A Compilation of Historical Notes

Regarding the Woodbridge Research Facility

Woodbridge, Virginia

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[Note that the following historical information is largely based on informal documents collected and/or prepared by C. Hyslop, WRF Technical Librarian, SLCHD-SD-TL over a number of years.]

A Complete History of the Woodbridge Research Facility

For thousands of years before the first Europeans arrived in America, Indians fished, hunted, and lived on the land now occupied by the Woodbridge Research Facility (WRF). In July of 1608, Captain John Smith of Jamestown, with his companions Dr. Russell, six gentlemen, and seven soldiers, explored the Potomac and Occoquan Rivers; they were the first Europeans to see this land. Smith's travel log says that he reached the confluence of the Potomac River and Occoquan Bay and while exploring there he encountered Native American groups whom he referred to as "Dogue Indians."[1] At that time, dense forests grew to the banks of the rivers and sheltered the native Dogue Indians; the Dogues were of Algonquin stock and were allied to the Piscataway and Anacostan tribes. At a point near the meeting of the Potomac and Occoquan Rivers known as Dogue Island, Captain Smith met with the Dogue king to bargain for corn to feed the people of Jamestown. After his exploration of the Potomac, Captain Smith devised a map of Virginia's lands and rivers which soon led other adventurers into what is now Prince William County.

Although English settlement of the Maryland side of the Potomac River began as early as the late 1630's, settlement of the Virginia side was not as rapid due to fears of Indian attacks. However, the defeat of the Potomac and Dogue groups in 1644 allowed for increased settlement. By 1651, a land patent for the area containing the WRF was given to Richard Turney.[2]

In 1653 Thomas Burbage of Nansemond County, Virginia, received a land grant of approximately 3000 acres, including all the land between the Occoquan Creek on the north and the Neabsco Creek on the south and extended west as far as the present town of Occoquan, except for 400 acres claimed by Robert Hebbard. This area became known as Burbage's Neck[3] and was the first land

grant located in present day Prince William County. Although Burbage owned this new land, he remained in Nansemond County as hostile Indians made life in this frontier area hazardous. When Thomas Burbage died in 1655, his widow, Elizabeth inherited the land and married Captain Edward Streator. The years of 1675-1676 were marked with constant fights and bloodshed between the colonists along the rivers and the remaining Indians but by 1677 the Indians moved to the west side of the Blue Ridge. By 1690 Burbage's Neck had changed ownership several times and was divided into smaller patents. One such patent[4] was owned by Martin Scarlet who had purchased approximately 700 acres of Burbage's Neck from Captain Streator including the land between the Occoquan and the Marumsco Creeks on which the Woodbridge Research Facility is now located. Martin Scarlet named this property the Deep Hole Estate[5] and it is believed that the name, Deep Hole, comes from an artesian spring located on the property[6].

Martin Scarlet lived on this land while serving as a representative for the County of Stafford (Prince William County was formed from Stafford County in 1731) in the House of Burgesses from 1680 to 1695 and as a Justice of the County Court[7, 8]. He was a gentleman of considerable importance. Martin Scarlet was a neighbor and political associate of such men as George Mason, John Washington, and William Fitzhugh. In 1691 Scarlet stated in a court hearing that he had "lived in this County of Stafford for near 30 years..."[9]. He died in 1695 and was buried in a cemetery on Deep Hole Farm[10].

Through the years the site of the early colonial cemetery on Deep Hole Farm has disappeared but two gravestones have survived. These stones were considered too large to be useful by a farmer who removed the other tombstones to form the foundation of a barn. For many years these two stones were used as boundary markers at points where property lines met, but have now been

placed under a tree near the picnic area of the Woodbridge Research Facility along the Occoquan River. The Scarlet tombstones dating from 1695 are situated close to the water's edge, and remnants of the original home associated with the graves may be uncovered nearby.[11] Oral tradition asserts that the original location of the Scarlet cemetery was along the water's edge, somewhere between Taylor's Point and Deephole Point and this location is noted as 44PW79 in the archaeological site survey records of the Virginia Division of Historic Resources. However, the headstones were subsequently removed, used as a foundation for a barn, and eventually discarded into the Occoquan River. The headstones were later "rediscovered" in the river and placed in their current location.[12] Although one stone is illegible, the inscription on the other reads, "M. S. 1695. Here lyes Martin Scarelt, Gentleman." The correct spelling of the name is Scarlet or Scarlett, but his monument has endured almost 300 years with his name misspelled. The second tombstone inscription was recorded by Mr. Henry J. Hutton in 1902 as "Here lyes ye body of ... Scarlett Gent ... Scarlett Gent. Married Febry. ... Died ... 1698." Research done by the Virginia WPA in the 1930's fills in some of the blanks: "Here lyes ye body of John Scarlett Gent. son of Martin Scarlett Gent." This stone was probably a table stone with a skull and crossbones design at the top and an hourglass below the inscription[13].

Scarlet's widow, Ann Green Scarlet, inherited some 740 acres which included the Deep Hole Estate. At the death of Ann's son, Joshua Green, the portion of Scarlet estate known as Deep Hole was inherited by Lettice Green Smith[14], Joshua's sister. In 1765 John Hancock, great-grandson of Lettice, sold Deep Hole Farm and other properties to Colonel John Taylor[15], who called all the land he owned between the Occoquan River and Neabsco Creek Deep Hole Plantation.

Deep Hole Farm was primarily a tobacco plantation until the

mid-1700's when the value of grain crops increased and the value of tobacco began to fluctuate. Tobacco was so important during the early years of Virginia that it was an accepted form of currency. In 1739, a 375-acre tract adjacent to Deep Hole Farm sold for 3500 pounds of tobacco[16]. Following the American Revolution, the economy of the Woodbridge area began a slow decline. Several factors appear to have contributed to this, among them the reduction in soil fertility from continual tobacco crops and the silting-in of harbors due to stripping of surface cover and plowing techniques of the 17th and 18th centuries.[17]

After his purchase of Deep Hole in 1765, Colonel Taylor developed the marsh area at the mouth of Marumsco Creek on the south edge of the present WRF site into a fishery. Fish were harvested in quantity at this location, then cleaned, salted, and packed. Barrels of dried and salted herring and other fish were packed away to feed the household during the winter months or to sell or trade when a surplus was available. Fisheries, including one on the southern edge of the Woodbridge facility, were important economically and are located on Civil War-era maps.[18]

Martin Scarlet and Colonel Taylor each ran ferries from Deep Hole Point to Sandy Point on the end of Mason's Neck, providing a means of crossing the Occoquan; the first bridge was not built until after 1795[19]. The main road crossed Occoquan Creek at the village of Occoquan. This road replaced the earlier one, which crossed by ferry at Colchester.[20]

The Taylor family owned this land for almost a century during a period of expansion and development. Deep Hole was close to the center of local society. It was ideally situated with water access on two sides for transportation and shipping and land access nearby. Approximately one quarter mile north of the Woodbridge Research Facility site ran the Potomac Path, an ancient Indian trail that was readily used by settlers when land

transportation was necessary. The Potomac Path remained the major land route from Alexandria to Fredericksburg; all the early public buildings, such as churches and ordinaries (taverns), were built along this road. The first court house of Prince William County was built at the point where the Potomac Path reached the Occoquan. By 1773 it was an official mail route, designated the King's Highway, but it played its most important role during the Revolutionary War. Rochambeau and Washington traveled from Mount Vernon to Williamsburg on the Potomac Path en route to Yorktown, and the entire French expeditionary force marched to and from Yorktown along this road[21].

In 1854 the executors of the Taylor estate sold Deep Hole[22] to Issac Newton, who in 1860 conveyed the land to Dr. William Musser. The Confederate blockade of the Potomac in 1861-1862 brought war ships into the area, patrolling the Potomac and the Occoquan[23]. A report of 16 November 1861 from Union General Hooker included a letter written by Confederate General W.H.C. Whiting stating, "[Union] General Sickles' division will land in force at Deep Hole."[24] General Hooker's report indicated that he knew Confederate General Whiting was anticipating an attack on the Confederate forts along the Potomac to break the blockade.

An 1861 aerial map of the Quantico-Woodbridge section of Virginia as seen from Thaddeus Lowe's balloon showed several Civil War encampment sites.[25] During the Civil War, Confederate batteries were constructed in the vicinity of the Woodbridge facility.[26] The Topographic Engineers Office of the U.S. Army mapped this area in January 1862 while surveying the defense possibilities. The surviving map, while carefully drawn, contains many errors in place names because the Union engineers relied on local residents to identify landmarks. A comparison of the 1862 map and the 1956 map will show that Deep Hole Point and Taylor Point have swapped places and the Marumsco Creek was misrecorded as May Rumsco Creek.

William Metzger[27] from Pennsylvania, locally regarded as a "carpetbagger",[28] acquired Deep Hole in 1888 and operated it as a hog farm. On Metzger's death in 1909, Deep Hole Farm was conveyed to John Lindsay Dawson of Fairfax County[29]; it remained in the Dawson family until 1949[30]. The Dawson family employed year-round tenants and raised Angus cattle and wheat that were traded in Charlottesville markets. During the spring months, a fishery was operated at Deep Hole Point where fresh shad, rockfish, and perch were packed and stored at an ice house for ultimate shipment to Washington, D.C.[31] Dawson Beach and Dawson Beach Road take their names from this family; Dawson Beach was a favorite recreation spot for local residents as late as the early 1940's[32]. The last remaining structure (pre-U.S. Army occupation of the WRF), the Dawson farmhouse, burned down in 1968. There are building foundations still remaining on the northern portion of the Woodbridge facility.[33]

In 1950 the Department of the Army purchased 648.61 acres known as Deep Hole Farm for a transmitting station and has retained ownership of the property since then.[34] An alignment for a road access to the site required an additional purchase of 0.07 acres in 1951, bringing the total fee owned acreage to 648.68 acres. In 1952, the site was designated as the Dept. of the Army Transmitting Station under the US Army Command and Administrative Communications Agency, Chief Signal Officer. The Station became one of the largest communications facilities in the world.[35]

Army personnel which operated and maintained the transmitting activity on the Deep Hole Farm site during the 1950-1969 period were members of the Strategic Communications Command of the Continental United States (STRATCOM-CONUS). STRATCOM-CONUS troops and troop units charged with major STRATCOM facilities within the Continental United States are descended from the 17th Signal Service Company that was activated to

operate the stations of the War Department Radio Net, created in the 1920's.

The War Dept. Radio Net grew rapidly and became World Wide in World War II, and was redesignated ACAN (the Army Command and Administrative Network). The 17th Signal Service Company, greatly over strength (over 1000 men) operated stations at many sites overseas as well as in the U.S.

In 1947 the Company became the 9423rd Technical Service Unit, TSU, and supported the Army Command and Administrative Communications Agency, ACACA, that was created that year as a Class II field activity under the Army Communications Service Division of the Office of the Chief Signal Officer. Among the major tasks of the 9423rd TSU was the operation of the big Pentagon Communications Center and supporting radio transmitting and receiving stations in the Washington area. Detachment No. 1 operated the transmitter station that had been activated at Woodbridge Virginia on 19 May 1952 (replacing an earlier transmitter site at Battery Cove, VA near Alexandria), Detachment No. 2 operated communications for the White House (this activity became the White House Army Signal Agency on 1 May 1954), Detachment No. 3 operated the receiver station at La Plata, Maryland.

In the 1957-1958 era, ACACA became redesignated USACA the U.S. Army Communications Agency, still a Class II field activity of the Chief Signal Office.[36, 37, 38]

In November 1960, the Chesapeake and Potomac Telephone Co. of Virginia was granted the right to construct, operate, and maintain an equipment building and install an underground cable (East Coast Relay Cable) on the Woodbridge Facility.[39]

In 1962, following a major Army reorganization, the Station

was redesignated the US Army CONUS Regional Communications Command, East Coast Radio Transmitting Station, Woodbridge, Virginia. In 1965, the station was placed under the US Army Strategic Communications Command, CONUS (USA STRATCOM-CONUS).[40]

The most notable closeouts were the big HF radio stations which the Army had maintained and operated since World War II at Woodbridge, Virginia (the transmitter site) and at La Plata, MD (the receiver site). Both were located in the outskirts of Washington D.C. Among the big transmitters that closed down at Woodbridge were the Kathryn system of long-range high-power transmission that had been developed years earlier along with other special transmitters such as the Lincoln Labs F9C and the RAKE systems to circumvent or get through enemy jamming and to provide relatively dependable high frequency communications.[41]

The dismantling of these sizable Army radio facilities resulted from a decision of the Secretary of Defense on 18 February 1969 to consolidate all HF radio services in the Washington area at existing Air Force and Navy sites. Although a few circuits remained in operation at the Woodbridge and La Plata stations till the end of June, STRATCOM-CONUS had begun dismantling as early as 24 April 1969 and completed the job by 30 August 1969, disposing of the equipment and the many antenna arrays (most notable was the fantastically huge TAHA, Tapered Aperture Horn Antenna, at Woodbridge)[42, 43].

As old ways of doing things thus changed or disappeared STRATCOM-CONUS energies diverted into new, still larger developments especially in the Washington area where Army and DoD headquarters growth was spilling out of the Pentagon and filling up large newly constructed buildings nearby. These were principally the Forrestal Building in D.C. itself and the Hoffman Building in Alexandria, VA[44].

In the summer of 1966, members of the Northern Virginia Chapter of the Archeological Society of Virginia obtained permission to excavate a colonial midden, or trash pit, found on the Woodbridge Research Facility near the pitcher's mound on the softball field of the present day picnic area. The artifacts currently on display in the main conference room of building 201 at the Woodbridge Research Facility were recovered at this time and were identified and dated by Ivor Nole-Hume, noted expert from the Colonial Williamsburg Foundation, and Alexandria Archeology. The items show a possible time range of 1680-1740. A detailed analysis of the pipe stems recovered yielded a mean date of 1725. Artifacts found during this study have been made available for display by the Prince William County Archeologist, Jan Townsend. Note that during a subsequent field examination of the property, undertaken in late-1991, a colonial pipe stem was found in an undisturbed section of earth in the same area as the earlier 1966 excavation. These artifacts further support the theory that this was the location of the 17th century Scarlet farmhouse.[45]

Between July 1969 and July 1970, the military radio station at Woodbridge remained inactive; however, on July 1, 1970, 641.68 fee owned acres were transferred to the U.S. Army Materiel Command (USAMC). The isolation of the facility and the moisture content of the soil for grounding purposes led to its use as an electromagnetic pulse (EMP) development and test site. The facility was designated the USAMC Woodbridge Research Facility, Woodbridge, Virginia. Also in 1970, 7 acres of the Woodbridge Housing Site were transferred to the U.S. Army Engineer Center and Fort Belvoir, VA (USAECFB) to provide off-base housing for enlisted personnel stationed at the nearby Ft. Belvoir Army facility. In July 1971, Harry Diamond Laboratories acquired the roughly 642 acres of land and 49,678 square feet of permanent buildings on the facility from the U.S. Army Mobility Equipment Research and Development Command (MERDC) as part of a

consolidation of USAMC nuclear weapons effects research and test activities. This consolidation was initiated by written recommendations from HQ, US Army MERDC in May 1970. The Electromagnetic Effects Laboratory, originally part of MERDC based at the Fort Belvoir Engineer Proving Ground, subsequently relocated to the Woodbridge Research Facility in September of 1971. In 1972, the Woodbridge Tie Cable (portion of C&P Telephone's East Coast Relay Cable placed in Nov. 1960) was removed from the conduit and manholes near the WRF's main entrance. The equipment building supporting this communications cable was abandoned in place and now serves as the Visitor Control Building, Bldg 101. In December 1972, 62.83 acres along Marumsco Creek were excessed and in August 1973, were transferred to the Department of the Interior, Bureau of Sports, Fisheries, and Wildlife. This acreage is used for wildlife conservation and is known as the Marumsco National Wildlife Refuge, which falls under the auspices of the U.S. Fish and Wildlife Service, National Wildlife Refuge System.[46] The Woodbridge Research Facility is on the approximately 578 acres that the Department of the Army has retained to date. The acres of open land and woods on the Woodbridge Research Facility make it an ideal home for many species of wildlife. It is also a favorite stopping place for migratory birds in spring and fall.

The Woodbridge Research Facility (WRF) is a satellite facility of Harry Diamond Laboratories, 2800 Powder Mill Road, Adelphi, MD 20783 (HDL). The Harry Diamond Laboratories are part of the U.S. Army Laboratory Command (LABCOM) which is a major subordinate command of the U.S. Army Materiel Command (AMC).

The primary mission of the Woodbridge Research Facility is to conduct investigations into the simulated effects of ElectroMagnetic Pulse (EMP) normally generated by a nuclear detonation, on strategic and tactical electrical and electronic systems. In addition it has the responsibility for developing

and operating simulators that provide the EMP environment for testing permanent installations as well as mobile military systems.[47]

For an explosion at 200 miles above the center of the (conterminous) United States, almost the whole country, as well as parts of Canada and Mexico, could be affected by the EMP.[48] The reality of damage to electrical and electronic equipment by the EMP has been established in various nuclear tests and by the use of EMP simulators. A number of failures in civilian electrical systems were reported to have been caused by the EMP from the high-altitude test explosions conducted in the Johnston Island area of the Pacific Ocean in 1962. One of the best authenticated cases was the simultaneous failure of 30 strings (series-connected loops) of street lights on the Hawaiian island of Oahu, at a distance of some 800 miles from ground zero. It was also reported that "hundreds" of burglar alarms in Honolulu began ringing and that many circuit breakers in power lines were opened.[49] Since the cessation of atmospheric weapons tests, heavy reliance has been placed on simulation to test the hardness of systems. Large-scale simulators are required for the final test of large systems. The two principal kinds of large simulators are metallic structures that guide an electromagnetic wave past a test object, and antennas that radiate an electromagnetic field to the object.[50]

With HDL being designated as the Army's lead laboratory for nuclear weapons effects research and development activities, WRF has been used for field test vulnerability assessments of new and fielded tactical systems to nuclear weapons effects. These assessments provide data for the development of hardening techniques to insure survivability of critical Army systems during and after a nuclear exchange. Actual nuclear testing would require exoatmospheric nuclear detonations which are now prohibited. While the principle threat from EMP is a product of

an exoatmospheric nuclear detonation, it can be simulated by means of high voltage testing equipment. The testing is a part of the overall mission and influences the engineering and fabrication of various means to harden the weapons and communications systems to exoatmospheric electromagnetic effects. WRF basic applications research involves EMP environment generation and prediction through analytical studies and computer modeling. The objectives of this research are to define the potential EMP environments associated with realistic tactical burst conditions and to develop the criteria for assessing a system's vulnerability to tactical threats.[51]

Five EMP simulators have been operated at the WRF to support research and development efforts over the period from 1971 to 1988. These simulators are the Biconic simulator, the Army EMP Simulator Operation (AESOP), the Repetitive EMP Simulator (REPS), the Vertical EMP Simulator (VEMPS), and the Suitcase Pulser. The first high-altitude type EMP simulator built at WRF, the Biconic simulator, became operational in 1971. This simulator later was decommissioned in 1976. To fulfill ongoing mission requirements, HDL is in the process of developing the VEMPS II, a new-generation EMP simulator.

AESOP was operated at WRF from 1974 to 1988. The simulator is a fixed, high-level simulator that is designed to test large transportable and mobile military equipment. AESOP produces horizontally polarized, high-altitude type electromagnetic pulses in the designated test volumes. At 50 meters from the simulator, the output level can range from 20 to 50 kilovolts per meter (kV/m). The simulator consists of a support structure 30 meters high and a 7 million volt (MV) pulse generator located between two antenna halves, each of which is 150 meters long.

REPS was operated at the WRF from 1976 to 1988. The simulator is a transportable, low-level simulator capable of

single shot or repetitive pulse operation. REPS is designed to test large fixed, mobile, and transportable military systems. The simulator produces horizontally polarized, high-altitude type electromagnetic pulses with a peak intensity of 8 kV/m at a distance of 50 meters from the simulator. The support structure, the pulse generator, and the antenna can be easily disassembled into subassemblies, which can be transported by truck or rail. The support structure consists of a system of wooden poles 20 meters in height. A 1.6 MV pulse generator is located between the antenna halves, each of which is 150 meters long.

VEMPS was operated at WRF from 1980 to 1988. VEMPS is a low-level simulator designed to support tests that require predominantly vertically polarized fields on portable military communications equipment. Vertically polarized EMP is differentiated because of its greater coupling effect with vertical objects, such as vertical antennas. The VEMPS simulator produces vertically polarized, high-altitude type electromagnetic pulses with a peak intensity of 1 kV/m at a distance of 50 meters from the simulator. The simulator consists of a simple wooden structure, an 80 kV pulse generator, and a 20 meter high vertical antenna.

The Suitcase Pulser was operated occasionally at WRF and at other locations from 1978 to 1988. The simulator is a miniature, transportable, low-level high-altitude type EMP simulator. It is designed to be fully self-contained and transportable so that it can be set up in one hour or less at a remote location. It is designed to perform diagnostic tests on fixed military facilities (buildings). The Suitcase Pulser can be configured to produce horizontally and vertically polarized, high-altitude type electromagnetic pulses with a peak intensity 0.8 kV/m at a distance of 50 meters from the simulator. The simulator consists of a 125 kV pulse generator and a 30-meter dipole antenna.

The VEMPS II simulator, currently in development, has not been constructed. The simulator is designed to be a fixed, large-area simulator to test large transportable and mobile military equipment. The VEMPS II simulator is designed to produce vertically polarized, high-altitude type electromagnetic pulses with a maximum peak intensity of 30 to 90 kV/m at a range of 50 meters. The simulator will consist of a support structure for the 7 MV pulse generator and a vertically oriented biconic antenna 15 meters long both above and below the pulse generator. It will be 49 meters in diameter and 30 meters high.[52]

On March 10, 1987, litigation[53] was brought against the U.S. Department of Defense (DOD) on the basis that existing National Environmental Policy Act (NEPA) documentation for their EMP simulators was inadequate. In April of 1988, in response to this litigation, the Army suspended all EMP simulator operations nationwide[54] and began preparation of appropriate NEPA documentation for their operations, including the operations at the WRF. On 16 May 1988, a "Stipulation and Order of Dismissal" to the aforementioned civil suit was filed with the Clerk, U.S. District Court, District of Columbia.[55] This settlement documented the agreements reached between the DOD and the plaintiffs regarding the resumption of EMP simulator operations at various installations throughout CONUS. A Draft Environmental Impact Statement (DEIS) was initiated for the operation of the EMP simulators at the WRF; however, it was not completed. On 12 July 1989, the Army announced a proposal to relocate the WRF EMP simulators to a new site, citing the following reasons: the need to continue EMP testing in accordance with Army requirements, the desire to use the economics of co-location of test operations, and the concern to adjust to the rapidly expanding population in the Woodbridge and Northern Virginia areas.[56]

On July 1, 1991, the Base Realignment And Closure (BRAC) commission recommended,[57] and the President subsequently

approved, the closure of the Woodbridge Research Facility and the transfer of mission elements to the Adelphi Laboratory Center, Adelphi, MD. On July 2, 1991, Prince William County signed a four-year lease with the Dept. of the Army on the 7-acre parcel of land adjoining the WRF (formerly known as the Woodbridge Housing Site) for $1 a year to provide housing for homeless families.[58]

In May 1992, a Memorandum of Agreement (MOA) was executed between the Commanding General (CG) LABCOM and the CG for the White Sands Missile Range (WSMR), Test and Evaluation Command (TECOM) to transfer the ownership of the LABCOM/HDL EMP simulators to the Nuclear Effects Directorate (NED) at the WSMR.[59] Selection of a final site on which to reconstitute these facilities and to construct the new VEMPS II facility is awaiting a Record of Decision (ROD) for the ongoing Relocation EIS and is expected to occur in December 1992/January 1993.

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55. Civil Action No. 87-0642-JGP; Foundation on Economic Trends, et al. (Plaintiffs) vs Casper W. Weinberger, et al. (Defendants); filed with Clerk, U.S. District Court, District of Columbia, May 16, 1988.
56. Harry Diamond Laboratories Command Information Bulletin, subject: Army announces relocation of EMP simulators from WRF; work force to remain at Woodbridge. Dated July 13, 1989.
57. Defense Base Closure and Realignment Commission Report to the President, July 1, 1991, pages 5-12 thru 5-13.
58. "County might want military land" by Joseph Curl, The Prince William Journal, July 10-11, 1991.
59. Memorandum of Agreement between the U.S. Army Laboratory Command/Harry Diamond Laboratories and the U.S. Army Test and Evaluation Command, dated 26 May 1992.

AN ANALYSIS OF

COLD WAR SIGNIFICANCE

WOODBRIDGE RESEARCH FACILITY
WOODBRIDGE, VIRGINIA

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AN ANALYSIS OF THE COLD WAR SIGNIFICANCE OF THE WOODBRIDGE RESEARCH FACILITY OPERATIONS

Perhaps the single most memorable facet of the Cold War is the possession of a tactical and strategic nuclear weapons capability by both sides and the ensuing escalation of inventories. The extreme destructive capability of a single warhead had been previously twice demonstrated to the world in the cases of Hiroshima and Nagasaki, Japan. This situation was further exacerbated by the conflicting ideologies of capitalism and communism and the repeated attempts by both factions to politically, militarily, and economically influence the development of third world nations.

Research into the military possibilities (offensive and defensive) of nuclear devices continued throughout the Cold War era. The atmospheric detonation of a nuclear device during the Johnston Island experiments demonstrated the effect of electromagnetic pulse (EMP) on the Hawaiian island of Oahu at a distance of 800 miles. This single event, perhaps more than any other, prompted the start of research into the effects of electromagnetic pulse on military and (critical) civilian electronic systems.

As research (primarily from above-ground testing) into the effects of nuclear weapons progressed, the world population began to develop a better understanding of the long-term impacts of nuclear residue on the earth's environment. Following the enactment of the treaty prohibiting above-ground detonation of these devices, scientists were forced to turn to other methods of directly studying the effects of EMP on electronic systems. At the same time, military (and commercial) electronic systems were undergoing a revolution in microelectronics technology; transitioning from the vacuum tube to the transistor. This new transistorized technology offered enhanced performance at reduced

cost and size. The drawback to adopting this new technology from a military standpoint was that the transistor was inherently more vulnerable to the effects of EMP.

As the understanding of the severity and breadth of the EMP interaction with advanced electronic systems developed, scientists turned initially to computers for help in determining system vulnerabilities. The problem with utilizing computer systems in these roles was that the computer technology was lagging slightly behind the development of military and consumer electronics, most possibly due to the smaller commercial market for the computer at that time. Additionally, the smaller electronic packaging that the transistor offered, provided military system developers with the ability to develop even more complex systems which could fit into the same volume as a reduced capability system using the older tube technology. This increased level of system complexity soon proved to be cost ineffective to evaluate EMP susceptibility using the largest of available computers. Although computer modelling techniques and capabilities have improved substantially over the years, these models are still insufficient to accurately assess system survivability by themselves.

The military eventually decided that it could not abide with the cost and uncertainty of determining system survivability relying solely on the rudimentary analyses being performed on computer systems. Scientists turned to alternative means of simulating the desired electromagnetic environment through the development of high-voltage generators and antennas for exposing a potential test object and directly recording the object's response. As the ease and cost effectiveness of these simulators improved, each of the various military departments began to develop simulators tailor-designed to their individual mission scenarios. For instance, the Navy incorporated a water environment into their facilities; the Air Force built facilities

which attempted to isolate test objects from EM wave interaction with the ground (simulating in-flight conditions); and, the Army developed facilities which included EM wave interaction with varied ground conditions (dry and/or wet earth, sand, etc.).

With respect to the Army's facilities, we have already pointed out their design significance as opposed to the other Navy and Air Force simulators. In addition, two separate major subordinate commands within the Army emerged with varied mission requirements and facilities; these were the U.S. Army Laboratory Command (LABCOM) and the U.S. Army Test and Evaluation Command (TECOM). Briefly, the mission of LABCOM is to perform the research and development aspects of nuclear survivability in a timely fashion so as to cost effectively impact the hardening of military (Army) systems while still in the pre-production line (prototype) stages. The TECOM mission is then to provide the appropriate test and evaluation activities to ensure that nuclear survivability has been properly incorporated into military (Army) systems.

Historically speaking, the TECOM has operated one EMP simulator in varying form through the years, now known as the WESTA (White Sands EMP System Test Array) which produces a threat-relatable EMP field over a limited volume (13.4m x 13.4m x 15.5m). The limitation on the WESTA test volume is principally due to the design of the simulator's antenna which is of the bounded-wave variety, implying that the test object must be contained within the two conductive plates forming the antenna. In the case of the WESTA, a multi-horned array is used as one plate and the soil below is used as the bottom plate. On the other hand, LABCOM has operated the AESOP (Army EMP Simulator Operations) facility at their Woodbridge site which produces threat-relatable fields over a significantly larger test volume (unobstructed out to 200m range from the antenna). The AESOP antenna is a horizontally polarized dipole structure, 300m in

overall length and elevated up to 20m above the ground. The AESOP facility provides the largest free-field radiating horizontally polarized EMP environment available in the free-world for testing mobile and/or transportable ground-based electronic systems.

The Army has recently announced its plans to relocate the LABCOM/Woodbridge EMP facilities to a remote western U.S. site. Subsequently, a memorandum of agreement has been signed to transfer ownership of the LABCOM/Woodbridge EMP simulators to the TECOM Nuclear Effects Directorate (NED) located at the White Sands Missile Range (WSMR), NM. LABCOM is developing an Environmental Impact Statement (EIS) for the relocation of these EMP simulators with a site selection for facility reconstitution scheduled for Dec. 1992 or Jan. 1993.

WHAT'S SIGNIFICANT ABOUT THE WRF FACILITIES:

1. The WRF EMP simulation facilities have been used for many years (1971-1988) to conduct system vulnerability assessments to the simulated electromagnetic pulse environment resulting from the detonation of a nuclear device at high-altitudes above the earth.
2. The data resulting from years of test operations using the WRF EMP simulation facilities has contributed to substantial cost savings in impacting system hardening during the early stages of military system development.
3. Many military systems (primarily Army) in the current DOD inventory have been tested for EMP vulnerability using the WRF EMP simulation facilities. Perhaps the most notable of these would be the M-1 tank, the U.S. Army's main battle tank, recently employed in Operation Desert Storm.

WHAT'S UNIQUE ABOUT THE WRF FACILITIES:

1. The AESOP EMP simulator provides the largest free-field radiating, horizontally polarized EMP environment available for conducting tests on mobile and/or transportable electronic systems.
2. The WRF EMP simulation facilities represent the majority of EMP simulation facilities in the U.S. Army inventory. These facilities are unique in design amongst all of the DoD facilities and in fact all of the world. That is to say that no two EMP simulators, to my knowledge, are identical. EMP simulators are designed differently from one another to support different mission requirements or testing scenarios.