

# Stories by and about Bill Manly

(As published in The Oak Ridger's Historically Speaking column during the week of 12/28/2020)

This is the third in the series of articles featuring Bill Manly researched and written by Carolyn Krause

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Bill Manly, an eminent metallurgist and manager and the only employee of Oak Ridge National Laboratory to receive the National Medal of Technology and Innovation, told some interesting stories in his day. And Oak Ridgers who had worked with him still have stories to tell about the man. Here are a few stories told by Manly during Steve Stow's interview of him in 2003 for ORNL's oral history collection.

A fellow student at Notre Dame dared Manly to ask Jane, then the secretary of the university's Metallurgy Department, for a date. He did, she said yes and they were soon married after that. His major professor at Notre Dame discouraged him from interviewing at ORNL, which had just established a new Metallurgy Division under John Frye. But he came to Oak Ridge for an interview anyway and ORNL hired him in 1949.

When he arrived, he asked for a three-bedroom D house even though he didn't qualify. He convinced the official that he would qualify by saying, "Don't you know a man could marry a woman who already has two children of the opposite sex – and one of them over six years old?"

Manly and his colleagues worked on the metallurgical challenges of the proposed nuclear airplane in the 1950s. They selected lightweight materials for shielding the aircraft reactor (being developed and tested at ORNL) to protect a potential crew from radiation. One problem they encountered was that the Michigan foundry that undertook the difficult task of melting and casting an aluminum-lithium shield for ORNL testing burned down. Another problem was that shielding made the plane too heavy to fly, one of several reasons why the project was terminated in 1961.

On the positive side, Manly told Stow, "The Aircraft Nuclear Propulsion Program built the Metallurgy Division," adding that "I'm most proud of the fact that we built a Metallurgy Division at ORNL. I worked hard to recruit the right people and get the right equipment so we had a number one Metallurgy Division."

As a result of Manly's efforts and the needs of ORNL's effort to build an operating molten salt reactor experiment (which today is still of interest to a few companies and nations), the division acquired a welding and brazing laboratory and groups that did nondestructive testing (to make sure thin tubes for reactor heat exchangers and radiators were flawless) and studied metallic powders and corrosion.

Manly and other metallurgists initially used stainless steel and a nickel-chromium alloy called Inconel as structural materials for the MSRE when they discovered a problem. "The fused salt would extract the chromium, which would react with the uranium fluoride to make chromium fluoride," Manly said, adding that they decided they had to find a better alloy. They sought a new alloy that possessed a certain strength, a certain oxidation resistance and compatibility with fused salts.

"Well, in those days in the 1960s, I was very close to some people at the International Nickel Company research lab up in New Jersey," Manly said. "Arrangements were made for me to go up and talk to the guy who really knew the alloy business. We came up with six alloys that I brought home where our metallurgists did experiments with them. I saw we needed to adjust the chemistry a little bit. So, the next and the last one we made, which we used in the MSRE, was what we called INOR-8." IN stands for International Nickel (INCO), and OR stands for Oak Ridge.

Manly credited ORNL's Hank Inouye with doing much of the development of INOR-8, which was later renamed Hastelloy-N by Haynes International (a company based in Kokomo, Ind., originally called Haynes Stellite, which Manly once headed and which was owned for over two decades by Union Carbide and then Cabot Corporation before becoming a separate company in the late 1980s).

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Haynes International produces the ORNL invention of Hastelloy-N commercially, along with a series of other products in the Hastelloy® family of nickel-chromium-molybdenum alloys. These materials are corrosion resistant and ideal for use in highly aggressive chemical environments at elevated temperatures.

"Hastelloy-N has been used in the Navy's submarine reactors as a canning material for pumps because of its magnetic characteristics," Manly told Stow, stating that this was the first example of Manly's successful efforts at technology transfer. He interacted with companies such as INCO and Superior Tube Company in Morristown, Pa., which manufactured high-quality tubing using alloys developed at ORNL.

One of Manly's best memories came from his ORNL-sponsored visit to the "Atoms for Peace" conference in 1958 in Geneva, Switzerland. His colleague Robert Charpie was tasked by ORNL Director Alvin Weinberg to mobilize electrical engineers and fusion scientists to build a fusion reactor exhibit for the conference. Manly relished his opportunity to show the fusion exhibit to Theodore Hesburgh, the president of Notre Dame University for 35 years. Hesburgh was in Geneva on his way to visit with the Pope.

Many Oak Ridgers remember that, after he retired and moved to Kingston in Roane County, Manly and his wife hosted church and hospital parties at his big house in nearby Kingston with stained glass windows and a swimming pool. That's where his visitors learned that he enjoyed hobbies such as blacksmithing, collecting antique tools and shooting fireworks.

Three Oak Ridgers have recollections about Bill Manly and their experiences in interacting with him as friends and work colleagues.

Bob Clausing, a fellow Presbyterian, worked in Manly's group in the 1950s and 60s. "One of Manly's qualities I appreciated was the many ways he supported his staff. He encouraged those who worked for him to develop their own careers even though this sometimes meant that excellent people moved to opportunities outside his purview and even outside of ORNL.

"I benefited from Manly's caring in another way when I was afflicted with polio. He worked with the director of health division to find the best possible treatment to help me recover the use of my severely affected muscles. A new hospital with great resources was available in Cincinnati. Bill put a mattress in the back of his station wagon and drove me there."

Vinod Sikka, a retired ORNL corporate fellow in ORNL's Metals and Ceramics Division, said that Manly "helped me commercialize a high-strength ferritic alloy, called Grade-91, that I developed in collaboration with Combustion Engineering (now Alstom Power) in Chattanooga. Grade-91, which had sales exceeding \$2-3 billion, was used in superheater and reheater tubing and in steam piping in fossil fuel plants.

"It was manufactured and sold in many countries including Japan, South Korea, India and the United States. It is still one of the most successful examples of technology transfer at ORNL."

Gene Ice, an ORNL corporate fellow and recent director of ORNL's Materials Science and Technology Division who knew that Manly was a legend in the division but had little interaction with him, said he and his wife Rosalyn had been invited once to an annual pig roast at the Manly mansion on Watts Bar Lake. The invitation was arranged by Ice's secretary who was once Manly's secretary.

"We pulled up to an imposing field where cars were being parked as though for a carnival or circus event," Ice said. "We then joined the throngs heading to the mansion with its impressive view of the lake, its museum of metallurgical instruments and its bunkhouse for Boy Scouts.

"I was particularly impressed by the metallurgical tools that almost completely lacked safety features. In

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the center of the event was a sheltered barbeque for the pig. The pig turned on a spit over hot coals creating an intoxicating aroma over the whole grounds.

"We were told that one year the revelers had imbibed a bit too much alcohol and somehow the pig roasting building had caught on fire and burned to the ground, eliminating the main course. Luckily at our visit, the pig was properly roasted and we enjoyed the event immensely."

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Thanks to Carolyn for these stories featuring Bill Manly.



Bill Manly