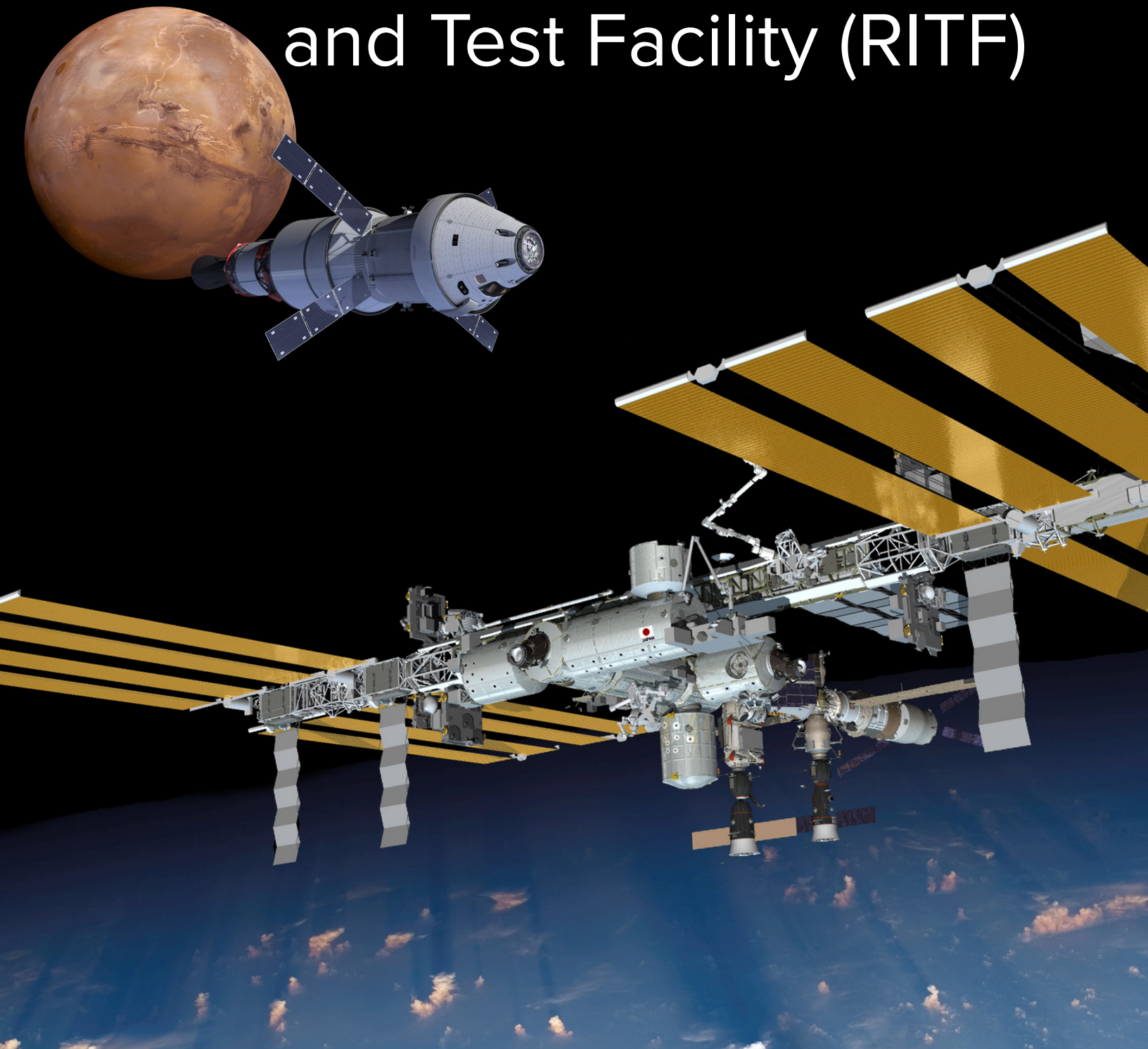
National Aeronautics and Space Administration

Excellence through dedication

Receiving Inspection and Test Facility (RITF)



Proven Dependability Delivers Results

NASA Johnson Space Center is home to a nationally accredited inspection and test facility. The RITF provides testing, evaluation services, and training to the aerospace community and industry.

As a unique laboratory with a wide range of both electrical and mechanical testing, analysis, and training capabilities, the RITF is developing new, collaborative partnerships. The facility specializes in failure mitigation through electrical and mechanical component screening and materials validations, and in failure analysis by conducting non-destructive and then increasingly invasive techniques as needed to determine the cause/mechanism of failure. Other services provided include “hands-on” training to engineers, technicians, and inspectors in the areas of soldering, surface mount technology (SMT), crimping, conformal coating, fiber-optic terminations, and electrostatic discharge (ESD).

Component Screening
Material Validation
Mechanical Properties
- Tensile
- Hardness
- Shear

Component Screening
- Functional
- Environmental
- DPA (Qualification)
- Life

Failure Analysis

Quantitative Analysis
- Fe Based Alloys
- Ni Based Alloys
- Al Based Alloys

Qualitative Analysis
- Precious metals
- % Comp. Solder Metals
- Foreign Object Debris

Wide Range of Capabilities

The RITF offers various standard failure analysis techniques. Specialized testing is also available.

- Screening
- Failure Analysis
- Material Selection
- Wire and Cable Testing
- Fastener Testing
- Mechanical Testing
- Chemical Analysis
- Material Testing
- Destructive Testing
- Metallurgical Analysis
- Weld & Welder Qualification Data
- Raw Material Testing
- Counterfeit Component Mitigation
- Fractography
- Component Life Testing

Counterfeit Parts Detection

CAUTION CAUTION CAUTION CAUTION CAUTION CAUTION

Despite best efforts, assembled products may still contain counterfeit parts. NASA, with RITF expertise, is exploring ways to expose them.

- Damage or loss of prime objective
- Risk for safety and national security
- Loss of sales and brand value
- Loss of business image

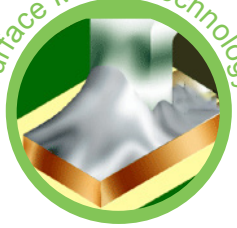
Workmanship Training

RITF personnel have years of experience in workmanship training ensuring consistent skills with proven techniques.

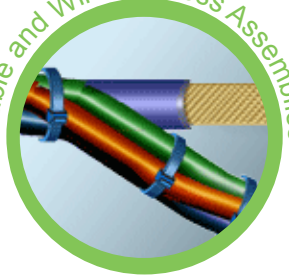
- Hands on Training

- Through-Hole Soldering

- Surface Mount Technology



- Cable and Wire Harness Assemblies



RITF Capabilities

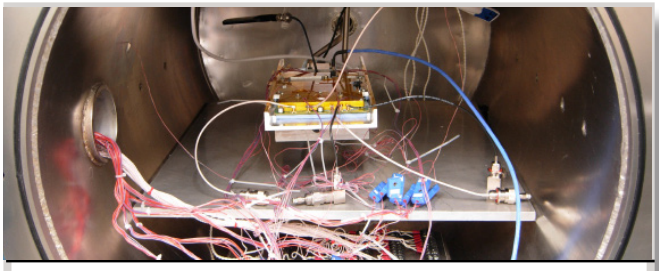
The RITF has a wide range of testing and analysis capabilities including chemical analysis, mechanical testing, metallography, and electrical screening of parts and components.

Particle Impact Noise Detection testing, known as PIND or PIN-D, is performed to detect loose particles inside a device cavity.

This is a nondestructive test to identify any devices that may have particles such as solder balls that could become dislodged and short out the device internally.

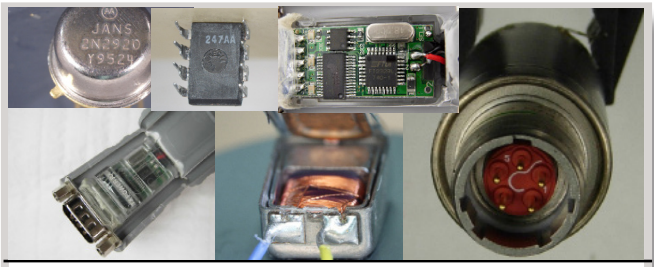
The **scanning electron microscope (SEM)** has many advantages over traditional microscopes. The SEM has a large depth of field, which allows more of a specimen to be in focus at one time. The SEM also provides higher resolution.

This examination can find defects including metallization defects and voids, diffusion faults, passivation faults, dielectric isolation defects, internal wires and bond pads, and die mounting.



The purpose of the **thermal vacuum chamber** is to expose payloads, mechanisms or components to representative hostile environments – a vacuum state combined with repeated cycling between high and low thermal extremes – in order to assess their likely flight performance.

Thermal vacuum chambers are used to test or evaluate a design prior to use to provide data to customers.

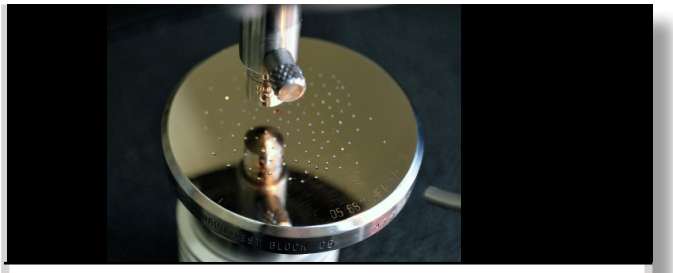


Testing and analysis of samples of parts and components is performed to ensure they meet the specifications to which they were procured.

With the shift of procurement to commercial off-the-shelf hardware, and the ever increasing problems with counterfeiting, the importance of screening continues to grow.

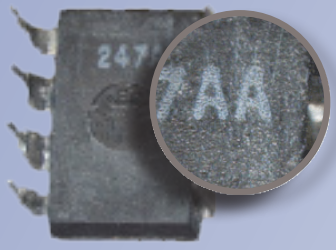
Our team of engineers and technicians have years of experience and the capabilities to support the full range of testing methods to military, aerospace, and commercial specifications.

DANGER!
Counterfeit parts are manufactured and sold with the intent to deceive.



The **Rockwell hardness test method** consists of indenting the test material with a diamond cone or hardened steel ball indenter. The permanent increase in depth of penetration, resulting from the application and removal of the additional major load, is used to calculate the Rockwell hardness number.

X-ray fluorescence is the emission of characteristic "secondary" (or fluorescent) X-rays from a material that has been excited by bombarding with high-energy X-rays or gamma rays. This technology is widely used for elemental analysis and chemical analysis, particularly in the investigation of metals, glass, and ceramics.



Counterfeit Part Detection

Counterfeit parts are marketed with the intent to deceive the customer. Customers are led to purchase substandard or defective parts while believing they have purchased high quality parts from reputable manufacturers. This intent to deceive defines a counterfeit part and separates it from faulty parts which have defects that are unknown to the manufacturer or distributor.

RITF has increasing capabilities and expertise to authenticate materials and parts. With any indication of fraud, the RITF also specializes in the investigative procedures to determine whether counterfeiting has occurred. Our screening services subject hardware, parts, components, and raw materials to a rigorous regiment of testing to identify if parts are substandard and to reveal if a part is suspected to be counterfeit.

Impact from Counterfeit Parts

For Industry

- Costs to mitigate the risk
- Costs to replace failed parts
- Loss of sales
- Loss of brand value or business image

For Government

- Risk for Safety and National Security
- Costs to detect counterfeit parts
- Loss of national assets due to illegal sales of counterfeit parts

RITF Capabilities

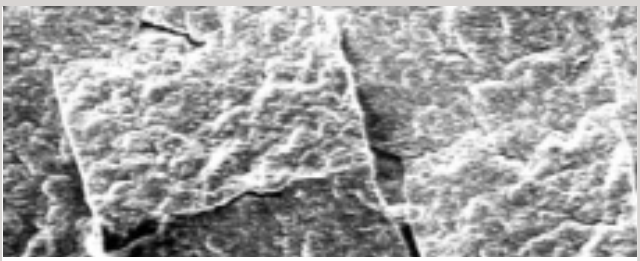
The RITF is a testing and analysis laboratory with all the necessary state of the art equipment to support everything from screening jobs to complete root cause failure analysis.

As a high standard laboratory and testing facility, the RITF continues to move forward, advancing its knowledge and executing improved methods for evaluation.

RITF customers receive the benefit of broad expertise in mechanical and electrical investigative methods.

These methods are selected to assist RITF engineers in achieving the most reliable and cost effective analysis to deliver the best service in the shortest amount of time.

RITF customers have come to expect the friendly and cooperative services offered by the staff. Competence, courtesy, timeliness and spot-on accuracy are hallmarks of the RITF team.

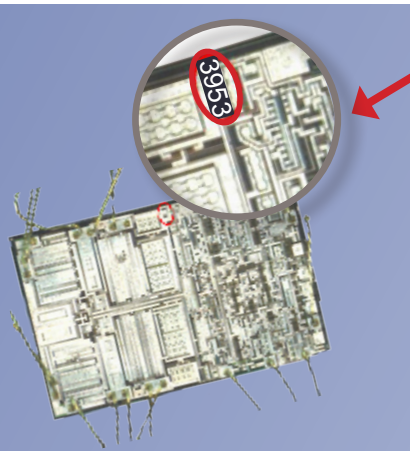


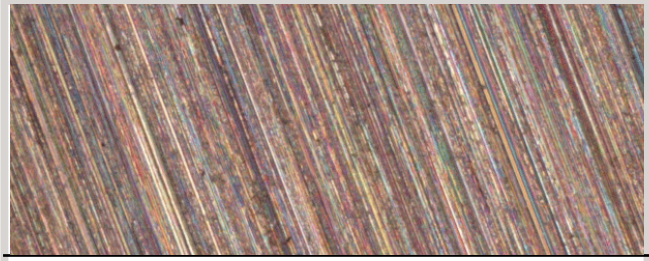
Fractography is the interpretation of features observed on fracture surfaces.

Fractography is utilized during failure analysis of components as a tool in determining the cause of fracture. Features within the fracture surface detail various causes/events that occurred during the failure.

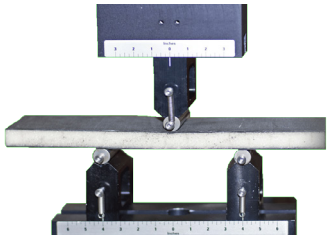
Shear testing is accomplished by exerting pressure (shear force) in the transverse plane of the sample until shear failure occurs.

Double shear testing verifies the ultimate strength of the parts. This data is critical for the pyrotechnics design to ensure the proper energy is used to shear the pins in various applications.



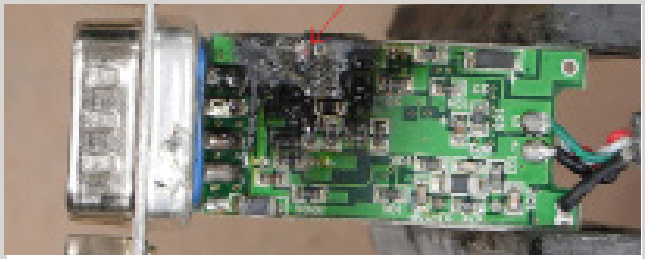


Metallographic preparation allows for the examination of a material's microstructure which aids in determining if the material has been processed correctly and therefore a critical step for product reliability and failure analysis.



Bend testing is a procedure to determine the relative ductility of metal that is to be formed (usually sheet, strip, plate or wire) or to determine soundness and toughness of metal (after welding, etc.) The specimen is usually bent over a specified diameter mandrel. The four general types of bends are: free bend, guided bend (ASTM E190), semi-guided bend (ASTM E290), and wrap-around bend.

Real-time radiography, or real-time radioscopy, is a nondestructive test method whereby an image is produced electronically, rather than on film, so that very little lag time occurs between the item being exposed to radiation and the resulting image.



Failure analysis deals with testing/analysis of a component or board which has failed during its life cycle to determine the root cause.
This can be applied during various phases of the part or component, such as design, in-use/flight, after useful life, etc.

Failure analysis provides the knowledge for repair, lessons learned, and design modifications to prevent future failures.

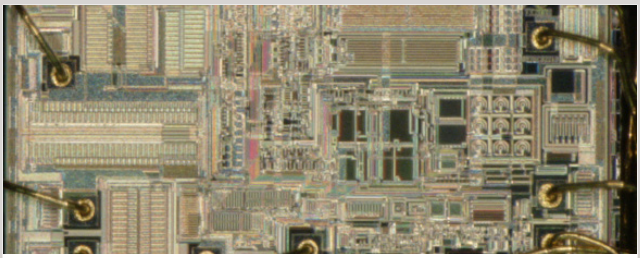
Counterfeit Full Bridge Pulse-Width Modulation Motor Drivers

The RITF received 25 of the subject devices suspected by the customer to be counterfeit. Visual examination of the logo and markings revealed no anomalies; however, conditions such as exposed copper at the pins and chips or holes in the packages caused concerns.

Radiography was then performed to peer into the device and it was discovered that 6 of the 25 devices had broken bond wires or no bond wires at all. Digging deeper into the device, chemical etching was performed to remove the plastic case and reveal the dies.

It was then discovered that the part number on the dies was 3953 instead of the expected part number 3952. The part was counterfeit.

RITF Capabilities

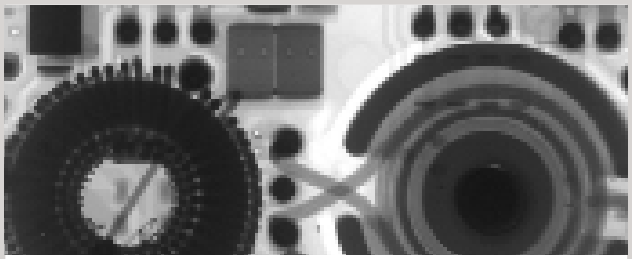


Destructive physical analysis is a systematic approach to disassembly of a component, electronics board, part, etc., and evaluating it down to the basic material and construction level.

DPA can be used to solve unique problems ranging from contamination issues, metallurgical questions, to complex failure analysis.

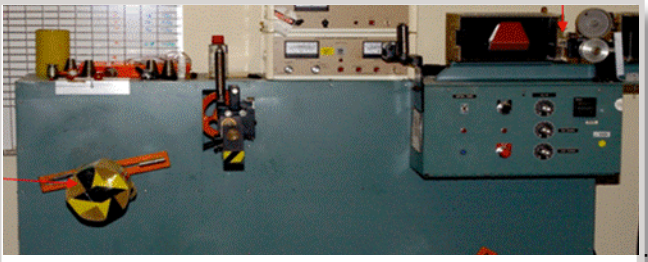
The **Fine / Gross leak testing** involves the hermeticity testing (seal, fine and gross leak tests) to determine the effectiveness of sealed packages.

Seal integrity testing is crucial for hermetic packages in military, space, and commercial applications. A loss of hermeticity is a reliability concern and will allow moisture and contaminants to enter the package cavity, shortening device lifetime.



The purpose of the **mechanical cross sectioning** in the context of failure analysis is the grinding of die or die and package - usually orthogonal to the surface of the die - to examine defects or structure.

Many defects, including shorts, ESD, EOS, and numerous processing defects, can only be physically verified in cross section.



Wire and cable testing is performed by conducting multiple tests including spark testing, cold bend, dimensional, etc.

Testing prevents non-compliant wire and cable from being used in NASA hardware, significantly reducing the likelihood of failures later in the life cycle.

The purpose of **emission microscopy** is to detect microcircuit failure sites by light emission leakages.

Emission microscopy is a failure analysis tool for efficiently locating integrated circuit failures - both front and backside.

OES testing can absolutely verify the chemical composition of metals. This can be critical in ensuring that the correct alloy is being implemented in the design application for which it is intended.

Any iron, nickel, or aluminum based metallic samples can be submitted for OES to provide accurate quantitive analysis of up to 14 different elements for a sample.

Customized Service

The RITF provides real-time support by working with customers to help them make the best decisions to solve their problems

Define and Collaborate

Fully Define the Problem

Our technical leads and engineers will meet with customers to gain background knowledge of the hardware, planned applications, schedule restrictions, and application knowledge of requirements such as those defined for ISS hardware, industry standards, and drawings to formulate test and analysis requirements.

The initial meeting sets the stage for identifying the specific work that the customer wants. What tests are needed? Are there any special set up needs?

Build and Execute the Plan

Setups and Fixtures

The RITF specializes in meeting customer expectations and creating individualized plans.

We work with customers to build unique tests if needed. This can include not only the procedures but the fabrication of test fixtures. Customers can come in and be part of the test set up phase. The RITF approach respects and includes the customer's expertise and preferences.

Deliver Results

Provide test feedback

Our team can determine product compliance to the appropriate specifications. We test to the applicable aerospace, military and industry standards such as:

ASTM F 606 / F 606 M, Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

NASM 1312-13, Fastener Test Methods for Double Shear Tests. This standard is focused on the details surrounding double shear testing of fasteners.

NASM 1312-8, Standard Practice, National Aerospace Standard, Fastener Test Methods, Method 8, Tensile Strength ASTM E8, Tension Tests of Metallic Materials

In order to meet our customers' needs we work with them to ensure the proper testing is done that will provide the appropriate feedback to allow them to make informed decisions.

Workmanship Training at the RITF

Special processes require special skills, knowledge, and experienced application. For over 15 years, the NASA/JSC/Receiving, Inspection and Test Facility has provided Agency-wide NASA Workmanship Standards compliance training, issuing more than 500 to 700 training completion certificates annually.

Workmanship Standards provide uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard for NASA programs and projects.

Training services include “hands-on” training to engineers, technicians, and inspectors in the areas of electrostatic discharge, soldering, surface mount technology, crimping, conformal coating, and fiber-optic terminations.

NASA Workmanship Standards provide uniform engineering and technical requirements for processes, procedures, practices, and methods that have been endorsed as standard for NASA programs and projects.

Case Study

Ellington Field Success Story

NASA was in the process of modifying instrumentation in approximately twenty T-38 aircraft used for astronaut training at Ellington Field, which required approximately 1800 circuit terminations. This level of work requires fidelity of workmanship expertise that was lacking as demonstrated by audits and functional tests when work was initiated.

Efforts were sought to reduce the number of discrepancies by arranging training for the workforce in specific disciplines. This training was provided by the NASA Workmanship instructors at the Receiving, Inspection and Test Facility at Johnson Space Center. After the training was completed, the number of discrepancies found on the reworked T-38s was reduced by 95%. The instruction provided by the NASA Workmanship instructors remedied the situation.

RITF offers the following classes. Please call for details and requests for specialized training.

- **Cabling, Harness, and Crimp, Wire Wrap**
  Instructors utilize lectures, demonstrations, and student application to develop NASA Workmanship Standard required knowledge and skills for soldering and crimping stranded wires, and cable fabrication.
  Length: 40 hours

- **Conformal Coating & Staking**
  Instructors utilize lectures, demonstrations, and student application to develop NASA Workmanship Standard required knowledge and skills for conformal coating and component and wire harness staking.
  Length: 24 hours

- **Electrostatic Discharge Control (ESD)**
  There are three levels of ESD classes that cover general ESD issues, learning to develop ESD control program techniques, and developing skills for performing an Electrostatic Protective Area (EPA) audit.
  Length: 4 hours for each level

- **Fiber Optic Terminations**
  Instructors utilize lectures, demonstrations, and student application to develop NASA Workmanship Standard required knowledge and skills for fiber optic termination and fusion splicing.
  Length: 24 hours

- **IPC-J-STD-001 Training - Soldered Electrical and Electronic Assemblies**
  Instructors utilize lectures, demonstrations, and student application to develop understanding of soldered electrical and electronic assemblies.
  Length: 40 hours

- **Lithium Battery Handling**
  Instructors utilize lectures and demonstrations about the hazards associated with lithium batteries.
  Length: 2 hours

- **NASA Standards Overview Training**
  This course provides management/supervisory-level personnel an overview of NASA's Workmanship Standards courses. Instructors utilize lectures on through-hole and surface mount soldering and inspections, cabling/harnessing/crimping, conformal coating/staking, and fiber optic terminations.
  Length: 8 hours

- **Surface Mount Technology**
  Instructors utilize lectures, demonstrations, and student application to develop NASA Workmanship Standard required knowledge and skills for soldering techniques, component lead tinning, solder dispensing, and component mounting.
  Length: 40 hours

- **Through-Hole Soldering**
  Instructors utilize lectures, demonstrations, and student application to develop NASA Workmanship Standard required knowledge and skills for fabrication of stranded wire and component lead tinning, component mounting and termination.
  Length: 40 hours

A2LA ACCREDITED

nqa. AS9100 Registered

ANAB ACCREDITED

Nationally accredited

Please contact the RITF for information or questions.

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A2LA Certificate Numbers
0257.01
0257.03

Internal site for NASA
https://ritf-sma.jsc.nasa.gov/index.html

External site
https://fal.jsc.nasa.gov

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