# Thoughts on Dr. Louis W. Tordella

With the passing of Dr. Louis Tordella, NSA has lost a true professional. Dr. Tordella brought decisive leadership and technical understanding to every issue he faced. He was always ahead of his time on new technologies. He introduced me to one of my passions, personal computers, long before they were common. Although he retired in 1974, he never lost interest in the Agency, our work, and our people. Even after retirement, he routinely brought new people and new technologies to us that could help NSA accomplish its mission. Dr. Tordella contributed more to the way NSA operates and is structured than any other individual. All of us who knew and worked with him respected his talent, decisiveness, and vision. As recently as last May he returned to NSA and participated in our Former Deputy Director's Day. With this memoriam, NSA honors him and the great contributions he made as a visionary, mentor, friend, and colleague.
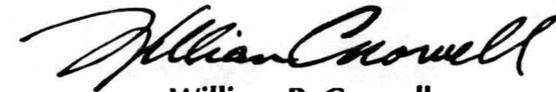
William P. Crowell
Deputy Director

The Education of a Deputy Director

by David A. Hatch

By mid-1941, much of the world was already at war, and it was clear to most that the United States would soon become involved, possibly within a year. The government began expanding the relatively small U.S. Armed Forces and encouraging defense industries; many individuals began to consider how they might aid their country in this time of crisis.

In this situation, in June 1941, a 30-year-old assistant professor of mathematics from Loyola University in Chicago presented himself at U.S. Fifth Army Headquarters in the Windy City. He explained to an arrogant major that he held a doctorate in mathematics, practiced cryptanalysis as a hobby, held an amateur radio license, and wanted to offer his service to his country. However, apparently surmising that the applicant simply wanted the prestige of a direct commission, the major replied, "When we want you, we'll draft you."

Disappointed, Dr. Louis W. Tordella returned to his teaching at Loyola University.

Service to his country in the military was not far off for the assistant professor. As it happened, he and some friends filled out questionnaires on their background and interests circulated by the American Academy of Science. Shortly thereafter, Dr. Tordella received a letter from Laurance Safford, who had organized the first modern naval cryptologic organization. Safford invited the assistant professor to take a correspondence course in cryptology and consider joining the Navy. While taking this course, Dr. Tordella learned that Navy investigators were interviewing his neighbors.

Dr. Louis W. Tordella was an extremely valuable asset, as the Navy quickly recognized. A native of Indiana, he had a doctorate in mathematics from the University of Illinois (with a major in algebra) and 8 years of teaching experience. The Navy was quick to capitalize on his talents: just weeks after he applied for a commission, Dr. Tordella became a Lieutenant (Junior Grade), assigned to the naval cryptologic organization, OP-20-G, in Washington, D.C.

In April 1942 when LTJG Tordella reported to OP-20-G at a "temporary" building on Constitution Avenue in the District of Columbia, OP-20-G was working against the communications of America's principal adversaries, Germany and Japan. The new officer received an 8-hour indoctrination, primarily "on-the-job training," and then immediately stood his first watch—supervising Direction Finding operations.

Dr. Tordella soon joined a team of mathematicians and technicians who sought ways to improve machine processing of German high-level ciphers. Naval cryptologists were working against the German ENIGMA machine, a rotor-based cipher device. The British had had considerable success solving ENIGMA-based messages until the German Navy adopted a four-rotor version.

The three-rotor ENIGMA had been solved with a special purpose processing machine known as the "bombe"; U.S. Naval cryptologists had taken up the challenge of developing a "bombe" capable of solving messages from the four-rotor ENIGMA.

After the new four-rotor "bombe" became operational, Dr. Tordella joined the give-and-take among technical personnel to seek shortcuts to increase processing speed. Eventually, the four-rotor "bombe" reached the "unheard of" speed of 1,300 tests per second.

Perhaps because of his civilian background in amateur radio, in early July 1942 Dr. Tordella was asked to consider a transfer to Bainbridge Island, one of the principal intercept stations against Japanese communications in the continental United States. The work at Bainbridge Island, where he was Assistant Officer in Charge (OIC), required new skills in collection and traffic analysis. On several occasions, Bainbridge Island's Officer in Charge was involved in direct support to the fighting forces, leaving Dr. Tordella as Acting OIC for long periods.

Many enlisted personnel at Bainbridge Island were graduates of elite training in Japanese communications intercept and were known collectively as the "On-the-Roof Gang" (because the location of their training had been atop a Navy building in the District of Columbia). Since many had been engaged in this work since the 1920's, they were highly skilled. Even though he was an officer, Dr. Tordella took intercept courses and on-the-job training conducted by this "gang" to learn the fundamentals of Japanese collection. (Years later, based on this unusual experience for an officer, Dr. Tordella was made an honorary member of the "Gang.")

Sometimes unexpected occurrences offer important opportunities; in 1944 Dr. Tordella turned to good advantage what first seemed like a bad break. In June he returned from Bainbridge Island to Washington, D.C., en route to an overseas posting, only to find that a COMINT old-timer had substituted his own name in the posting. Instead of going overseas, Dr. Tordella was sent to Bell Laboratories in Manhattan for a 12-week course in special processing equipment.

Once the course was completed, he was selected to set up a research and development station for the equipment just studied. Originally intended for use in the South Pacific, it was established in late 1944 at Skaggs Island, near San Francisco. Skaggs Island served as an equipment test station, so that his nearly 2 years of duty there gave Dr. Tordella invaluable experience in equipment design as well as testing; when something didn't work, his unit simply created devices to replace it. Occasional liaison with nearby Army cryptologic units also provided some insight into the changing nature of government cryptology and the necessity for future interservice cooperation.

With the end of the war, Dr. Tordella briefly considered making the Navy his career, but instead chose to join OP-20-G (later the Naval Security Group)

as a civilian mathematician. One important factor in making this decision, he later recalled, was his desire to avoid the frequent family relocations inherent in a military career. However, since he "thoroughly enjoyed the work," he had no doubts about making cryptology his career. (His decision to continue with the government did not mean the end of his academic involvement—Dr. Tordella taught advanced mathematics 2 nights a week at George Washington University until the time of his selection as Deputy Director.)

He returned from the west coast in June 1946 to OP-20-G headquarters, now at Nebraska Avenue in the District of Columbia, and left the Navy in October of that year. Mustering out, he switched his uniform for civilian clothes and reported the next day to the same job at the same desk. Dr. Tordella's vision for cryptologic operations and his management skills to accomplish his vision quickly brought him to the attention of his superiors, and he was given greater responsibilities early.

His early experience as a civilian in naval cryptology involved research and development, particularly in the new field of computers. Some naval personnel who had gained expertise during the war established a new company named Electronic Research Associates (ERA), based in St. Paul, MN. Many of the early advances in computer technology emerged from ERA and contracts or ideas from naval cryptologic research needs. At that time, the Navy conducted much of its specialized electronics research through contractors, and Dr. Tordella conducted extensive interactions with a number of companies. Among them, he supervised the relationship with ERA and became a frequent traveller to St. Paul.

Dr. Tordella's office did extensive development work on the prototype for ATLAS, one of the first general-purpose computers in the Navy; he later estimated that they did as much as 50 percent of the design work for this device. In fact, the very name came out of his office: a yeoman overheard Dr. Tordella and colleagues discussing an appropriate name for the computer and suggested "ATLAS," because of its (then) advanced power.

Building on its wartime cooperation with Great Britain, the United States negotiated a continuing relationship under what became known as the BRUSA Agreement. Both the U.S. Army and Navy sent three representatives to the founding conference; Dr. Tordella, as a civilian, accompanied two Navy captains to the United Kingdom. One additional benefit of his attendance was the bevy of friends he made in the UK cryptologic organization, many of whom he worked with later in his career.

When the Armed Forces Security Agency (AFSA) was formed in 1949 in an attempt to centralize government cryptology, Dr. Tordella transferred to this fledgling organization, again in Research and Development. In 1951, he moved to AFSA's Plans and Policy Organization as deputy chief, with responsibility for communications security (COMSEC) problems. This brought him into frequent contact with LTG Ralph Canine, the second Director of AFSA

(and first Director of NSA, when the National Security Agency succeeded AFSA in 1952). Canine was a tough old soldier, demanding of his subordinates, but also ready to push forward those who excelled in the tasks he assigned them.

One acute problem in AFSA's early days was the lack of centralization in cryptologic equipment among the services, as well as between the services and AFSA. A particularly thorny dilemma revolved around the AFSAM-7, a rotor-based cryptographic device: the Navy wanted one version of the rotor, AFSA another. General Canine was resolved to have uniformity in the equipment. The solution to the problem illustrates the characters of both Dr. Tordella and General Canine.

The Director called Dr. Tordella in and asked for ideas to solve the controversy with the Navy. Dr. Tordella suggested appointing an "AFSAM Czar," with powers to work through the problem. When General Canine asked who might qualify to be this "czar," Dr. Tordella named three individuals. General Canine next asked for a candid review of their strengths and weaknesses; Dr. Tordella provided a rundown on the candidates. Finally, General Canine asked for a single nomination; Dr. Tordella named one of the three finalists. General Canine said that he agreed with the choice, but that Dr. Tordella was to be the "AFSAM Czar."

"What are my orders?" asked the new czar.

"Make it happen," directed the general.

And Dr. Tordella did. The final AFSAM-7 design incorporated a feature allowing it to use either the Navy or the AFSA version of the rotors.

While civilian promotions had been slow in the early days of AFSA, General Canine emphasized the promotion of civilians into the upper ranks of management. The first civilian promoted to Grade 15, a relatively high level in the 1950's, was Dr. Louis W. Tordella.

Dr. Tordella also became the first NSA civilian selected to attend the National War College. At that time, the entire Department of Defense had one civilian allocation for the College, which was awarded on a competitive basis; Dr. Tordella attended for the academic year 1954.

Upon his return from the National War College, Dr. Tordella was appointed chief of a major production organization, a position he held for 2 years. The Director explained that Dr. Tordella had spent a great deal of time in the technical aspect of the business, but needed to acquire production experience. General Canine clearly had marked him for higher things.

After about 2 years in the production organization, Dr. Tordella switched positions with Oliver Kirby, then NSA's liaison at the Pentagon. At the Defense Department Office of Special Operations, Dr. Tordella worked with Graves B. Erskine, a Marine Corps four-star general; Dr. Tordella later recalled him as "no-nonsense." In addition to explaining NSA activities to military and civilian leaders unfamiliar with cryptology, Dr. Tordella had responsibility for budget-

ing, including obtaining funding for NSA computer development.

Among other duties, Dr. Tordella occasionally substituted for General Erskine at community meetings, including the Intelligence Advisory Committee—to which the Director of NSA (DIRNSA) was never invited. It was likely that General Canine was not consoled even when Dr. Tordella assured him that these meetings were merely "talking sessions." Whatever their content, these gatherings were invaluable in getting Dr. Tordella familiar with the inner workings and the people at senior levels in the intelligence and national security communities.

In late July 1958, General Erskine used a flimsy excuse to send Dr. Tordella to confer with the new Director, General John A. Samford. At first the DIRNSA engaged Dr. Tordella in general chit-chat, then explained that he had to select a new deputy and would appreciate Dr. Tordella's viewpoints on what functions the deputy should assume. Dr. Tordella replied that a deputy should be the Director's "alter ego," ready and able to fill in for him when the Director was not available. General Samford approved this concept enthusiastically and offered Dr. Tordella the next Deputy Directorship on the spot. As he later recalled, Dr. Tordella thought about it—"for 3 seconds."

Although he may not have realized it, Dr. Tordella represented expertise and experience in many fields of endeavor not acquired by most NSA seniors. In particular, his work in the Intelligence Community complemented the vision he had always exhibited in managing and improving cryptologic operations. He was clearly the most logical choice for Deputy Director.

NSA had had two civilian Deputy Directors since its founding (AFSA had had military Vice Directors). The first, Joseph Ream, had come from outside the community, and had left after a relatively short tenure.

Dr. Tordella visited Howard Engstrom, the sitting Deputy, and asked him what he did in the position. Engstrom replied that he had never tried to serve as Deputy, that he had spent his time pushing special projects. Engstrom also revealed to his astonished successor that there were virtually no files on the Deputy Directorship to serve as guides to action.

Thus, it fell to Dr. Tordella to define the modern office of NSA Deputy Director, both in theory and practice. In fact, Dr. Tordella set the standards by which the office of "D/DIR" is defined; for the following decade and a half he provided NSA with management stability and continuity in changing and troubled times.

The Plan to Save NSA

by Tom Johnson

Few of us have been here long enough to understand the forces that molded NSA. Even fewer are aware of the threat to NSA's existence during the early years, or of the role that Dr. Louis W. Tordella played in its survival.

A CIA official has called the decade of the 1950's the "Dark Ages" of American SIGINT. The cryptologic organizations that had emerged triumphant from World War II were viewed by "insiders" as shattered hulks of their former selves. By 1952, when Dwight D. Eisenhower was elected President, the Army and Navy cryptologists, who had read virtually every high-level code system of their World War II adversaries, could do this no more. The lack of success contributed to the destruction of the Armed Forces Security Agency (AFSA), which had been created in 1949 to unify the cryptologic business. The "smart money" was betting that the new organization, called the National Security Agency (NSA), would not last much longer than AFSA.

NSA opened its doors in 1952 under siege conditions. Its main non-DOD customers, CIA, and State Department, were skeptical of NSA's prospects, and CIA hedged its own bets by creating a SIGINT system of its own. It lured Frank Rowlett, one of NSA's top people, to its own fold with the unwritten purpose of doing for itself what NSA was chartered to do. It was a "produce or else" atmosphere for NSA. If its stature were not restored, there was a considerable prospect that the Agency would go out of business, and the cryptologic business would again be fragmented and inefficient.

During the remainder of the Eisenhower years (1952-60), a succession of boards and commissions examined NSA to chart progress and assess the chances of success. One board followed another in a seemingly endless succession of examinations. Each of the investigations concluded that cryptology should be further centralized, but the committees believed that high-grade cryptanalysis was too tough a job for NSA. Thus, a movement developed to establish an independent "think tank" that would do all the higher-level mathematics.

Counted among those who believed in NSA's ability to weather the storm was Dr. Tordella. He had been a leader in the effort to centralize cryptology in the late 1940's. A succession of failed experiments, including AFSA, only indicated to Dr. Tordella that the system should be refined, not scrapped. With improvements, centralized cryptology could come out on top. He became an enthusiastic supporter of NSA, and served in a succession of key assignments. After returning from the National War College in 1954 (he was the first NSA civilian ever to attend a war college), he became chief of COLL, the office which managed the worldwide collection system. Later, in 1957, he went to work for a DOD-level office that supervised NSA for the Secretary of Defense

and had the final say in all budgetary matters. In 1958, he was named NSA's third Deputy Director.

Dr. Tordella believed that technology would save NSA. Starting out with the Navy's OP-20-G in World War II, he became an expert in the brand new field of computers. At a time when a true "computer" had yet to be invented, believing in such machines took considerable foresight. He pushed OP-20-G and its successor, the Naval Security Group (NSG), toward exploiting the concepts inherent in computer processing. NSG became involved in leading-edge computer development using "high science" approaches to processing and cryptanalysis. In the early years of the succeeding decade, many of these projects stumbled, and few turned out quite the way NSA had hoped. But Dr. Tordella knew that computers were the way out and continued to force NSA into state-of-the-art machines and concepts.

By the time Dr. Tordella became Deputy Director in 1958, the twin concepts of centralization and high technology were having an effect. NSA had begun succeeding where it had failed earlier. A "blue ribbon" panel headed by Dr. William O. Baker of Bell Laboratories reported to President Eisenhower that NSA was providing the best intelligence in the community. Believing that cryptography had outrun cryptanalysis, Dr. Baker was skeptical of NSA's long-range abilities in codebreaking. (Dr. Tordella, who had worked with Dr. Baker at Bell Laboratories during the war, disagreed with him.) But Dr. Baker pointed to the other things that the SIGINT system was producing as being the most important intelligence available to the chief executive.

Dr. Tordella believed that NSA must itself sponsor research into second-generation computer technology and pushed hard for a new project called "Lightning." The concept of Lightning was to develop new computer technology that would be many times faster than technology then under development. He and others convinced General Canine, NSA's first Director, that an NSA-industry partnership was essential, and Canine obtained $25 million in "seed money" for the project. With this then-unusual sum, NSA went into a partnership with IBM, RCA, and Sperry Rand Univac. The corporations conducted research on cryogenic components, component subminiaturization, and super fast switching devices called tunnel diodes. Although Lightning never resulted in a computer, the research involved was highly innovative and led the way to the application of such concepts in future computers. By the late 1950's, NSA began succeeding in several areas where it had met failure before.

Dr. Tordella also opposed the "think tank" idea. If mathematics at NSA was not strong enough, the right answer was to hire more and better mathematicians, not to farm out the job to a private contractor.

In 1954, James Killian, a Harvard professor who later became the President's science advisor, headed a "surprise attack" panel. Killian believed that more than 90 percent of war warnings would inevitably come from SIGINT. But since

nuclear attack could come in a matter of minutes, it would be necessary to speed up the timeline on SIGINT to beat that clock. From then on, the focus of the SIGINT process was on speed.

The concern was exacerbated following the Soviet launching of Sputnik in 1957. President Eisenhower directed that the Intelligence Community create a system that could get him critical information within minutes. This imposed more pressure on NSA to tailor a responsive system. Once again, Dr. Tordella came up with an answer. That answer was CRITICOMM.

Dr. Tordella took an NSA communications system that was still on the drawing board and fashioned it into a worldwide communications system. Once connected, all the communications pieces would comprise a single net which would be harnessed together by a series of communications relay centers. Those centers would, with a few exceptions, be located at existing field stations overseas. Since war warnings were presumed to emanate from SIGINT, NSA would manage the system. Through a system of automatic relays, the new communications net would be capable of delivering critical information (called "CRITIC") to the President within 10 minutes.

When the paperwork was finished, NSA's Director, General John Samford, and Dr. Tordella were called to the White House to brief the President. Although Dr. Tordella had been Samford's deputy for only a month, he did most of the talking. He described in detail how the system would work and what funding level would be needed. At the end of Dr. Tordella's pitch, President Eisenhower turned to his Deputy Secretary of Defense and said, "Do it." Thus, the CRITICOMM system was born.

In the end, the Agency convinced its detractors, and NSA emerged from the harrowing 1950's with a cryptologic system that closely resembles what we have today. That is, it was tightly centralized, highly technological, and fast. The system that resulted grew from Dr. Tordella's vision of the late 1940's and he did much to make it happen.

When John F. Kennedy became President in 1961, Dr. Tordella had already been NSA's Deputy Director for 2½ years. He would continue to serve for another 14 years, and would outlast seven Directors and five Presidents.

When he retired in 1974, Dr. Tordella had converted the Deputy Director's post from a job to an institution.