How to Make a Pretty Good Borescope for less than $15

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This article describes how I made two pretty good borescopes for viewing the interior of my aircraft cylinders and valves on my laptop computer for less that $15 each.

Over the past few years Mike Busch has issued a number of articles that strongly suggest using a borescope to inspect the condition of the cylinders on an aircraft any time the plugs are removed. He has especially emphasized the need to inspect the condition of the cylinder exhaust valves.

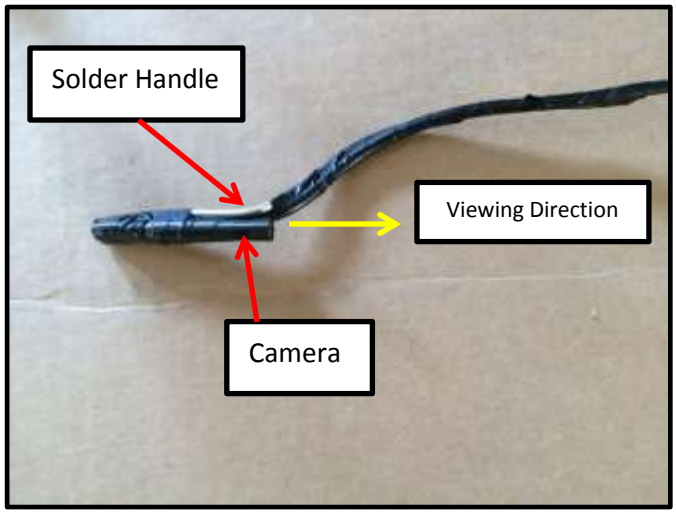
The only problem for many of us is that we do not have access to a borescope. Searching the web we find that there are a number of very good, "professional quality" borescopes available. Unfortunately they often cost around $2000. These are high quality machines with articulating tips that provide high quality images. Following these devices, there are then a number of "good" quality machines in the $500 and up price range. These machines tend to provide satisfactory images but lack some of the features of the highest quality machines. Following these mid range machines there are then a number of low cost devices in the $75 and up range. These machines can be a challenge to obtain acceptable images.

If you search the internet for "usb borescopes" you will most likely come across a wide range of rather inexpensive devices. I was intrigued with these "cheap" devices that might generally fall into the category of "cheap Chinese junk". That did not deture me from buying and trying several models. The first model I bought had a wood handle and a heavy flexible metalic outer sheath. The camera head had several embedded led lights. I found that the device took amazingly high resolution images and the led's provided adequate light to view dark places. However, on the downside, I was unable to figure out a method where the probe could be inserted into a cylinder sparkplug hole and then be bent back to view the valves. It did work fairly well in viewing the cylinder walls and piston head. While playing with the device, I got some oily grease on the camera lens. In trying to clean the lens I found that whatever solvent I used cause the leds to fail.

I then bought a different device with a removeable 45 degree mirror attachment for the end of the camera. The camera was also advertised as "waterproof". What I found was that while the 45 degree head improved viewing around corners, the limp wire cord on the camera made it difficult to position the camera through the sparkplug hole.

Practicing on an salvage cylinder, I found that in order to get an acceptable view of the valves, the camera really needed to be inserted into a sparkplug hole and then be able to view back towards the spark plug opening and valves. I was not certain what would happen if the cord on the camera was tightly bent back on itself, but I decided that this was the only solution so I placed a very tight 180 degree bend right at the back of the camera and then used high quality electrical tape to secure the cord to the camera body. I felt there was also a need to have a flexible handle on the camera to be able to accurately position the camera in the cylinder. To accomplish this, I cut off an 8" section of lead-free

solder to create a handle. I flattened the end of the solder a bit and taped it to the camera/cord assembly as shown on the next photo.



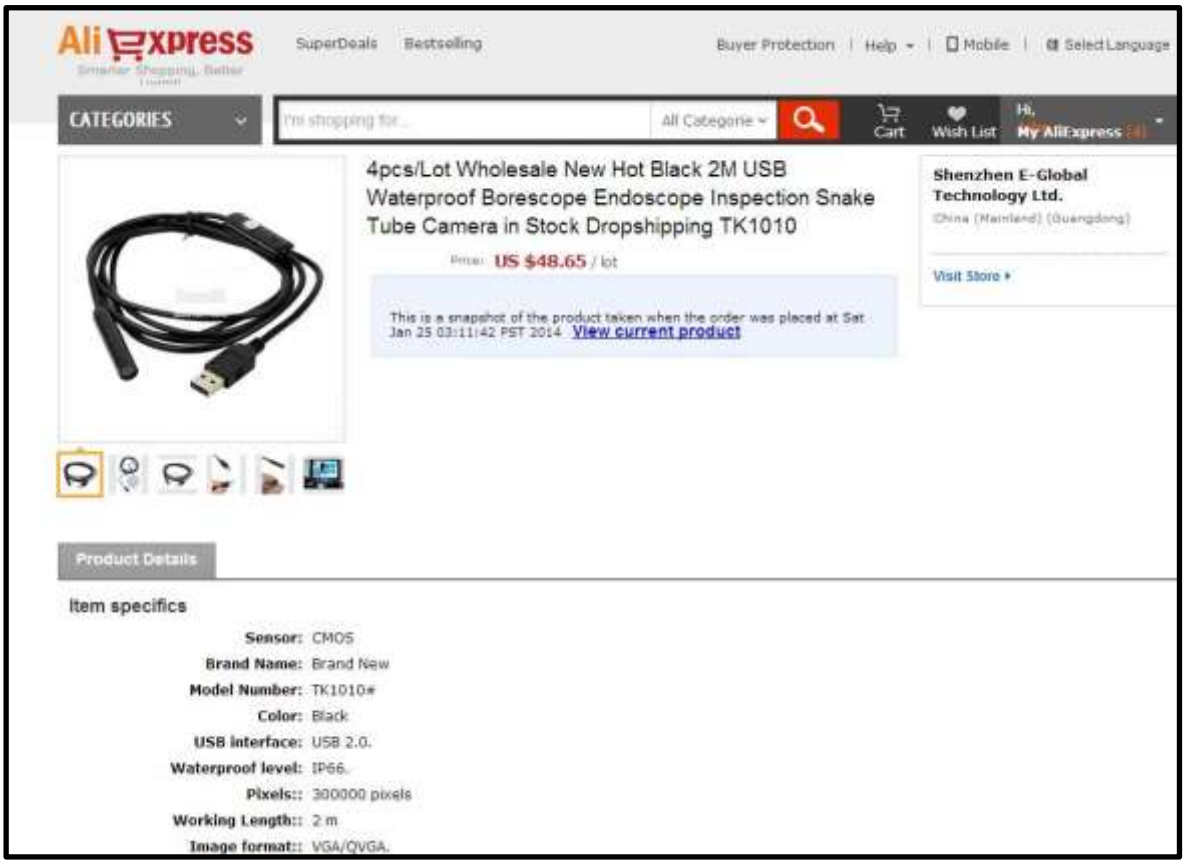
This is a photo of the camera with the cord bent back on itself and taped to the camera. You can also see a portion of the Solder used as a handle on the camera. The handle can be bent to position the camera below the exhaust valve after inserting the camera into the plug hole. It is important to minimize the overall diameter of the camera and handle as the assembly must be inserted into the spark plug hole.

While this camera setup works pretty good for viewing the valves, it no longer can be used to view the cylinder walls and piston head. Therefore I decided to create a second camera without bending the camera back but with the solder handle.

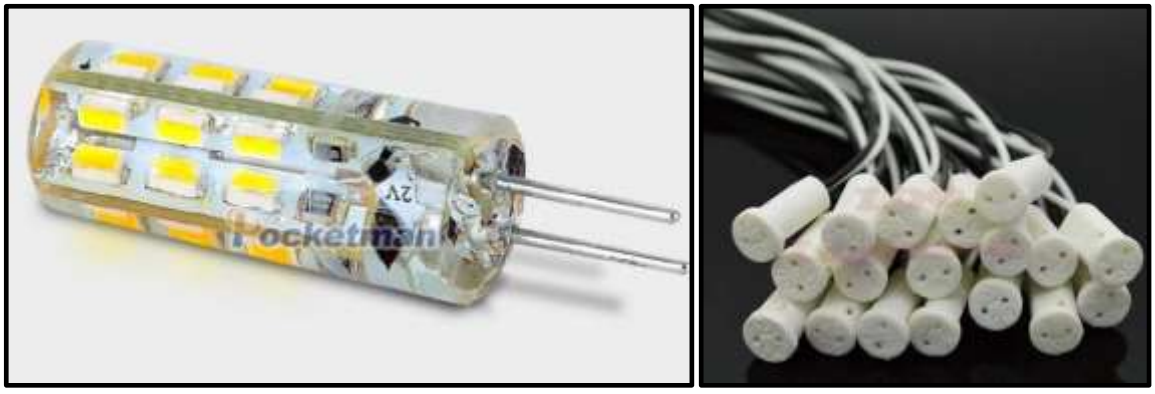
The software that comes with the camera has instructions that appear to be translated from Chinese to English by someone who did not know a word of english. However having said that, I found that the mini CD that came with the unit was able to install the viewing software onto my Windows 7 PC. For my older Windows XP machine, the viewing software could be copied from the CD to the hard drive and worked fine without actually being “Installed”.

Below are a couple of photos captured on my laptop from the camera. The left photo is a view of the exhaust valve. The right photo is a photo of my watch, just to display the relative image quality. One issue related to the image quality is the amount of light within the cylinder. I have a number of different flashlights that can be extended into the second spark plug hole. I tried these flashlights and, while the extra light did improve the captured image, additional light was needed.

I mentioned earlier that if you seach the internet for “usb borescope” you will find a number of devices. I ended up purchasing a couple different styles of units from “AliExpress”. I have no reason to believe that these units are any better or worse that similar devices from other vendors or websites. For this study, one of the primary factors was the cost. Below is a screen shot of the units I ended up using. This is a package of four units for a total cost of $48.65. Shipping is free but I think they ship them by boat from China so it takes quite a while to get them.

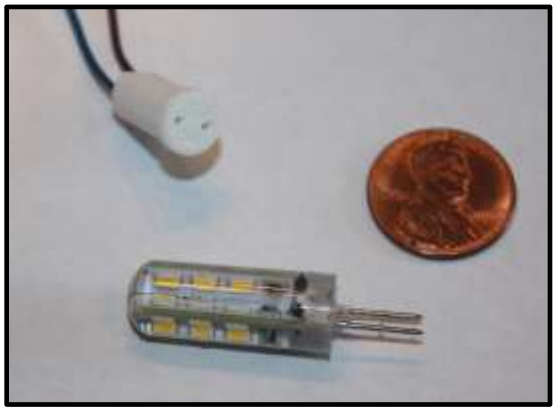


To address the need for better lighting in the cylinder, I searched for small LED lamps. Below are photos of a multi-segment LED lamp and small lamp sockets that I came across.



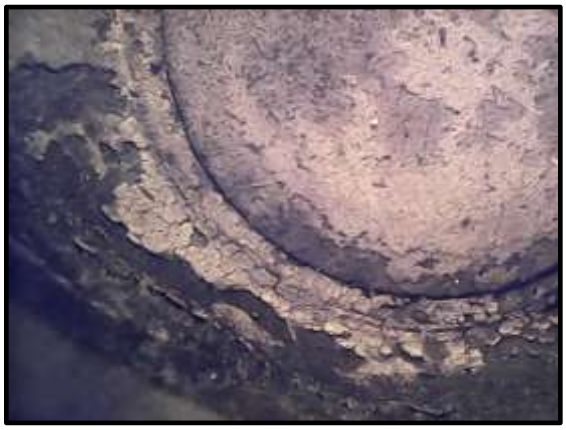
I ordered some of the 12 VDC lamps and sockets. As shown below, I purchased 6 lamps from AliExpress for $9.99, and 20 lamp sockets for $8.54.

To power the lamp, I came across an old 12VDC power supply in my pile of obsolete junk that I might need some day.



This photo shows the size of the lamp and socket as compared to a penny. The LED's in the lamp are encapsulated in some type of rubbery RTV type material. This eliminates the concern that one might have with glass enclosed lamps breaking while inside the engine cylinder.

To demonstrate how much the additional light improves the capture of images, the next photo shows the exhaust valve in a different cylinder on the left and the intake valve on the right with the additional light from the multi-segment lamp.



It should be noted that the software for the camera permits capturing either still photos or video. I have used the software on both a Windows 7 laptop and a Windows XP laptop. As one might guess, the quality of the displayed camera output is primarily a function of the laptop display resolution.

I plan to continue to experiment in ways to improve the internal inspect of aircraft cylinders, but for now this inexpensive option seems to have potential for doing the job.

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For additional information related to articles and recommendations by Mike Busch, visit his website at https://www.savvymx.com/ and click on the "resources" tab. If you have an opportunity to attend Oshkosh Airventure, I can also highly recommend that you attend his many technical presentations.

For additional information on the AliExpress website, go to: http://www.aliexpress.com/

Link for multisegment lamps that I used: http://www.aliexpress.com/item/10pcs-Free-Shipping-New-Arrival-G4-Light-3W-24-SMD-3014-Led-Bulb-Replace-30W-halogen/1562328138.html

Link for the lamp sockets that I used: http://www.aliexpress.com/item/MOQ-20pcs-30cm-G4-plug-adater-power-Crystal-bulb-Lamp-bead-halogen-special-ceramic-socket-Droplight/1521949721.html

Link for the usb cameras that I used: http://www.aliexpress.com/item/4pcs-Lot-Wholesale-New-Hot-Black-2M-USB-Waterproof-Borescope-Endoscope-Inspection-Snake-Tube-Camera-in/1441315250.html

Link for an earlier version of a camera that I used with a 45 degree mirror attachment: http://www.aliexpress.com/item/Free-shipping-7mm-lens-USB-endoscope-6-LED-IP67-Waterproof-Camera-Borescope-5M-mini-computer-camera/998085407.html