ZENMUSE X5 'NO VIDEO TRANSMISSION SIGNAL' fix, (if a corrupt Texas Instruments (TI) DaVinci 368 chip firmware is to blame, which is the case about 90% of the time.)

**** READ THIS ENTIRE DOCUMENT BEFORE ATTEMPTING ITS STEPS. THIS IS IMPORTANT! ****

NOTE: This project/process is NOT FOR THE FAINT-OF-HEART! You can further 'brick' your X5, damage your PC/laptop, or worse. You'll need (at a minimum), the following: a quality surface-mount appropriate soldering station, a reliable FTDI (USB-to-serial) converter/adapter (available on Amazon, among MANY sources), some stranded wires (with connectors on one end appropriate for your FTDI board and 1/16 inch, stripped and tinned wires at the other end), a 'micro' tool set (micro Philips and Torx bits at a minimum), an X-Acto (or similar) knife (for its thin blade, which will be used to pry open the plastic gimbal protector sleeves/shells), some decent quality heatsink compound/thermal paste (same as used on PC CPU's, etc.), and the necessary software package/s. LINKS TO THE SOFTWARE ARE NOT INCLUDED, since they frequently don't work/go 'dark', so you'll need to have some skills with Google's search engine, as well. If all goes well, you'll be rewarded with a working X5 camera that was, until the successful completion of the following steps, destined for the trash heap or used as a paperweight! Note that the following steps omit some details, like the exact location of screws, etc. If you're mechanically inclined, you won't have any issues. Also, the following steps NEED TO BE COMPLETED IN ORDER!

1. As an overview of the many next steps, you will be disassembling the camera to the point where the Hi-Res Encoder/Gimbal Control Board (the first/top board under main cover), and the Live-View Encoder Board/image transmission board (under the powered-side of the gimbal arm, and the board we need to put new firmware into), are removed. Here are the (relatively) detailed steps for this mechanical disassembly portion, in the order they need to occur.

    a. First, remove the BACK cover of the camera (this is the large, black cover at the rear of the camera body behind the lens), by removing the SIX (6) micro Torx screws. Lift it off the camera body and set it (and the screws) aside.

    b. Next, remove the black plastic heatsink cover/duct, which is held in place by TWO (2) Philips screws. Lift it off the heatsink/board and set it and its screws aside. Then remove the heatsink for the Hi-Res Encoder/Gimbal Control Board by removing the three (3) Philips (micro drivers/tools required for ALL this work, as noted above.) The heatsink is held to the underlying chips (Ambarella video processor and memory), by some thermally conductive 'tape'. This will tend to stick to the chips/heatsink, so 'rotate' the heatsink back and forth a little at a time, until the heatsink is free of the chips. DO NOT PRY UPWARD ON THE HEATSINK, AS YOU COULD RIP THE CHIPS OFF THE BOARD!

    c. Again, (as stated above), the heatsink interface/compound DJI uses is a 'tape', not a paste and it will likely come apart/disintegrate when you remove the heatsink (it 'fragments' about 90% of the time), and will leave pieces stuck to the chips and heatsink. THIS MUST BE COMPLETELY REMOVED, PRIOR TO USING NEW THERMAL PASTE ON REASSEMBLY! DO NOT reuse this heatsink 'tape', even IF it comes off in one piece! Set the CLEANED heatsink aside, along with its three screws.

d. Next, under the heatsink, there are three brass threaded hold-downs, which hold the Hi-Res Encoder/Gimbal Control Board to the Image Sensor Board. First, CAREFULLY remove the TWO (2) ribbon cables which are held into their connectors with 'cam over' retention bars. CAREFULLY pry the dark-colored bars up (until they're vertical) and then VERY CAREFULLY, (using a straightened paper clip or some other tool that'll get between the cable bend and the connector), pull the cables from their connectors (outward, towards the camera body), to remove them. IF THEY DON'T EASILY SLIDE FROM THEIR CONNECTORS, THE RETENTION BARS AREN'T CORRECLY RELEASED! THESE CABLES ARE VERY DELICATE AND RIPPING/BREAKING ONE WILL RENDER THE PROJECT FAILED, AS THESE CABLES ARE NOT SOLD AS PARTS!! After these two ribbon cables are free, remove the three (3) brass threaded hold downs. ***DO NOT, UNDER ANY CIRCUMSTANCES, LOOSEN THE FOUR (4) PHILIPS SCREWS ON THE IMAGE SENSOR BOARD***!! These are ADJUSTMENT screws which move the sensor closer to/further from the lens. **IF YOU MOVE ONE, IT IS IMPOSSIBLE TO FIX THE OUT-OF-FOCUS IMAGE RESULTING FROM YOUR ERROR! YOU HAVE BEEN WARNED**!

e. Next, remove the TINY fan connector from the Hi-Res Encoder/Gimbal Control Board and move it out of the way. (DO NOT PULL ON THE TINY WIRES!) Grab the connector body and pull straight up. Move the cable and connector out of the way of the camera body/board.

f. Next, CAREFULLY pry up the short press-connector interconnect cable (the 3rd ribbon cable on the board), by PRYING ONE SIDE STRAIGHT UP A SMALL AMOUNT, THEN SWITCH TO THE OPPOSITE SIDE AND PRY IT UP A SMALL AMOUNT. (It's a sort of snap-fit, like the ones inside an iPhone). This cable connects the gimbal control board to the image sensor board. It's advised that you remove BOTH ends of this interconnect cable and set it aside.

g. Now, while holding the two remaining ribbon cables' ends (disconnected from the Hi-Res Encoder/Gimbal Control Board in step 'd', above) out of the way, lift this board off the camera and set it aside, along with the three (3) brass threaded hold-downs.

h. The next steps are a bit difficult to describe, but the covers (plastic) on BOTH the driven (stepper motor) side/arm AND the opposite side/arm of the gimbal must be PRIED OFF/APART. You can use an X-Acto blade, but you must be VERY CAREFUL not to insert the blade too deep, as there is another ribbon cable inside! There are FOUR (4) 'half-shells' of plastic which, once pried loose, will fall away from the arm, revealing (on the driven side) the FOUR (4) screws that hold the arm to the camera. There is also a curved plastic piece that clips to the camera body and protects a VERY delicate gimbal motor ribbon cable (also on the driven side.) This piece has a slot in it that surrounds the ribbon cable**. BE VERY, VERY CAREFUL removing this piece, as the slot is very thin and when you are pulling the piece off, it will catch on the cable. If this cable is damaged, it's GAME OVER**.

i. Next, remove the FOUR (4) screws (micro Torx), from the driven (motor) side gimbal arm-to-camera body. This isn't easy, because the opposite-side (non-driven arm) is in the way and must be moved in many different orientations to gain access to each of the screws. Also on this unpowered-side gimbal arm, there are TWO (2) screws (micro Philips) which hold the unpowered gimbal arm to the camera body. These screws are 'buried' down beside the Live View Encoder Board, and must be VERY CAREFULLY removed. The screws are next to the two ribbon cables and the encoder board. Use a magnetic bit, so they don't fall down into the camera body. If they do, you MUST retrieve them to prevent electrical shorts! Next, you need to 'walk' (a little movement on each side at a time), the gimbal arms off the camera body, since the two arms are rigidly connected together. ***YOU MUST BE EXTRA CAREFUL WITH THIS STEP, AS THE TWO RIBBON CABLES REMOVED IN STEP 'd', ABOVE, ARE A TIGHT FIT AND FOLDED INTO THE CREVICES BETWEEN THE CAMERA BODY AND IMAGE SENSOR BOARD! PULLING ON THESE WITHOUT CARE WILL RIP THEM APART AND, YEP...GAME OVER! GENTLY LIFT THE GIMBAL ARMS STRAIGHT UP AND THE CABLES SHOULD LIFT OUT OF THE TIGHT RECESSES AT THE CORNERS OF THE CAMERA BODY. GUIDE THEM AS YOU GO, AND AGAIN, BE VERY, VERY CAREFUL***!

j. Now you can see the Live View Encoder Board (our 'target' board), inside the driven-side gimbal arm, mounted with three (3) micro Philips screws. CAREFULLY REMOVE THE RIBBON CABLE FROM THIS BOARD (it's a cam-over bar type, like the two previously removed cables in step 'd'), and is the opposite end of one of the two you removed earlier. Since this cable is now free of the boards on both ends, set it aside (it's the MOST DELICATE OF THE CABLES!) Next, remove the three (3) screws and CAREFULLY lift the board off the one pin and slide it STRAIGHT OUT from the arm/body. DO NOT LIFT IT UP VERY FAR, ONLY ENOUGH TO CLEAR THE LOCATING PIN! There is an LED (the one you see on the camera when it's mounted on the drone), and if you lift the board straight up, you'll rip the LED off the board, because it's a special type with a built-in light extension that mates with the clear LED 'lens' on the camera. CONGRATULATIONS, YOU'VE REACHED THE END OF THE MECHANICAL DISASSEMBLY! Now, on to the real work for this project!

**** FIRMWARE RELOAD STEPS ****

2. With the Live View Encoder Board removed and at your SMC/SMD soldering station, you'll need to connect the following wires from your USB-to-Serial board (FTDI board), by CAREFULLY soldering to the pads on the board as follows (solder the tinned ends of the wires to the board.) The opposite ends of the wires need to have connectors compatible with your FTDI board. NOTE: It's a good idea to clean and 'pre-tin' the pads, first. And, once the wires are soldered to the pads, DO NOT PULL UPWARD ON THEM, AS THE PADS CAN EASILY BE RIPPED OFF THE BOARD! IF SO, YEP...GAME OVER!

a. Solder the tinned end of a wire to the '5V' pad on the board. MAKE SURE THIS WIRE IS SOLDERED TO THE '5V' (5 volt) pad and NOT THE 3V3 (3.3 volt) pad! Also, at this time, if your FTDI board has a jumper for 3.3 or 5 volt power, MAKE SURE IT'S ON 5 VOLTS! If not, it will underpower the board and could damage the chips, or at the very least, nothing will work! MAKE SURE IT'S SET TO 5 VOLTS, AND THE WIRE IS SOLDERED TO THE '5V' PAD ON THE BOARD! The other end of this wire (the connector end) will eventually get connected to the 5 VOLT PIN on your FTDI adapter, and will power-on the encoder board.

b. Next, solder the tinned end of a wire to the 'TXP' (TRANSMIT data) pad on the encoder board. The other end of this wire (the connector end) will get connected to the RX (RECEIVE) pin on your FTDI board. This is because you need the ENCODER BOARD to TRANSMIT DATA to the RECEIVE pin on the adapter, and vice-versa. See the next step.

c. Now, solder the tinned end of a wire to the 'RXP' (RECEIVE data) pad on the encoder board. The other end of this wire (the connector end) will get connected to the TX (TRANSMIT) pin on your FTDI board. This is because you need the ENCODER BOARD to RECEIVE DATA from the TRANSMIT pin on the adapter, and vice-versa. See the previous step.

d. Finally, solder the tinned end of a wire to the 'GND' pad on the encoder board. The other end of this wire (the connector end) will get connected to the GND (ground) pin on your FTDI adapter.

e. Next, you'll need to fabricate a 'jumper wire' (tinned at both ends, one end 1/16-inch and the other about ¼-inch), that will bridge the 'BTSEL00' and 'BTSEL01' pads together on the encoder board, with the other end soldered to the '3V3' (3.3 volt) pad on the board. Thus, this wire will essentially connect the TWO boot-select pads together (at the ¼-inch end), and then go to the 3.3 volt pad (1/16-inch end.) LEAVE A LITTLE SLACK IN THE MIDDLE OF THIS WIRE. That will make it MUCH easier to cut this wire in the middle (to disconnect the BTSEL pads from 3.3 volts), so we can get the board to boot normally (with the new firmware installed), to check our success. This jumper is required to put the DaVinci chip into a 'flash mode' that will allow us to load new firmware into the NAND flash chip (which is most often what causes the 'no video transmission signal' problem with ALL THESE CAMERAS, NOT JUST THE X5.)

f. Now you'll need to find and download an app from a user named '***gaucho***' (Google it, as the location constantly changes, and I had to search multiple threads to find it, only to go back the next day and find the link no longer worked for download), called '***P3PFV10***'. This is THE HEART/SECRET TO THE SUCCESS OF THIS PROJECT, AND GAUCHO DESERVES MUCH CREDIT FOR ALL HIS EFFORTS! He posted a LOT of information on the Phantom Pilots' blog (website) about this code/problem with the P3P (Phantom 3 Pro) camera, and that will be the best place to start. It's a LOT of reading, but it will give you the background you need to understand what we're doing here. This software was developed to fix the Phantom 3 Pro camera/gimbal combo, which is NOTHING LIKE an X5. But as I had nothing to lose with the two 'dead' X5 cameras I had, and after reading blogs/posts/websites/GitHubs, etc., for two whole days, completely reading over 1,000 posts, I came to the conclusion that almost all the DJI cameras which use an Ambarella and DaVinci chipset (either 365 or 368), utilize the same firmware images, loaded into the same NAND memory locations on their respective encoder/transmission boards. I think that's perhaps the reason nobody seems to have tried this application to fix an X5, but again, I really had nothing to lose. Anyhow, find and download this application and install it ('***P3PFV10***') to your WINDOWS PC (or laptop.) I am running Windows 11, and it works fine on that platform. THIS IS THE KEY TO THIS PROJECT.

g. Once installed, start the application. It'll open a window with multiple, colored 'buttons', each of which has to be executed in order. DISREGARD THE PICTURE SHOWING HOW TO CONNECT THE WIRES, SINCE THEY ARE FOR THE PHANTOM 3 PRO CAMERA/GIMBAL. The video DOES have some good information about the software process, so watch it if you want, but your board will look nothing like the one in the video!

h. Now, plug the opposite ends (with connectors) of the following wires you soldered to the pads on the encoder board, onto the pins on your FTDI board. The wire soldered to the 'TXP' pad plugs to your RX connector on the FTDI board. The wire you soldered to the 'RXP' pad plugs to the TX connector on your FTDI board and finally, the wire you soldered to the GND pad plugs to the GND connector on the FTDI board. If you get the TX/RX wires backwards, you won't cause any damage, but nothing will happen in the following steps. Remember, TX to RX and RX to TX. If you got them backwards just swap them around**. LEAVE THE 5V WIRE DISCONNECTED FROM YOUR FTDI BOARD, FOR NOW**!

i. Next, click the button that says something about 'DRIVER...' on it and follow the steps to install the drivers needed for your FTDI board (if they're not already installed.) Basically, if you see your board in the drop down at the TOP of the app, you DON'T NEED TO INSTALL A DRIVER. If you DO NOT see your board in the drop down, proceed with the steps from clicking the button, BEFORE proceeding to the next step.

j.

k. Now, with the THREE wires (TX, RX and GND) properly (check your work), connected to your FTDI board and your PC/laptop powered-on and running the P3PV10 software, plug the FTDI board into any USB slot on your PC/laptop. Then, from the DROP DOWN (at the very top of the GUI), select your FTDI board (it will likely be the only option available) from the drop down. If your board doesn't appear in the drop down, you'll need to install the driver from the app (or one that came with your board), first, as noted in the previous step. Once it appears in the drop down list, SELECT it.

l. Next, **CONNECT THE 5V WIRE TO THE FTDI ADAPTER**. This will power-on the encoder board (if you soldered everything correctly), and on one side of the board (the chip side), you'll see a GREED LED illuminated. This tells you the board is correctly powered-on.

m. Select the 'Click to launch Putty' button and verify that you see BOOTME...BOOTME...BOOTME... (repeating) on the screen. If not, unplug the 5V wire and plug it back into the board. IF YOU STILL DON'T SEE 'BOOTME... (repeating), YOU CONNECTED OR CONFIGURED SOMETHING WRONG. UNPLUG THE FTDI BOARD AND CHECK YOUR WORK.! BE CAREFUL! Once you have verified that all your wiring is correct, if you still don't see 'BOOTME' (repeating) on the Putty screen, try again pulling the 5V wire off the FTDI adapter and plug it back in. Once you see the 'BOOTME' (repeating) on the screen/window, proceed to the next step.

n. CLOSE the notepad AND Python windows that were opened for you by the application (the Python window should still be repeating 'BOOT ME', and the Notepad window just tells you that should be happening.)

o. Now... it's **TIME FOR THE MAGIC**! Select the 'Click to start flashing' button. If everything goes well, you'll see a LOT of text scrolling. Note that the FIRST TIME you click this button, the flashing process will get TWO STEPS IN (two progress bars), and STOP. DON'T DO ANYTHING. The application is aware of this 'issue', and it will close the first attempt and start a new one. The second time, it'll load the first two bars and then CONTINUE to load the remaining firmware into the NAND chip. LET IT COMPLETE (it takes a couple of minutes, since you're only at 115K bits/second, over a serial connection!)

p. When the process is complete, **DISCONNECT THE 5V WIRE** from the FTDI adapter (this removes power from the encoder board and the green LED will go OFF.)

q. Now, using a pair of cutters, cut the jumper wire from the 3.3V (3V3) pads to the two BTSEL0x pads, where you left some slack in the wire/middle. This places the board in REGULAR OPERATING MODE, so we can check our progress.

r. On the app, select the 'Click to launch Putty' button again (you could also run a terminal program like TeraTerm, Windows Terminal, etc., but honestly the Putty program works fine for this monitoring step and is already configured for your FTDI board), and **THEN RE-PLUG THE 5V WIRE INTO THE FTDI ADAPTER**.

s. If the flash was successful *AND THE ONLY ISSUE WITH YOUR CAMERA WAS BAD FIRMWARE FOR THE DAVINCI CHIP* (note that there can be TONS of other issues, but more than 90% of them have this problem), you should see many lines of data scrolling on the screen as the encoder board comes back to life! Watch for 'loading kernel' and make sure (even if the first attempts show it didn't load early in the boot), that it does (near the end of all the scrolling) eventually load and ends with 'starting kernel', or something to that effect. You may also see occasional 'video reports', as the DaVinci chip sends packets of video to the Cypress (USB) chip, which means that video will now be getting to your transmitter and DJI-Go app! IF that's what you see, YOU'RE ALMOST DONE! If NOT, and the process stops with 'abort', or 'cannot locate kernel', etc., you have bigger issues, and this project will not solve all of them. *THAT DOESN'T MEAN YOU'RE DEFEATED, IT JUST MEANS THERE'S A LOT MORE 'MANUAL FLASHING'* work to do, which is outside the 'scope' of this tutorial. You can still leave your board connected to your FTDI adapter, and just read more blogs/posts, etc., about how to fix these more serious problems. I'd suggest starting with the GitHub repository/Wiki, by Googling 'DJI firmware GitHub', and go from there. It has many of the software 'tools' and instructions you'll need. **IT IS STILL POSSIBLE TO FIX YOUR CAMERA**!

t. Assuming step 'q', above, WAS successful, remove everything from the PC and then UNSOLDER ALL THE WIRES YOU SOLDERED TO THE ENCODER BOARD PADS. LEAVE THESE PADS CLEAN OF ALL BUT A MINIMAL AMOUNT OF SOLDER.

u. Now, by reversing all the disassembly steps (steps 1a thru 1j), REASSEMBLE YOUR CAMERA. Here's another warning about BEING VERY, VERY CAREFUL WITH THE RIBBON CABLES! NONE of these internal cables are available to buy, so if you rip or otherwise damage one...YEP, IT'S GAME OVER! Note that YOU MUST USE NEW THERMAL COMPOUND/PASTE IN TWO PLACES (BETWEEN THE ENCODER BOARD AND ARM AND THE GIMBAL BOARD AND ITS HEATSINK!) You're putting the camera back together TO THE POINT YOU CAN MOUNT IT ON THE DRONE and it's 'relatively balanced' (you can temporarily leave off the back cover, and all plastic covers), but once again**, BE VERY, VERY CAREFUL WITH RIBBON CABLE ROUTING (ESPECIALLY THE TWO THAT GET SQUEEZED BETWEEN THE CAMERA BODY AND BOARDS)**, and make sure you replace the interconnect (snap-in) cable that connects the two boards together.

v. NEXT...THE MOMENT OF TRUTH! Mount the camera to the drone, start the DJI-GO app (on whatever your device is for flight) and power-on the drone. **MAKE SURE THAT THERE IS NO SD CARD IN THE CAMERA**.

w. If the problem was with the firmware, **YOU WILL NOTE THAT YOU NOW HAVE VIDEO ON YOUR DJI-GO DEVICE! CONGRATULATIONS ON A JOB WELL DONE AND A LOT OF MONEY SAVED**!! Power-off the drone and remove the camera.

x. Now finish reassembling the camera. **AGAIN, MAKE SURE THAT YOU USE/USED NEW THERMAL COMPOUND ON THE HEATSINK AND ENCODER BOARD. If you OMIITTED THIS STEP, GO BACK, DISASSEMBLE THE CAMERA AGAIN (GOOD LUCK WITH THE RIBBON CABLES), AND USE THE COMPOUND! IF YOU DON'T, THE CAMERA WILL NOT LAST LONG, AS THE CHIPS WILL OVERHEAT AND DESTROY THEMSELVES. HARDLY WORTH IT, SINCE YOU'VE DONE ALL THIS WORK! AND ONCE AGAIN...BE CAREFUL THAT YOU DON'T PINCH A RIBBON CABLE BETWEEN THE CAMERA BACK AND THE BODY, BECAUSE...YEP, GAME OVER**!

y. FINALLY, YOU'RE NOT DONE UNTIL YOU EXECUTE A FIRMWARE UPDATE FROM DJI. **One note of caution, here. *NEVER, EVER, EVER ATTEMPT AN UPDATE ON THE DRONE WITH THE TRANSMITTER/RADIO POWERED-ON! NEVER*!** This is what likely 'bricked' the camera in the first place (if leaving it unused for months wasn't the culprit**.) THE AIRCRAFT CANNOT CORRECTLY UPDATE THE FIRMWARE WHILE IT'S ALSO TRYING TO OPERATE NORMALLY! AGAIN, PUT YOUR TRASNMITTER IN ANOTHER ROOM AND MAKE SURE IT'S POWERED OFF PRIOR TO STARTING AND UNTIL YOU'VE CONFIRMED A SUCCESSFUL UPDATE BY LOOKING AT THE TEXT FILE ON THE SD CARD! NEVER POWER-ON THE TRANSMITTER WHILE AN SD CARD WITH A DJI UPDATE IS IN THE CAMERA! ON AN X5, THIS IS ALMOST GUARANTEED TO BRICK THE CAMERA AND ON THE NEXT FLIGHT ATTEMPT YOU'LL SEE "NO VIDEO TRANSMISSION SIGNAL"! You'll have to go through ALL THE STEPS AGAIN, TO FIX IT, and it's very likely the ribbon cables won't survive that! Also, PLEASE POWER-ON THE DRONE AND RADIO AT LEAST ONCE A MONTH, SO YOU KEEP THE NAND CHIPS 'REFRESHED', AND THEY DON'T LOSE THEIR CONTENTS, PUTTING YOU RIGHT BACK AT STEP ONE**!

z. So, while you DO have video at this point, you're using some images (firmware) from a Phantom 3 Pro, which PROBABLY have differences. The good news is that now you can correctly update the firmware on the camera from an 'official' DJI firmware update. In some cases, this update (to the latest firmware) will end with an 'ABORT' message (in the text file that can be found in the root of the SD card where you placed the .BIN file from DJI.) This is because the drone thinks it already has ALL the latest firmware installed (including on the camera, which isn't true.) In this case, you can decide to DOWNGRADE the firmware (there's a process to follow for this that involves a special 'magic file', which will not be covered here), OR, you can decide to leave everything the way it is**. In my case, one of the two cameras I resurrected is STILL RUNNING THE P3P FIRMWARE FROM THE APP, and it's working JUST FINE**. Your call!

aa. IF THIS WORKED FOR YOU, PLEASE CLICK ON THE BOTTOM (YELLOW) BUTTON ON THE P3PV10 APP, AND 'BUY THE DEVELOPER A COFFEE/MAKE A DONATION'! AFTER ALL, HE SAVED YOU A FORTUNE (OR AT LEAST A CAMERA!)

*** END OF DOCUMENT ***