The steps that need to be taken to complete the first iteration of the ROV:

1. Figure out how to transmit USB signal over a long distance (50 m). What we know:

   - We need to use *cat5* Ethernet cables.
   - Need to use USB extenders (can be bought off the shelf `http://www.amazon.co.uk/NEWLink-CAT5-USB-EXTENDER-SYSTEM/dp/B0018D5DUU`)

   DONE!

2. Have to minimise the number of wires in the umbilical to make the tether light so that it does not restrict the ROV too much and does not sink and get wrapped around stuff on the bottom.

   - Should try to use a USB hub on-board to use only one Ethernet cable to have a live feed from the camera and communicate with the Arduino over serial.
   - If simultaneous communication with the camera and Arduino can't be achieved over the same USB cable, we should use I^2C to communicate with the Arduino - it's simple and we will use the same bus when upgrading to AUV to interface the Arduino with a Beagleboard or the Raspberry Pi that will be responsible for autonomy. I^2C range can be extended using P82B96 from Texas Instruments.
     `http://uk.rs-online.com/web/p/bus-buffers/8122662/`
     `http://www.ti.com/lit/ds/symlink/p82b96.pdf`
     `http://www.nxp.com/documents/application_note/AN10658.pdf`

   DONE!

3. Should use external 9 or 12 V power supply - portable, easy to charge, available:
   `http://www.ebay.co.uk/bhp/12v-li-ion-battery`
   DONE!

4. Power management

   - Will need MOSFET-type transistors to control power levels delivered to propulsion and LED subsystems
   - Could look at having a power-consumption monitor for future reference and design evaluation
   - Add a voltage monitor for the battery system
   - Have an emergency breaker in case of a short-circuit maybe?
   - Need to come up with a way to shift down voltage from 12 to 9 `http://www.ti.com/lit/ds/symlink/lp2950-33.pdf`
   - need to make it possible to invert poles for the motors to work in reverse `https://learn.adafruit.com/adafruit-arduino-lesson-15-dc-motor-reversing/parts`

5. Need technical drawings of the Arduino and other components to work on the general arrangement (GA)

6. Use PVC pipe as the main hull pressure vessel

   - Simple pipe like this should do:
     `http://www.diy.com/departments/floplast-black-soil-pipe-dia110mm-l1m/261999_BQ.prd`

- Could use a T-shape as well to have easier access to the central part of the hull
- Ends can be capped with socket plugs like this
  http://www.diy.com/departments/floplast-terracotta-socket-plug-dia110mm-l123mm/81463_BQ.prd
- External mounting can be done without drilling holes with clamps like so
  http://www.diy.com/departments/floplast-black-pipe-clip-dia110mm-l25mm/80964_BQ.prd
- Joining can be achieved using adhesives
  http://www.diy.com/departments/evo-stik-pvc-weld-50-ml/36242_BQ.prd

7. In order to accommodate camera in front a window from plexiglass can be added (may use the same adhesive as for the PVC/ABS hull elements)
   http://www.plasticsheets.com/5mm-clear-acrylic-sheet/

8. Cables can be put through threaded plugs

   - Can use a male and female elements like these
     http://uk.rs-online.com/web/p/pvc-abs-threaded-fittings/2123717/
     http://uk.rs-online.com/web/p/pvc-abs-threaded-fittings/2123537/
   - Drill a hole through the male plug, put the cable through and make the connector end "stick out" on the inner side of the hull
   - Use silicone layer to seal-off the hole, fill the rest of the plug with epoxy resin for pressure/water resistance (**make sure the resin does not melt the cable**)

9. Can use a processor supervisor circuit to provide automatic reset functionality from on-board in case the μ-c falls over
   http://uk.rs-online.com/web/p/processor-supervisors/6674266/
   http://ww1.microchip.com/downloads/en/DeviceDoc/21370c.pdf

10. Use ultra-light LEDs to illuminate the camera target
    http://www.ebay.com/itm/1000-pcs-PLCC-6-5050-SMD-3-CHIPS-white-Ultra-bright-LED-/231560265873

11. Tether

    - Should consist of an Ethernet CAT5 cable (if using I^2C add another one)
    - Should have a dedicated power cable
    - Consider adding extra buoyancy elements (Styrofoam) for neutral/slightly positive buoyancy
    - Should aim to have the tether attached on the top of the ROV, pointing vertically upwards
    - Consider an extra nylon rope for emergency recovery - make sure to have some slack in the cable for stress relief

12. Sensors

    - Pressure sensor
      http://www.ebay.com/itm/Pressure-transducer-or-sender-60-psi-stainless-steel-for-oil-fuel-air-water-/261508176203
    - Temperature sensor (tbc)

- Camera - use whatever USB webcam
- Gyroscope
- Compass
- Accelerometer - look at AUV/quadcopter off-the-shelf elements
- Think of a way to measure flow speed easily (look at model boat elements, Pitot tube, pressure sensors?)

Table 1: Work break-down structure.

Task	**Person**	**Status**	**Notes**
I^2C	Alek	Done	Figure out how to send/receive data reliably, re-use serial comms communication functions and data-packeting if possible
Component tech. drawings	Artur	Not started	Create technical drawings of the various components being considered to allow early GA of the vessel to be created
USB range extension	Both	Done	Test the video feed relay over a long USB cable once the extenders arrive
Masses & Centres	Artur	Not started	Start indexing the components and noting their mass and CG locations for balancing the vessel
Control interface (GUI)	Both	In-progress	Get a way of visualising camera feed and sending/receiving info