ME40 Teardown

DEKO Cordless Drill

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Prepared for: Gary Leisk and Luisa Chiesa

March 6, 2020

Exploded View

1. Casing that connects planetary gearbox to front of drill
2. Continuation of #1
3. Metal ring, part of #1 and #2
4. Fastener (control box)
5. Planetary gearbox
6. Top of planetary gearbox
7. End of planetary gearbox, connects to motor
8. Charger
9. Spring around drill tip
10. Top of motor casing
11. Wires, connects battery to motor
12. Front of drill casing
13. Support

14. Bearing
15. Ball bearing ring
16. Top of motor
17. Computer chip
18. Fastener
19. Rechargeable battery
20. Screw
21. DC Brushless Motor
22. Power switch
23. Casing
24. Directional switch
25. Spacer (chuck)
26. Half screw (chuck)
27. Press fit bearing (chuck)
28. Part of front of drill casing, helps hold the other pieces together
29. Part of planetary gearbox
30. Washer
31. Chuck
32. Power adjuster
33. Other side of wirebox
34. Ring, part of top of drill
35. Trigger

Product Decomposition

Design Organization: Echo	**Date: 3/6/2020**

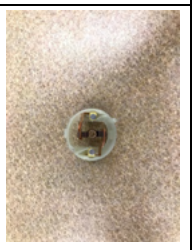
Product Decomposed: Cordless Drill

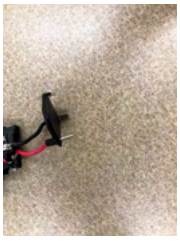
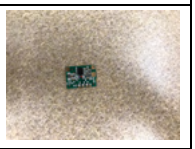
Description: This drill allows users to have a large range of motion with its rechargeable and detachable battery.

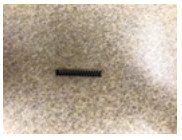
How it works: User selects the power, torque, and direction, and then pulls the trigger. Pulling the trigger sends a signal to the computer chip and light. The light turns on and the computer chip sends power from the battery to the motor, which turns the planetary gearbox to add more power. This turns the drill bit. As the user applies pressure or pulls away, they either screw in or remove a screw.

Parts:

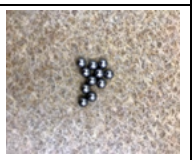
Part #	Part Name	# Req'd	Material	Mfg Process	Image
1	Outer casing	2	Plastic and rubber	Injection molding	 
2	Battery	1	Plastic	Injection molded casing	  
3	Charger	1	Plastic and metal	Drawn wire, blanked prongs	
4	Brushed DC Motor	1	Metal, copper wires, plastic	Cup drawing for casing, gear rolling,	

				injection molded plates	 
5	Motor Casing	1	Metal	Rolled sheet metal, bent	
6	Motor Cover	1	Aluminum	Blanked sheet metal	
7	Brushes on DC Motor	1	Copper	Machined	
8	Power/Control Box (side 1)	1	Plastic, metal, wires	Wire drawing	 
9	Power/Control Box (side 2)	1	Plastic, metal	Injection molding	

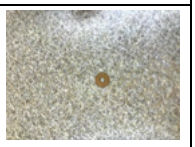
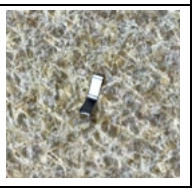
10	Directional switch	1	Plastic	Injection molding	 
11	Electrical Power Converter	1	Plastic, conductive metal	Wire drawing, injection molding	
12	Computer Chip	1	Silicon, metal	Soldering	
13	Trigger	1	Plastic	Injection molding	
14	Trigger Switch	1	Plastic	Injection molding	
15	Gearbox Casing	1	Plastic	Injection molding	 

					
16	Large Spring	1	Metal	Extrusion, bending	 
17	1-2 Switch	1	Plastic	Injection Molding	
18	Trigger Spring	1	Metal	Extrusion, bending	
19	Torque Controller	1	Plastic	Injection Molding	 
20	Chuck	1	Steel	Machined stock metal	  
21	Drill Tip Casing (Deconstructed/torn apart)	1	Plastic, metal	Injection Molding	

					 
22	Chuck Screw	1	Steel	Thread rolling	
23	Front of Drill Casing	1	Plastic	Injection Molding	 
24	Metal Ring	1	Steel	Extruded pipe, sheared	
25	Ball Bearing Ring	1	Metal, plastic	Injection Molding	
26	Spindle	1	Steel	Thread rolling, machining	
27	Planetary Gearbox: Outer Rings (internal spur gears)	3	Steel	Extruded pipe, sheared	

					
28	Planetary Gearbox: Sun Gears	3	Steel	Gear rolling	 
29	Planetary Gearbox: Planet Gears	13 (2 sets of 5, 1 set of 3)	Steel	Gear rolling	
30	Gearbox Casing Fasteners	2	Metal	Extrusion	
31	Ball Bearings	11	Metal	Die casting	
32	Top of Motor Casing	1	Plastic	Injection Molding	
33	Thin, wide ring	1	Metal	Extrusion	
34	Thin ring	1	Metal	Extrusion	
35	Top of Gearbox	1	Metal	Extrusion, shearing	
36	Outer Gearbox Casing/Top Connector	1	Plastic, metal	Injection Molding	

37	Screws	2	Steel	Thread rolling	
38	Support	1	Plastic, metal	Injection molding	
39	Screw-on ring	1	Metal	Extrusion, tapping	 
40	Small silver spring	2	Metal	Extrusion, bending	 
41	Casing Screws	7	Metal	Gear rolling	
42	Fastener	1	Aluminum	Die casting	
43	Control Box Fasteners	6	Plastic	Gear rolling	
44	Fasteners	2	Aluminum	Bending	
45	Fasteners	2	Aluminum	Bending	
46	Horseshoe Fastener	1	Metal	Bending	

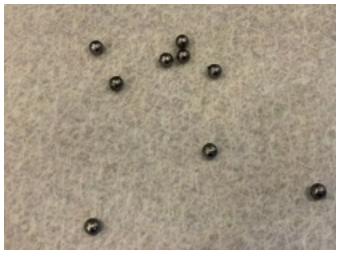
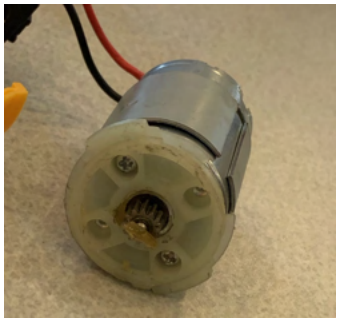
47	1-2 Switch Fastener	1	Metal	Thread rolling	
48	Small Black Screw	1	Metal	Thread rolling	
49	Small Fastener	2	Plastic	Thread rolling	 
50	Control Box Screw	1	Metal	Thread rolling	
51	Smallest Black Spring	1	Metal	Extrusion, bending	
52	Fastener	1	Plastic	Injection molding	
53	Fastener	1	Copper	Bending	
54	Fastener Ring	1	Plastic	Extrusion	
55	Thick Fastener Ring	1	Plastic	Extrusion	
56	Fastener	1	Metal	Bending	

Disassembly:

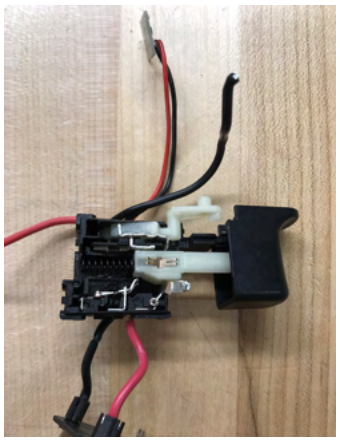
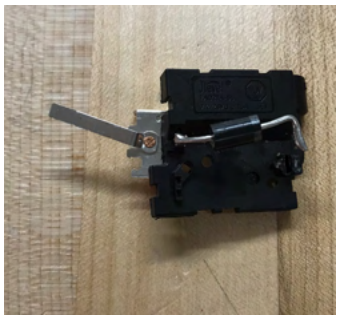
Step #	Procedure	Part #s removed (referring to decomposition table)	Image
1	Remove screws from the casing, pull the casing apart	1, 41	
2	Remove 1-2 switch and directional switch	10, 17, 47	 

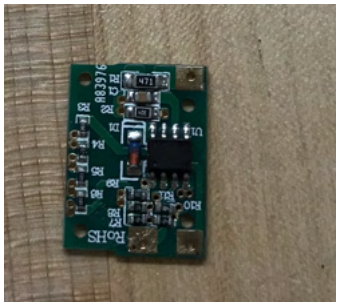
3	Remove motor, gearbox, control box, and drill chuck from casing	4-7, 20, 27-36	   

			
4	Remove drill chuck and attached gear box. The black casing is separable into 3 parts: the top covers the drill tip and interacts with the 2nd layer in order to tighten or loosen the jaws. The bottom layer is rotated in order to adjust torque.	27-31, 33-36	
5	Take metal fasteners out of gearbox case in order to open casing, remove planetary gear system from gearbox casing, and then remove ball bearings from end of casing as well. The planetary gear system consists of 3 sets of planetary gears. Each set has either 3 or 5 planet gears rotating around 1 fixed sun gear. There are 3 internal spur gears to contain the whole system. Ball bearings are used to reduce friction. 2 metal rods are used to keep the system together.	27 - 31, 33-36	 

			  
6	Cut wires on motor, remove motor top, pull off motor casing, take off section with copper brushes. The back part of the motor contains a fan to prevent overheating and the motor casing protects the permanent magnets and electromagnetic coils of wire.	4-7, 32	 

7	Remove plastic fasteners on control box, pull trigger out of control box, remove computer chip from control box.	8, 9, 12, 13-15, 18, 38, 43-45, 50	   

			
8	Unscrew main screw holding the chuck of the drill together. The black casing should come off in three parts mentioned in step 4. The chuck of the drill separates into the following main components: the drill bit holder with 3 jaws, 2 bearings (one is press fit), drill tip metal casing, spindle, and ball bearing ring. Starting from the bottom of the chuck, the spindle is connected at one end to the planetary gearbox, and threaded into the drill bit holder at the other end. A press fit bearing is fit onto the main body of the spindle. Resting on the main ring circling around the drill bit holder are the ball bearing ring and the split in half bearing. The 3 jaws slide into 3 angled sheaths from the top of the drill bit holder. A screw fits in the middle of the 3 jaws and holds the chuck together. A metal dome shaped cap fits on top of the drill bit holder and the black casing fits around the entire structure.	19- 21, 23-26	  

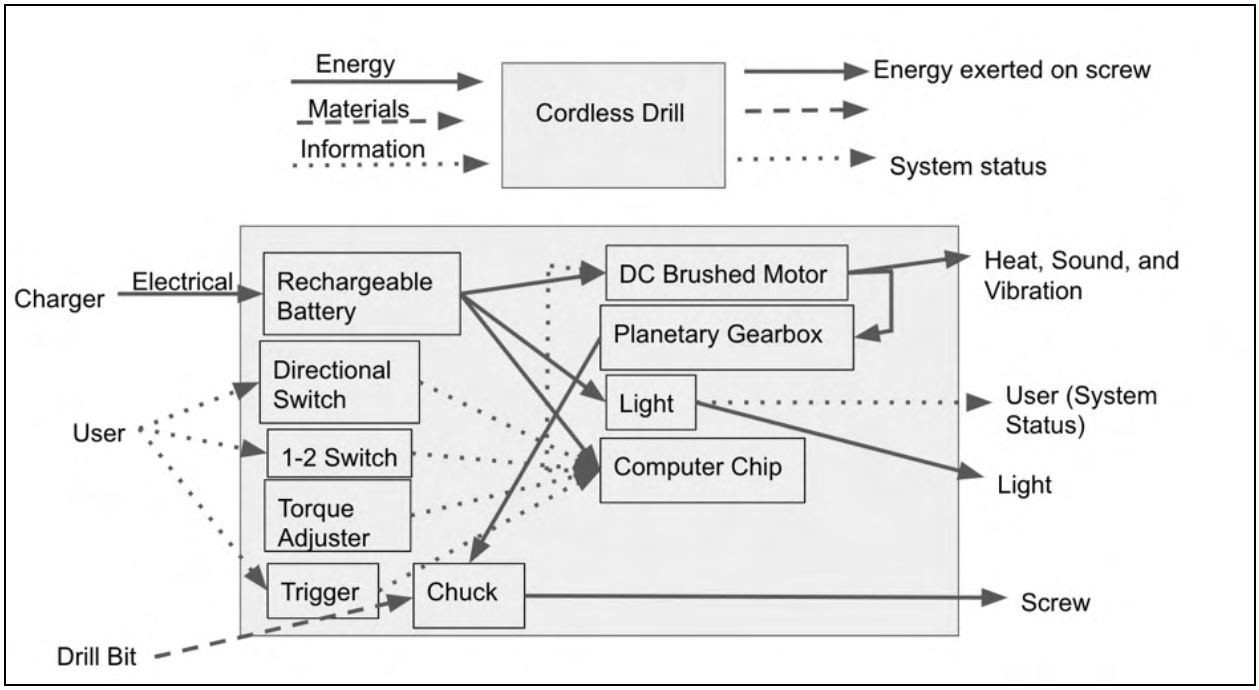
			  

Team member: Gus Brown

Team member: Rebecca Shen

Team member: Margaret Cook

Function Structure



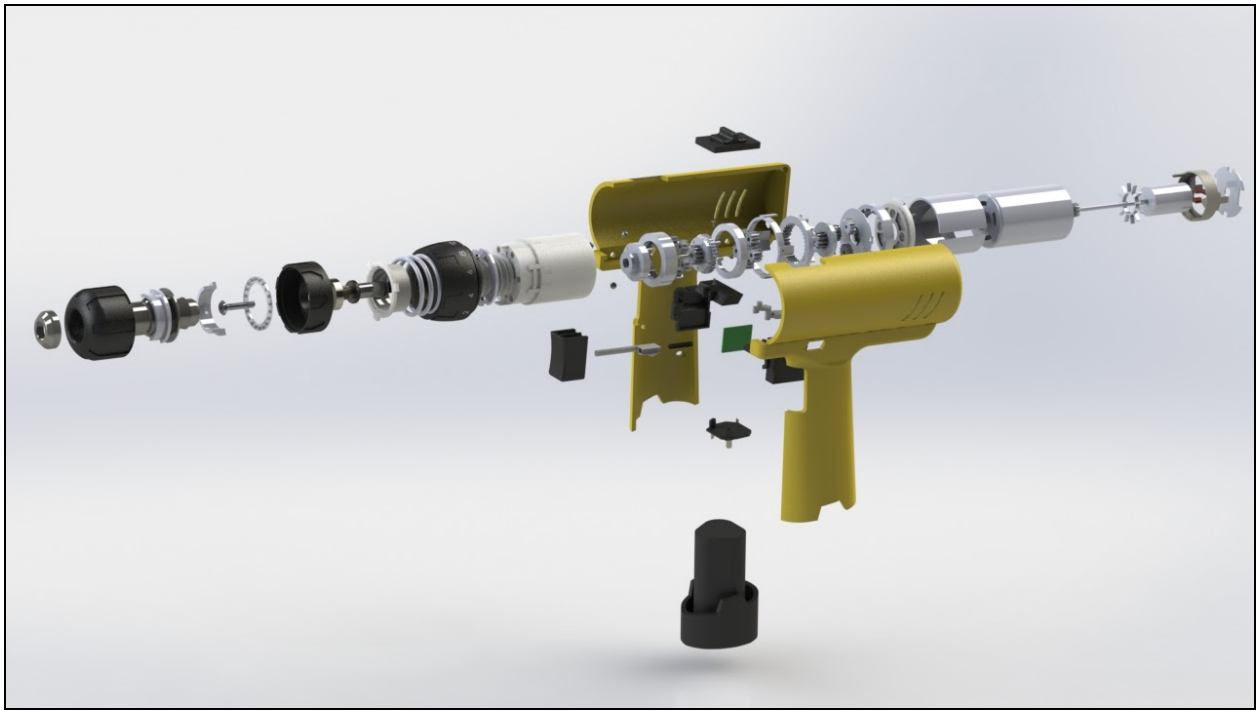
Images of SolidWorks Models

Fully Assembled:

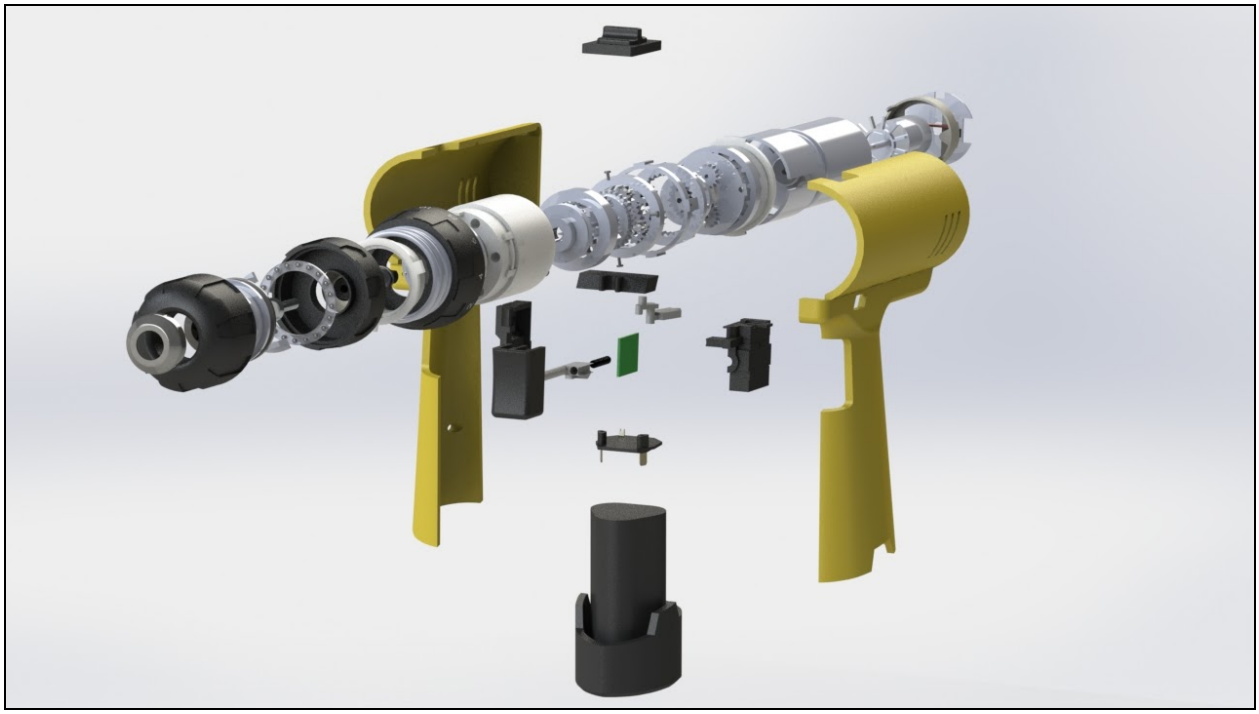
Open Side View:

Open Isometric View:

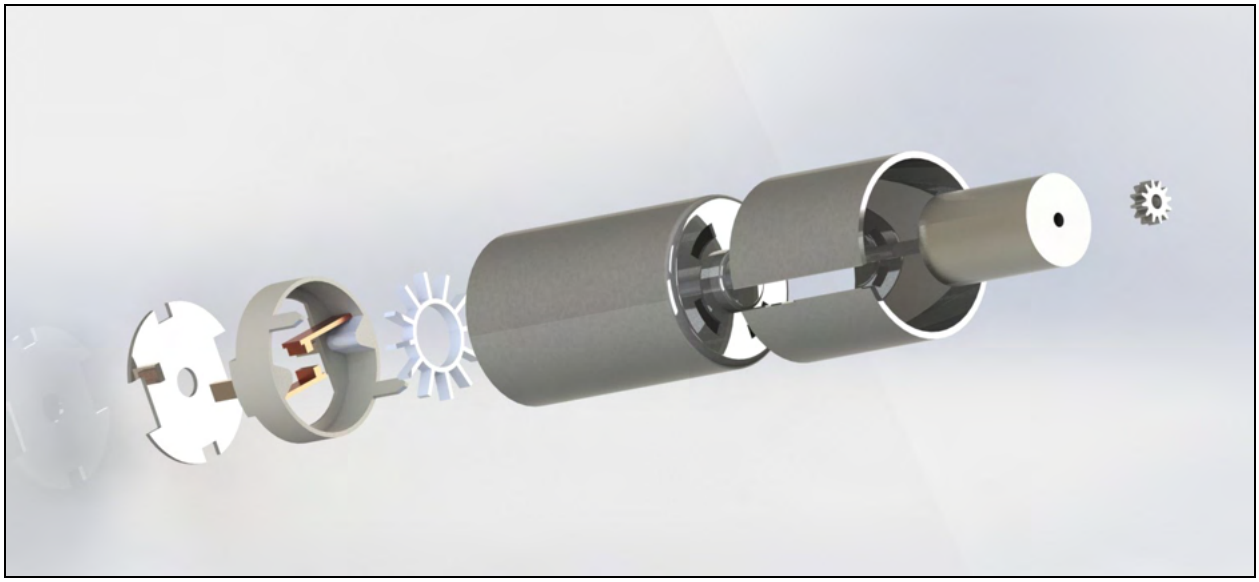
Exploded Side View:



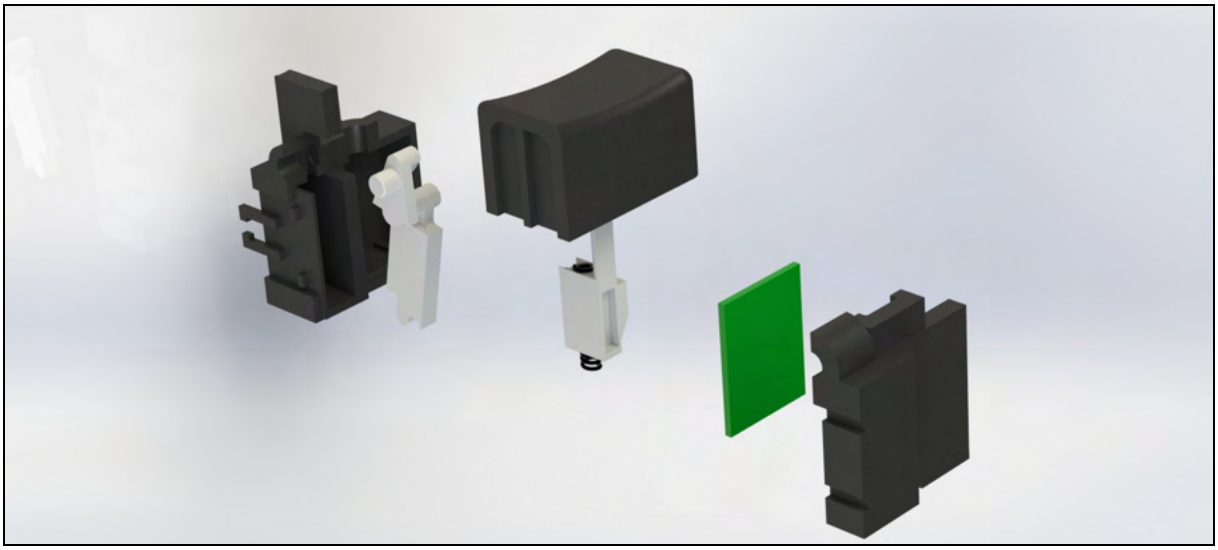
Exploded Isometric View:



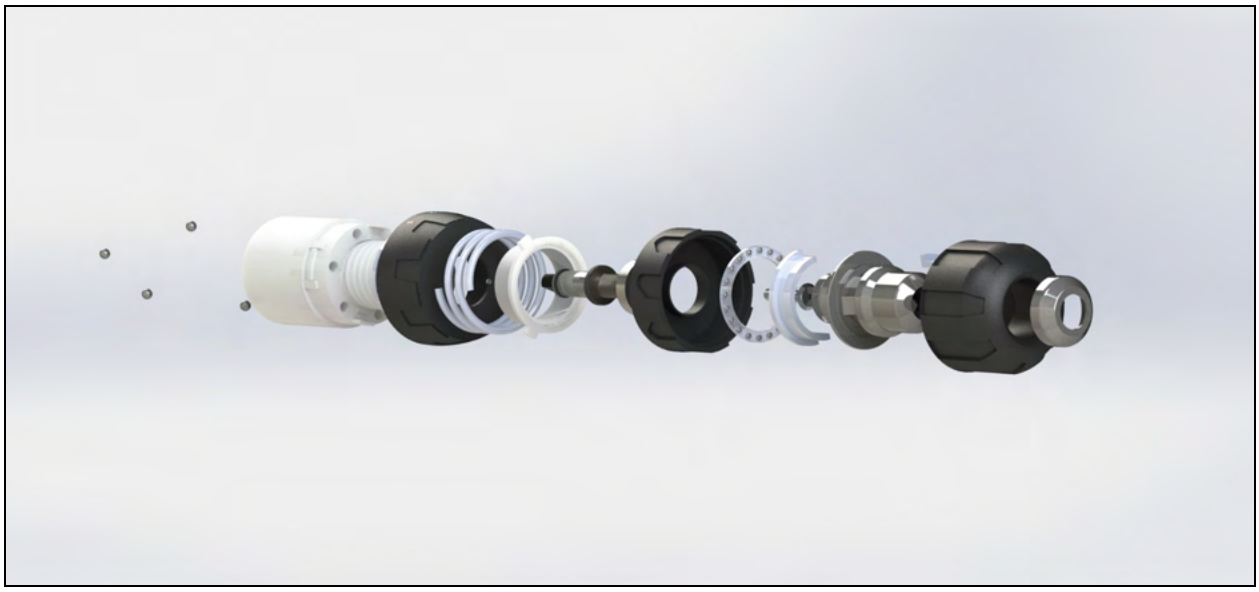
Exploded Motor Assembly:



Exploded Trigger and Control Box Assembly:



Exploded Chuck Assembly:



Exploded Planetary Gearbox Assembly: