

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.

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

e-mail: nicolette.jardine@nrl.navy.mil

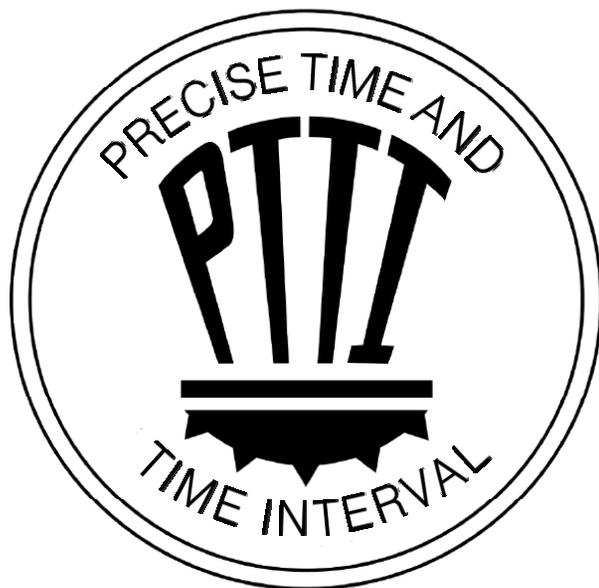
Mail this card to Mrs. Faulkner at the address on Page iv.

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

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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 15th 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

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
Exhibiting: Mr. Gary Geil, 949-361-0212
or gary@gmainsc.cc
General: Mrs. Sheila Faulkner, 703-532-6411
or bopenyan@aol.com
Registration: Ms. Nikki Jardine, 202-767-2595
or 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) 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.

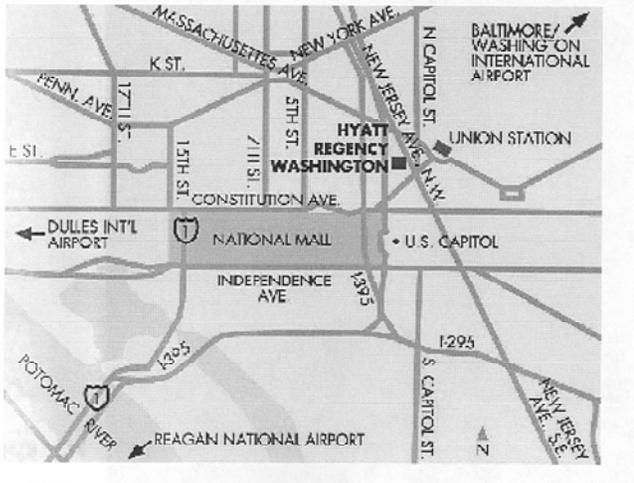
BY CAR: 1. Follow RETURN TO TERMINAL toward DEPARTURES. 2. Stay straight to ARRIVALS. 3. ARRIVALS becomes AIRPORT EXIT. 4. AIRPORT EXIT becomes I-195 W. 5. Merge onto MD-295 S on exit 2B toward Washington. 6. Merge onto US-50 W/New York Ave NE toward Washington. 7. Turn Right onto Florida Ave NE. 8. 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

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

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.

EXECUTIVE COMMITTEE

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and
Istituto Elettrotecnico Nazionale Galileo Ferraris

1997

PROFESSOR BERNARD RENÉ GUINOT
Honorary Astronomer
Paris Observatory

1998

DR. JACQUES VANIER
National Research Counsel (Retired)

1999

DR. LEONARD S. CUTLER
Agilent Technologies

2000

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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Timing Solutions Corporation

DR. RICHARD L. SYDNOR

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
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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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