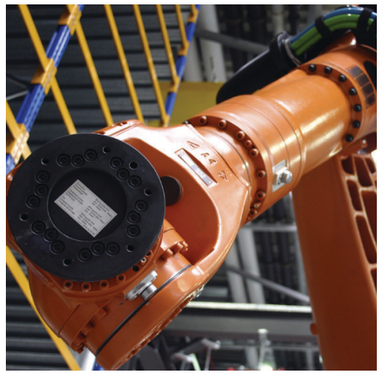
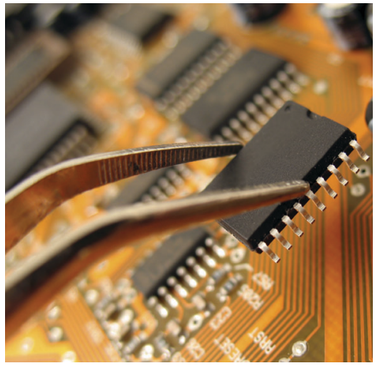
D A C U M

PROFILE

ELECTRONIC & INSTRUMENTATION TECHNICIAN





Panel Members:

Ronald L. Stanford, Operations Manager, Technical Services Department, Johns Hopkins University Applied Physics Laboratory

Michael Chase, Senior Technical Skills Instructor, Northrop Grumman Corporation, Electronic Systems

Mike Brocka, Senior Controls Engineer, BD Diagnostics

Daniel Kmett, Team Leader—Maintenance, BD Diagnostics

Sam Woods, Senior Engineering Manager—Electronics, Black & Decker Corporation

Mark Jackson, Aircraft Instrumentation Technician, NAWCAD-Patuxent River Air Station

Kent Ladd, Instrument & Control Instructor, General Physics Corporation

Johnathan Akers, Engineering Technician, Smiths Detection Edgewood

Facilitator: **Dennis M. Faber**, TIME Center

TECHNOLOGY & INNOVATION IN MANUFACTURING EDUCATION

TIME center

An NSF sponsored ATE center

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The **ELECTRONIC & INSTRUMENTATION TECHNICIANS** design, fabricate, assemble, test, tune, and troubleshoot electronic products, components and systems using a variety of hardware and software tools and techniques. They design, prototype, and test new products and systems in research and development settings. They produce new products from ray materials or assemble and fabricate new products from manufactured components in production settings. They may also install, troubleshoot, calibrate, maintain, and repair industrial controls, programmable logic controllers, and precise measurement and analytical equipment used in manufacturing settings. They provide informal and formal training to other groups, and they maintain effective relationships with co-workers and customers to insure quality products. At higher skill and experience levels, technicians may lead work teams and develop specialized areas of expertise.

DUTIES: ⮜---------- **TASKS** ----------⮞

A.	**MAINTAIN A SAFE AND SECURE WORK ENVIRONMENT** ➤	Maintain a clean and safe work area A-1 E	Follow company and job-specific safety procedures A-2 E	Adhere to safe practices guidelines A-3 E	Discuss monthly safety talk points with department members A-4 E	Complete safety training and exams A-5 E	Follow federal, state and local regulations A-6 E	Follow security requirements for the particular work area and components A-7 E	Maintain security clearance records annually A-8 E	Follow electro-static-discharge (ESD) procedures A-9 E
		Handle hazardous materials according to Material Safety Data Sheets (MSDS) requirements A-10 E		Follow clean room procedures A-11 E	Follow high voltage safety procedures A-12 E	Perform safety inspection audits A-13 S				
B.	**MAINTAIN AND CALIBRATE TEST EQUIPMENT** ➤	Perform preventive maintenance on test equipment B-1 E	Run Performance checks B-2 E	Recognize performance problems B-3 E	Record calibration data B-4 E	Follow the established calibration schedule B-5 E	Verify that equipment is within calibration dates B-6 E	Diagnose problems B-7 E[b] S[c]	Repair the test equipment where possible. B-8 S	Evaluate the usefulness of current equipment and the need for new equipment B-9 S
		Perform complete test verification or calibration on test equipment, if required B-10 S								
C.	**COMMUNICATE WITH OTHERS** ➤	Maintain open communication with supervisor C-1 E	Maintain working relationship with other departments C-2 E	Interact with customers and vendors in a professional manner C-3 E	Prepare written reports C-4 E	Maintain working relationships with co-workers C-5 E	Share information and expertise with co-workers C-6 E	Solicit feedback from internal and external customer C-7 E	Present verbal reports C-8 E	Provide informal/OJT training to co-workers C-9 E[b] S[c]
		Prepare standard operating procedures (SOPs) C-10 S	Mentor co-workers C-11 S	Supervise lower-level technicians C-12 S						
D.	**ASSEMBLE PRODUCTS** ➤	Follow pre-determined assembly procedures for deliverable product D-1 E	Interpret sketches, schematics, and blue prints D-2 E	Interpret verbal directions and instructions D-3 E	Ensure the availability of necessary parts D-4 E	Verify parts against specifications or requirements D-5 E	Initiate engineering change requests D-6 E	Prepare sketches and schematics D-7 E	Follow accepted standards and practices for mechanical and electrical assembly D-8 E	
		Perform wire wrapping D-9 E	Fabricate cable harnesses D-10 E	Solder components and wires D-11 E	Inspect products D-12 E	Perform a functional check of components and systems D-13 E	Assure that the assembly process falls within controls and specifications D-14 E	Layout boards, chassis, and other assemblies D-15 E	Fabricate board assemblies D-16 E[b] S[c]	Build test boxes, panels, chassis, racks D-17 E[b] S[c]
		Set-up programmable equipment D-18 S	Weld parts and components (laser, spot, stitch welds) D-19 S	Perform wire bonding (ball, stitch, wedge, ribbon) D-20 S	Connect a network D-21 S	Modify software to interface among network components D-22 S				

E. TEST ENGINEERING DEVELOPMENT PRODUCTS

Assembly test equipment E-1 E	Record test data E-2 E	Forward results to engineering E-3 E	Perform preliminary tests (mechanical and/or electronic) E-4 E[b] S[c]	Develop test specifications and procedures in collaboration with engineering E-5 S	Review/research previous test information (logs books, people, data manuals) E-6 S	Recommend capital equipment expenditures E-7 S	Design test fixtures E-8 S	Design/develop an assembly process for Engineering Development products E-9 S
Design test set(s) E-10 S	Fabricate test fixtures E-11 S	Fabricate test sets E-12 S	Circuit check the product E-13 S	Write test software E-14 S	Analyze preliminary test data (graphical, mathematical, statistical analyses) E-15 S	Make required adjustments/ changes E-16 S	Prepare reports E-17 S	Teach a robot E-18 S

F. TEST DELIVERABLE PRODUCTS

Assemble and configure test equipment F-1 E	Ensure that test equipment is calibrated F-2 E	Record test data F-3 E	Ensure that product is routed to the next level F-4 E	Verify documentation integrity F-5 S	Review the test specification F-6 S	Calibrate the test set F-7 S	Perform the test (mechanical, electronic) and/or environmental) F-8 S	Tune the circuit to meet parameters and test specifications F-9 S
Analyze the test data (graphical, mathematical, , statistical analyses F-10 S	Certify the results F-11 S							

G. TROUBLESHOOT EQUIPMENT AND PRODUCTS

Research the equipment G-1 E	Research the product G-2 E	Use troubleshooting aids and equipment manuals G-3 E	Perform sensual inspection (visual, audio, smell, touch) G-4 E	Trace circuits G-5 E	Apply troubleshooting techniques at the systems level G-6 E	Apply troubleshooting techniques at the sub-assembly level G-7 E	Apply troubleshooting techniques at the board level G-8 E	Apply troubleshooting techniques t the component level G-9 E
Seek help from other resources, when needed G-10 E	Generate a non-conformance report G-11 E	Maintain detailed records and logs G-12 E	Verify operation of the test set G-13 E[b] S[c]	Define the failure G-14 E[b] S[c]	Localize the failure G-15 E[b] S[c]	Repair the equipment or product,, if possible G-16 E[b] S[c]	Determine the need for specialized troubleshooting equipment G-17 S	Develop troubleshooting aids and equipment manuals G-18 S
Notify the appropriate department and/or person of troubleshooting trends and results G-19 S		Update documentation for products G-20 S						

H. PURCHASE/ORDER PARTS AND MATERIALS

Identify needed parts H-1 E	Identify suppliers H-2 E	Check availability and price of parts (electronically and manually) H-3 E	Complete required paper work (manual/ electronic) H-4 E	Obtain supervisor/ program authorization H-5 E	Expedite the purchase H-6 E	Receive the delivery H-7 E	Follow the required purchasing process (competitive bid/sole source, etc.) H-8 E	Submit internal orders using the computerized process H-9 E[b] S[c]
Identify and verify requirements H-10 S	Make substitutions where necessary H-11 S							

I. PERFORM ADMINISTRATIVE DUTIES

Complete daily logs I-1 E	Participate in meetings I-2 E	Account for time with correct charge numbers I-3 E	Complete time records (electronic and manual) I-4 E	Verify that equipment is calibrated on regular basis I-5 E	Complete required forms (calibrating, labeling, security, ESD) I-6 E	Maintain the required level of security in work areas I-7 E	Prepare written reports I-8 E	Participate in audits I-9 E
Maintain files and records I-10 E	Maintain inventory as required by department I-11 E	Coordinate travel plans I-12 E	Prioritize workload based on information from managers and production I-13 S	Develop work process flow I-14 S	Schedule work areas and equipment I-15 L			

J. MAINTAIN AND IMPROVE JOB SKILLS

Maintain certifications and/or qualifications J-1 E	Participate in job or equipment-specific training J-2 E	Maintain currency of technical skills J-3 E	Acquire new information using a variety of resources (people, manuals, publications) J-4 E	Design and implement a career development plan J-5 E	Suggest process and product improvements J-6 E	Develop and deliver informal and formal training J-7 L

E = Entry-level Technicians are expected to perform these tasks
S = Specialist-level Technicians are expected to perform these and entry-level tasks
L = Lead Technicians can perform these and entry- and specialist-level tasks

E[b] = Entry-level Technicians can perform these tasks at basic levels
S[c] = Specialist-level Technicians can perform these tasks at more complex levels

Knowledge and Skills

Math – Applied

- Engineering Numerics (Powers of 10, Hexadecimal, Octadecimal & Binary)
- Algebra
  - 1st Degree Equations
  - 2 Unknowns
- Boolean Logic
- Trigonometry
  - Logarithms
  - Sine/Cosine Functions
- Vector Analysis
- Statistics
  - Central Tendency
  - Mean/Standard Deviations
  - Skewedness/Kurtosis
  - Variance
  - Measures of Deviations from the Mean
  - Process Control Statistical
- Graphing/Histographs
- Calculating Wave Length Frequencies and Power Values

Electronics

- OHM's Law
- Circuit theory
  - AC/DC
  - Analog
  - Digital
  - Microelectronics & Microprocessors—Basic Knowledge
  - Solid State
  - Parallel & Series Circuits
- Network Components (Fiber Optic, Wireless, CAT 5 Ethernet)
- Fiber Optic Theory
- Fiber Optic Cabling
- Transformers
- High Voltage
- 3 Phase
- Motors/Generators
- Basic Antennae Theory
- RF Theory
  - Microwave
  - S Parameters
- Power Electronics

Applied Physics

- Temperature, Mass, Mechanics, Optics Weights & Measures, Time, Acceleration, Torquing
- Motors and Generators—Torque, Gears, Power, Speed, Micro Strain
- Fundamental Quantities
- Light
- Propagation (RF Sources)

Soldering (IPC-J Standard)

- Discrete
- Ball Grit Array
- Vacuum Soldering
- Quality Inspection Skills
- Surface Mount

Troubleshooting Techniques

- Board
- Sub-Assembly
- Component
- System

Blueprint Reading/Schematics

Mechanical Design and Drawing Skills

Technical Writing Skills

- Forms, Short Reports

Computer Skills

- Word Processing, Spread Sheets, Databases, Presentation
- E-Mail
- Intranet Usage
- Operating Systems (Windows, Unix, Linux)
- Read Code/Write Code for Troubleshooting
- Data Entry/Analysis

Reading Comprehension

- Technical Manuals & Literature
- Standards
- Schematics
- Logic Diagrams
- Flow Charts
- Procedures

International Standards

- ISO 14001
- MIL-STD 45662-A (NASA Space Standard)
- ISO 9000

Legal/Regulatory Requirements & Liabilities

- UL/EU Standards
- CSA Standards

Record Keeping and Documentation

Interpersonal Skills

- Conflict Resolution
- Interaction with Co-Workers

Communication Skills

- Interaction with Others
- Teamwork
- Informal Presentations
- Follow Instructions (Written & Verbal)
- Listening Skills

Mechanical Assembly Skills

Decision-Making Skills

Environmental Testing for Product Qualification

Ethics and Integrity in the Workplace

Programming and Software Skills

- Linux
- Solaris (Army)
- Java
- C++, Visual Basic
- Test Software (PIC, Stamp)
- Test Equipment (Lab View)
- Schematic Capture Software (AutoCAD, Pro E, Inventor, Mentor, Solid Works)

Tools and Equipment

1. Oscilloscope
2. Multi-meter
3. Spectrum analyzer
4. Power meter
5. Frequency analyzer
6. Frequency generator
7. Network analyzer
8. Scaler analyzer
9. Logic analyzer
10. Power supply
11. LCR meter
12. Personal computer
13. Soldering irons
14. Hand tools
15. Power tools
16. Voltmeter (vector)
17. Personal protective equipment
18. Welding tools
19. Bonding agents
20. Bonding tools and ovens
21. Environmental test chambers
22. Wire wrap gun
23. Extraction/insertion tools
24. Crimping tools
25. Magnifiers
26. Geiger counter
27. Scientific calculator
28. Microscope
29. Precision measuring tools (micrometers, calipers, etc.)
30. Thermal plates
31. Thermometer
32. Noise figure meter
33. Noise generator
34. Corona partial discharge equipment
35. Ammeter
36. Turns Count equipment
37. Ohmmeters
38. Vibration equipment
39. Automated surface mount technology
40. Time domain reflectometer
41. Dynamometer
42. Ultrasound measurements tools

This material is supported by an NSF ATE Program Grant (0302754). Any opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.