-19 capstone->longshots Directory
  
- Torque Sensor:
  - We could try to get the original prototype up and running to test out the PWM/Voltage drop idea for calculating torque
  
- Client Meeting 3:
  - The last client meeting with Pietro didn't give more information on where we should go forward with our project; he seems to like the direction we are taking
    - The concerns with how the backlash testing is currently being conducted was brought about again during this meeting, the consensus is that the personnel haven't put much consideration into the process
  
- Outside Help for Backlash Testing:
  - Jake received contact from an engineer looking to help with some equipment for our project, and Jake gave the budget info and what we were looking for
    - The follow up meeting with this contact was a dud; the contact never showed up after concerns that the pricing of the equipment would be well outside our budget
  
- German Piezo Actuator:
  - Incredible actuator for use with backlash testing, still waiting to hear quote back from the company
    - This actuator would calculate the backlash in the  $\mu\text{m}$  to nm range.
  - \*\*Edit: The price would be taking too much of the budget, we can't feasibly buy this equipment\*\*

**To Do:**

- Look at dial indicators as a contingency system for backlash testing; see which dials the Nightforce personnel use currently
- Attempt to get the 2016 prototype operational again for torque testing
- Prepare for Concept Design Review, to be done no later than 16 NOV
  - We'll need a conference-type room that can house ~20 people, not including clients and instructors; possibly consider one of the rooms in the IRIC

30 October 2018  
Meeting 7

**Meeting Notes:**

- Those in attendance: Tom, Jake, Morgan, David, Dr. Cordon
- Absent: Sarah

-Linear Actuator:

- There is a strong possibility that this may be a good idea moving forward
- \*\*We should hear a quote back soon on the laser sensor\*\*
  - "The best way to [set up the system] is to position the sensors apart from the actuator"
  - We could consider positioning the sensor on top of the rod, to mitigate any obstruction the sensor might cause to the turntable
- The resolution of the linear actuator is well within the specifications set in the project and the readings Pietro gave us
  - \*\*The resolution is in  $\mu\text{m}$ , not inches as was misconstrued\*\*
- The actuator comes with its own controller, which we may consider using if it is written in the same coding language as the controller we will be using
  - The controller costs \$1,136 apart from the actuator
- We can use a cheap actuator if we end up going the laser sensor route

-Design Review:

- This will be a formal review of our final design, with client in attendance
- We need to hold this review as soon as possible, and contact Pietro to let him know this needs to be done
  - Refer to previous meeting notes for more details about this

**To do:**

- Look into high performance microcontrollers
  - Will need to run around 2 stepper motors and ~6 actuators
- Look into mounting for slide tables and an adequate stepper motor for handling the turntable
  - The motor will need to be able to support the weight of each table
- Ask Pietro for an unburnished turret(s) to use for sampling initial torque values
- Keep looking into possible linear displacement sensors
- Laser cut the turntable/key system components to showcase during the client meeting tomorrow



6 November 2018  
Meeting 8

**Meeting Notes:**

- Those in attendance: Tom, Morgan, Jake, David
- Absent: Sarah, Dr. Cordon

-Purchases:

- We need to start purchases *today*
  - We might consider starting the project without the backlash sensing, in order to make sure we focus effort on making the burnishing system is quality
    - The laser sensor is one of our best bets for backlash. We will leave it up to Nightforce whether they want to procure a laser sensor for our project
- Morgan provided a purchasing form, that is located on our design suite table
  - Some of the components (motor, actuators) David will need over the winter break to use in conjunction with constructing the code
  - Many of the larger parts (e.g. the base, etc) can be machined, and will save a lot on the budget

-Logbook/Portfolio Turn-in:

- There hasn't been a lot of updating on the portfolio
  - Consider making a schedule to follow, to ensure constant and quantitative maintenance
- Logbook turn-in is Thursday (8 November), we will email Dr. Cordon for a time to turn in material to him

-Wikipage:

- Consider making a schedule for the wikipage, to follow the same ideas as for the portfolio

**To Do:**

- Prepare the portfolio for Thursday, try to keep more updated as we continue
- Look at which design reviews are going on now, attend *at least 2*
- Order:
  - Stepper motor, slide table, clamping actuator, burnishing stepper, microcontroller

13 November 2018

Meeting 9

**Meeting Notes:**

- Those in attendance: Tom, Morgan, Jake, David
- Absent: Sarah, Dr. Cordon

-Purchases:

- Most items received last Friday (9 November), still waiting on one actuator which is scheduled to arrive today
  - Start thinking about other components we may need to purchase
- We will need raw materials to work with for the base and other structural items
  - Might do well to talk to the shop guy, will update further at later point
  - Will look for ¼ inch steel; how will connections be made? (brackets, drill, etc)
    - Screw v. Weld - the pros and cons of both are very similar

-Logbook Turn-in:

- We had hoped to talk to Dr. Cordon in person, but he has not been available, even by email
  - We will need our individual logbooks for during the break, so we will email Dr. Cordon one more time. If he does not respond, we will hold onto our logbooks until further notice

-Wikipage:

- Tom will need: an individual picture, hometown, short biography, career goals, and graduation date from UI
  - Maybe swap biography for interest in project
  - Future career goals and why we have interest in the project instead of bio

**To Do:**

- Email Dr. Cordon about the logbook turn-in, make sure we are communicating often with each other and outside correspondence
- Ask Pietro further about the laser sensor and about the Design Review date
- Wikipage and portfolio schedule development over the Fall Break:
  - Tom and Jake: Wikipage ; Morgan and David: Portfolio
- Items to deliver to Tom for the wikipage

27 November 2018  
Meeting 10

**Meeting Notes:**

- Those in attendance: Tom, Morgan, Jake, David, Sarah, Dr. Cordon
  
- Winter Break Action Items:
  - Tom, Jake, Morgan: "Do what they can do"; want to be able to take advantage of the break while it lasts
  - David: Will try to get the basic coding done for the microcontroller, with values for each peripheral attachment
  
- Machining Parts:
  - Won't necessarily be able to "machine" parts in the lab on campus, the width of the machine will only go to ~12 inches
    - .-We don't plan to use the shop for large items (e.g. the base plate), but will need to keep track of the limitations as we consider extra parts to be made
  
- Design Review Debrief:
  - Went well, we will need to refine the budget and find out whether a laser sensor will be affordable off of what we have
  
- Snapshot 2:
  - We will be able to set up Thursday afternoon during the lecture time
    - Nothing new to add to existing items for this, will have someone early to make sure everything is correct
  
- Fall Break Debrief:
  - Found a stepper conversion that will fit a D-insert
  - More items have been added to the wikipage
    - Will need to doublecheck ensure everything is up to date
  - Will need to use Autocad more moving forward with designing each piece
    - Should determine which actuators to use for backlash

**To Do:**

- Finish Team Member forms (if not already done) and the Wikipage information to Tom
- Logbooks will be turned in to Dr. Dan Tuesday, 12 December, with the form

04 December 2018

Meeting 11

**Meeting Notes:**

-Those in attendance: Tom, Morgan, Jake

*-Concept Review Items*

- The concept design review went well from our end. We will have to work tirelessly to finish this project.

*-Winter Break Action Items*

- We will try to make some headway over break.

- David will work on getting the generic code written

- Morgan and Tom will meet up to do some machining if the shop is open over break

*-Logbook Turn In*

- We will turn in our logbooks this week to Dr. Cordon and get them back so we can work break

*-Wiki Page*

- Tom discussed the wiki page and we are all going to submit our project learning and bio to Tom today.

*-Backlash Sensor* - We are getting quotes on sensors to compare and will purchase one soon hopefully. We are still waiting to hear about additional funds available.

**To Do:**

-Turn logbooks and Portfolio in to Dr Dan

-Ask Pietro further about the laser sensor

- Deliver items to Tom for the wikipage

-Purchase Laser Sensor

16 January 2019  
Meeting 12

**Meeting Notes:**

-Those in attendance: Tom, Morgan, Jake, David

*-Coding Progress*

- David made good progress over break with the coding

*-Modeling*

- The next couple weeks will be spent modeling

- We need to decide on a configuration for the base plate

- Brainstorm how to align hex screw every time for the burnishing station

*-Meeting times*

- We have decided Wednesday mornings at 8am will be our official meetings

*-Backlash Sensor* – Our sensor is purchased and being shipped

**To Do:**

-Register for Expo (Morgan)

-Model every component

-keep updating code (David)

23 January 2019  
Meeting 13

**Meeting Notes:**

-Those in attendance: Tom, Morgan, Jake, David

*-Coding Progress*

- David made good progress over break with the coding

*-Modeling*

- The next couple weeks will be spent modeling

- We need to decide on a configuration for the base plate

- Aligning hex screw every time for the burnishing station will hopefully work off of the flex in the turn table.

*-Meeting times*

- We have decided Wednesday mornings work best for our meetings and we will meet with Dr. Dan separately to keep him up to speed.

*-Backlash Sensor* – Our Laser sensor has arrived. David will begin working with it this week to see how it works.

**To Do:**

-Model every component

-keep updating code (David)

-work with sensor (David)

-Assemble the burnishing station

30 January 2019

Meeting 14

**Meeting Notes:**

-Those in attendance: Tom, Morgan, Jake

-*Coding Progress*

- David worked with the laser sensor and found that the program is easy to configure and should work well. However, the sensor needs external power that our circuit board is not capable of supplying.

-*Modeling*

- We need to decide on a configuration for the base plate

- Aligning hex screw every time for the burnishing station will hopefully work off the flex in the turn table.

-Prototype assembly

-We have begun to build the bracket for the burnishing station and will have that finished by the end of the week.

-We need to purchase the base plate so we can start mounting things to it.

**To Do:**

-Model every component

-keep updating code (David)

-work with sensor (David)

-Assemble the burnishing station

-Purchase a wall adapter (Morgan)

-Purchase Baseplate

6 February 2019  
Meeting 15

**Meeting Notes:**

-Those in attendance: Tom, Morgan, Jake, David

*-Coding Progress*

- David worked with the laser sensor. As soon as we get external power source he should get it working easily.

-We will test to see how laser interference affects accuracy

*-Modeling*

- Modeling is nearly complete

- Need to finish modeling the backlash station

*-Backlash Station*

- Looking at using a slide table actuator.

*-Prototype assembly*

-Need to finish making the burnishing bracket.

-We will purchase the base plate and turntable materials today, so we can start machining.

**To Do:**

-Model backlash station (Jake)

-keep updating code (David)

-work with sensor (David)

-Assemble the burnishing station

-Purchase Raw materials



20 February 2019  
Meeting 16

**Meeting Notes:**

-Those in attendance: Tom, Morgan

*-Modeling*

- Modeling is nearly complete
- Need to finish modeling the backlash station

*-Backlash Station*

- slide table actuator has been purchased.

*-Prototype assembly*

- Burnishing bracket is complete.
- 267-298 turn table is machined
- keyway stepper connection is machined
- We will machine the base plate on Friday, so we can start assembling.
- keyway and keyed shaft will be ordered today

*-Upcoming dates*

- Logbooks due ASAP
- Portfolio, Team Citizenship form, and Wikipage update are all due on March 5th

**To Do:**

- Model backlash station (Jake)
- keep updating code (David)
- work with sensor (David)
- Machine base plate
- Purchase materials (Morgan)

27 February 2019

Meeting 17

**Meeting Notes:**

-Those in attendance: David, Morgan, Tom, Jake

-Backlash Station

- slide table actuator is being shipped, poor weather has slowed that process.

-Prototype assembly

-Machining is nearly complete.

-two turn tables need machined

-keyway needs machined

-The base plate is machined besides the backlash station.

-keyway and keyed shaft are also being shipping

-Upcoming dates

-Logbooks due tomorrow to Dr Dan

-Portfolio, Team Citizenship form, and Wikipage update are all due on March 5th

**To Do:**

-Model backlash station (Jake)

-keep updating code (David)

-work with sensor (David)

06 March 2019

Meeting 18

**Meeting Notes:**

-Those in attendance: David, Morgan, Tom, Jake

-Backlash Station

- slide table actuator has arrived, we will begin machining components this week.

-Prototype assembly

-Machining is nearly complete.

-two turn tables need machined

-keyway has been machined

-keyway and keyed shaft arrived in the mail

-Upcoming dates

-Portfolio, Team Citizenship form, and Wikipage update are all due ASAP

**To Do:**

-Machine backlash station

-figure out drill chuck

-re-drill bracket holes

- remake clamp

20 March 2019

Meeting 19

**Meeting Notes:**

-Those in attendance: Morgan, Tom

-Backlash Station

- Pull actuator has arrived, hopefully we will make some headway with the backlash station this week.

-Prototype assembly

-Machining is nearly complete.

-two turn tables need machined

-we are working on fixing the burnishing bracket

-we will get drill chuck fixed this week

-need to get the prototype ready to start adding code

-Upcoming dates

-We need to start working on our design report

**To Do:**

-Machine backlash station

-figure out drill chuck

-re-drill bracket holes

- remake clamp

27 March 2019  
Meeting 20

**Meeting Notes:**

- Those in attendance: Morgan, Tom
  
- Report
  - Most of the report we have essentially already written.
  - We will start writing soon
  
- Prototype assembly
  - Jake is machining the backlash station today
  - two turn tables need machined
  - we will drill out the burnishing holes today
  - drill chuck is fixed
  - clamping arm is fixed
  - we will add code to the stuff today
  
- Meeting with Pietro today at 6:30

**To Do:**

- Machine backlash station
- re-drill bracket holes
- add code
- write report

03 April 2019  
Meeting 21

**Meeting Notes:**

- Those in attendance: Morgan, Tom, Jake
  
- Report
  - Most of the report we have essentially already written.
  - We will start writing soon
  
- Prototype assembly
  - Jake is working on machining the backlash station
  - two turn tables will be machined Friday
  - burnishing holes are fixed
  - debugger has arrived
  - we will try to figure out how the debugger works without David

**To Do:**

- Machine backlash station
- add code
- start writing the report
- machine turn tables

10 April 2019  
Meeting 22

**Meeting Notes:**

-Those in attendance: Morgan, Jake, Tom

-Report

- Started compiling some pieces of the report.
- We will start writing in depth after Expo

-Prototype assembly

- Backlash clamp is complete
- Backlash shelf is nearly complete
- we will add code to the stuff today
- Ejectors are nearly completed

-Meeting with Pietro today at 6:30

**To Do:**

- finish machining backlash station
- finish machining ejectors
- machine last turntable
- Cut keyway in second turntable
- Label 10 position switch
- add code
- make poster board
- write report