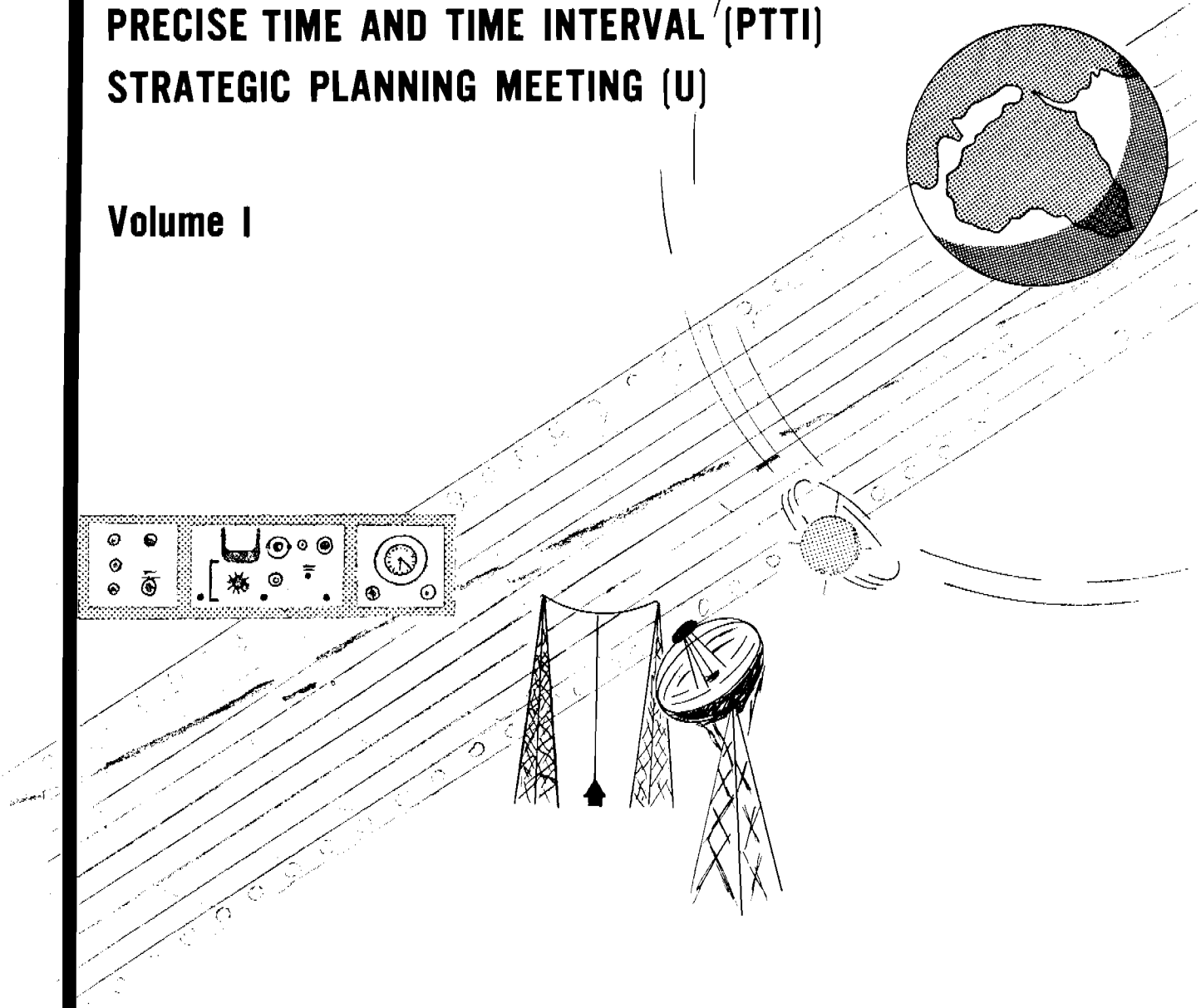
Proceedings from

PRECISE TIME AND TIME INTERVAL (PTTI) STRATEGIC PLANNING MEETING (U)

Volume I



December 10-11, 1970

FOREWORD

The Second Department of Defense Precise Time and Time Interval (PTTI) Strategic Planning Meeting sponsored by the Naval Observatory was held December 10 - 11, 1970 in Washington, D.C., to accomplish the following objectives:

- Disseminate information associated with Precise Time and Time Interval dissemination
- Review present and future requirements for Precise Time and Time Interval dissemination
- Review status of current and planned systems for Precise Time and Time Interval dissemination

This report contains a summary of Precise Time and Time Interval topics discussed during the conference. The overall Conference Proceedings are contained in two volumes: Volume I is unclassified for distribution; Volume II is classified SECRET and copies may be obtained by writing the U.S. Naval Observatory, Technical Officer, Washington, D.C. 20390.

Barry M. Atwood

LCDR. Barry M. Atwood
Chairman

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WELCOME

by Dr. L. B. Wetzel*

It is indeed a pleasure to have this opportunity to welcome you to the Naval Research Laboratory (NRL). We are delighted to host this very important conference. For the sake of those of you who are unfamiliar with the Laboratory, I would like to take just a moment to indicate a point of history. NRL opened its doors in 1923 with only two divisions: radio and sound. Nowadays, we call these divisions by more up-to-date titles: Communication Sciences and Acoustics. In the intervening years, specialty laboratories have been added which are grouped into four major areas: Electronics, Materials, General Sciences, and most recently, Oceanology. I am sure that many of you are familiar with the numerous contributions made in each of these areas over nearly 50 years; indeed, we will celebrate our 50th anniversary in another three years, so we have come a long way. Actually, I still occasionally encounter an alumnus of those early days -- someone who might have spent time grinding crystals back in the 1920's for one of the original crystal controlled transmitters which was developed here. Some of our early scientific work -- for example, the development of the transmitter for the Breit-Tuve experiment -- was in the development of crystal controlled equipment.

The interest and deep involvement of NRL in frequency and time -- particularly precise frequency and time -- have extended to the present day. I like to think that our recent developments in the generation and transfer of precise time and time interval, of which you will hear during

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the conference from Mr. Stone, Mr. Murray, and Mr. Easton, show a healthy persistence of this early innovative spirit. You appear to have a very impressive program outlined and some interesting equipment on display here for the next two days. I am sure you are going to have a very productive meeting. Thank you.

INTRODUCTION

by Captain John R. Hankey, USN*

On behalf of the Naval Observatory, I want to welcome each of you here this morning. In particular, I want to express my appreciation to Dr. Wetzel and to the Naval Research Laboratory for allowing us to utilize their very fine facilities. Our lecture hall at the Naval Observatory is perhaps only one-fourth the size of this one, which is why we are meeting here. Many thanks for your generosity.

I understand that this is the second conference of this type. I did not have the opportunity to attend the last one held about 18 months ago, as I just became Superintendent in September. I must say that the number of people who have honored us by attending this conference impresses me very much; and, since "time is money," I am not going to take up much of yours.

Time is the subject of a good many sayings in our cultural background: "A stitch in time saves nine," "time flies," and, as I just said, "time is money." All of these indicate how important the subject of time is -- even to our ancestors. It is obvious by your attendance that all of you have fully absorbed your cultural heritage, and have seen the importance of time and time interval as it has been expanding in these days of rapid technological progress.

Even before I came to the Naval Observatory, I was aware that time was a major concern. As a navigator, I utilized controlled time ticks to

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measure the chronometer's rate which was one of the principle functions of my job when I first went aboard a ship. Now, of course, we are not talking in terms of seconds or even microseconds, but rather in terms of nanoseconds. Dr. G.M.R. Winkler, Director of our Time Service Division at the Naval Observatory, has really kindled my interest in this particular subject. Through conferences such as this, I can learn more about "time." Also, since one of our primary goals is to refine the systems to an optimum state of compatibility, systems managers have an opportunity to become better acquainted with Precise Time and Time Interval techniques.

At present we are engaged in negotiations with the Coast Guard concerning synchronization of additional LORAN-C chains as one aspect of our current work. It is a difficult job, in that Congress authorizes work without appropriating the necessary money. Although the Department of Defense has assigned the responsibility for the determination of Precise Time and Time Interval and its dissemination throughout the Department of Defense to the Naval Observatory, concomitantly, we have received neither additional money nor additional people. It is only through the very fine cooperation we have received from all of you that we have been able to achieve as much as we have, and I want to thank all of you for that assistance.

During the upcoming presentations and the discussions which will follow, we hope there will be a fine free exchange of information. We hope that you will be critical, particularly of us, because we do not exist in a vacuum and the work we do could well be improved. Naturally, we want to do the best job we possibly can in this important role. We solicit your frank criticisms.

Now, as I said previously, "time is money," so I am not going to take up any more of yours. My remarks were designed only to set the stage and to express appreciation to both you and the Naval Research

Laboratory. Many of you have come long distances to be here, and the Laboratory has foregone other uses that it might have had for its facilities in order to accommodate us.

The Naval Observatory, located on Massachusetts Avenue in Northwest Washington, is well worth a visit for those of you who may not have already been there. Besides being a place of some scientific interest, it is a rather pleasant place to visit. In its present location, the Observatory dates back to 1893. Prior to that, in 1844, it was established at 24th and E Streets; and, even prior to that in 1830, it was located downtown just north of the Capitol. So, we have a fairly lengthy history. I think you might find it interesting to visit our present location--now only 70 years old. If you will indicate to LCdr. Barry Atwood or Dr. Winkler a desire to visit the Observatory and have a guided tour, whether day or night, these gentlemen will be glad to arrange one for you.

At this time I would like to turn the meeting over to our technical program. Thank you.