



## Nuclear Test Reactor

GE Hitachi Nuclear Energy (GEH) has facilities worldwide to support our customers' needs. GEH's Nuclear Test Reactor (NTR) at the Vallecitos Nuclear Center (VNC) offers neutron radiography for a wide variety of applications. The reactor is suited for a high volume of one-of-kind exposures, with all work conforming to the applicable ASTM and MIL standards.

### More than 40 Years of Experience => Customer Value

Neutron radiography work has been performed at VNC for more than 40 years. Our employees were intimately involved in the early development of high-quality beams, imaging techniques, image and beam quality indicators, and neutron radiography standards and are certified to both the NAS 410 and SNTC-1A industry standards.

### Robust Portfolio of Radiography Services and Products

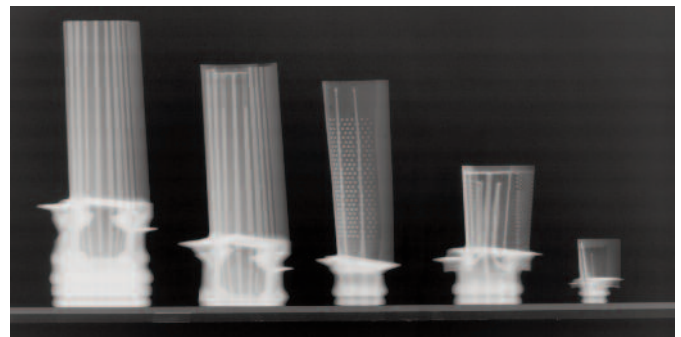
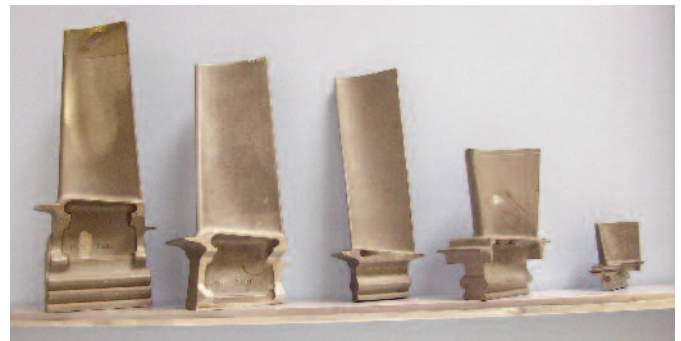
- High volume neutron radiography using dual neutron beams
- One-of-a-kind customer directed radiography for defect analysis and verification
- High-resolution direct radiography
- Indirect dysprosium transfer radiography for special applications
- Parts handling, custom fixtures, and setups with S/N accountability
- Handling of most hazardous materials
- Development of unique specifications, procedure and technique cards
- Neutron radiographic label paper

### Wide Array of Technology Applications

Neutron radiography is a non-destructive technique similar to X-radiography (X-ray), except that a beam of neutrons is used to produce the image. Since neutrons interact with materials differently than X-rays, the image produced on film is also distinctly different. Neutron radiography is particularly well suited for imaging pyrotechnics and other hydrogenous materials within a metallic or other dense material. This includes light elemental material such as epoxy bonds and O-ring seals inside metal structures, epoxy adhesives, and other materials such as rubber or plastic.

Neutron radiograph image details are strikingly different from those identified in X-rays including low-density, hydrogenous material like epoxy bonds, seals inside metal structures, or hydrides in titanium and other metals.

Thus, GEH's neutron radiography service enables you to determine the integrity, continuity, and density of critical components and structural materials inside zero-defect equipment even when dense metal exteriors shield these objects.



Turbine blades



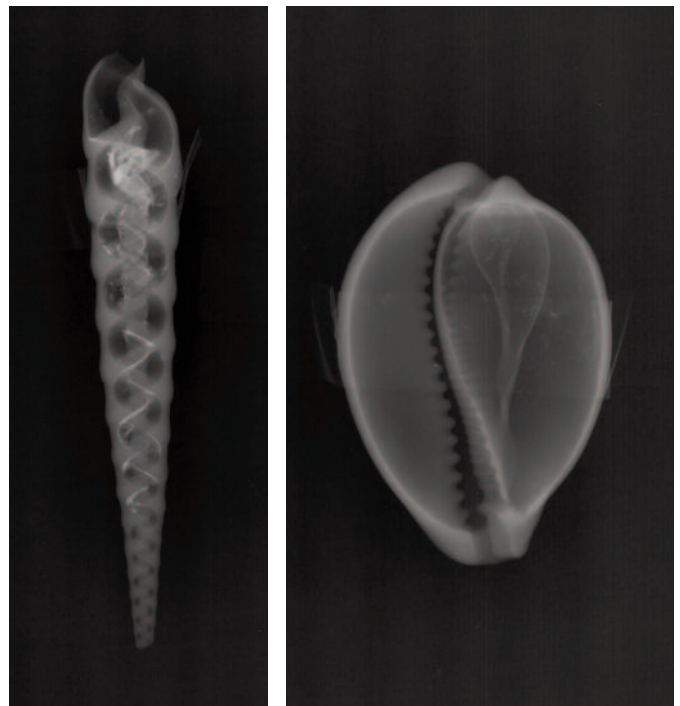
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This unique non-destructive testing service has proved successful for a variety of industrial applications. GEH has produced more than 170,000 neutron radiographs for manufacturers who have used it to examine high-performance jet engine turbine blades, aerospace pyrotechnic devices, rocket motor injectors, diffusers, nozzles, NASA space shuttle hardware, electronic devices, and other defense and commercial industry components.

The NTR is also uniquely situated to provide neutron radiographic services on highly radioactive components such as irradiated nuclear fuel and other reactor components. Working in conjunction with the licensed activities of the Engineering and Materials Service group at VNC, the NTR has the capability of imaging irradiated materials using an indirect dysprosium transfer neutron radiographic process.

## Neutron Irradiation of Materials

VNC's NTR contains several facilities for short-term neutron irradiation/activation of materials. The exposure rates can be up to  $2 \times 10^{12}$  nv in either long- or short-term irradiation cycles. Various sample sizes can be accommodated. Special techniques are available, such as cadmium filters to eliminate thermal neutrons and rotational facilities to ensure uniform exposure. Neutron irradiation/activation services have been provided at VNC since 1957. These services have been used in research and development, instrument calibration, radioactive sources, materials effects, and activation analysis.



Sea shells



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For further information email or call GE Hitachi Nuclear Energy at our Vallecitos Nuclear Center (attn: Neutron Radiography Department):  
email: [Vallecitos@ge.com](mailto:Vallecitos@ge.com), phone: 925-862-4283.

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