

**TRENT MOSHANSKY – MIND’S EYE DESIGN - [www.mindseyedesign.net](http://www.mindseyedesign.net)**



**BUILD SYNOPSIS - OVERVIEW/BREAKDOWN**

**IRONMAN MK6 FULL BODY-FUNCTIONAL-WEARABLE ARMOR BUILD PROJECT**





Dear sweet baby Jesus...“By Thor’s Mjolnir...TRUE BELIEVERS ...”what a journey...phew! lol

What a journey this has been, absolutely...umm... errr...‘loved’...EVERY minute of this rather massive, at times, quite frustrating and very intense 3D Print and Design Build aspiration, burning creative desire from concept to creation ☺. And I am very happy to say, it turned out pretty much like I envisioned when I decided to take on such a daunting, yet, such a rewarding task and build project. Here is my overview and bit of background, and I like to throw in some funny humorous bits and pieces in to make it interesting to all.

Since I was like 4-5 years old, I absolutely became inspired...well, obsessed with DC and Marvel comic books and their characters, most specifically Iron Man. I have not only been one the biggest fans of Tony Stark’s character and his alter ego for over 40 years, but I had as one of my main childhood hobbies of comic book collecting and after over a decade or so into teenage years had also amassed the entire Iron Man comic book collection up to issue #250 (When Rhodes, new poor writer’s and artist’s took over ☹) Needless to say, I knew everything there was to possibly know about this amazingly clever, original, charismatic, and loveable superhero character and said to family and friends that I would one day build a ‘lifelike,’ life sized Iron Man armored suit. (Here’s a funny...kind of sad background story for y’all and enjoy at my expense...and tears...lol)

Then puberty hit, common sense and any adolescent critical thought completely “went out the window” and I got totally obsessed with skateboarding and went on family vacation trip to California-San Francisco, San Diego and Santa Cruz in like 1985. That was when I then came up with the...‘BRILLIANT’ idea to fund my trip and to buy a bunch of trendy skateboard crap was to sell my PRECIOUS collection of said ‘1-250’ Iron Man collection and was totally taken to the ‘woodshed’ by a cranky, sketchy, slimy old comic book store guy in town for the...umm...‘life changing’ sum of a whopping...\$350....oops...( I bet that crotchety ol’ bugger is still laughing in his grave till this day that I funded his retirement in ‘one fell swoop’ most likely)... talk about a pant’s down, good oll’ fashioned ass-spanking...hahaha (eternal sighhhs)

Regardless, this all gave me the relentless, burning desire to create my own real life size Iron Man and to make a long story short...I have now done exactly that to enjoy standing in my living room every day and night for the rest of my life. (However, it would take a substantial and legitimate offer to... perhaps part with one day ;)

## **BUILD OVERVIEW AND BREAKDOWN**

I have seen only a couple of other creators attempt and complete this entire MARK VI build, and like all my build projects I strive for not only as close to real/realistic, believability, and with total originality always try to make my works a complete...‘one of a kind’ as much as I am able. Almost all I have seen (3 or 4 others I know of anyhow) attempt this Mark VI and most used the “ CRASHWORKS3D” sold by ‘Stark3d’ ‘Mark 6 or 7’ Arduino Nano custom Iron Man module. (\*Almost gave up and gave into buying this a few times to save my sanity really (lol) but knew I could save the money and customize my own ‘DUAL’ Nano technique ‘Brain’ system to work and saved myself over \$100 dollars and I believe makes my build that much more challenging, unique, and interesting ;). Here’s a list of approximately 11 totally

customized, original features, were fabricated and/or built in and created/or customized myself on this build)

- **1.** All gold armor parts printed in 'Gold Silk' printer filament (Duramic on biceps and triceps, & 1t1tyt 'Gold Silk' on thighs as this gold is the best looking by far I believe, but very tricky to produce large, tall prints in cooler temps etc. I go into this further down in this write up so take heed) I wanted to and tried doing hands and forearms in a cool 'crimson dynamo' like color red silk, but after numerous test print failures with it I just did the hands and forearms which turned out quite well, but switched to regular 'grey' filaments for majority of the rest of armor.
- **2.** Hyundai 5 volt power hub, with 3 USB 2.0 ports (with built in spotlight for which works amazing helping light inside body to work on any wiring, Arduino Nano issues should they arise...and boy let me tell you they do when you least want or expect unfortunately) This thing is amazing and can be left on and last for many hours on end without charging and power all lighting, microcontrollers and their servo power and functions, charge bluetooth speaker (phone...anything with a usb 2.0 plug), transmit data/coding simply connecting to power laptop 'on the fly' if necessary as well. Used a second smaller, 2 usb 2.0 ports 5v power supply for all head power/servo and lighting separately.
- **3.** Not 1, but 2 NANO ARDUINOs as the 'brains' for lighting and servos and found and used excellent, much better power terminal mounts with flathead mini screws to secure wiring (You can view in upcoming videos and website pics etc.\*\*\*muuuch better than trying to do this nano without....trust me...IT WILL NOT WORK trying to use standalone Nano module and will make you want to "Hulk smash" it to utter pieces haha)  
\*Note My reason for using 2 Nano's is from having extensive knowledge and experience working in Telecom over a decade with data cables CAT5e and 6e etc was well aware of issues with data cable touching other power cables I wanted totally separate function control on separate USB 5 volt power supplies as well.
- **4.** Nano #1- Controls all head power for lighting, servos, one chin limit switch at chin to trigger faceplate 'open' and closed'/recess back in arm, turn off/ dim, and or brighten missile laser lights., and voice synthesizer which clips to clip inside faceplate in front of mouth (which I wired with JST connector to be easily removed from custom body neck mount to quickly swap out for other builds)  
Nano #2- Controls all the Hyundai power supply mount and interior colored lighting, missile launchers lights/power, servos (x2 left and right forearms) x2 limit switches on both wrists to trigger/launch out/recess back in arm, turn off/ dim, and or brighten missile laser lights, and finally, a DPDT lighted power switch which I drilled hole and installed in right hip round casing...looks and works awesome and able to switch on/off with gloves on (\*I literally learnt this the verry hard way by 'trapping' myself fit testing entire upper armor first time and almost had to call someone to come help me take it off lol!!!)
- **5.** Arduino "HC-05 Bluetooth receiver/transmitter module" for original voice, or Jarvis/Friday, sound/armor effects, music from phone. (Wired to Nano #1 and helmet wiring harness separately from all body lights/power and servo power as mentioned)

- **6.** One “Blue Piston” Bluetooth speaker pod in back armor velcro mount. Totally removable/portable. Charge cord wired to Nano #2 along with all body lights, servos and run to body wiring harness powered on its own battery, with original charge cord spliced and wired to factory charge through mini usb from Hyundai 5 volt power hub in custom back body mount.
- **7.** 4x ‘REED Switches’ spliced into ground wiring to control totally unique/original hand gauntlet Repulsor(s) illumination/lighting powering, as well 4x (2 per boot sole) Boot bottoms Repulsor(s)/rockets. To illustrate further, (\*I am in process of video and picture build demonstration fully unveiling soon!) The first set of REED switches are mounted in the back of opposable hand tops armor plates, so when the hands are raised face front raised back towards both forearm wrist to the magnets mounted there (Simultaneously or individually), the REED switches trigger and light up the hand Repulsors simulating movie blasts, relax hands down and light goes off. Second set of REED switches wired and mounted to ground wire inside the outer sides of legs, halfway down the outer thighs. Magnets were mounted at base of inner wrists of hand gauntlets to trigger these REED switches to simulate movie flying effects by holding arms/inside of wrist with hands pointed away from thighs like he does in the movies. (Again, simultaneously or individually)
- **8.** For all the red painting and finishing, I realized I could incorporate totally original custom paint scheme and design, and on top of the usual Metalcast Red over 2-3 stage base coats (Primer-Chrome/Apple Red base) I painted in shadowing and weathering/ battle damaged look and finish. (I also learned umm...verry quickly btw..this Metalcast coating can run like a ‘mad wild boar’ so take heed lol) Additionally, added much needed custom chrome tape accenting for ‘titanium like look (metal armor ‘seams’) and in my opinion sticking as close to as traditional, comic-movie like look and color scheme it truly took this to another level on appeal of look, much more believable and realistic and daylight/dark lighting accentuation. LOVE how it adds so much to look.
- **9.** Custom cut 4 inch diameter aluminum flexible ducting molded and formed into elbows and knees, wrapped and heat formed 3m Gold Frisket/Transfer cel on both knees (anatomically correct to my body dimensions and movements to fill the ‘negative-empty space’ between select opposable armor joint pieces)
- **10.** Custom designed and installed into interior back armor ‘hanger’ implementing a shoulder width, flexible ¾ inch (Washing machine) water tubing to mount ‘free-wheeling’ fully opposable Shoulder armor ‘yolks’ across back of my trapezius (back of neck/shoulders) which supports not only hanging the entire armor perfectly at my height without having to wear it all to complete maintenance and work on, but all the arm, legs, ribs/ hips (girdle) and leg strapping and clips, worked incredibly well and better than I thought it would. All body sections designed to simply unclip individually (2-3 minute total body connecting/assembly/disconnecting/disassembly time), or, by entire arm or leg, as well the back, ribs and hips can be removed on their own or kept together for ease of storage and maintenance to prevent overuse and damage. All body wiring separated along with strapping sections with clips, using JST connectors throughout entire joint location in armor, as well as, the separate Nano #1 & #2 microcontrollers with wiring harness’ and power supply’ designed to plug in as a totally independent, removable helmet and neck assembly.

- **11.** I used DrCyanide's Iron Man Missile Launcher Prototype (see links provided below) custom scaled and inserted directly and installed into forearm cuts made in forearm prints. Laser pointer LEDs mounted in between each missile. \*Note: design prevents hatch from closing.

## **RESOURCES AND RESEARCH**

A very special thanks to "DaDave" and "DrCyanide" on Thingiverse open source 3D Printing site for the armor models and print files...no way I could have tried to design engineer, model, scale, nor, complete in nowhere near the time of 14 months which this took me to complete. (This is my second full armor 3D build (@ mindseyedesign.net) and very pleased with it and looks pretty cool, but essentially a test prototype for another possible future completely original design Iron Man build)

Another shout out to Frank of "Frankly Built" on his popular YouTube channel creating similar builds with almost identical backgrounds and experience (which I find uncanny outside his military background versus mine haha) and his tutorials on wiring, servos and switches helped me out immensely several times. Serious cheers to Frank and I definitely recommend checking out his build work as well.

### **MAIN BUILD STL. FILE(S)**

Iron Man MK6 MK 6 Suit by DaDave is licensed under the Creative Commons - Attribution - Non-Commercial license.

<http://www.thingiverse.com/thing:1779274>

<http://creativecommons.org/licenses/by-nc/3.0/>

### **# Miscellaneous 3d Print files and materials Summary**

I prefer and built the MK3 helmet to wear with this complete build, as I like the look much more. You can download it from "Jhon De Sousa" on the following link:

<http://www.thingiverse.com/thing:260152>

Most parts are found on the following 24cm high Iron Man MK6 shell figure from "RohitVen"

<http://www.thingiverse.com/thing:1026995>

The gloves are made of a Papakura file. The glove is originally made by "Zabana" and remixed by "darkside501st". Below the original link for the glove:

<http://www.therpf.com/showthread.php?t=139470&highlight=hand+zabana>

As arc reactor I used this Modell from "Thaurus":

<http://www.thingiverse.com/thing:1377484>

Customized install of Forearm missile launchers Prototype x2 - Iron Man Mini Rocket Prototype by DrCyanide on Thingiverse: <https://www.thingiverse.com/thing:4538761>

## **BUDGETED BUILD MATERIAL COST /(vs ACTUAL COST) BUILD DURATION ETC.**

I originally estimated around a year and a half (at least) to a complete build time-duration (which I beat by two full months...whoohoo...win! ;), \$1500 area material and printed parts budget, but thankfully, most all materials were purchased prior to this outrageous, ridiculous price gauging and inflation raging on since last year so my actual cost/budget came in around \$1000 ...unbelievably really. (If I were to add the electricity cost for running extensive power tools, compressors, workshop heating, printer running

24/7 for 3 months it would easily add another \$600-800 above this actual cost estimation, perhaps much more I'm sure)

- 12-15 spools of 3D printing PLA filament approximately \$30-50 (Silks \$35-50) \$300-\$350
- 15-20 cans of paints- Primers, Clear coat, Chromes, MetalCast (\$26 a can!!) \$250
- 5 Volt power hub x2, Full body/head 22 gauge soft silicone and (tinned) solid core circuitry wiring (approximately 20-25 feet length) \$150
- All Arduino Nanos (2), servos (4), 30+LEDs, JST connector kit, all switches, hot glue, Crazy Glue/ Fiberglass Resin (Bondo), 6 x electrical tape, 4x duct tape and 2x chrome metal tape rolls \$250

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TOTAL: \$1000.00 (CAD)

### **BUILD MATERIALS LIST (EXPANDED)**

Nearly all parts were 3D printed using Creality Ender 6 (260x260x250mm build plate). Outside of a few of the printed parts, some buckles (printed or bought), Nylon weaved strapping and friction clips, and a lot of soft foam for a little comfort and to cover empty body part and joint spaces. This build also requires the following print filaments, paints, parts, microcontrollers, multiple REED, Limit and DPDT switches, wiring and numerous added electronics etc.

- x2 Arduino Nano micro controllers (Arduino Uno or clone 'Elegoo' could work but much larger)
- X1 Bluetooth Speaker hub/pod (with supplied or other suitable mini usb charge cord)
- x1 Arduino HC-05 Bluetooth Transmitter/Receiver Module
- x1 'Cosplay Voice Changer' synthesizer speaker unit (bought mine through Amazon, not great but works well enough and pretty cheap in cost)
- x2 5V USB Power supplies - Main hub 3 port, backup 2 port
- x8 Switches (or whatever) x4 REED (Wrists and thighs), x3 Limit (arm missile x2 and 1 in chin of helmet), x1 Main Body Power control
- Helmet requires: 2 Cosplay (LED eye lights) 4xM4 bushings, 2XMG995 Servos, M2-3 nuts/bolts
- Hand Repulsors Left/Right x2 LEDs (1 high powered LED each), Boot repulsors x4(2 each), Arc Reactor Chest x9 (3 High Powered White LEDs main load with regular LEDs perimeter blue x4 and orange x2)
- Interior power supplies with Nano 'brain' inside body will require approximately 10-15 LED lights (or whatever you wish to use on your own)
- Body lighting - 8 High power white LEDs, blue, orange, red and yellow, 4x M4x10, 4x M3x20, 4x M3 nut, acrylic glass and several other homemade/fabricated parts and mounting materials for custom designed chest Arc Reactor, main body switch and abs, ribs, boot louvers/flaps...(you'd be shocked how even an empty clear plastic box of chocolates works like it's made for certain features like casings etc. ;)
- Chest: Acryl glass
- EVA foam for a comfortable and flexible back rest and neck (if you want to make a neck)
- Old pair of 'Dockers' very thick soled shoes to butcher to crap lol

\*\*\* It might be that some parts do not fit to your body. YOU MUST FIT TEST using sizing rings (\*slicer cuts for circumference sizing to thighs, biceps/triceps, elbows, wrists, ankles, knees and forearms etc...you get the idea lol) and use failed prints to fit test if possible. \*\*\***VERY** important...to actually even attempt to scale, slice properly and effeciently print, assemble and complete this project in its entirety (TRUST ME ON THIS...you'll thank me...ughhh) CHECK ALL OF THESE criteria before you even attempt to print all.

For visual help on scaling to personal body size purposes (I've been told I have a bigger brain/head ;) and scaled the helmet file down from its original size at 100% down to 93% (fits perfectly, yet a little tight with neck backing attached but looks great and believable) Additionally, I am approximately 5 foot 10 in height with a weight of 170 pounds with lean-muscular build.

### **PRINTER SETTINGS**

**Printer:** Creality Ender 6 using 'Creality Slicer-Cura' printer slicer software program.

**Temp:** PLA at 200-210-220°C, 50°C heat bed and 45mm/s speed

**Rafts:** Yes

**Supports:** Yes (Learnt how to do custom supports to save literally... a 'ton' of wasted filament btw)

**Resolution:** 0.2

**Infill:** 15-(up to 18-20 on tricky delicate parts, especially gold and red silks!)

**Walls:** At least 0.8 mm if you really want to wear it. I used 1.2mm walls

**Print Speeds:** Factory default speeds in my opinion for best results (\*Up to you, but like I mentioned mine is really fast, but cons are wobble and print failure and ensuing utter regret, anger and pain lol)

You will need to mirror many parts with your slicer. The chest, back, hips are just half models, you will need to print a second, mirrored one for the full suit. All parts were printed one full piece if possible, full size (except back-2, hips-4, ribs-4 and hands, boot flaps, boots-2 each etc.) of PLA at 200-210-220°C, 50°C heat bed and 45mm/s speed. (My C-6 is really, really fast, but round and delicate parts need to be printed slower obviously, but full tall prints will wobble and cool too much and crack if set more than 150% print speed, particularly the Gold and red silk PLA, very finicky and nearly gave up but finally got it to work well enough to work (and in my opinion, looks much better than the few others that have completed similar builds going via the gold paint rout, especially in direct lighting/sunlight).

Gold/Chrome/metallic paints cannot be clear coated appropriately jsyk and in my opinion I think looks very weak-fake and simply plastic looking, but understandable the difficulty nailing silk filaments prints this large in my almost 5 years experience 3D Printing, and can be infuriating and quite wasteful of filament and at mostly higher costs. You will also need a substantial period of time to print this entire armored suit, It took me almost exactly 3 months from November 2021-January 2022 (24/7) and approximately 15kg or so of filament to print the whole suit. (Approximately 12-15 full spools)

**\*Additional Note:** I live in Canada and experienced for 5 years now very different 3D Printing at colder temperatures and lower heat/humidity setting adjustment needed in winter compared to the limited others I have seen attempting this in US/Globally... very important living here compared vs. these locales.

### **\*POST PRINTING AND PART PAINTING AND FINISH**

I connected the few multiple print parts with Crazy or hot Glue and a soldering Iron (majority full prints). You might glue it but I do not believe that it will last long if you really wish to wear it. If you want a real good costume you will need to sand and paint/clear coat everything. (This might be the most work outside of all the entire body and head wiring, mechanizing with servos etc.) For the complete suit prepping, paint and finishing you will need several weeks. I am a Professional painter/Airbrush Artist with over 30 years, so have the experience to complete very quickly and estimated completion time of approximately 50-60 hours on this massive task alone. (Otherwise, you can print it all at a higher quality print settings and much higher times, but that would require much more time or printers. I have one



large and one medium format printers and like I mentioned and this all took me nearly 3 full months 24/7 running a 'two horse' farm.)

**\*\*\* Aching, and well...literally 'breaking' ;{**

It might look pretty good, but because of the tough fittings and sometimes narrow parts it hurts a little at a few positions. Especially the knee and the elbow are complicated. To drink something while I wear the suit a straw is necessary. Some parts might break off if they are not printed well or you move too extreme, an extreme 'lunging' pose or crouching too far, bending over (think lego tower collapsing haha) So test everything before you paint it, this will save you a LOT of work. I see many that worry so much about the damage to paint from wear and tear and try as you might, there is virtually nothing you can do to prevent such (it's also the whole point of using chrome and Apple Red base coating reveals on body wide scratching/grinding especially on boots/ankles/shoulders/neck/ribs/abs and hips) and is not only totally unpreventable, but looks much more like real weathering and battle damage, so try not to worry yourself much about it if you at all are, trust me. ☺

If I can share any vital piece of advice cautioning to anyone thinking/wishing to attempt to replicate this entire build, just let me be very frank and humbling about what is absolutely required to accomplish this entire build...

**#1. AVOID the..."HULK SMASH" LOL!**

Although I have always been extremely encouraging with younger Artist/Designers to push their limits and comfort zones, however, IF you don't have at least intermediate to advanced overall 3D modeling, 3D printing, prepping and painting and finishing CRUCIAL experience first and foremost, but almost as essential is VERY disciplined thought/build processes and UTMOST 'even keel' reactions as possible...and PATIENCE, don't even think about it.

For now perhaps, may I suggest try gaining this experience and knowhow and to just work on one body piece at a time, using this and my website and all available researching online and learn from scratch how to do professionally....it's definitely worth the time and effort to learn I can assure you ☺

However, in saying that, and with utmost encouragement, some areas of tensile strengths of filaments and part damage to prepping and finishing, overall design and functionality failures at certain times of completion and testing were utterly...'TORTUREOUS', sometimes very deflating and can be very disappointing at certain times, but, more so the electronic and mechanization, so be prepared to use much patience, forethought and foresight to avoid as many painful 'hiccups' as possible.

**CONCLUSION /BUILD WRAP UP**

Take my word on this also...especially on the helmet eyes-lights, servo arms and wiring-lengths etc...NIGHTMARISH cheap, weak design flaws in eyes power mounts and using only PLA/ABS or whatever plastics, if I had drill press, metal bender, torch and plasma cutter and other long list of expensive tools I simply would have just saved myself the insufferable 'pain and agony' and designed and fabricated the helmet servo arms, 3D printed hinges/pins/clasps on hips, abs, boots etc myself.

I could have sworn I saw my hands turning a deep, deep green, then growing ten times their size a few times in 14 months...love Shellhead and even the oool' Hulkster, but sooo glad it's over for that reason alone. ☺

Otherwise, I completely encourage any aspiring or experienced Artist/Designer to fully challenge themselves more than ever...“Face Front and Assemble!!!” I think that’s all can think of and pretty much sums it up for you all best I can. Hope you like and appreciate the effort in this extremely detailed, helpful write up (I never had lol) and Cheers to all fans of this awesome superhero character! Please feel free to contact me for any desired personal build project desires/ideas and to check out this project and so much more of my latest on my website @ [www.mindseyedesign.net](http://www.mindseyedesign.net)

Thanks for your interest,

GO FOR IT AND GOOD LUCK!

**TRENT MOSHANSKY**

