

**ADVANCE PROGRAM  
THIRTY-SIXTH ANNUAL  
PRECISE TIME AND TIME INTERVAL (PTTI)  
SYSTEMS AND APPLICATIONS MEETING**



**December 7–9, 2004**

**36 Years of Progress  
1969-2004**

**Hyatt Regency Hotel  
Washington, DC**

## Monday, December 6, 2004

0800-1300 Exhibition setup of booths  
0730-0830 Tutorial Breakfast  
0830-1645 Tutorials  
1215-1330 Tutorial Lunch  
1300-1700 Exhibitor Set-Up  
1700-1830 Icebreaker and Refreshments – Exhibitor Area  
1900-2100 Registration – PTTI Meeting\*  
1900-2100 Committee on GPS and GLONASS Time Transfer Standards

## Tuesday, December 7, 2004

0700-0800 Speakers' Breakfast  
0700-1600 Speakers' Room  
0700-0800 Attendees' Breakfast–Pre-Function Area  
0700-1600 Registration  
0800-0840 Opening Session  
0800-1700 Technical Exhibits  
0840-0940 Session I  
0940-1000 Intermission – Exhibits Area  
1000-1200 Session II  
1200-1330 Lunch  
1330-1530 Session III  
1530-1550 Intermission – Exhibit Area  
1550-1710 Session IV  
1800-1930 Reception

## Wednesday, December 8, 2004

0700-0800 Speakers' Breakfast  
0700-1600 Speakers' Room  
0700-0800 Attendees' Breakfast–Pre-Function Area  
0700-1600 Registration  
0800-1700 Technical Exhibits  
0800-0912 Session V  
0912-0940 Intermission – Exhibits Area  
0940-1130 Session VI Poster Session  
1130-1300 Lunch  
1300-1400 Session VII  
1400-1500 Session VIII  
1500-1520 Intermission – Exhibits Area  
1520-1640 Session IX Panel Discussion  
1700-1800 Joint Executive Committee and Advisory Board Meeting  
1900-2000 Evening Activity with Speaker and Refreshments

## Thursday, December 9, 2004

0700-0800 Speakers' Breakfast  
0700-1400 Speakers' Room  
0700-0800 Attendees' Breakfast–Pre-Function Area  
0700-1200 Registration  
0800-0920 Session X  
0920-0940 Intermission  
0940-1120 Session XI  
1120-1300 Lunch  
1300-1420 Session XII  
1420-1440 General Discussion  
1440 Close of Meeting

\*Registration for the PTTI Meeting is available each day.  
Exhibits are open Tuesday and Wednesday only.

**REGISTRATION CARD  
THIRTY SIXTH ANNUAL  
PRECISE TIME AND TIME INTERVAL  
SYSTEMS AND APPLICATIONS  
DECEMBER 7—9, 2004**

NAME \_\_\_\_\_  
First Initial Last

AGENCY \_\_\_\_\_  
Company or Organization

ADDRESS \_\_\_\_\_  
Street  
 \_\_\_\_\_  
City, State, and Country

TELEPHONE \_\_\_\_\_ FAX \_\_\_\_\_

E-MAIL \_\_\_\_\_

- Registration (will pay on site) †‡  
 Registration Amount Enclosed †‡ No. \_\_\_\_\_ \$ \_\_\_\_\_

{† \$350.00 if postmarked on or before November 15; \$400.00 thereafter. (Covers entry to all sessions, two receptions, three breakfasts, lunch on Tuesday and Wednesday, Evening Event on Wednesday, and one copy of the Proceedings.)

‡ Student/Retiree fee - \$50.00. (Must be fully retired or full-time student to qualify for the reduced registration fee. Covers entry to the sessions and exhibits only.)

- Additional Reception Tickets(\$30 each) No. \_\_\_\_\_ \$ \_\_\_\_\_  
 Breakfast Tickets (\$20 each) No. \_\_\_\_\_ \$ \_\_\_\_\_  
 Lunch Tickets (\$25 each) No. \_\_\_\_\_ \$ \_\_\_\_\_  
 Tutorial(\$250) No. \_\_\_\_\_ \$ \_\_\_\_\_  
 Proceedings (Costs on Page vii) No. \_\_\_\_\_ \$ \_\_\_\_\_  
 Total Amount Enclosed \$ \_\_\_\_\_

Mark here if purchasing Proceedings only.

Make checks payable to *Treasurer, PTIT*; we cannot accept payment by credit card

- Speaker  Exhibitor  Session Chairman

Are you staying in the hotel? Yes \_\_\_\_\_ No \_\_\_\_\_

If you have special dietary or physical requirements, please contact Mrs. Sheila Faulkner at 703-532-6411,

e-mail: [bopenyan@aol.com](mailto:bopenyan@aol.com).

Questions? Contact Ms. Jardine at 202-767-2595 or

e-mail: [nicolette.jardine@nrl.navy.mil](mailto:nicolette.jardine@nrl.navy.mil)

**Mail this card to Mrs. Faulkner at the address on Page iv.**

**ADVANCE PROGRAM**  
**THIRTY-SIXTH ANNUAL**  
**PRECISE TIME AND TIME INTERVAL (PTTI)**  
**SYSTEMS AND APPLICATIONS MEETING**

Sponsored by

U.S. Naval Observatory  
U.S. Naval Research Laboratory  
NASA Jet Propulsion Laboratory  
U.S. Air Force Office of Scientific Research  
Defense Information Systems Agency  
U.S. Coast Guard Navigation Center

December 7 – 9, 2004



**Hyatt Regency Hotel**  
**Washington, DC**

# Table of Contents

|  |                    |
|--|--------------------|
| Schedule.....                                  | Inside Front Cover |
| Registration Card.....                         | Front of Book      |
| Objectives .....                               | iii                |
| Meeting Information.....                       | iv                 |
| Registration .....                             | iv                 |
| Cancellation Policy.....                       | iv                 |
| PTTI Home Page.....                            | iv                 |
| PTTI 2004 Tutorials (Reserve Early) .....      | v                  |
| Questions.....                                 | v                  |
| Registration Desk Hours.....                   | v                  |
| <b>ATTENTION INTERNATIONAL ATTENDEES .....</b> | <b>v</b>           |
| Hotel Reservations.....                        | vi                 |
| Transportation.....                            | vi                 |
| Icebreaker.....                                | vi                 |
| Parking.....                                   | vii                |
| Directions.....                                | vii                |
| Messages.....                                  | viii               |
| Speakers' Room.....                            | viii               |
| Presented Papers.....                          | viii               |
| Temperature.....                               | viii               |
| 37th Annual PTTI Meeting.....                  | viii               |
| Evening Activity on Wednesday.....             | viii               |
| Exhibit Information .....                      | viii               |
| List of Potential Exhibitors .....             | ix                 |
| Proceedings.....                               | ix                 |
| Executive Committee.....                       | x                  |
| PTTI Meeting Officers.....                     | xi                 |
| PTTI Award Committee.....                      | xii                |
| PTTI Advisory Board.....                       | xiii               |
| Session Chairs.....                            | xiv                |
| Agenda.....                                    | xv-xxv             |
| Hotel Registration Card.....                   | Rear of Book       |

## OBJECTIVES

The objectives of the PTTI Systems and Applications Meeting are to:

- Disseminate and coordinate PTTI information at the user level,
  - Review present and future PTTI requirements,
  - Inform Government engineers, technicians, and Managers of precise time and frequency technology and its problems, and
  - Provide an opportunity for an active exchange of new technology associated with PTTI.
- 
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This year, the PTTI addresses:

- Satellite Time Transfer, Precise Time and Frequency Applications in Industry
- Galileo, GPS, and GLONASS
- Algorithms and Methods
- Advanced Clocks
- Time and Frequency Standards Laboratories, Activities and Updates
- Military Users and Systems
- Time Synchronization
- PTTI Vendor Presentations

## WELCOME TO THE PTTI 2004

### MEETING INFORMATION

#### Registration

Please send the PTTI registration form to:

Mail to:  
Sachs Freeman Associates, Incorporated  
% Mrs. Sheila Faulkner  
3159 Patrick Henry Drive  
Falls Church, VA 22044  
United States of America  
Or FAX to:  
703-532-6238  
Or e-mail to:  
bopenyan@aol.com

**The registration fee is \$400.00. Note: If payment is received postmarked on or before 15 November 2004 the cost is \$350.00.**

The full registration fee includes entry to all the sessions, the exhibit area, a copy of the Proceedings, the Ice Breaker, the Welcoming Reception, breakfast each day and lunch Tuesday and Wednesday. Guest tickets are \$30.00 for the reception, and \$25.00 for lunch.

The registration fee for students and full-time retirees is \$50.00 and includes entry to the scientific sessions and exhibit area only. It does not include a copy of the Proceedings, entry to breakfasts, lunches, or receptions.

The registration fee for the tutorials is \$250. This includes breakfast and lunch and a copy of the Tutorials, but does not include the PTTI Proceedings or admission to the PTTI meetings or receptions.

Please make checks payable to: **Treasurer, PTTI. Credit cards are not accepted.** Attendees, including presenters and exhibitors, must register and receive a badge which must be worn for admission to all sessions and functions. Badges for attendees are not transferable.

Visitor badges **for the exhibit area only** may be obtained at the registration desk. The exhibit area is open to everyone.

#### Cancellation policy

All requests for cancellation must be received in writing before November 15, 2004. On or after November 15<sup>th</sup> there is a \$175.00 cancellation fee. Refunds are not given for "no shows", however, substitutions are allowed.

#### PTTI Home Page

Access the PTTI Home Page from the World Wide Web at:  
<http://tycho.usno.navy.mil/ptti.html>

PTTI 2004 on-line registration is also available via the PTTI Home Page. <http://tycho.usno.navy.mil/pttiregform.html>

Please remember to take advantage of the reduced early registration fee. Payment has to be postmarked on or before November 15, 2004.

## PTTI 2004 Tutorials

Tutorials take place prior to PTTI 2004 on Monday, December 6, 2004. For detailed information regarding the tutorials, please contact Mrs. Rachel Gross via voice mail at 202-404-4011, or by e-mail at [gross@juno.nrl.navy.mil](mailto:gross@juno.nrl.navy.mil)

The fee for the all day tutorials is \$250. Breakfast and lunch are included. Please register using the attached "Registration Card" or "on-line" at the above Web address.

0730 – 0830 **Breakfast**  
0830 – 0930 **History of Clocks and GPS** - Dr. Joe White, U.S. Naval Research Laboratory  
0930 – 1030 **History of Galileo** - Dr. Eduardo Detoma, SEPA  
1030 – 1045 **Intermission**  
1045 – 1215 **Crystal Technology** - Dr. John Vig, U.S. Army  
1215 – 1330 **Lunch**  
1330 – 1430 **GPS and All its Applications** - Dr. Hugo Fruehauf, FEI-Zyfer, Incorporated  
1430 – 1530 **Satellite Time and Frequency Transfer** - Christine Hackman, JILA, University of Colorado  
1530 – 1545 **Intermission**  
1545 – 1645 **Frequency Stability Analysis of Oscillators and Clocks** - David Howe, National Institute of Standards and Technology

## Questions

Please contact the following people for information on matters concerning:

Technical questions: Dr. Joe White, 202-767-5111  
or [joe.white@nrl.navy.mil](mailto:joe.white@nrl.navy.mil)  
Exhibiting: Mr. Gary Geil, 949-361-0212  
or [gary@gmainc.cc](mailto:gary@gmainc.cc)  
General: Mrs. Sheila Faulkner, 703-532-6411  
or [bopenyan@aol.com](mailto:bopenyan@aol.com)  
Registration: Ms. Nikki Jardine, 202-767-2595  
or [nicolette.jardine@nrl.navy.mil](mailto:nicolette.jardine@nrl.navy.mil)

## Registration Desk Hours

The registration desk will be open during the following hours:

|                       |             |
|-----------------------|-------------|
| 6 December, Monday    | 1900 – 2100 |
| 7 December, Tuesday   | 0700 – 1600 |
| 8 December, Wednesday | 0700 – 1600 |
| 9 December, Thursday  | 0700 – 1200 |

## ATTENTION INTERNATIONAL ATTENDEES

Starting 1 October, 2003, each Visa Waiver Program traveler must present a machine-readable passport (MRP) at the U.S. port of entry to enter the U.S. without a visa, otherwise a nonimmigrant visa is required. This change includes all categories of passports, when the traveler is seeking to enter the U.S.

### Contact your country's passport office.

For further information see U.S. Department of State notice at <http://travel.state.gov/vwp.html>, and the PTTI web site, <http://tycho.usno.navy.mil/ptti.html>.

## Hotel Reservations

Mail or FAX the hotel reservation card (found in the back of the book)

to:

The Hyatt Regency Hotel on Capitol Hill  
(PTTI 2004 Meeting Room Block)  
400 New Jersey Avenue NW  
Washington, DC 20001  
202-737-1234 (Reservations)  
FAX 202-942-1512

When reservations are made, mention PTTI 2004 to receive the group sleeping room rate. The PTTI rate is available from December 5 through December 10, 2004. Check-in time is 1500 (3:00 PM EST) and check-out time is Noon. Rooms are held until 1600 (4:00 PM EST) if not guaranteed for late arrival by a credit card or one night's deposit. The block of reserved rooms will be released November 5 so reserve early. If rooms are available after that date, reservations will be accepted at the group rate. If you leave before your scheduled departure date without informing the Hilton, you will be charged an early departure fee.

## Transportation to Washington, DC United Airlines

United Airlines has been chosen as the official carrier for PTTI 2004 and is pleased to offer the best available fares and schedules that fit your travel needs.

To obtain the best fares or schedule information, please call United's Meeting Desk at 1-800-521-4040 and refer to the Meeting Plus ID code 556XF. The fares are available from December 3 through December 12, 2004.

An additional 5% discount is available if you book and purchase a ticket at least 60 days in advance of the contracted travel dates. This increases the discount to 5% plus 5% off the lowest applicable fare or 10% plus 5% off the unrestricted coach fare. You or your travel agent should call without delay, as seats may be limited.

## Transportation to Hotel Airport Shuttle (Recommended)

Super Shuttle service is recommended from Baltimore Airport, Dulles Airport and Reagan National Airport to the hotel. No reservations are necessary for Super Shuttle. ([www.supershuttle.com](http://www.supershuttle.com)) At the Baltimore Airport, the Super Shuttle desk is at Ground Transportation Pier C.

## Rental Car (Alternate A)

Avis has been chosen as the official rent-a-car company for PTTI 2004. To receive a reduced rate, call 1-800-331-1600 to book your reservation and give the Avis Meeting Sales Agent the Avis Worldwide Discount (AWD) number for PTTI 2004 — J628452. Special meeting rates are available from November 29 through December 16, 2004.

## Driving, Metro, and Train Directions

### From Ronald Reagan Washington National Airport (7

**miles):** 15 minutes by car or 20 minutes via Metro subway to Union Station - 2 blocks walking distance from hotel. Driving: Take George Washington Pkwy. Exit on I-395 North to Washington. Follow signs to U.S. Capitol. At tunnel, take first exit, U.S. Capitol/D St., NW. Proceed to first light, (D St.), turn right and go to 2nd traffic light. Turn left on New Jersey Ave. Hotel is on left.

**From Dulles International Airport (25 miles):** 45 minutes by car or taxi. Driving: Follow signs to Washington D.C. on Dulles Toll/Access Road. Follow center lane (no toll) to I-66 East to Washington. Cross Roosevelt Bridge. Follow signs to Constitution Ave. toward U.S. Capitol. Proceed approximately 2.5 miles. Turn left onto Louisiana Ave., NW. Travel to the 3rd light. Turn left on New Jersey Ave. Hotel is on left.

### From Baltimore–Washington International Airport:

BY TRAIN (preferred): Take the free shuttle from the airport to the BWI train station. The trains run every 30 to 60 minutes to Union Station in Washington D.C. The Fare is approximately \$8 to \$10 on the local and \$20 to \$30 on AMTRAC. Union Station is 2 blocks from the Hotel.

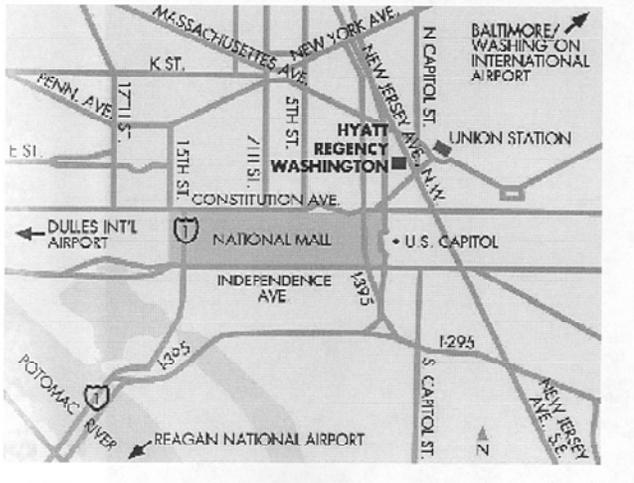
BY CAR: 1. Follow RETURN TO TERMINAL toward DEPARTURES. 2. Stay straight to ARRIVALS. 3. ARRIVALS becomes AIRPORT EXIT. 4. AIRPORT EXIT becomes I-195 W. 5. Merge onto MD-295 S on exit 2B toward Washington. 6. Merge onto US-50 W/New York Ave NE toward Washington. 7. Turn Right onto Florida Ave NE. 8. Turn Slightly Left onto P ST NE. 9. Turn Left onto N Capitol ST NW. 10. Turn Slightly Right onto Louisiana Ave NW. 11. Turn Slightly Right onto D ST NW. 12. Turn left on New Jersey Ave. Hotel is on left.

### Parking

Only Valet parking is available at the hotel. The use of the Metro (the local subway system) is strongly recommended. Parking at the hotel is \$33 per night including taxes.

### Taxis (Alternate B)

Taxi fees from Baltimore/Washington International Airport are \$65 to \$70; from Dulles International Airport they are \$55 to \$60; and from Reagan National Airport they are \$15 to \$20. It is recommended that travel from Baltimore be done by Super Shuttle or by train, see above.



## **Messages**

Messages may be left for PTTI attendees through the hotel's telephone number of 202-737-1234.

## **Speakers' Room**

Please check the PTTI Registration Desk or the hotel's Function Board for the location of the Speakers' Room. Session chairpersons should alert their sessions' members to meet them in the Speakers' Room for the speakers' breakfast that is served each day. Supplies for speakers' are available during the day.

## **Presented Papers**

Papers in electronic form (Word or TEX) must be submitted by e-mail or on diskette to Dr. Lee A. Breakiron, Editorial Chairman, (lab@kepler.usno.navy.mil) by December 7, 2004 unless prior arrangements have been made with him. If prior arrangements have not been made, the paper will not be published in the Proceedings. For paper style, see the Authors' Kit on the Web at [http://tycho.usno.navy.mil/author\\_kit.html](http://tycho.usno.navy.mil/author_kit.html)

## **Temperature**

The climate during late November and early December in the Washington, D.C. area is cold. A coat or raincoat is recommended.

## **The 37th Annual PTTI Meeting**

In 2005, the 37th Annual PTTI Meeting will meet jointly with the IEEE Frequency Control Symposium and will meet in Vancouver, British Columbia, Canada, August 28 through September 1.

## **Evening Activity on Wednesday, December 8**

Dr. Dimitar Ouzounov of NASA Goddard Space Flight Center will give a talk on "Earthquake Studies from Space." Refreshments will be served.

## **Exhibit Information**

The exhibit area is adjacent to the general session. For exhibit information, please contact:

Gary Geil  
or Don Mitchell  
Geil Marketing Associates  
1064 Calle Negocio, Suite D  
San Clemente, CA 92673  
1-949-361-0212  
FAX 1-949-361-0312  
e-mail [gary@mainc.cc](mailto:gary@mainc.cc)

## List of Potential Exhibitors for PTTI 2004

|                                   |                                  |
|-----------------------------------|----------------------------------|
| Agilent Technologies              | Precise Time and Frequency, Inc. |
| Allen Osborne Associates, Inc.    | Quartzlock, U.K., Ltd.           |
| Arbiter Systems, Inc.             | SpectraDynamics                  |
| Astrogeodynamical Observatory     | Spectrum Geophysical             |
| Brandywine Communications         | Instruments                      |
| End Run                           | Stanford Research Systems        |
| FEL-Zyfer, Inc.                   | Symmetricom                      |
| Frequency Electronics, Inc.       | Synergy Systems                  |
| GPS Networking                    | Temex Neuchatel Time S.A.        |
| GPS World                         | Thales Navigation                |
| Guide Technology                  | TimeTech, GmbH                   |
| J-Time Meinberg USA               | Timing Solutions Corporation     |
| Lange-Electric GmbH               | TRAK Microwave Corporation       |
| Locus                             | Trimble Navigation               |
| Magellan Ashtech Products         | U.S. Naval Observatory           |
| Military University of Technology |                                  |
| Motorola                          |                                  |
| Oscilloquartz                     |                                  |

## Icebreaker

The Icebreaker is a "Get Acquainted" Function in the Exhibitors Area on Monday, December 6, 2004 from 1700 to 1830. Refreshments will be served.

## Proceedings

The proceedings, on a CD in Adobe Acrobat (PDF) format, will be mailed to the attendees in 2005. If you cannot attend, but wish to reserve a copy of the Proceedings, please return the Registration Card with a check for \$350 made out to Treasurer, PTTI. Please note on the card that you are not attending. Your reserved copy will be sent to you. If you wish extra copies, they will also be available at \$350.

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**1995**

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National Institute of Standards and Technology (Retired)

**1996**

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Politecnico di Torino  
and  
Istituto Elettrotecnico Nazionale Galileo Ferraris

**1997**

**PROFESSOR BERNARD RENÉ GUINOT**  
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Paris Observatory

**1998**

**DR. JACQUES VANIER**  
National Research Counsel (Retired)

**1999**

**DR. LEONARD S. CUTLER**  
Agilent Technologies

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**MR. ROGER EASTON**  
U.S. Naval Research Laboratory (Retired)

**2001**

**DR. ROBERT F. C. VESSOT**  
Smithsonian Astrophysical Observatory (Retired)

**2002**

**MR. HARRY PETERS**  
Sigma Tau, Incorporated (Retired)

**2003**

**MR. S. CLARK WARDRIP**  
National Aeronautics and Space Administration  
Goddard Space Flight Center (Retired)

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NASA Jet Propulsion Laboratory

**DR. ANDY WU**

The Aerospace Corporation

## **PTTI 2004 SESSION CHAIRS**

### **SESSION I – Vendor Presentations**

DR. SAM STEIN

Timing Solutions Corporation

### **SESSION II – Time and Frequency Transfer I**

DR. JUDAH LEVINE

National Institute of Standards and Technology

### **SESSION III – Time and Frequency Transfer II**

DR. WLODEK LEWANDOWSKI

Bureau International des Poids et Mesures

### **SESSION IV – Clock Measurements**

DR. SAM STEIN

Timing Solutions Corporation

### **SESSION V – Timing Laboratory Reports**

DR. FELICITAS ARIAS

Bureau International des Poids et Mesures

### **SESSION VI – Poster Session**

MR. RAIMOND MELKERS

Titan Corporation

### **SESSION VII – PTTI Special**

DR. KEN SENIOR

U.S. Naval Research Laboratory

### **SESSION VIII – GNSS Interoperability**

DR. PASCALE DEFRAIGNE

Royal Observatory of Belgium

### **SESSION IX – Panel Discussion (GNSS Interoperability)**

DR. EDOARDO DETOMA

Sistemi Elettronica Per Automazione

### **SESSION X – Small Clocks and Oscillators**

DR. ROBERT TJOELKER

NASA Jet Propulsion Laboratory

### **SESSION XI – Clocks for Space**

MR. RON BEARD

U.S. Naval Research Laboratory

### **SESSION XII – Algorithms**

DR. CHARLES GREENHALL

NASA Jet Propulsion Laboratory

**PTTI 2004  
THIRTY-SIXTH ANNUAL  
PRECISE TIME AND TIME INTERVAL (PTTI)  
SYSTEMS AND APPLICATIONS MEETING**

**TUESDAY, DECEMBER 7, 2004**

**0800 – 0805 OPENING**

Dr. Lara S. Schmidt, *The RAND Corporation*

**0805 – 0820 OPENING REMARKS**

Captain D. W. Gillard,  
*U.S. Naval Observatory*

**0820 – 0835 DISTINGUISHED PTTI SERVICE AWARD**

Presented by Dr. Joe White,  
*U.S. Naval Research Laboratory*

**0835 – 0840 CALL TO SESSION**

Dr. Ken Senior,  
*U.S. Naval Research Laboratory*

**SESSION I PTTI VENDOR PRESENTATIONS**

**0840 – 0940 Chairman: Sam Stein,**  
*Timing Solutions Corporation*

**0940 – 1000 INTERMISSION**

**SESSION II TIME AND FREQUENCY TRANSFER I**

**Chairman: Judah Levine,** *National Institute of  
Standards and Technology*

**1000 – 1020 Paper 1: FILTER PARAMETER INFLUENCE  
ON GPS CARRIER PHASE REAL-TIME  
TIME AND FREQUENCY TRANSFER FOR  
SHORT AND LONG BASELINES**

C. Rieck, P. Jarlemark, K. Jaldehag, and  
J. Johansson, *SP Swedish National Testing and  
Research Institute, Sweden*

**1020 – 1040 Paper 2: COPING WITH OVERLOAD ON  
THE NETWORK TIME PROTOCOL PUBLIC  
SERVICE**

D. Mills, *University of Delaware*; R. Schmidt, *U.S.  
Naval Observatory*; J. Levine, *National Institute of  
Standards and Technology*; D. Plonka, *University of  
Wisconsin*

**1040 – 1100 Paper 3: STUDY OF THE CAPABILITIES  
OF THE GEODETIC RECEIVERS FOR  
TIME AND FREQUENCY TRANSFER**

P. Defraigne and C. Bruyninx, *Royal Observatory of  
Belgium, Belgium*

**TUESDAY, DECEMBER 7, 2004**

- 1100 – 1120 Paper 4: STUDY OF TIME TRANSFER METHODS I, COMPARISONS OF GEODETIC CLOCK ANALYSIS STRATEGIES**  
C. Bruyninx, F. Roosbeek, and P. Defraigne, *Royal Observatory of Belgium*; J. Ray, *National Geodetic Survey* and *Bureau International des Poids et Mesures, France*; K. Senior, *U.S. Naval research Laboratory*
- 1120 – 1140 Paper 5: STUDY OF TIME TRANSFER METHODS II, TWSTFT VERSUS GEODETIC CLOCK COMPARISONS**  
G. Petit and X. Jiang, *Bureau International des Poids et Mesures, France*
- 1140 – 1200 Paper 6: AVERAGING SATELLITE TIMING DATA FOR NATIONAL AND INTERNATIONAL TIME COORDINATION**  
J. Levine, *National Institute of Standards and Technology*
- 1200 – 1330 LUNCH**
- SESSION III TIME AND FREQUENCY TRANSFER II**  
**Chairman: Wlodek Lewandowski**, *Bureau International des Poids et Mesures, France*
- 1330 – 1350 Paper 7: THE DEVELOPMENT OF THE DUAL FREQUENCY GPS RECEIVER FOR TIME TRANSFER**  
Y. Gao, Z. Wang, and Y. Qi, *National Time Service Center, China*
- 1350 – 1410 Paper 8: HIGHLY ACCURATE SYNTONIZATION USING A GPS SINGLE-FREQUENCY RECEIVER WITH REAL-TIME ATMOSPHERIC DELAY FORECASTING MODEL**  
C. Cheng, F. Chang, and K. Tu, *National Taiwan University, Taiwan*; L. Wang, *Chunghwa Telecom, Taiwan*
- 1410 – 1430 Paper 9: QUANTUM POSITIONING SYSTEM BASED ON SECOND-ORDER COHERENCE OF ENTANGLED PHOTONS**  
T. Bahder, *U.S. Army Research Laboratory*

**TUESDAY, DECEMBER 7, 2004**

**1430 – 1450 Paper 10: ADDING WATER VAPOR  
RADIOMETER TO GPS CARRIER-PHASE  
TIME TRANSFER**

C. Hackman, *University of Colorado*; J. Levine,  
*National Institute of Standards and Technology*

**1450 – 1510 Paper 11: REFLECTIONS ON TEN TEARS  
OF NETWORK TIME SERVICE**

R. Schmidt, *U. S. Naval Observatory*

**1510 – 1530 Paper 12: DEVELOPMENT OF CARRIER  
PHASE BASED TWO-WAY SATELLITE  
TIME AND FREQUENCY TRANSFER  
(TWSTFT)**

B. Fonville and D. Matsakis, *U.S. Naval Observatory*;  
W. Schäfer and A. Pawlitzki, *TimeTech, GmbH*,  
*Germany*

**1530 – 1550 INTERMISSION**

**SESSION IV CLOCK MEASUREMENTS**

**Chairman: Sam Stein**, *Timing Solutions  
Corporation*

**1550 – 1610 Paper 13: USING DSP TECHNIQUE TO  
AVERAGE ADC SAMPLES FOR  
IMPROVING THE FREQUENCY  
MEASUREMENT RESOLUTION**

S. Chen and C. Liao, *National Standard Time and  
Frequency Laboratory, Taiwan*

**1610 – 1630 Paper 14: ALLAN VARIANCE ESTIMATED  
BY PHASE NOISE MEASUREMENTS**

P. Chang, H. Peng, and S. Lin, *National Time and  
Frequency Laboratory, Taiwan*

**1630 – 1650 Paper 15: ALLAN VARIANCE ESTIMATED  
BY DIRECT SAMPLING OF RF SIGNALS**

W. Solbrig, J. Hein, S. Stein, J. Grove, P. Schweiger,  
and R. Martin, *Timing Solutions Corporation*

**1650 – 1710 Paper 16: ULTRA-LOW NOISE CAVITY  
STABILIZED MICROWAVE REFERENCE  
OSCILLATOR USING AIR-DIELECTRIC  
RESONATOR**

D. Howe and C. Nelson, *National Institute of  
Standards and Technology*; A. Gupta, *National  
Physical Laboratory, India*

**1800 – 1930 RECEPTION**

**WEDNESDAY DECEMBER 8, 2004**

**SESSION V TIMING LABORATORY REPORTS**

**Chairman: Felicitas Arias, Bureau**

*International des Poids et Mesures*

**0800 – 0808 Paper 17: TIME AND FREQUENCY  
ACTIVITIES AT THE PHYSIKALISCH -  
TECHNISCHE BUNDESANSTALT**

J. Becker, A. Bauch, D. Piester, and T Polewka,  
*Physikalisch-Technische Bundesanstalt, Germany*

**0808 – 0816 Paper 18: LITHUANIAN NATIONAL TIME  
AND FREQUENCY STANDARD**

R. Miškinis, *Semiconductor Physics Institute, Lithuania*

**0816 – 0824 Paper 19: OVERVIEW OF RESEARCH  
ACTIVITIES ON TIME AND FREQUENCY  
AT THE NATIONAL INSTITUTE OF  
INFORMATION AND COMMUNICATIONS  
TECHNOLOGY**

M. Hosokawa, Y. Takahashi, S. Hama, H. Toriyama,  
and T. Morikawa, *National Institute of Information  
and Communications Technology, Japan*

**0824 – 0832 Paper 20: DEVELOPMENTS IN THE FIELD  
OF TIME AND FREQUENCY IN POLAND**

J. Nawrocki and P. Nogaś, *Space Research Center,  
Poland*

**0832 – 0840 Paper 21: TIME KEEPING AT NTSC**

Z. Wang and S. Dong, *Standard Time and Frequency  
Laboratory, China*

**0840 – 0848 Paper 22: THE FUTURE MODEL OF  
TAI(TL)**

S. Lin, *National Standard Time and Frequency  
Laboratory, Taiwan*

**0848 – 0856 Paper 23: TIME AND FREQUENCY  
ACTIVITIES AT THE U.S. NAVAL  
OBSERVATORY**

D. Matsakis, *U.S. Naval Observatory*

**WEDNESDAY DECEMBER 8, 2004**

**0856 – 0904 Paper 24: IMPROVED OPERATIONS AT THE APL TIME AND FREQUENCY LABORATORY**

R. Dragonette, M. Miranian, and M. Reinhart, *Johns Hopkins University Applied Physics Laboratory*

**0904 – 0912 Paper 25: UPDATE ON TIME AND FREQUENCY AT NIST**

T. O'Brian, *National Institute of Standards and Technology*

**0912 – 0940 INTERMISSION**

**SESSION VI POSTER SESSION**

**0940 – 1130 Chairman: Raimond Melkers, Titan Corporation**

**Poster 1: STUDIES OF AN OPTIMAL SAMPLE TIME FOR A CRYSTAL CLOCK IN GPS-BASED TIMEKEEPING**

Y. Shmaliy, O. Robles-Morales, and O. Ibarra-Manzano, *Guanajuato University, Mexico*

**Poster 2: ESTABLISHMENT OF AN INTERNET TIME SERVER AT THE ROYAL OBSERVATORY OF BELGIUM**

F. Roosbeek, A. Somerhausen, and F. Defraigne, *Royal Observatory of Belgium, Belgium*

**Poster 3: LATEST CALIBRATION OF GLONASS P-CODE TIME RECEIVERS**

A. Foks and J. Nawrocki, *Space Research Center, Astrogeodynamical Observatory, Poland; W. Lewandowski, Bureau International des Poids et Mesures, France*

**Poster 4: TIME AND FREQUENCY ACTIVITIES AT THE PHYSIKALISCH-TECHNISCHE BUNDESANSTALT**

J. Becker, A. Bauch, D. Piester, and T. Polewka, *Physikalisch-Technische Bundesanstalt, Germany*

**Poster 5: LITHUANIAN NATIONAL TIME AND FREQUENCY STANDARD**

R. Miškinis, *Semiconductor Physics Institute, Lithuania*

**Poster 6: THE ACCURACY OF TWO-WAY TIME TRANSFER CALIBRATIONS**

L. Breakiron, A. Smith, E. Powers, and D. Matsakis, *U.S. Naval Observatory*

**WEDNESDAY DECEMBER 8, 2004**

**Poster 7: OVERVIEW OF RESEARCH  
ACTIVITIES ON TIME AND FREQUENCY  
AT THE NATIONAL INSTITUTE OF  
INFORMATION AND COMMUNICATIONS  
TECHNOLOGY**

M. Hosokawa, Y. Takahashi, S. Hama, H. Toriyama,  
and T. Morikawa, *National Institute of Information  
and Communications Technology, Japan*

**Poster 8: DEVELOPMENTS IN THE FIELD  
OF TIME AND FREQUENCY IN POLAND**

J. Nawrocki and P. Nogaś, *Space Research Center,  
Astrogeodynamical Observatory, Poland*

**Poster 9: TIMEKEEPING AT NTSC**

Z. Wang and S. Dong, *Standard Time and Frequency  
Laboratory, Chinese Academy of Sciences, China*

**Poster 10: THE FUTURE MODEL OF  
TAI(TL)**

S. Lin *National Standard Time and Frequency  
Laboratory, Chunghwa Telecom Company, Limited,  
Taiwan*

**Poster 11: TIME AND FREQUENCY  
ACTIVITIES AT THE U.S. NAVAL  
OBSERVATORY**

D. Matsakis, *U.S. Naval Observatory*

**Poster 12: IMPROVED OPERATIONS AT  
THE APL TIME AND FREQUENCY  
LABORATORY**

R. Dragonette, M. Miranian, and M. Reinhart, *Johns  
Hopkins University Applied Physics Laboratory*

**Poster 13: UPDATE ON TIME AND  
FREQUENCY ACTIVITIES AT NIST**

T. O'Brian, *National Institute of Standards and  
Technology*

**1130 – 1300 LUNCH**

## WEDNESDAY, DECEMBER 8, 2004

### SESSION VII PTTI SPECIAL

**Chairman:** *Ken Senior, U.S. Naval Research  
Laboratory*

**1300 – 1320 Paper 26: FIRST EVALUATION AND  
EXPERIMENTAL RESULTS ON THE  
DETERMINATION OF [UTC-UTC(K)]  
UNCERTAINTIES**

*W. Lewandowski, Bureau International des Poids et  
Mesures; D. Matsakis, U.S. Naval Observatory;  
G. Panfilo, Politecnico di Torino, Italy; P. Tavella,  
Istituto Elettronico Nazionale Galileo Ferraris, Italy*

**1320 – 1340 Paper 27: LEVERAGING THE AIR FORCE  
ENTERPRISE APPROACH TO TIME AND  
FREQUENCY SYNCHRONIZATION: A  
PROPOSAL**

*G. Bell, The Mitre Corporation; J. Scarano, U.S. Air  
Force*

**1340 – 1400 Paper 28: TERMINOLOGY FOR THE  
GPS'S UTC PRODUCT**

*A. Gifford, National Aeronautics and Space  
Administration; S. Hutsell, Shriever Air Force Base;  
T. Bartholomew, TASC*

### SESSION VIII GNSS INTEROPERABILITY

**Chairman:** *Pascale Defraigne, Royal  
Observatory of Belgium, Belgium*

**1400 – 1420 Paper 29: SOME TESTS OF THE TTS-3,  
MULTISYSTEM TIME TRANSFER  
RECEIVER**

*J. Nawrocki and P. Nogaś Space Research Center,  
Astrogeodynamical Observatory, Poland;  
W. Lewandowski, Bureau International des Poids et  
Mesures, France*

**1420 – 1440 Paper 30: TIMING ASPECTS OF GPS  
GALILEO INTEROPERABILITY:  
CHALLENGES AND SOLUTIONS**

*A. Moudrak, A. Konovaltsev, J. Furthner, and  
J. Hammesfahr, Institute of Communications and  
Navigation, Germany; A. Bauch,  
Physikalisch-Technische Bundesanstalt, Germany;  
P. Defraigne, Royal Observatory of Belgium, Belgium;  
S. Bedrich, Kayser-Threde GmbH, Germany*

**WEDNESDAY, DECEMBER 8, 2004**

**1440 – 1500 Paper 31: DESIGN OF THE PRECISE  
TIME FACILITY FOR GALILEO**

S. Bedrich, *Kayser-Threde GmbH, Germany*;

A. Bauch, *Physikalisch-Technische Bundesanstalt,  
Germany*; A. Moudrak, *Deutsches Zentrum für Luft-  
und Raumfahrt, Germany*, W. Schäfer, *TimeTech  
GmbH, Germany*

**1500 – 1520 INTERMISSION**

**SESSION IX PANEL DISCUSSION (GNSS  
INTEROPERABILITY)**

**1520 – 1640 Chairman: Edoardo Detoma, *Sistemi  
Elettronica Per Automazione, Torino, Italy***

**1700 – 1800 Combined Executive Committee and  
Advisory Board Meeting**

**1900 Evening Activity with Speaker and  
Refreshments**

**THURSDAY, DECEMBER 9, 2004**

**SESSION X SMALL CLOCKS AND OSCILLATORS**

**Chairman: Robert Tjoelker**, *NASA Jet*

*Propulsion Laboratory*

**0800 – 0820 Paper 32: THE CHIP-SCALE ATOMIC  
CLOCK LOW-POWER PHYSICS PACKAGE  
DEVELOPMENT**

R. Lutwak and W. Riley, *Symmetricom*; M. Varghese

and M. Mescher, *Charles Stark Draper Laboratory*;

D. Serkland and G. Peake, *Sandia National*

*Laboratories*

**0820 – 0840 Paper 33: COMPONENTS FOR  
BATCH-FABRICATABLE CHIP-SCALE  
ATOMIC CLOCKS**

M. Kwakernaak, S. Lipp, S. McBride, P. Zanzucchi,

W. Chan, V. Khalfin, H. An, R. Whaley, B. Willner,

A. Ulmer, J. Li, A. Braan and J. Abeles, *Sarnoff*

*Corporation*; A. Post, Y. Jau, and W. Happer,

*Princeton University*

**0840 – 0900 Paper 34: DEVELOPMENTS IN  
ULTRA-STABLE CLOCKS FOR  
DEEP-SPACE RELIABILITY**

G. Weaver, M. Miranian, and M. Reinhart, *Johns*

*Hopkins University Applied Physics Laboratory*

**0900 – 0920 Paper 35: MICROFABRICATED ATOMIC  
CLOCKS AT NIST**

S. Knappe, L. Liew, J. Moreland, L. Hollberg, and

J. Kitching, *National Institute of Standards and*

*Technology*; P. Schwindt and V. Shah, *National*

*Institute of Standards and Technology and University*

*of Colorado*

**0920 – 0940 INTERMISSION**

**SESSION XI CLOCKS FOR SPACE**

**Chairman: Ron Beard**, *U.S. Naval Research*

*Laboratory*

**0940 – 1000 Paper 36: FREQUENCY EQUILIBRATION  
AND THE LIGHT-SHIFT EFFECT IN BLOCK  
IIR GPS RUBIDIUM CLOCKS**

J. Camparo, *The Aerospace Corporation*

**THURSDAY, DECEMBER 9, 2004**

**1000 – 1020 Paper 37: LONG TERM FREQUENCY STABILITY OF U.S. NAVAL OBSERVATORY'S MASERS**

D., Matsakis and P. Koppang, *U.S. Naval Observatory*; M. Garvey, *Symmetricom, Incorporated*

**1020 – 1040 Paper 38: DEVELOPMENT OF A SPACEBORNE HYDROGEN MASER ATOMIC CLOCK FOR A QUASI-ZENITH SATELLITE**

H. Ito, T. Morikawa, H. Ishida, S. Hama, K. Kimura, and S. Yokota, *National Institute of Information and Communications Technology, Japan*; S. Mattori, Y. Numata, M. Kitayama, and K. Takahei, *Anritsu Corporation, Japan*

**1040 – 1100 Paper 39 SPACEBORNE ATOMIC CLOCKS IN GPS**

R. Beard and J. White, *U.S. Naval Research Laboratory*

**1100 – 1120 Paper 40: COMPARATIVE ANALYSIS OF GPS CLOCK PERFORMANCE USING BOTH CODE-PHASE AND CARRIER DERIVED PSEUDORANGE OBSERVATIONS**

J. Oaks and M. Largay, *U.S. Naval Research Laboratory*; W. Reid, *SFA, Incorporated*; J. Buisson, *AEI*

**1120 – 1300 LUNCH**

**SESSION XII ALGORITHMS**

**Chairman: Charles Greenhall, NASA Jet Propulsion Laboratory**

**1300 – 1320 Paper 41: AN UNBIASED FIR FILTER FOR THE TIME ERROR MODEL OF A LOCAL CLOCK IN APPLICATIONS TO GPS-BASED TIMEKEEPING**

Y. Shmaliy, *Guanajuato University, Mexico*

**THURSDAY, DECEMBER 9, 2004**

**1320 – 1340 Paper 42: THE ALLAN VARIANCE AS AN ESTIMATOR OF THE LONG-MEMORY PARAMETER**

L. Schmidt, *The RAND Corporation*; J. Skinner, *U.S. Naval Observatory*

**1340 – 1400 Paper 43: GPS CLOCK AND TIMESCALE MANAGEMENT IN THE MASTER CONTROL STATION**

S. Hutsell, *Schriever Air Force Base*

**1400 – 1420 Paper 44: ESTIMATING THE INSTABILITY OF A COMPOSITE CLOCK**

C. Greenhall, *NASA Jet Propulsion Laboratory*

**1420 – 1440 GENERAL DISCUSSION**

**Joe White**, *U.S. Naval Research Laboratory*

**1440 CLOSE OF MEETING**

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