Background and Project Plan

For

Russian START Treaty SLBM Telemetry Processor Exhibit for the National Cryptologic Museum

By

Richard L. Bernard

Acquisition Team Representative

National Cryptologic Museum Foundation

November 2016

Soviet/Russian START SLBM Telemetry Data Processor

Table of Contents

Topic	Page
Introduction and Overview	3
Aspects of the 1991 USSR/U.S. START Treaty	4
Data Processing Process and Equipment History	7
References and Background Information	10

Russian Developed START Treaty Logo

Russian Federation - Ministry Of Defense

Offensive Weapons Agreement Logo

Introduction and Overview

An opportunity has presented itself to create an outstanding National Cryptologic Museum (NCM) exhibit that portrays the critical results from the processing and analysis of Soviet/Russian (hereafter referred to as Russian) provided missile test telemetry data tapes to the U.S. under the START Regime from December 5, 1994 through December 2009. Three complete units of Russian magnetic tape playback units and related data processing equipment have been decommissioned and are available to the National Cryptologic Museum Foundation (NCMF). The three Russian data processing sets are UNCLASSIFIED, are not listed on any U.S. Government property account, and are available to be donated to the National Cryptologic Museum Foundation and then provided to the NCM.

Several mid-level managers at applicable U.S. government agencies have indicated that they have no operational requirements for the units. Additionally, the Russians have not asked for the units to be returned. Informal discussions with U.S. government elements associated with the START efforts agree that inclusion in a National Cryptologic Museum exhibit would be appropriate location for the unclassified units.

The NCM Curator, Mr. Patrick Weadon, strongly supports this proposal for a NCM display of one of the START data processor units. Such a display would be a significant addition to the Museum and he is planning space for the SLBM data conversion unit within the Museum's Cold War section. The other two units would be retained in the NCM storage location until the new NCM is completed, and may be loaned to other intelligence museums in the interim if so requested.

The telemetric processing aspects of the Treaty contributed significantly to the verification that any new, or modified, Russian remaining strategic missile capabilities were within the technical limits of the treaty.

U.S. Department of State July 16, 2009 release by the Bureau of Verification Compliance and Implementation document "The Legacy of START and Related U.S. Policies" noted that the START Treaty reduced the USSR, and related parties, warheads attributed to deployed ICBMs and SLBMs (and deployed heavy bombers) from 9,584 in December 5, 1994, to 3,909 in January 1, 2009. (Ref 4)

Aspects of the 1991 USSR/US START Treaty

A crucial aspect of understanding the capabilities of intercontinental ballistic missiles is to obtain and analyze the missile performance from test launches. This provides an understanding of expected missile performance when the system enters operation. During the Cold War between the Soviet Union and the United States, few topics were higher priority in the U.S. Intelligence Community than understanding Soviet Inter-Continental Ballistic Missile (ICBM) and Submarine-Launched Ballistic Missile (SLBM) performance. Normally this required U.S. aircraft, ships, land sites, and satellites (referred to as National Technical Means in Treaty documents) to receive and record the events and any emanated signals for future U.S. processing and analysis.

A major milestone was reached during May 1972, when President Nixon and General Secretary Brezhnev signed the **"Interim Agreement between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitations of Strategic Offensive Arms."** This became known as SALT I and entered into force in October 1972. Article V (of VIII) of the interim SALT agreement stated in part***: "Each party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provision of this Interim Agreement. This obligation sha*****ll not require changes in current construction, assembly, conversion, or overhaul practices."** (Ref 1)

As is often the case with diplomatic language, some of the terms were necessarily vague. In particular, the term "national technical means" was probably intentionally left to the imagination. The interim agreement was accompanied by a number of "agreed statements, common understandings, and unilateral statements regarding the basic topic. Discussions continued under Presidents Ford and Carter and culminated during June 1979 when President Carter and General Secretary Brezhnev signed the SALT II agreement (with minor word changes to make it clear that the "telemetric information" segment was a part of the treaty) and added a "Second Common Understanding" which reads as follows: ***"Each party is free to use various methods of transmitting telemetric information during testing, including its encryption, except that, in accordance with the provisions of paragraph 3 of Article XV of the Treaty, neither Party shall engage in deliberate denial of telemetric information, such as through the use of telemetry encryption, whenever such denial impedes verification of compliance with the provisions of the Treaty."*** *(Ref 2)*

During the SALT I and SALT II Treaties the U.S. could only collect telemetry from Russian ICBM and SLBM missile tests that were within range of U.S. assets such as ground stations, mobile platforms or other ***"National Technical Means."***

With the end of the Cold War during 1991, the U.S. and the USSR entered into a new treaty - the ***"Strategic Arms Reduction Treaty"*** abbreviated START (Ref 3). It was signed on July 31, 1991. This treaty included a "Telemetry Protocol" that called for the exchange of very specific

telemetric data on certain ICBM and submarine-launched ballistic missile (SLBM) tests conducted by each party. The data was to be exchanged on magnetic tapes that contained all of the telemetric data broadcast during the designated flight test. The treaty also contained limitations on the use of encryption. Under this provision complete telemetric data sets were provided to the U.S. directly by Russia for ICBMs and SLBMs covered under START. Within the U. S. the telemetric data was routed to the National Security Agency for processing on Russia-supplied tape and data processing units.

The START SLBM Russian tape and data processing unit consists of two recording mechanisms and the electronic equipment that was necessary for the U.S. playback and duplication of the Russian 20 channel magnetic tapes. Other than the electric power cables, all cabling for this unit was self-contained. This unit was used on Russian ships or submarines; it was spring mounted so that the movement of the ship among the waves would not interfere with the recording. This unit came with floor stands for use in a laboratory environment. The other two Russian tape processing units for ICBM/SLBM telemetry were constructed in conventional equipment "racks" similar to U.S. land based magnetic tape telemetry data processing equipment. Photographs of these two units are presented later in this document,

The photograph below is the SLBM data processing unit provided to the U.S., along with documentation, training, and spare parts to use under the START provisions. Note the magnetic tape and data processor on the left side of this unit. This is the playback drive that enabled the U.S. to process the signals recorded by the USSR from their own test launched SLBM missiles. The Treaty included specific instructions to the USSR and the U.S. on how to provide data copies to either party.

START SLBM Data Processor Unit
(Constructed for seaborne environmental operations)

Data Processing Process and Equipment History

Introduction

The START telemetry processing effort was created to process tapes received in accordance with the START treaty between the United States and Russia. The Treaty was signed during 1991 and ratified in 1993. The START Treaty applied to specific nuclear Intercontinental Ballistic Missiles (ICBMs) and Submarine-Launched Ballistic Missiles (SLBMs) controlled by United States, and the Russian Federation, including the Ukraine, Belarus, and Kazakhstan.

Any time Russian conducted a Treaty-related missile, they were required to record the telemetry and provide it to the U.S. The recordings were delivered to the U.S. Embassy in Moscow, and from there it was couriered to the On Site Inspection Agency (OSIA) in the U.S. The OSIA passed the Russia-supplied telemetric data sets to NSA for processing on the Russia-supplied equipment.

Each party provided training to its counterparts on the signal analysis and processing equipment. U.S. representatives went to Moscow, Russian representatives came to the U.S. All dealings with Treaty matters were at the OSIA, which was near Dulles International Airport. The OSIA was the liaison between the Russians and the U.S. for all international treaty related matters. NOTE: The Agency is now known as the Defense Threat Reduction Agency (DTRA) and located at Fort Belvoir, Virginia.

Individual Event Telemetry Exchange Timelines

Under the terms of the START Treaty, each side provided the other with a launch notification indicating that a treaty controlled missile launch was planned.

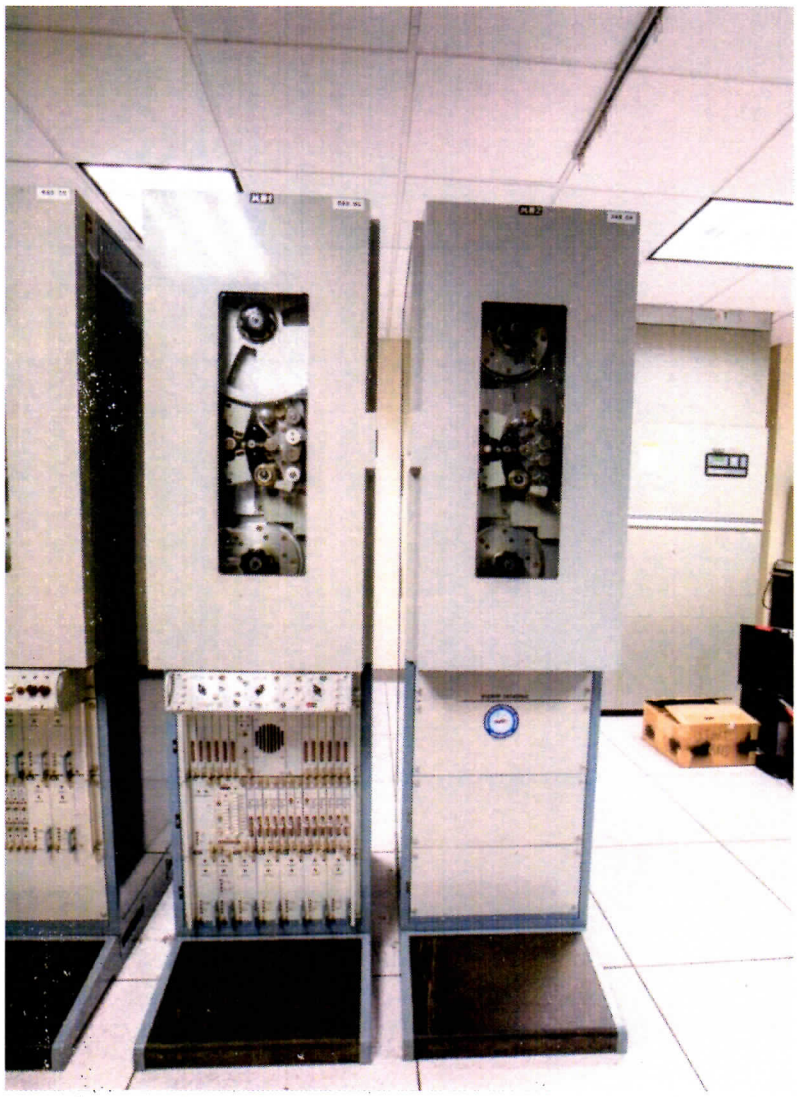
The timeline for processing was based on the launch date. In accordance with the Treaty, all telemetry recordings associated with a Treaty-covered missile launch must be delivered to the other embassy no later than 65 days after the launch. The country that received the tapes had no more than 65 additional days from tape delivery to advise the country that delivered the tapes about unplayable media or other problems. If the country that received the tapes determined there was a possible problem of some kind, they would demarche the other country for either an explanation of the anomaly or, in some cases, request another copy of the tape.

Equipment and Tapes Features

Telemetry playback and analysis equipment was exchanged between Russia and the U.S. in 1993. The U.S. provided the Russian Federation with Honeywell recorders, and the Russians supplied three different units of magnetic playback and data conversion to the U.S. The need for

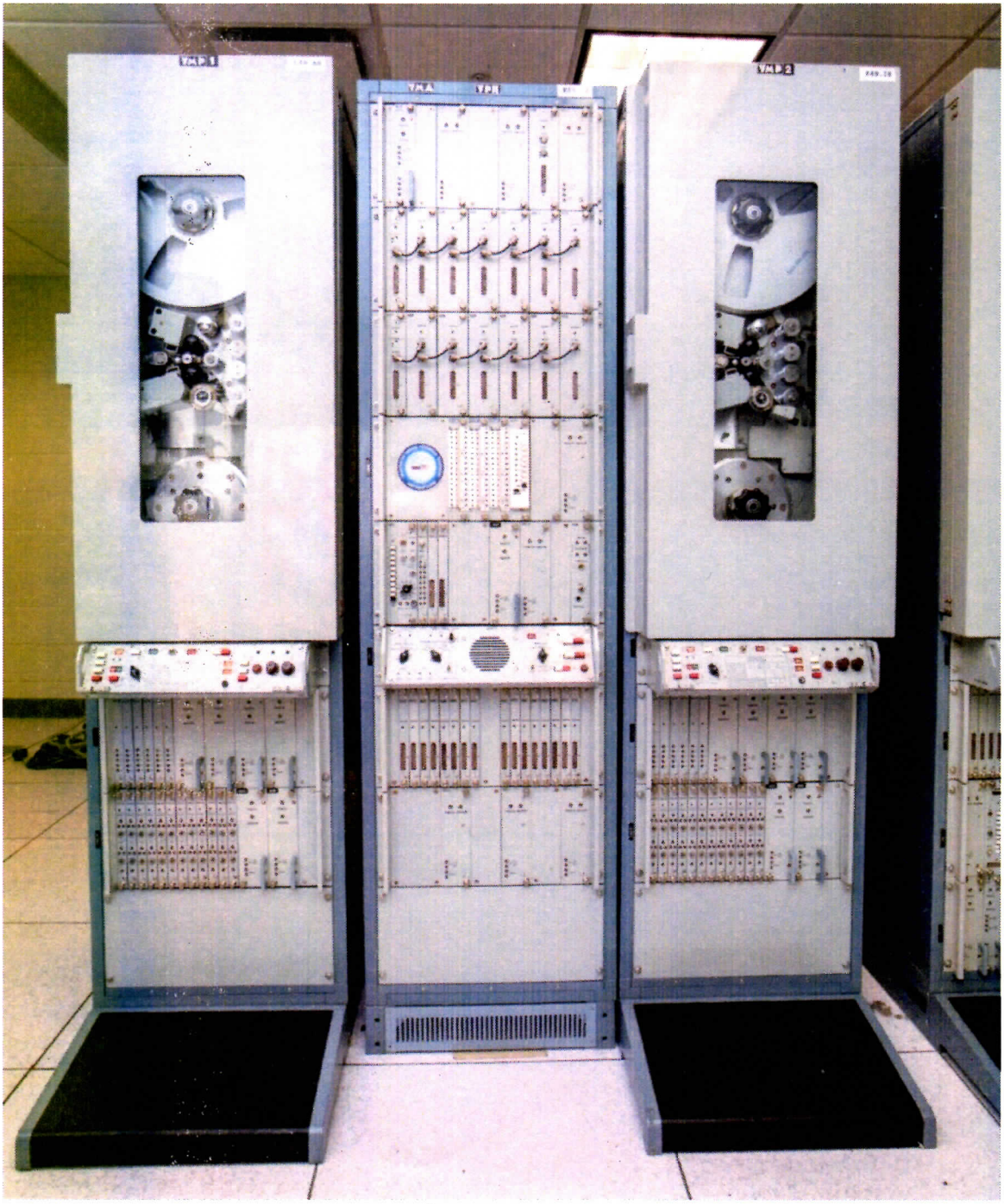
different equipment was primarily caused by the number of recording tracks for each tape and the application of "Miller Code" to some of the Russian signal tapes. One of the units was for Treaty SLBM telemetry, one was for selected ICMB telemetry, and one was for selected ICBM/SLBM telemetry. All equipment was new and was based on using a European electricity standard requiring 380 volts at 50 Hz in order to operate.

The ICBM set of equipment, which was based on 1960s technology, consisted of two recording and playback units. In this set one rack is a playback recorder that also has electronic equipment which controls both racks and the signal flow for a specific set of ICBM telemetry signals, and the other rack simply a record and playback machine using a different type of magnetic tape.



START Unit ICBM Data Processor Set
(Constructed for surface room environment operations)

The set of ICBM/SLBM data processing equipment consists of two individual playback recorders, as well as a separate rack which controls the signal flow for a separate set of ICBM/SLBM telemetry signals.



START Unit for Selected ICBM/SLBM Data Processing

(Constructed for surface room environment operations)

References and Additional Information

References and Related Documents

Ref 1 – *"Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms"* (SALT I), May 26, 1972

Ref 2 – *"Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Strategic Offensive Arms, Together with the Agreed Statements and Common Understandings Regarding the Treaty"*, (SALT II), June 18, 1979.

Ref 3 – *"Treaty between the United States of America and the Union of Soviet Socialist Republics on the Reduction and Limitation of Strategic Offensive Arms"*, (START) July 31, 1991.

Ref 4 - *"The Legacy of START and Related U.S. Policies"*, Bureau of Verification, Compliance and Implementation, U.S. Department of State, July 16, 2009

– Ashton B. Carter and William J. Perry, *"Preventive Defense – A new Security Strategy for America"*, Brookings Institute Press, Washington, D.C. 1999.

- Amy F. Woolf, "Monitoring and Verification in Arms Control", Congressional Research Service, December 23, 2011.

– William J. Perry, *"My Journey at the Nuclear Brink"*, Stanford University Press, Stanford, California, 2015

The Author

Richard L. Bernard is a retired NSA Senior Executive with over forty years of SIGINT experience. He became an NSA civilian in 1954 and served in a succession of engineering and engineering management positions involving telemetry intelligence data collection and analysis throughout his career. Among other assignments he served as Deputy Chief of the Line-of-Sight Systems Group in the Research and Engineering Organization. Mr. Bernard was one of the first set of NSA personnel in 1959 assigned to address NSA's new Electronic Intelligence (ELINT) and Telemetry Intelligence (TELINT) responsibilities. He was an active participant in working with the DoD Military Departments, CIA, and foreign partners on TELINT matters throughout his career.

He retired from NSA in 1985 to work in private industry. In 1996 he became a consultant to the NSA Center for Cryptologic History (CCH). While there he has completed several documents and presentations on the history of ELINT and TELINT, the latter now designated Foreign Instrumentation Signals Intelligence (FISINT), and he continues to prepare history documents and presentations for CCH. Mr. Bernard joined the National Cryptologic Museum Foundation (NCMF) in 1998 and has been active as a member. He currently serves as an Acquisition Committee Representative and is the Committee lead manager for this START foreign telemetry processing exhibit for the National Cryptologic Museum.