Presentation Outline

Note: 15 minutes to present, 10-15 minutes for questions. See suggested times next to sections

- Judges Introduce Themselves
- Hand judges binders
- Kyle introduces team and himself (15 seconds)
- Individual Introductions going down the line (1 minute)
    - Name
    - Year in School (coming academic year)
    - Years on Team (can list both year competing in internationals and year of experience if different)
    - Role on Team (e.g. Electrical Team lead, Analog Subteam, etc)
- Mission Theme - Kyle (30 seconds)
    - Large need for for oil exploration and production with increasing oil usage
    - ROVs provide maintenance, ensure safety, and scientific data on surrounding area
    - Our team designed ROV *Cerulean* to provide these services

- General Vehicle - Josh (1 minute)
    - Frame
        - Made of 4, 6061 t-6 Aluminum Plates stacked to form 3 separate layers
        - Basic shape of the ROV is influenced by tools(will see shortly) , as well as the thruster placements.
        - The thrusters are placed at 20 degree offsets from the front and rear of the ROV. Ideal because best balance between turn speed and forward thrust
        - After Basic Shape, did stress/strain analysis on the frame. Used that info to determine how to cut out large sections of each plate, forming significantly lighter frame.
        - Cutting away material impossible with plastic -> lower yield strength.
        - Math -> determined frame is XXX lbs lighter than similar frame w/ common plastics -> due to inability to cut away large sections.
        - FEA determined ROV can safely support 300 kg man jump.
    - Buoyancy
        - Tube provides buoyancy
        - Ballasts

    - Tether Management
        - Tether is securely attached (1 point), neatly bundled (1 point), and excellent tether management protocol developed (1 point)

- Mission Tools - Josh Berg (everyone, physically point out where each tool is located and why. If you don't know why, ask Josh) (4 minutes total)
    - *Manipulator - Sanay (30 seconds)
        - **Fixed manipulator for simple control**
        - **Made of Aluminum, uses servos to move**
        - **shape allows cylindrical objects to be picked up with ease**
        - **Located front center and is the main tool,**
    - Algae Collector and Pump - Sanay (30 seconds)
        - **Bilge pump used for suction**
        - **Algae collected in pipe/tubing**
        - **Vacuum cleaner nozzle to funnel algae**
    - Lift Line Attachment and Gasket Hook - Sanay (30 seconds)
        - JOSH CAN YOU HELP WITH THIS ONE
        - yeah give me a sec
        - thanks i have stuff i can put in here but not sure if its enough
        - **No active Control**
        - **Similar to a bear trap but significantly safer**
        - **semi circular cutouts for gripping pipe**
    - Flow Meter - Sanay (30 seconds)
        - impeller turned by flow of water
        - impeller triggers switch causing impulses
        - time between impulses read and rotations per minute are recorded
    - Distance Measurement Tool - Teal (30 seconds)
        - Uses laser to find distances via (???? What)
        - Used for multiple missions: x and x
        - By using the law of cosins, we are able to find the length of the PVC pole
    - Valve Turner - Teal (30 seconds)
        - Rotates appendage to turn valve
        - Shaped such that it won't slip on PVC square
        - Lining up is easy, given the shape is self centering
    - Flange Installer -Teal (30 seconds
        - Used to place flange and bolts in end of PVC tube acting as pipeline
        - Uses multi-part action to assure flange stays in place when pulling back
        - Uses cone to center on pipe
    - Voltage Measurement Tool - Teal (30 seconds)
        - Used to test for corrosion on pipes, which normally have a voltage passes through to inhibit the corrosion
        - Built to be very easy, and efficient, testing 3 of the 4 points simultaneously
        - Only need to ram into test pole, then rotate to get next test point

- Electronics Tube - Josh (30 seconds)
    - Consists of the polycarbonate body, two coupling rings, and 2 end caps.
        - polycarbonate tube not constant surface. Can deflect. -> Coupling rings provide constant sealing surface for the endcaps -. use 2 quad o rings per endcap.
    - Bottom endcap mounted to the base of the frame.-> tube placed on top of that.
    - Notice top endcap features a particular pattern -> if you look, the top plate of the frame has the inverse. -> the top plate acts as a locking mechanism.
        - top endcap is inserted, then twisted to lock in. This mechanism was added for easy access to electronics.
    - Nice Transition to Evan.

- Electrical Overview - Evan (30 seconds)
    - Custom designed electronics - 6 circuit boards on ROV plus 1 at the surface for communication
        - responsible for tasks like communication, power monitoring, reading sensor data, and controlling specialized tooling
    - designed in Eagle
    - These 6 boards slot into the `Backplane` which cleanly connects all of the boards
    - We'll take the next few minutes to discuss how each of these boards work
    - reference SID
- Application Board - Evan (30 seconds)
    - houses electronics for mission specific tools and sensors
    - collaborative effort with many contributions from new members of the team
        - led drivers for controller brightness of camera lighting
        - 2 current monitored hbridges for the algae collector and valve turning tools
        - 2 stepper drivers for laser measurement tool
        - 1 current monitor for detecting closure of claw
        - sensors for voltage probe
- Motor controllers - Evan (30 seconds)
    - custom motor controller designed to replace black box, stock motor controllers
    - operates at 24V, up to 5A continuous operation
    - uses differential communication for noise immunity
    - independently addressable with short and thermal fault reporting
- Tether - Sam (30 seconds)
    - Tried 2-wire method using modulation
        - the data and video are "added on top of the power cables"
        - done to make tether easier to manage

    - designed alt com board due to concerns of not finely tuned values causing interference
    - both boards have ability to send data through the lines as well as up to 2 cameras at a time.
- Cameras - Sam (15 seconds)
    - analog cameras that output standard composite video (which is what is usually found in devices that connect to TVs like DVD players).
    - There are a total of 4 mounted cameras
        - 3 are statically mounted
        - 1 mounted onto the laser distance measurement tool
    - The cameras have fish-eye lenses for a wider viewing angle
- Power Conversion Board - JoLynn (15 seconds)
    - converts input voltage to various other levels
    - Decoupling the data from powerline
    - main power passes through current sensor IC
        - monitor power drawn remotely
- Motor Distribution Board - JoLynn (15 seconds)
    - Provides power for all eight thrusters
        - pass through converter brick, 48V to 24V
    - LED indication of blown fuses, using a fuse-detection circuit
        - outputs a fuse detection signal
- Micro-board - Nick (30 seconds)
    - STM32 F4 arm processor 168 MHz - enables real time communications and processing
    - Has 9-axis IMU for real time positioning
    - More powerful than an arduino
    - no off the shelf hardware supported our custom use case
- Backplane - Nick (30 seconds)
    - Everything comes together in the backplane
    - like a motherboard for a computer, but “dumb”
        - Has no active components
    - top side has connectors for all of our boards
    - bottom side has connectors for binders
        - eliminates wires except for those under the backplane
- Software - Matt (2 minutes)
    - Micro-board
        - Written in C with ST Libraries
        - Reads states from BattleStation
        - Delivers status updates to the BattleStation
    - BattleStation
        - Written in C++ with Qt so it makes it cross platform
        - Talks to the Joystick and the ROV over serial
        - Runs on our laptop, with configuration and calculations for the copilot

        - Allows multiple configuration option
        - Computes thruster vectors and tool states based off of input and sends to ROV
        - Checksum and structured packet
    - Control Scheme
        - Meant to be easily controllable, similar to driving a car, with the added vertical direction
        - A "slow mode" that allows for more precision movements (reduced sensitivity)
        - Most common tools and and options are configured to controller, the rest of easily enabled by the BattleStation via the copilot
- Safety - JoLynn (30 seconds)
    - Safety Features and Philosophy Highlighted
        - Fast blow fuses
        - Fuse detection
        - No significant injuries
        - Safety certification by Purdue Radiological and Environmental Management
    - Reference how we use safety checklist - reference in binder
    - Warning Labels and Safeguards on Potential Hazardous Parts…
        - Shrouded propellers
        - Laser guard
- Logistics - JoLynn (30 seconds)
    - Structure
        - 3 teams (electrical, software, and mechanical)
        - Administrative (captain, tech writer, graphics designer, and sponsorship coordinator)
    - Schedule
        - Train new members beginning of school year
        - Practice vehicle
        - Design and construct new vehicle
    - Budget (Kyle-15 seconds)
        - $23,000 budgeted and spent almost that
        - Raised more through companies, school, etc., invested for next year
- Conclusion - Kyle (30 seconds)
    - Skills
        - Taught PCB design, mechanical machinery, CAD, Qt library, etc.
        - Teamwork?
    - Lessons learned
        - More training in the beginning
        - Better time budgeting
    - Final
        - The best ROV ever

- Future with returning young members
- Thanks for time and ready for questions