

MANUFACTURING EQUIPMENT AND RESOURCES



General Atomics Electromagnetic Systems (GA-EMS) combines extensive manufacturing and test expertise with cutting-edge equipment to support exacting component and product designs for aerospace and defense, industrial, energy, and commercial applications. GA-EMS is focused on the design and manufacture of complex electronics, precision metal components, and turnkey assemblies. We machine, assemble, and test components to meet tight tolerances and harsh environments, and measure each product against the highest quality, compliance, and safety standards in the industry.

MANUFACTURING EQUIPMENT AND RESOURCES

CNC

Quantity	Description	Specifications
1	CNC Vertical Mill	Model: Hass VF-6; CNC Control 8100 rpm spindle; 30 HP; V50; 24-Position Tool Changer Axis Travel: X=64 in, Y=32 in, Z=30 in; Rotary Table: 6 in
4	CNC Vertical Mill	Model: Hass VF-6SS; HSM CNC Control 12000 rpm spindle; 30 HP; V40; 24-Position Tool Changer Axis Travel: X=64 in, Y=32 in, Z=30 in
1	CNC Vertical Mill	Model: Hass VF-2 20 HP; V40 Axis Travel: X=30 in, Y=16 in, Z=20 in
3	CNC Lathe	Model: Hass ST-30 20 HP; 21 in X 26 in capacity with bar feed and tool touch off system
1	CNC Lathe	Model: Hass ST-40L with Live Tooling 30 HP; 25 in X 80 in capacity with 15 in chuck
1	Hass Vertical Mill	Model: Hass VF-12/50 8100 rpm spindle; 30 HP; V50; 24-Position Tool Changer Axis Travel: X=150 in, Y=32 in, Z=30 in
1	Vertical Mill	Model: DMG MORI NVX 7000 60 Cat 40 Big-Plus tool stations; Renishaw measuring system 14000 rpm spindle and 5-axis Tsudakoma trunnion
1	Horizontal Mill	Model: Okuma MB-5000 Dual pallet 500 mm; Max weight 1100 lb; High pressure coolant; 40 Big-Plus taper
1	Vertical Mill	Model: Okuma M560-V 41 in x 22 in with 4th axis indexer
1	CNC Vertical Milling Machine	Model: YCM XV 1020A; Fanuc MXP100i control 10000 rpm spindle; 15 HP; V40; 24-Position Tool Changer Axis Travel: X=42 in, Y=20 in, Z=21 in
1	Waterjet Cutting Machine	Model: Techni M66 For material 5 ft x 10 ft; Maximum continuous cutting pressure of 66000 psi
1	Ram Type Horizontal Boring Mill	Model: Union PCR-150; Heidenhain iTNC 530 CNC Control 62 HP spindle; 3000 rpm; 40-Station Tool Changer Axis Travel: X=393 in, Y=157 in, Z=59 in; Ram Travel, W=28 in Spindle Stroke; DV 45 Heavy Duty Rotary Table; 3D Touch Probe
1	Horizontal Boring Mill	Model: MTE BF 4200; Heidenhain iTNC 530 CNC Controls 40 HP Universal Spindle, 3000 rpm; V50; 40-Station Tool Changer Axis Travel: 59 in Vertical, 157 in Cross, 39 in Z Axis
1	Horizontal Boring Mill	Model: MTE BF 4200; Heidenhain iTNC 530 CNC Controls 3000 rpm spindle; 40 HP; V50; 20-Station Tool Changer Axis Travel: 59 in Vertical, 157 in Cross, 39 in Z Axis
1	Mill/Turn	Model: DMG MORI NTX 2000 Celos control with Twin Spindle and 12000 rpm tool spindle and live tooling lower turret with 10 in chucks and 76 capto C6 tool storage
1	Lathe	Model: DMG MORI NLX 2500 SY 700 25 in x 60 in twin turret with 10000 rpm live tooling and Y axis and 12 ft bar feed
1	Punch Press	Model: Amada EMK 3612 33-ton with 58 stations; Max material 3/16 in x 60 in x 120 in
1	Wire Electrical Discharge Machine	Model: Sodick ALN600G Max. Thickness 13.39; Max Part weight 2200 lb with 4th axis indexer Axis Travel: 23.6 in = X, 15.75 in = Y, 13.78 in = Z
1	Large Lathe	Model: Republic Lagun TUR2050MN/CNC Swing: Bedway 94 in; Cross Slide 76 in Length 372 in

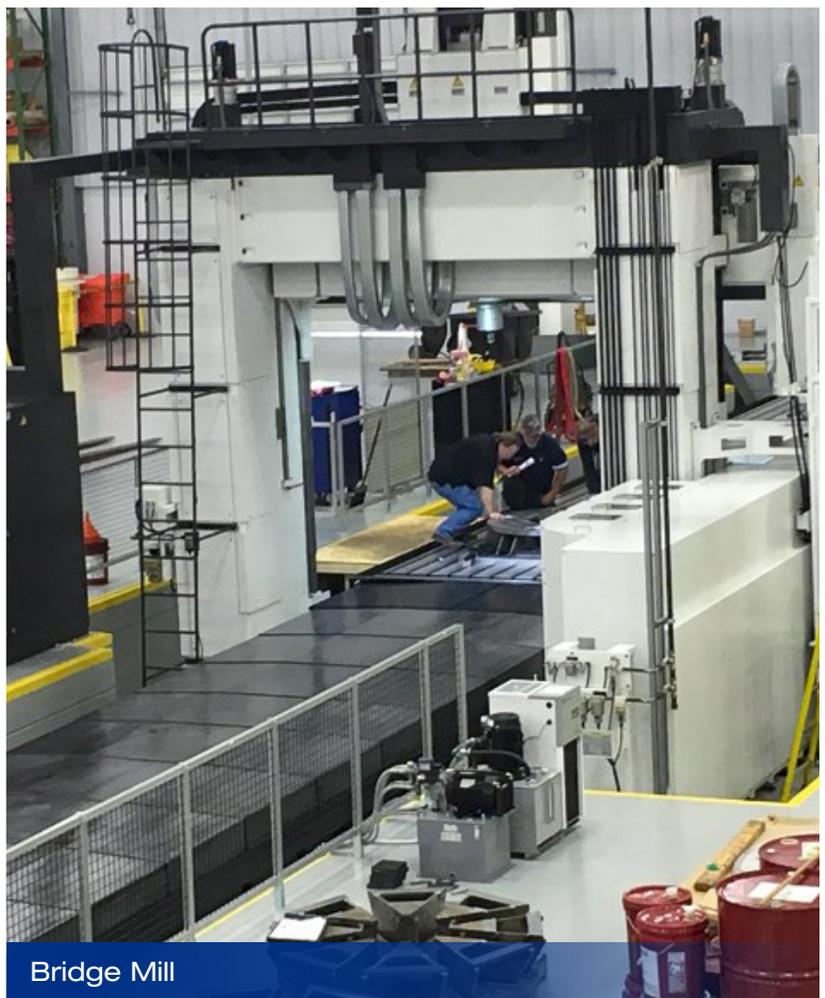
MANUFACTURING EQUIPMENT AND RESOURCES

CNC

Quantity	Description	Specifications
1	Verticle Turning Lathe	Model: BOST Capacity: 118 in diameter, 150 in height Includes 90° right angle head
1	Bridge Mill	Model: Okuma MCR-BIII; 30 x 120 with 5 axis capability 6000 rpm spindle; 160000 lb table weight capacity Size 3.7m (12 ft) x 12m (~40 ft), 3 Interchangeable heads, including 5 axis head
1	Surface Grinder	Model: Clausing 16 in x 40 in; Max weight 1000 lb
1	Surface Grinder	Model: Clausing 12 in x 24 in; Max weight 500 lb
1	Band Saw	Model: Hydmech S-23A Meters from 90° to 60°; 16 in H x 20 in W capacity at 90°; 8.8 HP motor; 1 ¼ in blade
1	Tool Pre Setter	Model: Parlec Series 2500 Cat 40-50 taper tools



Lathe



Bridge Mill



Vertical Mill

MANUFACTURING EQUIPMENT AND RESOURCES

FABRICATION

Quantity	Description	Specifications
2	Large Weld Positioner	0°-180° tilt; full 360° rotation
2	Welding Positioner	Model: Panjuris 3000 lb capacity; 30 in table with full tilting capability
1	Power Source	Model: Polysoude PC-350 CW Capable of welding tubes up to 4 in of various material types, carbon and stainless steel. Various orbital welding heads for automated pipe welding.
35	Miller Welders	Multi-process welding equipment capable of welding SMAW, FCAW, GMAW and GTAW
1	Plasma Cutter	Model: Max-200 Manual plasma cutter, capable of cutting variety of materials, carbon and stainless steel
10	Weld Station	Fully equipped stations for fabrication and assembly for contract components with full complement of Bluco flexible fixturing
1	Lincoln Python X	7 axis CNC robotic plasma cutting equipment
1	Auto Submerge Arc Welder	Weld up to 48 in diameter pipe of varies and different material types
1	Band Saw	Model: Hydmech V-18 vertical tilt frame



Lincoln Python X



Large Weld Positioner



Auto Submerged Arc Welder



Large Weld Positioner

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PRINTED CIRCUIT BOARD ASSEMBLY

Quantity	Description	Specifications
2	X-Ray Inspection System	Model: VJ Electronics Vertex 130 19 in x 20 in Inspection Area 130KV X-Ray Source Enhanced Measurement and Annotation Features
1	Inline Automated Optical Inspection	Model: Nordson FX-940 1 top-down and 4 side angle cameras with 3D Fusion lighting Throughput: [30 sq/ft per sec] > 1.5 million components per hour Minimum Component Size: 0201; 01005
1	Flying Probe	Model: SPEA 4050s2 Connector tester interface 64 Channel analog matrix Electroscan Open Pin test capability LED color and intensity test Short test impedance based
3	Robotic Selective Solder Cells	Model: Pillarhouse Jade MKII Fiducial correction capability Top and bottom preheaters with closed loop thermocouple temp control Nitrogen inerted soldering environment Sonotec Ultrasonic Fluxer Leaded and leadfree capability
1	Vibration Table	Model: Thermotron DSX-8000 45 kVA amplifier 16 in armature diameter Sine Force Rating: 8000 lb force (35.6 kN) peak Random Force Rating: 8000 lbs force (35.6 kN) RMS Shock Force Rating: 4ms ½ Sine= 200g with 65 lb payload Frequency Range: 5 to 3000 Hz Displacement: 2.5 in peak to peak sine or 3 in shock Payload support: 1000 lbs
1	Robotic Selective Conformal Coat Line	Non-atomized film coater with rotation and tilt Film pattern width: 6.35 mm to 19.05 mm Coating Velocity: 130 to 510 mm/sec Masking requirement near zero In-line IR cure oven
1	Surface Mount Stencil Printer (Prototype/low volume line)	Model: DEK Horizon 03iX In-Line Stencil Printer 12 sec core cycle time Cognex Vision System Fiducial recognition and correction Programmable print pressure, Print speed, Print gap, Substrate separation, with multiple print modes Programmable under screen cleaner, fully programmable with wet/dry/vacuum Grid-Lok board support system
1	Solder Paste Machine	DEK Horizon 03iX In-Line Stencil Printer 12 sec core cycle time Cognex Vision System Fiducial recognition and correction Programmable print pressure, Print speed, Print gap, Substrate separation, with multiple print modes Programmable under screen cleaner, fully programmable with wet/dry/vacuum Grid-Lok board support system
1	In-Process Solder Paste Inspection (Product Surface Mount Line)	Model: Koh Young KY8030-2, 3D Solder Paste Inspection System Measurement Capabilities: Insufficient paste, Excessive paste, Missing paste, Bridging, Shape deformity, Paste displacement, Volume, Height, and Area

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PRINTED CIRCUIT BOARD ASSEMBLY

Quantity	Description	Specifications
2	Pick and Place Machine	Model: ASM Siplace SX1 CPP combined with Siplace SX1 TH Combined 35000 per hour placement rate Comp Size Range: 03015 to 125mm x 10mm Jedec Tray Elevator Glue application (jet method directly to comp) Three 60 lane and one 30 lane feeder trolley Offline trolley docking station for off-line feeder setup Pre-wired to accept an additional gantry head for future/temporary needs
2	Pick and Place Machines (Prototype/low volume line)	Model: I-Pulse M4E Combined 10000 per hour placement rate Min Placement Size: 0402 chip Jedec Tray Elevator 120 lane feeder capacity
1	Reflow Oven (Production Surface Mount Line)	Model: BTU Pyramax Reflow Solder System Oven Atmosphere: Air Controlled heated zones: 10 top, 10 bottom Forced convection heating Total Heated Length: 125 in; Total Cooling Length: 230 in
1	Reflow Oven (Prototype/low volume line)	Model: Heller 1707 EXL Controlled heated zones: 7 top, 7 bottom
1	X-Ray Counter	Model: VJ Electronics XQuikII component reel counter >99% accuracy Counts 7 in and 15 in reels; Counts four 7 in reels per pass
1	Vapor Phase Soldering System	Model: Asscon VP6000 Vapor Phase technology for high mass substrates Filtration unit to remove contaminants from the Galdon Vacuum chamber for void free solder joints
1	Environmental Chamber	Model: ESPEC Platinum Series Temperature and Humidity Chamber 61 cu/ft Interior chamber size Temperature Range: -70° to 180° C Temperature Constancy: +/- .5°C Temperature Uniformity: +/- 2°C Humidity Range: 10 to 95% Includes dry contacts to control UUT power



PCBA Capabilities

CAPACITOR MANUFACTURING

Quantity	Description	Specifications
5	Automated Foil Winding	Capable of winding dielectric materials from 2 in up to 25 in in width Pneumatic/servo controlled rollers Edge folding capabilities Tab insertion capabilities
1	Automatic High Speed Winder	For element winding where hard plastic or paper cores are required 20 m per sec winding capabilities Can wind films up to 160 mm wide
2	Automatic Speed Winder	For flat element winding with inner leaf capabilities 13 m per sec winding capabilities Dual and Single Mode winding achievable Can wind films up to 153 mm wide (single mode) and 75 mm wide (dual mode)
18	Vacuum/Pressure Impregnation Tanks	Utilizing five different impregnates with varying dielectric properties based on application Capable of processing capacitors up to 46 in tall when installed vertically Fully automated cycles with point of use HMI interface and centralized data storage system
3	High Voltage Test Bunkers	Capable of testing up to 150 KV Automated rep rate testing capabilities Liquid cooling
1	Corona Test Station	Partial Discharge testing up to 30 KV
1	Robotic Arc Spray Booth	Robotic end spray capabilities Large viewing window Rotating door and fixtures for offline set up



Vacuum/Pressure Impregnation Tanks



Robotic Capacitor Soldering Station



Automatic High Speed Winders

MANUFACTURING EQUIPMENT AND RESOURCES

ELECTRICAL, WIRING, AND MOTOR ASSEMBLY

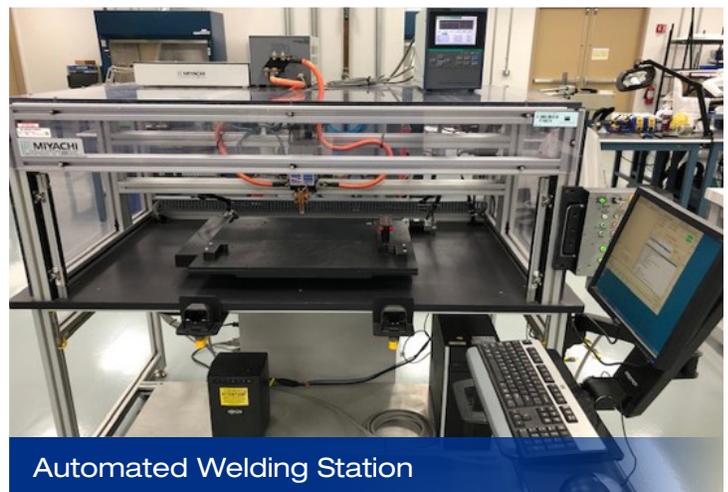
Quantity	Description	Specifications
1	Laser Marking System	Model: Legend 36EXT-1200W
1	Label Screen Printer	Model: Logo Jet UVx90
128	Assembly Bench	Electronic and wiring components, and assemblies complete with ESD controlled environment
1	Vacuum Curing Oven	Model: Cascade Tech SVO-10 24 in x 24 in capacity
1	Line-X Applicator	Moto Man Robot for applying Line-x spray across exterior applications
1	Grinding Booth	Dustron filtration booth 14 ft x 8 ft
1	Large Drill Press	Model: Baileigh-RD-1600H
3	Brazing Machine	12 KVA – 100 KVA
2	Hot/Cold Press	250-ton french oil presses with bed size capacity of 46 in x 46 in
1	Induction Heating Machine	Annealing copper tabs through an induction heating process
2	Downdraft Booth	Model: Donaldson Torit
1	Cable Cutter and Stripper	Model: Schleuniger Mega Strip 9650
1	Caterpillar Cable Puller	Model: Tulsa Power Model CC21 large power cable off 15 K reels
	Forklift	8000 lb, 12000 lb, 16000 lb, and 45000 lb
1	Portable Crane System	Model: Combilift SC 100000 lb lift capacity



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BATTERIES

Quantity	Description	Specifications
1	CEC Battery Cell Automated Tester	Custom CEC equipment S/N 0718-7654 Capable of testing 240 batteries in 30 min Measures battery voltage and impedance, records the data
2	Automated Welding Stations	Welder 1: Custom Amada-Miyachi 2 thin line model 88 parallel weld heads 18.5 in x 24.5 in programmable XY stage
1	Manual Welding Stations	Model: Amada-Miyachi 2 thin line model 88 parallel weld heads
1	ADAM Data Collection Unit	Model: Custom Amada-Miyachi
1	Test System	Model: Multifunction Series 4000 MACCOR Regenerative battery testing up to 5V
4	Battery Test System	Model: CHROMA 17020 Regenerative battery testing up to 60V
2	Battery Test System	Model: CHROMA A693000 Regenerative battery testing up to 365V



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RADIATION MONITORING SYSTEMS MANUFACTURING

Quantity	Description	Specifications
1	SMT Rework Station	Model: ERSA HR 200 400W hybrid high-power heating element 800W infrared heating plate Simple power selection
1	Inspection Microscope	Model: Leica [S9 i stereoscope with integrated camera] Capture of JPGs or MP4s directly to SD card 9:1 zoom with magnification 6.1x - 55x
3	Burn In Temperature Chamber	Model: ESPEC EPL-4H 32 cu/ft humidity controlled Temperature Range: -35° to 180° C
1	Automated Partial Discharge System	Model: Omicron MPD 600



Burn In Temperature Chamber

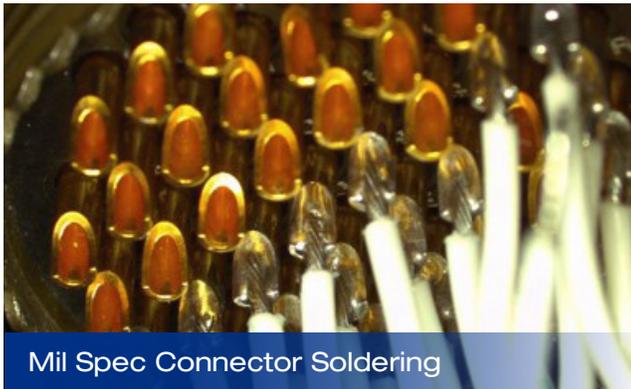


Automated PD Tester

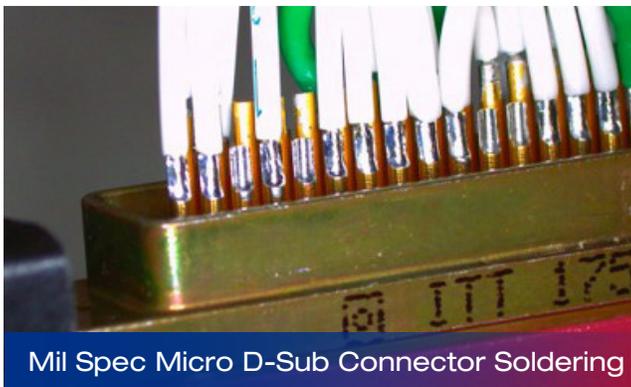
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CABLE ASSEMBLY MANUFACTURING

Quantity	Description	Specifications
1	Cut and Strip Machine	Model: Schleuniger PowerStrip 9500 Cable lengths from 2 in - 3280 ft Wire sizes up to 4AWG stranded and 10AWG solid Feed speeds up to 6.4 ft/sec
1	Inspection Microscope	Model: Leica S9 i stereoscope with integrated camera Capture of JPGs or MP4s directly to SD card 9:1 zoom with magnification 6.1x - 55x
1	Brady Wraaptor Wire ID Printer	Model: Amada-Miyachi 2 thin line model 88 parallel weld heads
1	ADAM Data Collection Unit	Utilizes zero-queue printing technology Print and apply labels in under 6.5 seconds Label application on wire from 0.060 in to 0.600 in
1	Benchtop Crimping System	Model: Artos Crimpmatic 963 20kN (4500 lb) of crimping force Handles wires up to 10AWG Crimp force monitoring functionality



Mil Spec Connector Soldering



Mil Spec Micro D-Sub Connector Soldering



Mil Spec Soldering of PCBA

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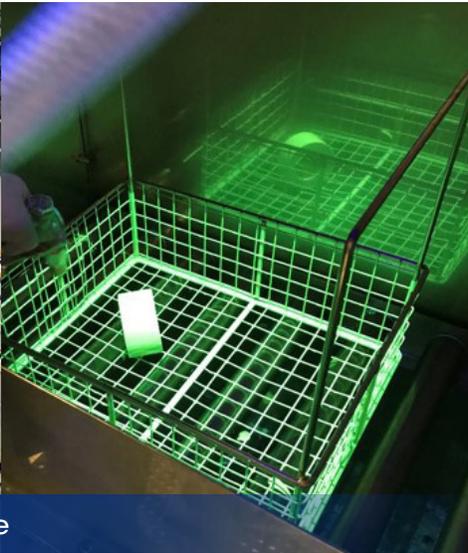
QUALITY ASSURANCE

Quantity	Description	Specifications
2	Mobile Laser Tracker	Model: LEICA Absolute AT960LR Portable – Accurate (10 microns) – Versatile Capable of interfacing with multiple accessories: T-Mac, T-Probe, Reflection Balls Wireless communication Direct interface with PC-DMIS GD&T software
1	Tracker - Machine Control Sensor	Model: LEICA T-Mac Four reflector positions used to establish a local coordinate system for object orientation Automation Interface Controller provides communication between machine controller and multiple measurement devices
1	Coordinate Measuring Machine	Model: B&S Global Advantage 15.30.10 5 micron accuracy with both digital/analog probes and analog scanning Equipped with laser/vision scanning probes Surface plate dimension 3 m x 1.5 m with 1 m in Z-axis travel System operates with both PC-DMIS and CAD++ software Ideal for large machined components requiring complex feature control verification
1	Coordinate Measuring Machine	Model: B&S Global Advantage 9.15.8 7 micron accuracy with analog probes and analog scanning Surface plate dimension .9 m x 1.5 m with .8 m in Z-axis travel System operates with both PC-DMIS and CAD++ software Ideal for mid-range sized components requiring complex feature control verification
1	Coordinate Measuring Machine	Model: Leitz Reference 10.7.6/B4 3 micron accuracy with analog probes and analog scanning Highest CMM accuracy of any CMM with articulating head Surface plate dimension 1 m x .7 m with .6 m in Z-axis travel System operates with both PC-DMIS and CAD++ software Ideal for small-sized complex machined components with tight tolerances below .001 in
1	Coordinate Measuring Machine	Model: Global S Chrome 9.12.8 7 micron accuracy with analog probes and analog scanning Surface plate dimension .9 m x 1.5 m with .8 m in Z-axis travel System operates with both PC-DMIS and CAD++ software Ideal for mid-range sized components requiring complex feature control verification
2	Optical Comparator	Model: 24PHD-M2E (with HARSH Environment Package) 24 in vertical screen with inversion capabilities 17 in touch screen, joy stick controls Internal edge detection system X,Y, and Q axis 10x, 20x, and 50x magnification Linear scales with .00025 mm resolution
-	NDE Capabilities (Staffed with Certified LVL III and LVL II NDE personnel)	Magnetic Particle MT Testing (MT) Bench -Portable MT equipment Dye Penetrate (PT) Line -Portable PT equipment Visual Inspection (VT) -Portable VT equipment
-	Coatings Inspection (Staffed with certified NACE LVL III coatings)	All required equipment to perform coatings inspections from cradle to grave. Subject Matter Experts on NAVSEA (009-32) Paint Standards

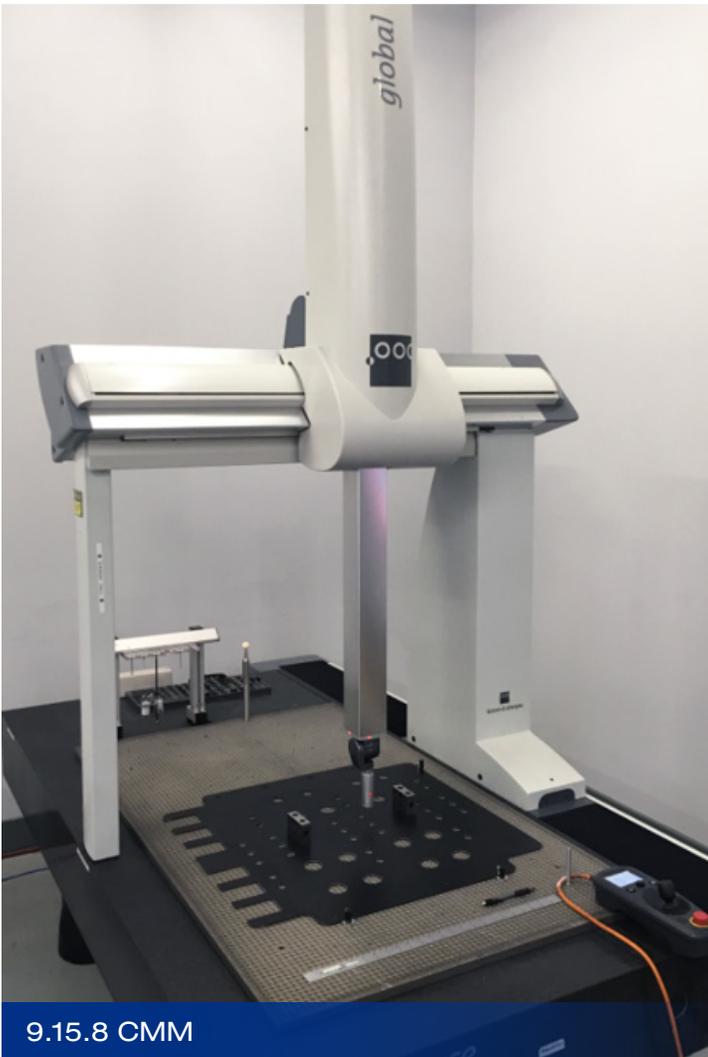
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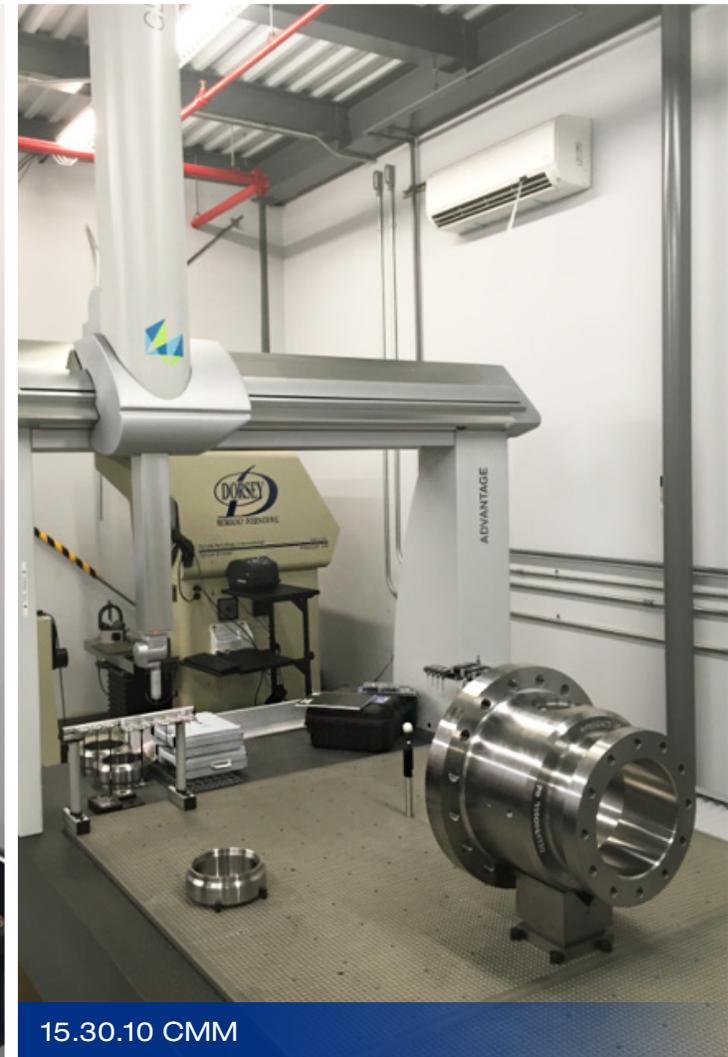
Dye Penetrant & Passivation Line



Optical Comparator



9.15.8 CMM



15.30.10 CMM

MANUFACTURING EQUIPMENT AND RESOURCES

GENERAL FACILITY

Quantity	Description	Specifications
	354000 sq/ft	Climate controlled facility with machining, welding, fabrication, assembly, and test
	~250000 sq/ft	Additional climate controlled manufacturing space, coming online in 2019
	44000 sq/ft	Climate controlled production warehousing
	30000 sq/ft	Climate controlled warehousing
1	Electrical Services	Bldg. 1 - 7 & 9: Fed by a 480v 4000a main Bldg. 1 & 2: Test stand is fed by a 13.7 KV 1200a main Bldg. 5: 8 MW is fed by a 13.7 KV 200a main Bldg. 8: Fed by 480v (2) 3000a mains Bldg. 10: Fed by a 480v 4000a main Bldg. 11: will be fed by a 480v 4000a main Bldg. 12: will be fed by a 480v 400a main luka plant: Fed by 480v (2) 800a mains & mechanical bldg is fed by a 2.4kv 600a main
11	Overhead cranes	1-ton, 10-ton, 35-ton, and 50-ton, 70-ton w 45 ft hook height
12	Forklifts	4000 lb, 6000 lb, 8000 lb, 12000 lb, 16000 lb, and 45000 lb
	Portable/Mobile Crane System	Model: Combilift SC with 100000 lift capacity
1	Mobile Crane	10-ton boom crane
6	Test Bay	High-energy electrical test bays
1	Test Bay	Hydro pressure testing
4	Coating Application	Environmentally controlled blast, paint, and special coatings booths
10000	Class 100 Clean Rooms	20500 sq/ft total with class 100 flow benches
1000	Class 1000 Clean Rooms	250 sq/ft total

ELECTRICAL TEST FACILITY

Quantity	Description	Specifications
3	Test Bunkers	High energy testing bunkers (400 kj capacitors and railgun applications)
1	Electrical Testing	Up to 150 kj capability
1	Software	Labview Control: automated discharge; shot testing; power supplies; SCR Stacks; Oscilloscopes; Data Collection; and water cooling
1	Regen Testing	Automated testing of arc sprayed capacitor pads
1	Corona Testing	Up to 30 kVac
18	Oscilloscope	Tektronic 2 & 4 channel
1	ScopeCoder	Yokogawa DL850; 16-channel
	Sensors	PEM Rogowski up to 150 kA, high voltage differential probes, hall effect current sensors up to 4 kA
1	Tester	Fiber Optic Light Loss report to provide resistance measurements and light loss readings of all cable assemblies within an assembly

MANUFACTURING EQUIPMENT AND RESOURCES

CERTIFICATIONS AND WORKFORCE DEVELOPMENT

- ISO 9001:2015/AS9100:2016
- ISO 14001:2015
- NQA-Compliant
- 10CFR50, Appendix B
- MIL-STD-2037 Sealed Insulation System Certification
- 10CFR21
- IPC-A-610/IPC J-Std-001 Soldering
- NQA-1 (2008) and NQA-1a (2009)
- Fiber Optics
- ANSI N45.2
- Six Sigma (green and black belts)
- Regulatory Guide 1.97
- Lean Management
- NUPIC
- ESD Control Certified
- J-STD-001
- EPS/DOT
- IPC610 and IPC 620 Class 3 certified technicians
- ANSI Y.14 GD&T
- Navy Fiber Optic Shipboard Certifications per NAVSEA 6872813 specifications
- Hazardous Toxic Waste Management (RCRA)
- Mil Spec M83513 and D38999 connector experience
- Hazardous Materials Transportation (HMT P30)
- OSHA Certifications:
 - 24 hour HazWoper Certified
 - Emergency Response Team
 - NIMS Incident Command System
 - 10/30 hour Safety Certifications
 - Crane, forklift, incident command system

