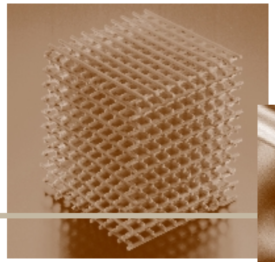

*Photonic bandgap crystal*

*Lead-free solder*

## The 1990s

### The 1990s

Encouraged by DOE, Ames Lab continued its efforts to transfer basic research findings to industry for the development of new materials, products and processes.

The Scalable Computing Laboratory was established to find ways of making parallel computing accessible and cost-effective for the scientific community. Researchers discovered the first non-carbon example of buckyballs – a new material important in the field of microelectronics. Scientists developed a DNA sequencer that was 24 times faster than other devices, and a technique that assessed the nature of DNA damage by chemical pollutants.

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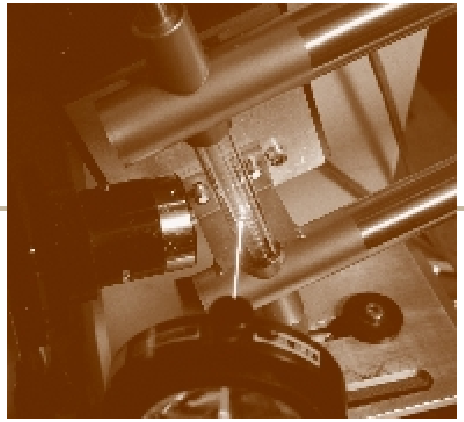
### Other key accomplishments:

- Developed benchmarking techniques that objectively compared computers of all sizes.
- Improved a method of turning molten metal into fine-grained metal powders.
- Predicted the geometry for a ceramic structure with a gap in the range of energy it could absorb or transmit. These structures improved the efficiency of lasers, sensing devices and antennas.
- Discovered a new class of materials that could make magnetic refrigeration a viable cooling technology for the future.
- Developed a high-strength lead-free solder.

## The future



*Detecting DNA damage from chemical pollutants*

### The future

As Ames Laboratory enters the 21st century, it remains committed to focusing diverse research strengths on issues of national concern, cultivating tomorrow's research talent and transferring technologies to industry.

Ames Laboratory is a U.S. Department of Energy research facility operated by Iowa State University, and is a member of ISU's Institute for Physical Research and Technology.

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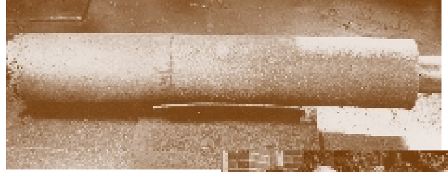
*(On the cover) Past and present work at Ames Laboratory converge in photos taken more than 50 years apart. In the top photo, an employee prepares to stamp billet numbers on uranium "biscuits" in the 1940s. Below, the fine droplets in a nebulizer are part of a current experiment that uses inductively coupled plasma-mass spectroscopy to identify trace elements in biological materials.*

# Ames Laboratory

# A history of innovation



*Uranium ingot*

## The 1940s

*Metallurgy group*

### The 1940s

Ames Laboratory's beginnings are rooted in the Manhattan Project, the nation's effort to develop atomic power. A scientist with uranium expertise was needed. Frank Spedding, head of Iowa State College's physical chemistry department and an expert in rare-earth metals, filled that role.

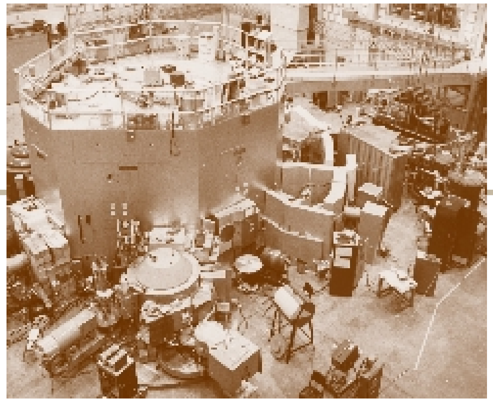
Spedding and metallurgist Harley Wilhelm developed a uranium purification process that is still used today. Campus facilities produced more than 2 million pounds of high-purity uranium metal between 1942 and 1945, when industry took over the process.

After World War II, Spedding urged the U.S. Atomic Energy Commission to create a research facility on the ISC campus. In 1947, the Ames Laboratory was born with Iowa State as its contractor.

### Other key accomplishments:

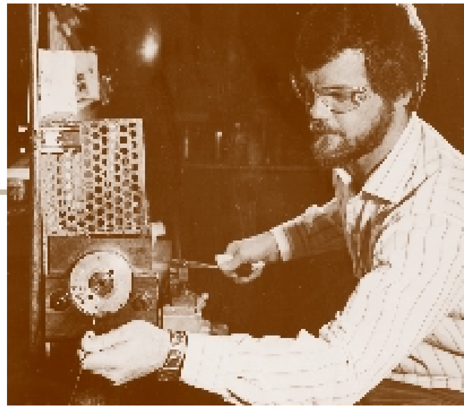
- Developed a process to recover uranium from scrap materials and convert it into good ingots.
- Developed an ion exchange process to separate rare-earth elements from each other in gram quantities — something not possible with other methods.
- Received the prestigious Army-Navy Flag for Excellence in Production for contributions to the war effort.
- Developed a large-scale production process for thorium using a bomb-reduction method.

Rare-earth separation columns



Research reactor

Transwall solar module



Materials Preparation Center

## The 1950s

The Lab's growing reputation for its work with rare-earth metals rapidly increased its workload. As the country explored the uses of nuclear power, Lab scientists studied nuclear fuels and structural materials for reactors.

Processes developed here resulted in the production of the purest rare-earth metals in the world while at the same time reducing the price of the metals as much as 1,000 percent. In most cases, Lab facilities served as models for large-scale production of rare-earth metals.

Lab scientists took advantage of Iowa State's synchrotron to pursue medium-energy physics research. Analytical chemistry efforts expanded to keep up with the need to analyze new materials.

### Other key accomplishments:

- Developed processes for separating hafnium, niobium, barium, strontium, cesium and rubidium.
- Discovered a new isotope, phosphorus-33.
- Separated high-purity rare earths in kilogram quantities.
- Developed a method of separating plutonium and fission products from spent uranium fuel.
- Produced high-purity yttrium metal in large quantities, shipping more than 18,000 pounds before industry took over the process.

## The 1960s

The Lab reached peak employment during the decade as its scientists continued exploring new materials. As part of that effort, the Lab built a 5-megawatt heavy-water reactor for neutron-diffraction studies and additional isotope separation research.

The AEC established the Rare-Earth Information Center at Ames Lab to provide the scientific and technical communities with information about rare-earth metals and their compounds.

### Other key accomplishments:

- Developed a process to produce thorium metal with a purity of 99.985 percent.
- Developed a process for producing high-purity vanadium metal for nuclear applications.
- Discovered a new isotope, copper-69.
- Conducted the first successful operation of an isotope separator connected to a reactor in order to study short-lived radioactivity produced by fission of uranium-235.

## The 1970s

As the Atomic Energy Commission evolved into the Department of Energy, efforts diversified as some research programs closed and new ones opened. Federal officials consolidated reactor facilities, leading to the closure of the research reactor. Ames Lab responded by putting new emphasis on applied mathematics, solar energy, fossil fuels and pollution control.

Innovative analytical techniques were developed to provide precise information from increasingly small samples. Foremost among them was inductively coupled plasma-atomic emission spectroscopy, which could rapidly and simultaneously detect up to 40 different trace metals from a small sample.

### Other key accomplishments:

- Developed a highly sensitive technique for the direct analysis of mercury in air, water, fish and soils.
- Developed a method for isolating minute amounts of organic compounds found in water.
- Developed a process for removing copper, tin and chromium from automotive scrap, yielding reclaimed steel pure enough for direct re-use.
- Developed an image-intensifier screen that significantly reduced exposure to medical X-rays.
- Developed a solar heating module that could both store and transmit solar energy.

## The 1980s

Research at Ames Lab evolved to meet local and national energy needs. Fossil energy research focused on ways to burn coal cleaner. New technologies were developed to clean up nuclear waste sites. High-performance computing research augmented the applied mathematics and solid-state physics programs.

Ames Lab became a national leader in the fields of superconductivity and nondestructive evaluation. In addition, DOE established the Materials Preparation Center at Ames Lab to strengthen the development of new materials.

### Other key accomplishments:

- Developed a liquid-junction solar cell that was efficient, durable and non-toxic.
- Received Defense Department funding to develop nondestructive evaluation techniques for aircraft.
- Became DOE's lead laboratory for managing the environmental assessment of energy-recovery processes.
- Developed a new method for alloying pure neodymium with iron, producing the feedstock for a widely used, lightweight, permanent-magnet material.
- Helped develop a material that changes form in a magnetic field, making it ideal for sonar and transducer applications.