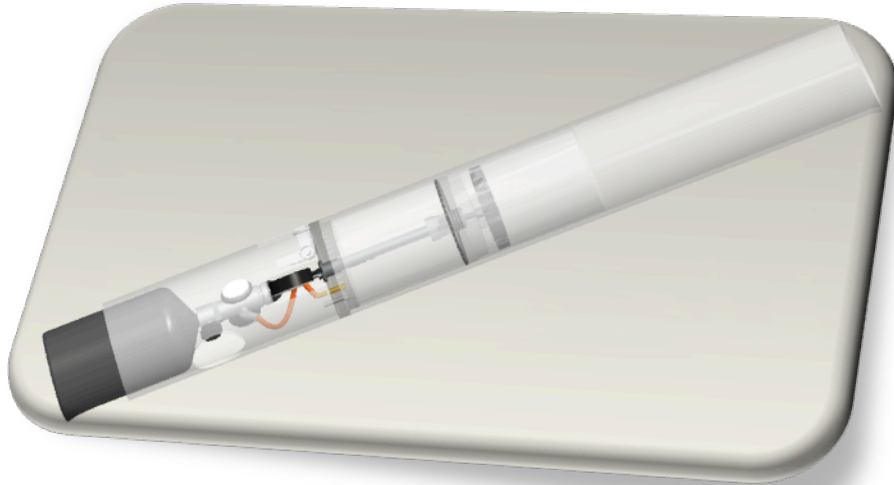


# Operations Manual

## Compact Pneumatic UAV Launcher



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**The aforementioned information and procedure is specifically written for the physical prototype in which is shown and provided, not the final design.**

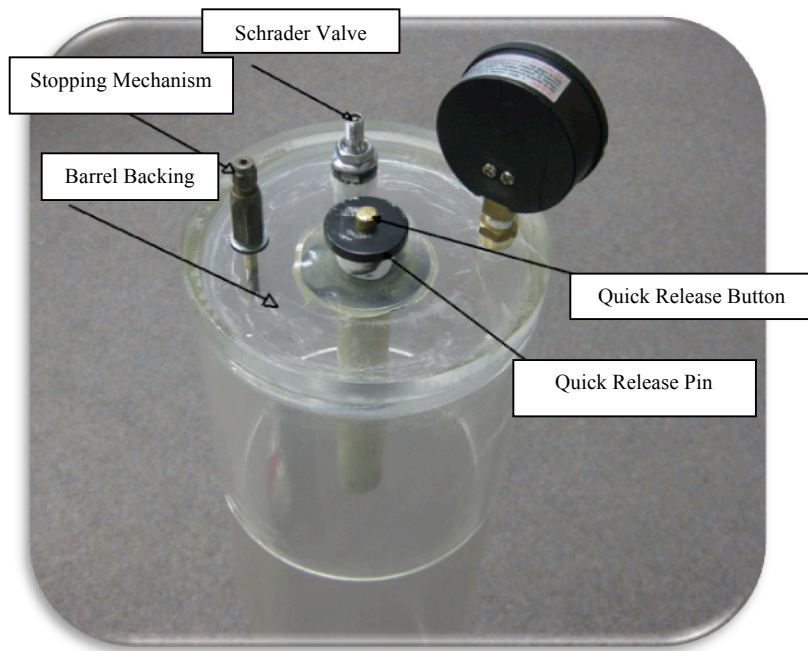
### **Cautions and Warnings**

- Do not stand in front of launcher when pressurized.
- Do not point launcher at anyone or anything when pressurized.
- Make sure sandbags are placed in such a way to absorb recoil and support the tube.
- Do not pressurize launcher above 65psi.
- Do not launch anything other than the UAV in which it was designed
- Do not launch the UAV with the launch tube unsecured.
- Do not try to adjust the regulated air pressure while the air system is connected to the launch tube.
- When calibrating the air system, do not open the flow from the high pressure tank unless the adjustable pressure knob is turned to zero.

- Operate at your own risk, Launchteam09 (Group 3), FAMU-FSU College of Engineering, nor any persons involved are responsible for accidents that may occur.

## **Getting to know your Launch Tube**

This section is to inform the user of all of the working parts of the Launch tube and gain general knowledge of their purposes. Refer to figures 1-3 while reading the description of each working part.



**Figure 1 - Barrel Backing and Components**



**Figure 2 - Carriage and Components**



**Figure 3 - Pressure Gauge Mounted to Backing**

# Launcher Components

**Barrel Backing-** the back of the launch tube in which all of the components are mounted and where air is delivered into the charge chamber. (Figure 1)

**Carriage-** the acrylic section of tube that holds the UAV during launch. It is equipped with a quick release receiver in the back; to lock onto the quick release pin. (Figure 2)

**Charge Chamber-** the sealed section of the tube that receives pressurized air. (Figure 4)

**Hammer Mechanism** – the part that uses rotational springs to press the quick release button so the user can operate the launch system from a safe distance.

**Pressure Gauge-** reads the pressure that the charge chamber is experiencing. (Figure 3)

**Quick Release Button-** the button on the quick release pin that the user must engage in order to launch the UAV under desired pressure. (Figure 1)

**Quick Release Pin-** the mechanism that holds and releases the carriage under a desired pressure. (Figure 1)

**Quick Release Receiver-** the metal part in the back of the carriage that attaches to the quick release pin. (Figure 2)

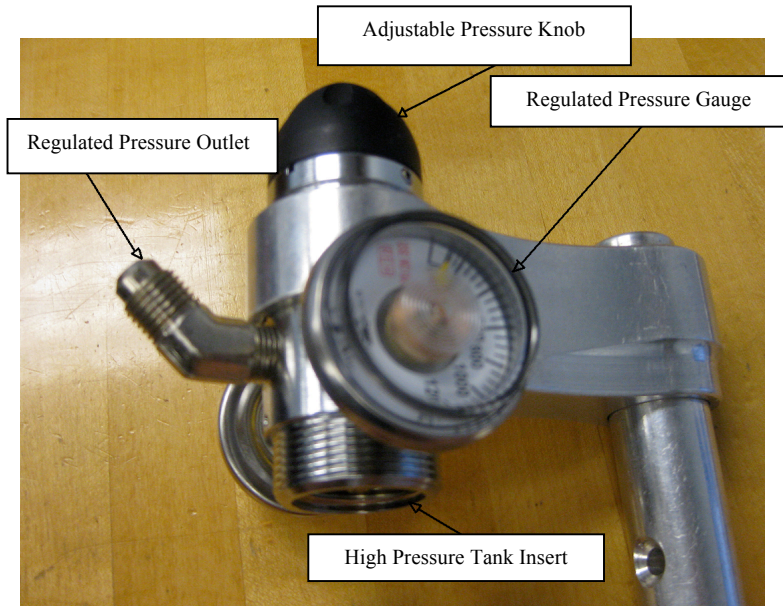
**Stopping Mechanism** – the stopping cable is attached to both the barrel backing and the back of the carriage to insure that the carriage does not leave the barrel of the launch tube upon launch. (Figures 1 and 2)

**Schrader Valve** – can be used to bleed the excess air out of the carriage in case of an emergency. It can also serve as a secondary way to load the charge chamber, by using a portable air compressor. (Figure 1)

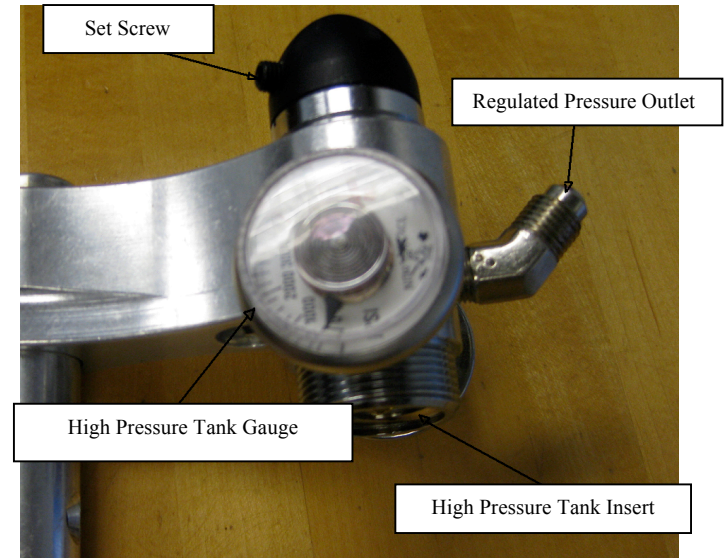


# Getting to know your Pressure Regulator

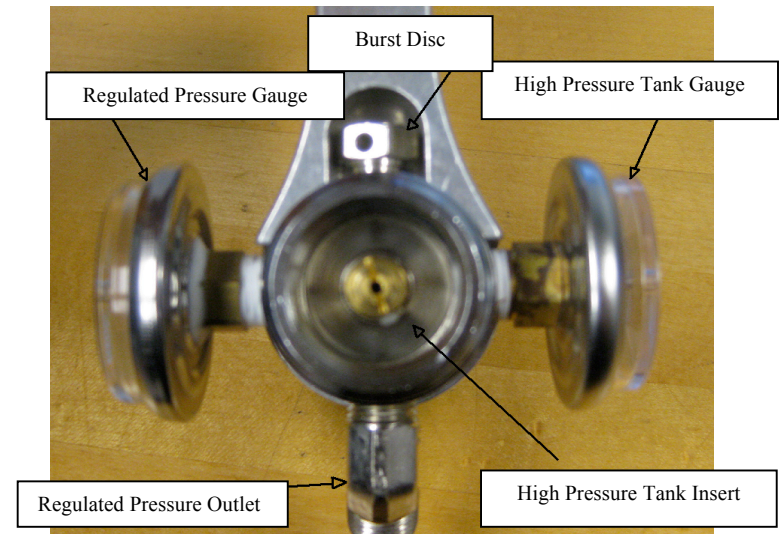
This section is to inform the user of all of the working parts of the High Pressure Regulator and gain general knowledge of their purposes. Refer to figures 4-6 while reading the description of each working part.



**Figure 2 Left side of High Pressure Regulator**



**Figure 3 Right side of the High Pressure Regulator**



**Figure 4 Back of the High Pressure Regulator**

## Regulator Components

**Adjustable Pressure knob** – this knob adjusts the pressure that will be coming out of the high-pressure braided line and into the charge chamber of the launch tube.

**Burst Disc** – this part insures that the pressure does not build to unsafe levels. If the pressure reaches a dangerous level, the burst disc will release the build up pressure and prevent damage to the air system.

**High Pressure Tank Gauge** – this gauge reads the pressure that is left in the reservoir tank. As pressure is bled out into the charge chamber, this pressure will decrease.

**High Pressure Tank Insert** – this is where the reservoir tank is attached to the High Pressure Gauge.

**Regulated Pressure Gauge** – this gauge reads the pressure that is bleeding into the charge chamber. The pressure of this gauge can be adjusted with the Adjustable Pressure knob.

**Regulated Pressure Outlet** – this opening is where the pressure that is controlled by the pressure knob and the Regulated Pressure Gauge will be exiting. A high pressure braided line will be attached here, feeding the air into the charge chamber.

**Set Screw** – this part locks the Adjustable Pressure knob into place once the user has adjusted it to the appropriate level.

## Assembly of Launcher System

### 1. Start with the Air System

- a. Make sure that the Reservoir tank is charged with pressurized air.
- b. Check the On/Off knob to make sure it is in the off position.
- c. Next, make sure that the adjustable pressure knob on the High Pressure Regulator is turned completely to the left, in the closed position.
- d. Insert the O-ring into the High Pressure Tank Insert of the High Pressure Regulator.
- e. Take the threaded end of the bottle nose and insert it into the High Pressure Tank Insert of the High Pressure Regulator.
- f. Tighten down the High Pressure Regulator onto the threads of the bottle nose, compressing the O-ring.
- g. Next, attach the Pressure Gauge from the barrel backing to the T-fitting provided.
- h. Attach the fitting to the proper end of the steel braided line.
- i. Screw the braided line onto the Regulated Pressure Outlet.
- j. Make sure all of the connections between the Pressure gauge, T-fitting, braided line, High Pressure Regulator, and Reservoir tank are secure.
- k. Turn the On/Off knob of the High Pressure Air Tank to the right, into the on position.
- l. The High Pressure tank gauge should show a high amount of pressurized air. There is now air pressure in the regulator, but since the Adjustable Pressure knob is in the off position, there is no air flow.

- m. Gently turn the Adjustable Pressure knob to the right while observing the Pressure gauge on the T-Fitting to prevent the pressure from exceeding 70psi.
- n. Once the pressure gauge on the T-fitting reads a steady 65psi, tighten the set screw in so that the Adjustable Pressure knob cannot move.
- o. Turn the On/Off knob on the high pressure air tank to the off position so that the high pressure tank gauge reads 0psi.
- p. Open the valve on the T-fitting to bleed the air remaining in the regulator.
- q. Remove the pressure gauge from the T-fitting.
- r. Screw the pressure gauge back into the barrel backing.

**The Air System is now ready to be installed into the back of the Launch tube.**

## 2. Next, Prepare the launch tube

- a. Observe the barrel backing.
- b. Remove the pressure gauge and set it aside for later use; if the gauge is left in, it will create a vacuum that will prevent the carriage from being loaded into the launch tube.
- c. Tighten down the Schrader valve.
- d. Tighten down the stopping mechanism.
- e. Insert the O-rings into the tube so that they rest on the lip of the charge chamber.
- f. Tighten down the stopping mechanism on the Carriage.
- g. Tilt the launch tube so that the carriage can be placed in barrel of the launch tube.
- h. Making sure the Quick Release Receiver enters the tube first, insert the carriage into the tube.
- i. Engage the hammer mechanism so that it continuously presses the Quick Release Button down.
- j. While the button is pressed, press the carriage down the barrel and onto the Quick Release Pin, compressing the o-

rings. There will be an audible “click” when the carriage is loaded.

- k. Replace the pressure gauge in the proper place in the barrel backing and tighten down.

**The launch tube is now ready to be attached to the Air Delivery System.**

## 3. Assembling the Air System to the Launch tube.

- a. Make sure that the On/Off knob on the high pressure air tank is in the off position.
- b. Check the regulated pressure gauge on the regulator to insure that there is no flow of air through the regulator.
- c. Remove the steel braided line from the regulated pressure outlet. (It is easier to install into the barrel backing first)
- d. Screw the steel braided line into the appropriate fitting on the barrel backing.
- e. Slide the regulator, with the tank attached, down the protective tube and orient it so that the steel braided line can be attached.
- f. Attach the steel braided line to the regulated pressure outlet.
- g. Tighten down both connection points on the steel braided line, to prevent leaks.

**The launch system is now assembled, but not yet ready to fire.**

# Operating the Launcher

## 1. Suggestions for Sandbagging the UAV Launcher.

- a. Make sure the angle of the UAV launcher is between 30-45 degrees.
- b. Support the back of the carriage with at least two sandbags to reduce the effect of recoil.
- c. The launcher needs to be secured from rising up when fired, place sandbags on top of the launch tube.
- d. Stack sandbags on the side of the launch tube so that it cannot move from side to side.

## 2. Preparing the launch tube for a day of Launching.

- a. Unscrew the pressure gauge from the barrel backing.
- b. Activate the hammer mechanism to push the button down.
- c. While the button is pressed, remove the carriage.
- d. Use a water based lube to lubricate the inside of the tube and the o-rings.
- e. Clean off the carriage.
- f. Reload the carriage into the barrel and compress it onto the o-rings until there is an audible “click”.
  
- g. Reset the hammer mechanism to the loaded position.

**Now, the charge chamber is ready to be pressurized for a launch.**

## 3. Steps to a Successful launch.

- a. Once section 1 of “Launching the Compact Pneumatic UAV Launcher” is complete it is time to pressurize the charge chamber.
  - b. Insert the UAV into the loaded carriage.
  - c. Go to the back of the launch tube.
  - d. Position yourself so you have access to the On/Off knob of the high pressure air tank while keeping an eye on the pressure gauge on the barrel backing.
  - e. Make sure there is nothing and no one directly in front of the launcher once the air is turned on.
  - f. Turn the On/Off knob of the high pressure air tank so that air pressure builds in the charge chamber.
  - g. Pressure should start building in the chamber after a short while. If it does, refer to step i.
  - h. If pressure is not building, make sure that air is coming through the regulator by looking at the regulated pressure gauge.
  - i. If pressure is passing through the regulator, you have a leak. Turn off the air and please refer to the “Troubleshooting Leaks” section of the manual.
  - j. Pressure is building, but turn the supply of air off to see how the system is retaining the air.
  - k. If the rate of pressure loss is very quick, you have a leak. Turn off the air supply and refer to the “Troubleshooting Leaks” section of the manual. If the rate of pressure loss is very slow, continue on.
4. Let the pressure build until the pressure gauge in the barrel backing reaches 65psi. The gauge should not exceed 65psi. In the event that it exceeds 65psi, quickly shut off the air supply and bleed off the air pressure via the Schrader valve. This means you have not set the regulator up properly and need to return to “How to Assemble the Air System”. If you have reached a steady 65psi reading, proceed.



- a. Turn off the air supply and wait for the reading on the pressure gauge to drop to 60psi. (There will be a very slow bleed in most cases)
- b. Once the pressure drops to 60psi, trigger the hammer mechanism.
- c. The UAV has been launched.

## **For use with the Stopping Mechanism**

**This part of the manual is only for use if the carriage continuously exits the barrel upon launch.** Note – while using the stopping mechanism, the o-rings in the barrel have a tendency to become out of line. The user will have to repeat steps m through o each time the o-rings have to be reset.

### **1. Connecting the cable to the stopping mechanism.**

- a. Remove the stopping mechanisms from the barrel backing and the carriage.
- b. Twist the top of the stopping mechanism so that it comes apart.
- c. Take out the pin/plug that is located in the mechanism.
- d. Thread one end of the cable through the open end of the piece that came off the top of the stopping mechanism.
- e. Fray the end of the cable that was threaded through.
- f. Place the pin back into the threaded hole, plugging the cable with the pin.
- g. Reassemble the stopping mechanism tightly.
- h. Measure the cable so that the cable is an inch or so longer than the barrel and cut it.
- i. Repeat steps b through g for the second stopping mechanism.

- j. Once both stopping mechanisms are connected to the cable, screw the one stopping mechanism into the barrel backing via the inside of the tube.
- k. Tighten it with a wrench if possible.
- l. The second stopping mechanism should barely stick out of the launch tube.
- m. While aligning the carriage with the launch tube carefully thread the stopping mechanism through the opening in back of the carriage.
- n. Once the stopping mechanism is pulled all of the way through and the cable is in tension, the carriage should be partially inside the barrel. If this is not the case, go back to step h and make the cable slightly shorter.
- o. Once the carriage is in the appropriate position, use the nut that came with one of the stopping mechanisms to tighten the stopping mechanism down, thus pressure sealing the washers.

**The launcher is now ready to be operated with the use of the stopping mechanism.**

## **Trouble shooting air leaks:**

**After making sure all connections between the air tank, regulator, and high pressure line are secure, make sure to check the following:**

### **Leaks through o-rings**

The most common form of leaks in the tube is due to the o-rings. If there are significant leaks around the o-rings, the lubricant will bubble around the o-rings when the barrel is pressurized. Try tightening down the pin receiver in the back of the carriage by screwing it in further by a degree or two. If the pin button does not pop out when the carriage is pushed down into the pin, slightly unscrew the receiver until the pin button will pop out. (Note: The o-rings will always leak slightly, but tightening down the o-ring as much as possible will give the best launch results.)

### **Leaks through carriage**

1. Pour water into the carriage.
2. Load low pressure into charge chamber.
3. Observe carriage for bubbles.
4. Depressurize barrel by bleeding the air out of the Schrader valve.

The bubbles, if any, will tell where exactly the leak(s) are. If bubbles are coming from the stopping mechanism hole, simply tighten down the sealing washers. If bubbles are coming from the acrylic bonding points, re-bond the joints and/or apply silicone caulk.

### **Leaks through the launch barrel backing**

1. Place launcher on the ground with the open end of the barrel on the ground.
2. Pour soapy bubbles around the barrel backing holes.

3. Pressurize barrel.
4. Observe barrel backing for bubbles.
5. Depressurize barrel by bleeding the air out of the Schrader valve.

If bubbles are present, either Teflon tape threads or apply silicone caulk minimally and carefully.