SCHEDULE

Monday, November 15, 2010
0800 – 1300 Exhibition setup of booth for Exhibitors
0730 – 0830 Tutorials Breakfast
0830 – 1630 Tutorials
1300 – 1700 Exhibitor Setup
1700 – 1830 Icebreaker - Exhibitor Area
1830 – 2100 Exhibitor Setup
1900 – 2100 Registration*

Tuesday, November 16, 2010
0700 – 1600 Registration*
0700 – 0800 Speakers' Breakfast
0700 – 1600 Speakers' Room
0700 – 0800 Attendees' Breakfast
0800 – 1700 Technical Exhibits**
0800 – 0805 Opening
0805 – 0810 Distinguished PTTI Service Award
0810 – 0815 In Memoriam – Harry Peters
0815 – 0830 Opening Remarks
0830 – 0835 Technical Chair Call to Session
0835 – 0950 Session I: National Laboratory Updates
0950 – 1010 Intermission
1010 – 1140 Session II: Vendor Presentations
1140 – 1300 Lunch
1300 – 1420 Session III: Atomic Standards
1420 – 1440 Intermission
1440 – 1600 Session IV: Space Clocks and GNSS
1600 – 1620 Introduction of Student Papers
1620 – 1740 Session V: Poster Session
1830 – 2000 Reception

Wednesday, November 17, 2010
0700 – 1600 Registration*
0700 – 0800 Speakers' Breakfast
0700 – 1600 Speakers' Room
0700 – 0800 Attendees' Breakfast
0800 – 1700 Technical Exhibits**
0800 – 0940 Session VI: Time Transfer
0940 – 1000 Intermission
1000 – 1140 Session VII: IEEE 1588 and NTP
1140 – 1150 Announcement of Student Paper Winners
1150 – 1320 Lunch
1320 – 1500 Session VIII: PTTI and Network Applications
1500 – 1520 Intermission
1520 – 1620 Session IX: Panel Discussion – GPS Mitigation in Challenged Environments
1700 – 1800 Joint Executive and Advisory Board Meeting
1900 – 2030 Special Event

Thursday, November 18, 2010
0700 – 1200 Registration*
0700 – 0800 Speakers' Breakfast
0700 – 1600 Speakers' Room
0700 – 0800 Attendees' Breakfast
0800 – 0940 Session X: Optical Time and Frequency Transfer
0940 – 1000 Intermission
1000 – 1140 Session XI: Clock Performance
1140 – 1310 Lunch
1310 – 1510 Session XII: Algorithms and Calibration
1510 – 1520 General Discussion
1520 Close of Meeting

*Registration is available each day. **Exhibits are open Tuesday and Wednesday only.
REGISTRATION FORM FOR PTTI 2010
Hyatt Regency, Reston, Virginia
November 15 – 18, 2010

NAME: _________________________________________________________
First   Last
AGENCY: ______________________________________________________
Company or Organization
ADDRESS:______________________________________________________
Street
_______________________________________________________________
City, State and Country
TELEPHONE: ________________________ FAX: ______________________
E-MAIL: ________________________________________________________

□ Speaker    □ Session Chairman    □ Exhibitor

Full Registration fee - $600; $550, if payment received/postmarked on or before October 15. Includes entry to the sessions and exhibit hall, the Tuesday and Wednesday luncheons, the Monday evening Ice Breaker, the Tuesday evening Welcoming Reception and one copy of the Proceedings.

Retiree registration fee - $75. The attendee must be fully retired to qualify for the reduced registration fee. Includes entry to the sessions and exhibit hall only.

Student registration fee - $75. The attendee must be a full-time student to qualify for the reduced registration fee. Includes all Full Registration benefits.

One Day registration fee - $200; includes entry to the sessions, exhibit hall and the offered luncheon for that day ONLY.

Tutorials Registration fee - $300; $250 if payment received/postmarked on or before October 15.

□ Registration Fee    $__________
□ One Day Registration ($200)    $__________
□ Tutorials Registration    $__________
□ Extra Reception Tickets ($55 each) No.___________ $__________
□ Extra Lunch Tickets ($25 each) No.___________ $__________
□ Extra Proceedings ($150 each) No.___________ $__________

TOTAL AMOUNT DUE    $__________

□ Check Enclosed       □ Will pay onsite (fax to 202-767-2845)
□ Mark here if purchasing Proceedings only and not attending conference.

Make checks payable to Treasurer, PTTI. If paying in advance, mail the payment and a copy of the registration card to:

Treasurer, PTTI
c/o Mrs. Sheila Faulkner
3159 Patrick Henry Drive
Falls Church, VA 22044, USA

When paying by check, the envelope must be postmarked on or before October 15 to receive all early discounts. All checks must be received no later than November 1.

To register online and/or pay by credit card, visit:
http://pttimeeting.org/registration.html

Online registration ends November 1. After that date, registration must be completed onsite.

Questions? Contact Ms. Jardine at 202-767-2595, DSN 297-2595, or nikki.jardine@nrl.navy.mil
PROGRAM

FORTY-SECOND 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
Defense Information Systems Agency
U.S. Coast Guard Navigation Center

November 15 — 18, 2010

Hyatt Regency Reston Town Center
Reston, Virginia
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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.

This year, the PTTI addresses:

- PTTI Vendor Presentations
- Time and Frequency Standards Laboratories: Activities and Updates
- Time Transfer — Theory, Techniques and Applications
- PTTI in Current Applications
- Atomic and Advanced Clocks
- Novel PTTI Applications
- Time Scales, Algorithms & Methods
- Timing Systems & Applications
- Military Applications
- Global Navigation Satellite Systems (GNSS)
- Receivers — Timing and Calibration
- Student Poster Competition
WELCOME TO PTTI 2010

Please make checks payable to Treasurer, PTTI. If paying in advance, please mail the check and a copy of the registration card to:

Treasurer, PTTI
c/o Mrs. Sheila Faulkner
3159 Patrick Henry Drive
Falls Church, VA 22044 USA

When paying by check, the envelope must be postmarked on or before October 15 to receive all early discounts. All checks must be received no later than November 1.

Register online: http://pttimeeting.org/registration.html. Online registration will be available until November 1. After that date, registration must be completed onsite.

If you are unable to register online, please fill out the enclosed Registration Card and send it to Ms. Nikki Jardine via fax (202-767-2845) or email (nikki.jardine@nrl.navy.mil).

PTTI accepts Visa, MasterCard and Discover via PayPal. A PayPal account is not required to complete the transaction. To pay with your credit card, please register online http://pttimeeting.org/registration.html. The resulting charge will appear on your statement as “PTTI Meeting.”

The full registration fee is $600 (early discounted fee is $550). Full registration includes entry to the sessions and exhibit hall, the Tuesday and Thursday luncheons, the Monday evening Ice Breaker, the Tuesday evening Welcoming Reception and one copy of the Proceedings. The fee increases on October 16.

The registration fee for full-time students is $75 and includes all Full Registration benefits. The registration fee for full-time retirees is $75 and includes entry to the sessions and exhibit area only. The One Day registration fee is $200 and includes entry to the sessions, exhibit hall and the offered lunch for that day ONLY.

The tutorials registration fee is $300 (early discounted fee is $250) and includes breakfast, lunch and a copy of the presentations. The fee increases on October 16. The tutorials will be held Monday, November 15.

Tickets for the luncheons ($25 each) and the reception ($55 each) can be purchased at the PTTI Registration Desk. Extra copies of the Proceedings are also available for purchase.

All attendees, including presenters and exhibitors, must register and receive a badge. The badge must be worn for admission to all sessions and functions and is not transferable. The exhibit area is open to everyone; visitor badges can be picked up at the registration desk.

If you have special dietary or physical requirements, please contact Mrs. Faulkner at 703-532-6411, Fax 703-532-6338 or bopenyan@aol.com.

Cancellation policy
All requests for cancellation must be received in writing before October 15, 2010. On or after October 15, there is a $300 cancellation fee. Refunds are not given for “no shows”; however, substitutions are allowed.

PTTI on the Web
Access PTTI online: http://www.pttimeeting.org
PTTI 2010 Tutorials Session
The Tutorials Session will take place on Monday, November 15. The Tutorials are intended for engineers, mathematicians, scientists or anyone who is new to the field of PTTI, as well as those who have been a part of the PTTI community. Please contact Francine Vannicola, francine.vannicola@nrl.navy.mil, 202-404-4015 (DSN 754-4015) for information on the Tutorials Session. Additional information on the speakers and the presentations is also available on the PTTI website, http://www.pttimeeting.org/tutorials.html.

The registration fee for the Tutorials Session is $250 postmarked on or before October 15 and $300 on and after October 16. The fee includes breakfast, lunch and a copy of the Tutorials presentations (notebook and CD).

Registration Desk Hours
The registration desk will be open during the following hours:
Monday, November 15, 1900 – 2100
Tuesday, November 16, 0700 – 1600
Wednesday, November 17, 0700 – 1600
Thursday, November 18, 0700 – 1200

Questions
Please contact the following people for information on matters concerning:

<table>
<thead>
<tr>
<th>Time</th>
<th>Subject</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830 – 0930</td>
<td>Time Recovery in the Field</td>
<td>Sam Stein Symmetricom, Inc.</td>
</tr>
<tr>
<td>0930 – 1030</td>
<td>Satellite Time &amp; Frequency Transfer</td>
<td>Ron Beard U.S. Naval Research Laboratory</td>
</tr>
<tr>
<td>1045 – 1145</td>
<td>Traceability in Time and Frequency Metrology</td>
<td>Mike Lombardi National Institute of Standards and Technology</td>
</tr>
<tr>
<td>1330 – 1430</td>
<td>Advanced Clocks</td>
<td>Robert Lutwak Symmetricom, Inc.</td>
</tr>
<tr>
<td>1445 – 1545</td>
<td>IEEE-1588 Telecommunications Applications</td>
<td>Lee Cosart Symmetricom, Inc.</td>
</tr>
</tbody>
</table>

The registration fee for the Tutorials Session is $250 postmarked on or before October 15 and $300 on and after October 16. The fee includes breakfast, lunch and a copy of the Tutorials presentations (notebook and CD).

Registration Desk Hours
The registration desk will be open during the following hours:
Monday, November 15, 1900 – 2100
Tuesday, November 16, 0700 – 1600
Wednesday, November 17, 0700 – 1600
Thursday, November 18, 0700 – 1200

Questions
Please contact the following people for information on matters concerning:

Technical questions
Francine Vannicola 202-404-4015 francine.vannicola@nrl.navy.mil

Exhibits
Gary Geil 949-361-0212 gary@gmasales.com
Don Mitchell 928-474-1088 don@gmasales.com

General
Sheila Faulkner 703-532-6411, Cell: 703-244-6346 bopenyan@aol.com

Exhibits
Gary Geil 949-361-0212 gary@gmasales.com
Don Mitchell 928-474-1088 don@gmasales.com

Registration
Nikki Jardine 202-767-2595 nikki.jardine@nrl.navy.mil
Hotel Reservations
Mail or FAX the hotel reservation card (located on the last page) to:

**Hyatt Regency Reston Town Center**
(PTTI 2010 Room Block)
1800 Presidents Street
Reston, Virginia, USA 20190
703-709-1234, Fax 703-925-8295

When making your reservations, be sure to mention PTTI 2010 to receive the group sleeping room rate. The PTTI rate is available November 10 – 22. Check-in time is 1500 (3:00 PM) and checkout time is Noon. Rooms will only be held if guaranteed with a credit card. The block of reserved rooms will be released **October 20**, so reserve early. If you leave before your scheduled departure date without informing the Hyatt, you will be charged an early departure fee. Reston offers a wide range of restaurants and shops.

The PTTI 2010 room rate is the government per diem rate of $207.

**Messages**
Messages may be left for PTTI attendees through the hotel's telephone number:
703-709-1234.

**Temperature**
The climate during November in the Washington, DC area will be cold. A coat or raincoat is recommended.

**Tours**
Tour information will be posted on the PTTI website, [http://pttimeeting.org](http://pttimeeting.org).

**Transportation Information**

**Official Airline**
American Airlines is the official airline for **PTTI 2010**. The Promotion Code is **35N9AI**.

U.S. and Canadian attendees: To make reservations, Please visit [http://www.AA.com](http://www.AA.com) or call **800-433-1790** and refer to the Promotion Code.

International attendees: To make reservations, please call your local reservations number and refer to the Promotion Code (STARfile 35N9AI).

Please be advised that there is a separate ticketing charge of $20.00 USD per ticket for tickets purchased via the phone or $30.00 USD per ticket for tickets purchased at the airport (this amount is subject to change). At this time, there is no ticketing fee for reservations made and ticketed through the American Airlines website.

**Official Rental Car**
Avis is the official rental car agency for **PTTI 2010**. The Avis Worldwide Discount (AWD) Number is **G027999**. Please use this AWD number when calling Avis directly at **888-754-8878** to receive the best car rental rates available. The discount includes unlimited mileage and is available from seven days before to seven days after the meeting. To make your reservation online, visit [https://www.avis.com](https://www.avis.com).

**Airport Shuttle**
The hotel offers a complimentary shuttle that arrives at the top of each hour from 6 am to 10 pm. It takes you directly to Dulles Airport; the drop off and pick up point will be at curbs 2A and 2H, adjacent to the lower level baggage claim level.
Parking
Covered valet and self parking are available. Valet parking is $24.00 overnight, with in/out privileges. Valet parking for the day only is $12.00. Self parking is available at no charge. The parking areas are large enough to accommodate vans.

Directions

Washington Dulles International Airport (6.59 miles)
From airport take Dulles Access Road East toward Washington, DC. At Reston, use Exit 12, Reston Parkway / VA 602 and make a Left on to Reston Parkway. Third traffic light turn left onto Bluemont Way. Turn right onto Presidents Street to the Northern VA hotel.

Ronald Reagan Washington National Airport / Washington, DC (22 miles)
Head north on the George Washington Memorial Parkway (crossing over into Virginia). Take the VA-123 exit toward Chain Bridge / McLean. Keep right at the fork to go on VA-123 S. Merge onto VA-267 W toward I-495 N / Dulles Airport (Portions toll). Take Reston Parkway / VA-602 exit- Exit 12. At the second traffic light turn left onto Bluemont Way. Turn right onto Presidents Street to the Northern VA hotel.

Baltimore and Points North (55.11 miles or more)
Follow I-95 South to Washington, DC beltway then exit right (west) onto I-495. Follow I-495 across the Potomac River into Virginia and exit right onto Rt. 267-Exit 45A toward Dulles Airport / Dulles Toll Road. Take Reston Parkway / VA-602 exit- Exit 12. At the second traffic light turn left onto Bluemont Way. Turn right onto Presidents Street to the Northern VA hotel.

Richmond and Points South (115.20 miles or more)
Follow I-95 North to Washington, DC beltway (at Springfield), then exit onto I-495 (north). Follow I-495 to Rt. 267-Exit 45A, toward Dulles Airport / Dulles Toll Road. Take Reston Parkway / VA-602 exit- Exit 12. Keep right at the fork to go on Reston Parkway / VA-602 N. Turn Left onto Bluemont Way. Turn right onto Presidents Street to the hotel in Northern VA.

Leesburg and Points West (19.72 miles or more)
Two choices: (A) Follow Rt. 7 East to Dranesville and turn right onto Reston Parkway (Rt. 602). Proceed south approximately 3 miles. Hotel will be on the right. (B) Take Dulles Greenway Toll Road East past Dulles International Airport to Exit 12, Reston Parkway. Turn left onto Reston Parkway. Third traffic light turn left onto Bluemont Way. Turn right onto Presidents Street to the Northern VA hotel.
Speakers' Breakfast
The author giving the oral presentation must attend the Speakers’ Breakfast on the morning of the presentation. Please ask at the PTTI Registration Desk for the location. The Speakers’ Breakfast will be held from 0700-0800 on Tuesday, Wednesday and Thursday. The purpose of this breakfast is to allow the Session Chairs to meet each of the presenters and coordinate any last minute details. This is also the time when the audio-visual equipment and the timing lights will be demonstrated. The Speakers' Breakfast is a mandatory event for each speaker giving a scheduled paper that day. If the presenter is not in attendance, the Session Chairs will not know if the presenter is prepared to present and may be forced to cancel the presentation.

Presented Papers
Presenters must send their presentations in PowerPoint (versions accepted up to 2010: all files must be PC/Windows compatible) to presentations@pttimeeting.org by November 8. In the event this deadline cannot be met, a CD-ROM or flash drive containing the presentation must be delivered to Mr. Douglas Boehm by 1800 the day before the presentation.

Please send a Microsoft Word electronic version of your Paper (e-mail, CD-ROM), formatted according to the PTTI Paper Preparation Instructions included in the Author's Kit, to Dr. Lee Breakiron, Editorial Chairman (lee.breakiron@usno.navy.mil) by November 18. If prior arrangements have not been made, the Paper will not be published in the Proceedings. The Author's Kit can be downloaded from http://www.pttimeeting.org/author_kit.pdf

Exhibits
The exhibits co-chairs are:

Gary Geil and Don Mitchell
Geil Marketing Associates
934 Calle Negocio Suite B, San Clemente, CA 92673
949-361-0212, Fax 949-361-0312
gary@gmasales.com or don@gmasales.com

List of Potential Exhibitors for PTTI 2010

Astrogeodynamical Observatory
AccuBeat, Ltd.
Brandywine Communications
Brilliant Instruments, Inc.
Brilliant Telecommunications
EndRun
Evertz
Frequency Electronics, Inc.
Furuno GPS OEM
GMV Aerospace and Defence, S.A.
GPS Networking
GPS World/Questex Media
GPS Source
GuideTech
The Historical Electronics Museum
Inside GNSS
The Institute of Navigation
ITT
Jackson Labs
JTime! Meinberg USA
Lange-Electronic GmbH
Locus
Military University of Technology
Mira Vista Technologies
Masterclock, Inc.
Morion, Inc.
NavTech GPS Supply
Noise eXtended Technologies S.A.S.
OEwaves
Osborne Technologies
Pascal
PikTime Systems, LTD
Poseidon Scientific Instruments
Precise Time and Frequency, Inc.
Quartzlock
Sanders & Associates, Inc.
SigNav
Spectracom Corp/Pendulum Instruments
SpectraDynamics, Inc.
SpectraTime
Spectrum Instruments, Inc.
Symmetricom – Timing Test and Measurements
Synergy Systems
Time & Frequency Solutions
TimeTech, LLC GmbH
TRAK Microwave Corporation
Trimble Navigation
U.S. Naval Observatory
XECO, Inc.
Student Poster Competition
The fourth annual PTTI Student Poster competition will take place at this year’s PTTI. The goal is to get students thinking early in their careers about the engineering and scientific applications of precise timing (in the broadest sense) and in that way maintain the vitality of our field in the 21st century. The competition also offers an opportunity for students to meet future employers and for employers to get a better sense of what skills young engineers and scientists are bringing to the marketplace.

The competition has an undergraduate and graduate division and submitted abstracts will cover any area dealing with “precise” timekeeping systems or applications. In light of the competition’s goal, there is a wide range of topics that students might address (i.e., biological to geophysical to astronomical). Consequently, the specific meaning of the word “precise” is taken in context. Abstracts can be submitted for posters dealing with literature reviews, laboratory work, or computational investigations.

Questions concerning the Student Poster Competition should be addressed to Mrs. Rachel Evans-Binfield, rachel.binfield@jhuapl.edu.

PTTI 2010 Evening Activities
On Monday, November 15 at 1700, the “Get Acquainted” Icebreaker function will be held in the Exhibits Hall. Refreshments will be served.

The Welcoming reception will be held Tuesday, November 16 at 1830.

On Wednesday, November 17 at 1900, PTTI 2010 is pleased to have Mrs. Carlene E. Stephens, Curator, Division of Work and Industry from the Smithsonian’s National Museum of American History. Mrs. Stephens will provide a preview of “Time and Navigation,” a new exhibit opening in late 2012 at the Smithsonian’s National Air and Space Museum. Refreshments will be served.

Proceedings
The Proceedings will be available on CD and mailed to the attendees in 2011. If you cannot attend, but wish to reserve a copy of the Proceedings, please return the Registration Card with a check for $150 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 $150.

Forty-third Annual PTTI Meeting
The 43rd Annual PTTI Systems and Applications Meeting (PTTI 2011) will be held November 14 — 17, 2011, at the Hyatt Regency, Long Beach, California.
PTTI EXECUTIVE COMMITTEE

MS. FRANCINE M. VANNICOLA, CHAIRMAN
U.S. Naval Research Laboratory

MR. RONALD L. BEARD
U.S. Naval Research Laboratory

DR. LEE A. BREAKIRON
U.S. Naval Observatory

MR. RICHARD CAMP
Defense Information Systems Agency

MS. NANCY C. HAMILTON
Department of Defense

DR. DENNIS D. MCCARTHY
U.S. Naval Observatory

CAPT. FRED PARKER
U.S. Coast Guard Navigation Center

DR. ROBERT L. TJOELKER
NASA Jet Propulsion Laboratory

DR. JOSEPH D. WHITE
U.S. Naval Research Laboratory
<table>
<thead>
<tr>
<th>Name</th>
<th>Company/Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR. S. CLARK WARDRIP</td>
<td>Global Strategies Group (North America) (GSGNA), Inc.</td>
</tr>
<tr>
<td>MR. MARTIN B. BLOCH</td>
<td>Frequency Electronics, Inc.</td>
</tr>
<tr>
<td>DR. EDOARDO DETOMA</td>
<td>SEPA S.p.A</td>
</tr>
<tr>
<td>DR. BRADFORD W. PARKINSON</td>
<td>Stanford University</td>
</tr>
<tr>
<td>MRS. SHEILA FAULKNER</td>
<td>GSGNA, Inc.</td>
</tr>
<tr>
<td>DR. VICTOR S. REINHARDT</td>
<td>Raytheon Space and Airborne Systems</td>
</tr>
<tr>
<td>DR. HENRY F. FLIEGEL</td>
<td>The Aerospace Corporation</td>
</tr>
<tr>
<td>MR. PASCAL ROCHAT</td>
<td>SpectraTime</td>
</tr>
<tr>
<td>MR. HUGO FRUEHAUF</td>
<td>ViaLogy LLC</td>
</tr>
<tr>
<td>MR. RONALD C. ROLOFF</td>
<td>Geil Marketing Associates, Inc.</td>
</tr>
<tr>
<td>DR. R. MICHAEL GARVEY</td>
<td>Symmetricom</td>
</tr>
<tr>
<td>DR. LARA S. SCHMIDT</td>
<td>The RAND Corporation</td>
</tr>
<tr>
<td>MR. GARY GEIL</td>
<td>Geil Marketing Associates, Inc.</td>
</tr>
<tr>
<td>DR. SAMUEL R. STEIN</td>
<td>Symmetricom, Inc</td>
</tr>
<tr>
<td>DR. WILLIAM J. KLEPCZYNSKI</td>
<td>U.S. Naval Observatory (Retired)</td>
</tr>
<tr>
<td>DR. PATRIZIA TAVELLA</td>
<td>INRIM</td>
</tr>
<tr>
<td>MR. WERNER R. LANGE</td>
<td>Lange-Electronic GmbH</td>
</tr>
<tr>
<td>PROFESSOR JACQUES VANIER</td>
<td>University of Montreal</td>
</tr>
<tr>
<td>DR. LEO A. MALLETTE</td>
<td>The Aerospace Corporation</td>
</tr>
<tr>
<td>DR. YAKOV L. VOROKHOVSKY</td>
<td>Morion, Inc.</td>
</tr>
<tr>
<td>MR. DONALD H. MITCHELL</td>
<td>Geil Marketing Associates, Inc.</td>
</tr>
<tr>
<td>DR. ANDY WU</td>
<td>The Aerospace Corporation</td>
</tr>
</tbody>
</table>
## 2010 Distinguished PTTI Service Award Selection Committee

**DR. DENNIS D. MCCARTHY, CHAIRMAN**  
U.S. Naval Observatory

**DR. LEO A. MALLETTE**  
The Aerospace Corporation

**MR. DON H. MITCHELL**  
Geil Marketing Associates

**DR. JACQUES VANIER**  
University of Montreal

<table>
<thead>
<tr>
<th>Year</th>
<th>Award Recipient</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>DR. GERNOT M. R. WINKLER</td>
<td>U.S. Naval Observatory (Retired)</td>
</tr>
<tr>
<td>1995</td>
<td>DR. JAMES A. BARNES</td>
<td>National Institute of Standards and Technology (Retired)</td>
</tr>
<tr>
<td>1996</td>
<td>PROFESSOR SIGFRIDO M. LESCHIUTTA</td>
<td>Politecnico di Torino and Istituto Elettrotecnico Nazionale Galileo Ferraris</td>
</tr>
<tr>
<td>1997</td>
<td>PROFESSOR BERNARD RENE GUINOT</td>
<td>Honorary Astronomer Paris Observatory</td>
</tr>
<tr>
<td>1998</td>
<td>DR. JACQUES VANIER</td>
<td>National Research Counsel (Retired)</td>
</tr>
<tr>
<td>1999</td>
<td>DR. LEONARD S. CUTLER</td>
<td>Agilent Technologies</td>
</tr>
<tr>
<td>2000</td>
<td>MR. ROGER EASTON</td>
<td>U.S. Naval Research Laboratory (Retired)</td>
</tr>
<tr>
<td>2001</td>
<td>DR. ROBERT F. C. VESSOT</td>
<td>Smithsonian Astrophysical Observatory (Retired)</td>
</tr>
<tr>
<td>2002</td>
<td>MR. HARRY PETERS</td>
<td>Sigma Tau, Incorporated (Retired)</td>
</tr>
<tr>
<td>2003</td>
<td>MR. S. CLARK WARDRIP</td>
<td>National Aeronautics and Space Administration (Retired)</td>
</tr>
<tr>
<td>2005</td>
<td>DR. NORMAN F. RAMSEY</td>
<td>Harvard University</td>
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<tr>
<td>2006</td>
<td>PROFESSOR DAVID L. MILLS</td>
<td>University of Delaware</td>
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<td>2007</td>
<td>DR. R. MICHAEL GARVEY</td>
<td>Symmetricom</td>
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<tr>
<td>2008</td>
<td>DR. PATRIZIA TAVELLA</td>
<td>Istituto Nazionale di Ricerca Metrologica</td>
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<tr>
<td>2009</td>
<td>DR. JUDAH LEVINE</td>
<td>National Institute of Standards and Technology</td>
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</tbody>
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PTTI 2010 MEETING OFFICERS

GENERAL CHAIRMAN
DR. LEO A. MALLETTE
The Aerospace Corporation

TECHNICAL PROGRAM COMMITTEE CHAIRMAN
MRS. RACHEL EVANS-BINFIELD
Johns Hopkins University/Applied Physics Laboratory

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National Institute of Standards and Technology

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U.S. Naval Research Laboratory

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TECHNICAL ASSISTANCE
MR. DOUG BOEHM
U.S. Naval Research Laboratory

MEETING ARRANGEMENTS
MRS. SHEILA FAULKNER
Global Strategies Group (North America), Inc.

REGISTRATION
MS. NICOLETTE JARDINE
U.S. Naval Research Laboratory
PTTI 2010 SESSION CHAIRS

SESSION I: National Laboratory Updates
GREG WEAVER
Johns Hopkins University/Applied Physics Laboratory

SESSION II: Vendor Presentations
RYAN DUPUIS
PerkinElmer Inc.

SESSION III: Atomic Standards
STEVEN JEFFERTS
National Institute of Standards and Technology

SESSION IV: Space Clocks and GNSS
DENNIS MANNING
National Geospatial-Intelligence Agency

SESSION V: Poster Session
JAMES CAMPARO
The Aerospace Corporation

SESSION VI: Time Transfer
CHRISTINE HACKMAN
U.S. Naval Observatory

SESSION VII: IEEE 1588 and NTP
GEORGE SHATON
Northrup Grumman

SESSION VIII: PTTI and Network Applications
JAMES WRIGHT
L-3 Communications

SESSION IX: Panel Discussion – GPS Mitigation in Challenged Environments
DENNIS MCCARTHY
U.S. Naval Observatory

RONALD BEARD
U.S. Naval Research Laboratory

SESSION X: Optical Time and Frequency Transfer
JAMES HANSSEN
U.S. Naval Observatory

SESSION XI: Clock Performance
STEFANIA ROMISCH
National Institute of Standards and Technology

SESSION XII: Algorithms and Calibration
PATRIZIA TAVELLA
Istituto Nazionale di Ricerca Metrologica
PTTI 2010
FORTY-SECOND ANNUAL
PRECISE TIME AND TIME INTERVAL (PTTI)
SYSTEMS AND APPLICATIONS MEETING

TUESDAY, NOVEMBER 16, 2010

0800 – 0805 OPENING
Leo A. Mallette, The Aerospace Corporation

0805 – 0810 IN MEMORIAM – HARRY PETERS
Paul Kop pang, U.S. Naval Observatory; Clark Wardrip, GSGNA, Inc.

0810 – 0815 DISTINGUISHED PTTI AWARD PRESENTATION

0815 – 0830 OPENING REMARKS
CAPT R. Scott Steadley, Superintendent, U.S. Naval Observatory

0830 – 0835 CALL TO SESSION
Rachel Binfield, Johns Hopkins University/Applied Physics Laboratory

SESSION I NATIONAL LABORATORY UPDATES
Chairman: Greg Weaver, Johns Hopkins University/Applied Physics Laboratory

0835 – 0850 Paper 1: TIME AND FREQUENCY ACTIVITIES AT THE U.S. NAVAL OBSERVATORY
D. Matsakis, U.S. Naval Observatory

0850 – 0905 Paper 2: TIME AND FREQUENCY ACTIVITIES AT THE JHU APPLIED PHYSICS LABORATORY
M. Miranian, G. Weaver, M. Reinhart and R. Dragonette, Johns Hopkins University/Applied Physics Laboratory

0905 – 0920 Paper 3: TIME AND FREQUENCY ACTIVITIES AT THE NAVAL RESEARCH LABORATORY
R. Beard, U.S. Naval Research Laboratory

0920 – 0935 Paper 4: ACTIVITIES AT THE STATE TIME AND FREQUENCY STANDARD OF RUSSIA
N. Koshelyaevsky, V. Kostromin, O. Sokolova, Zagirova, Department of Metrology for Time and Space FGUP “VNIIFTRI,” Russia

0935 – 0950 Paper 5: TIMEKEEPING OF NTSC IN RECENT YEARS
H. Yuan and L. Qu, Chinese Academy of Sciences, China

0950 – 1010 INTERMISSION

SESSION II VENDOR PRESENTATIONS
1010 – 1140 Chairman: Ryan Dupuis, PerkinElmer Inc.
TUESDAY, NOVEMBER 16, 2010

1140 – 1300 LUNCH

SESSION III ATOMIC STANDARDS
Chairman: Steven Jefferts, National Institute of Standards and Technology

1300 – 1320 Paper 6: MCAFS – A MINIATURE COLD ATOM FREQUENCY STANDARD
V. Shah, A. Martins and R. Lutwak, Symmetricom

1320 – 1340 Paper 7: PERFORMANCE OF FEI SPACE-CLASS RUBIDIUM ATOMIC STANDARDS
M. Bloch, O. Mancini and T. McClelland, Frequency Electronics, Inc.

1340 – 1400 Paper 8: 10⁻¹⁰ LEVEL SIMPLE SINGLE OVEN OCXO
M. Ito, H. Mitome, T. Oita and N. Dempa, Kogyo Co., Ltd., Japan

1400 – 1420 Paper 9: A RUBIDIUM PORTABLE ATOMIC FOUNTAIN FREQUENCY STANDARD
P. Kunz, T.P. Heavner and S.R.Jefferts, National Institute of Standards and Technology

1420 – 1440 INTERMISSION

SESSION IV SPACE CLOCKS AND GNSS
Chairman: Dennis Manning, National Geospatial-Intelligence Agency

1440 – 1500 Paper 10: ACTUAL OPERATION SIMULATION OF RESSOX GROUND EXPERIMENTS
T. Iwata, K. Saito, K. Machita and T. Matsuzawa, National Institute of Advanced Industrial Science and Technology, Japan

1500 – 1520 Paper 11: GALILEO COMMON VIEW: FORMAT, PROCESSING AND TESTS WITH GIOVE
P. Defraigne, Royal Observatory of Belgium; and A. Mudrak, S. Binda, Galileo Project Office, European Space Agency

1520 – 1540 Paper 12: LONG-TERM PERFORMANCE ANALYSIS OF GIOVE CLOCKS
P. Waller, F. Gonzalez, S. Binda, European Space Agency, ESA-ESTEC, The Netherlands; D. Rodriguez and G. Tobias, GMV S.A., Spain; and A. Cernigliaro, P. Tavella, Istituto Nazionale di Ricerca Metrologica, Italy

1540 – 1600 Paper 13: GPS BLOCK IIF ATOMIC FREQUENCY STANDARDS ANALYSIS
INTRODUCTION OF STUDENT PAPERS
James Camparo, The Aerospace Corporation

SESSION V POSTER SESSION
1620 – 1740
Chairman: James Camparo, The Aerospace Corporation

Poster 1: STUDIES ON IMPROVED COMPACT PHYSICS PACKAGE FOR RB CELL STANDARDS
T. Bandi, C. Affolderbach and G. Mileti, Laboratoire Temps-Fréquence, University of Neuchâtel, Switzerland

Poster 2: SPUR CORRELATION IN AN ARRAY OF DIRECT DIGITAL SYNTHESIZERS

Poster 3: EVALUATION OF A GPS RECEIVER FOR CODE AND CARRIER-PHASE TIME AND FREQUENCY TRANSFER
V. Zhang and M. Lombardi, National Institute of Standards and Technology

Poster 4: HOW TO HANDLE A SATELLITE CHANGE IN AN OPERATIONAL TWTSFT NETWORK?
K. Liang, National Institute of Metrology, China; and T. Feldmann, D. Piester, A. Bauch, Physikalisch-Technische Bundesanstalt, Germany

Poster 5: CHARACTERIZATION OF PHASE NOISE EFFECTS IN THE PHOTODETECTION OF ULTRASHORT OPTICAL PULSES
J.A. Taylor, Department of Physics, University of Colorado; F. Quinlan, A. Hati, C. Nelson, S.A. Diddams, National Institute of Standards and Technology; and S. Datta, A. Joshi, Discovery Semiconductors, Inc.

Poster 6: INRIM TIME AND FREQUENCY LABORATORY: A NEW DATA MANAGEMENT SYSTEM (DMS)
V. Pettiti, R. Costa, G. Cerretto, F. Cordara, P. Tavella, D. Orgiazzi and G. Reffo, Istituto Nazionale di Ricerca Metrologica, Italy

Poster 7: THE STABILITY OF CARRIER-PHASE GPS RECEIVERS
L.A. Breakiron, U.S. Naval Observatory

Poster 8: PTTI 2030 – SYSTEM APPLICATIONS OF ADVANCED CLOCKS
R. Dupuis, PerkinElmer Inc.; and B. Owings, Symmetricom

Poster 9: PTTI 2030 – TIME TRANSFER AND APPLICATIONS IN 2030
J. Wright, L-3 Communications; and S. Mitchell, U.S. Naval Observatory
POSTER SESSION (cont.)

Poster 10: PTTI 2030 – THINKING OUTSIDE THE BOX
P. Kunz and S. Römisch, National Institute of Standards and Technology

1830 – 2000 RECEPTION
SESSION VI  TIME TRANSFER
Chairman: Christine Hackman, U.S. Naval Observatory

0800 – 0820  Paper 14: ACCURACY AND PRECISION OF USNO GPS CARRIER PHASE TIME TRANSFER
C. Hackman and D. Matsakis, U.S. Naval Observatory

0820 – 0840  Paper 15: SIMPLE METHODS FOR THE ESTIMATION OF THE SHORT TERM STABILITY OF GNSS ON BOARD CLOCKS
J. Delporte, C. Boulanger and F. Mercier, CNES – French Space Agency, France

0840 – 0900  Paper 16: NEAR REAL-TIME MONITORING OF FREQUENCY STANDARDS AND TIME SCALES USING PPP
G. Cerretto, P. Tavella, Istituto Nazionale di Ricerca Metrologica, Italy; F. Lahaye, Y. Mireault, Natural Resources Canada; and D. Rovera, LNE-SYRTE, OP, France

0900 – 0920  Paper 17: AOS STUDIES ON USE OF GNSS FOR TIME TRANSFER
J. Nawrocki, P. Nogas and P. Lejba, Astrogeodynamical Observatory, Poland

0920 – 0940  Paper 18: INTEGRATED DOPPLER CORRECTION TO TWSTFT USING ROUND-TRIP MEASUREMENT
Y. Huang, W. Tseng and S. Lin, Telecommunication Laboratories, Chunghwa Telecom, Taiwan

0940 – 1000  INTERMISSION

SESSION VII  IEEE-1588 AND NTP
Chairman: George Shaton, Northrup Grumman

1000 – 1020  Paper 19: PERFORMANCE OF IEEE 1588 IN LARGE-SCALE NETWORKS
G. Gaderer, N. Simanic, P. Loschmidt and B. Coric, Institute for Integrated Sensor Systems, Austrian Academy of Sciences, Austria

1020 – 1040  Paper 20: LAYER 1 ETHERNET CLOCK SYNCHRONIZATION
R. Exel, G. Gaderer, Institute for Integrated Sensor Systems, Austrian Academy of Sciences; and N. Kerö, Oregano Systems

1040 – 1100  Paper 21: IEEE 1588 FREQUENCY AND TIME TRANSFER MEASUREMENT AND ANALYSIS
L. Cosart, Symmetricom, Inc.

1100 – 1120  Paper 22: A NETWORK TIME PROTOCOL STRATUM-1 SERVER FED BY IEEE-1588
R. Schmidt, U.S. Naval Observatory
WEDNESDAY, NOVEMBER 17, 2010

SESSION VII  IEEE-1588 AND NTP (cont.)

1120 – 1140  Paper 23: TIME SYNCHRONIZING USING IEEE-1588 + SYNCHRONOUS ETHERNET IN A TIME-SETTING MODE OF OPERATION
P. S. Bedrosian, LSI Corporation

1140 – 1150  ANNOUNCEMENT OF STUDENT PAPER WINNERS
Leo Mallette, The Aerospace Corporation

1150 – 1320  LUNCH

SESSION VIII  PTTI AND NETWORK APPLICATIONS
Chairman: James Wright, L-3 Communications

1320 – 1340  Paper 24: IEEE-1588 DEPLOYED ON THE EASTERN RANGE
W. Rendla and J. Wright, L-3 Communications, SpaceLift Range Systems Contract

1340 – 1400  Paper 25: A REVIEW AND ANALYSIS OF IEEE 1588 SECURITY MEASURES
A. Treytl, B. Hirschler and G. Gaderer, Austrian Academy of Sciences, Institute for Integrated Sensor Systems, Austria

1400 – 1420  Paper 26: UTC TIME TRANSFER FOR HIGH FREQUENCY TRADING (HFT) USING IS-95 CDMA BASE STATION TRANSMISSIONS AND PTP
M. Korreng, EndRun Technologies

G. Weaver, J. Garstecki and S. Reynolds, Johns Hopkins University/Applied Physics Laboratory

1440 – 1500  Paper 28: VERY PRECISE SYNCHRONIZATION OF A GROUP OF PSEUDOLITES
W. Lange, Lange-Electronic GmbH, Germany

1500 – 1520  INTERMISSION

SESSION IX  PANEL DISCUSSION: GPS MITIGATION IN CHALLENGED ENVIRONMENTS
Chairman: Dennis McCarthy, U.S. Naval Observatory;
Ronald Beard, U.S. Naval Research Laboratory

1700 – 1800  JOINT EXECUTIVE AND ADVISORY BOARD MEETING

SESSION X  OPTICAL TIME AND FREQUENCY TRANSFER
Chairman:  James Hanssen, U.S. Naval Observatory

A. Czubla, Central Office of Measures; Ł. Śliwczyński, P. Krehlik, Ł. Buczek, M. Lipiński, AGH University of Science and Technology; and Jerzy Nawrocki, Polish Academy of Sciences, Poland

Ph. Guillemot, S. Leon, CNES –French Space Agency; P. Exertier, E. Samain, F. Pierron, OCA – Observatoire de la Côte d’Azur; and Ph. Laurent, M. Abgrall J. Achkar, D. Rovera, K. Djerroud, SYRTE – Observatoire de Paris, France

0840 – 0900  Paper 31:  SINGLE WAY FIBER-BASED TIME TRANSFER WITH ACTIVE DETECTION OF TRANSFER TIME VARIATIONS
S. Ebenhag and P. Hedekvist, SP Technical Research Institute of Sweden

0900 – 0920  Paper 32:  TIME TRANSFER IN OPTICAL NETWORK
V. Smotlacha, CESNET, Czech Republic; A. Kuna, Institute of Photonics and Electronics, AS CR, Czech Republic; and W. Mache, Bundesamt für Eich - und Vermessungswesen, Austria

0920 – 0940  Paper 33:  COMPENSATED FIBER OPTIC FREQUENCY DISTRIBUTION EQUIPMENT
J. MacDonald and G. Conway, Linear Photonics, LLC

0940 – 1000  INTERMISSION

SESSION XI  CLOCK PERFORMANCE
Chairman:  Stefania Romisch, National Institute of Standards and Technology

1000 – 1020  Paper 34:  PRIMARY FREQUENCY STANDARDS AT NIST
T.P. Heavner, T.E. Parker, P. Kunz, J.H. Shirley and S.R. Jefferts, National Institute of Standards and Technology

1020 – 1040  Paper 35:  CORRELATIONS IN HYDROGEN MASER FREQUENCIES
T.E. Parker, S.R. Jefferts and T.P. Heavner, National Institute of Standards and Technology

1040 – 1100  Paper 36:  AN AUTOMATIC SWITCHING MATRIX (ASM) FOR THE GALILEO PTF
E. Detoma and P. Griseri, SEPA S.p.A., Italy; A. Moudrak, M. S. Gestido, ESA ESTEC, The Netherlands; and M. Blanchi, R. Zanello, Thales Alenia Space Italia, Italy
THURSDAY, NOVEMBER 18, 2010

SESSION XI  CLOCK PERFORMANCE (cont.)

1100 – 1120  Paper 37: ON-BOARD GPS CLOCK MONITORING
M. Weiss, National Institute of Standards and Technology; R. Beard, U.S. Naval Research Laboratory; P. Shome, Federal Aviation Administration

1120 – 1140  Paper 38: PERFORMANCE COMPARISON OF TWO COMPOSITE CLOCKS SIMULATING FUTURE GPS CLOCK SCENARIOS
M. Suess, German Aerospace Center – DLR, Germany; D. Matsakis, U.S. Naval Observatory; and C.A. Greenhall, Jet Propulsion Laboratory

1140 – 1310  LUNCH

SESSION XII  ALGORITHMS AND CALIBRATION
Chairman: Patrizia Tavella, Istituto Nazionale di Ricerca Metrologica

1310 – 1330  Paper 39: AN ALGORITHM FOR THE DETECTION OF FREQUENCY JUMPS IN SPACE CLOCKS
L. Galleani, Politecnico di Torino; P. Tavella, INRIM

1330 – 1350  Paper 40: ADVANCED GPS BASED TIME LINK CALIBRATION WITH PTB’S NEW CALIBRATION SYSTEM
T. Feldmann, A. Bauch, D. Piester, M. Rost, Physikalisch-Technische Bundesanstalt, Germany; and E. Goldberg, S. Mitchell, B. Fonville, U.S. Naval Observatory

1350 – 1410  Paper 41: MULTI-SCALE CLOCK ENSEMBLING USING WAVELETS
K. Senior, U.S. Naval Research Laboratory; and D. Percival, University of Washington

A. Proia, Centre National d’Etudes Spatiales, France; and G. Cibiel, Bureau International des Poids et Mesures, France

1430 – 1450  Paper 43: EVALUATION OF GNSS TIMING RECEIVERS
J. Prillaman, S. Mitchell, B. Fonville, B. Goldberg and E. Powers, U.S. Naval Observatory

1450 – 1510  Paper 44: THE REALIZATION OF TA(NIM) AND UTC(NIM)

1510 – 1520  GENERAL DISCUSSION
Francine Vannicola, U.S. Naval Research Laboratory

1520  CLOSE OF MEETING
HOTEL RESERVATION CARD

The block of rooms for the PTTI 2010 rate will be released on October 20.

Please mail or FAX to:

Hyatt Regency Reston Town Center
(PTTI 2010 Room Block)
1800 Presidents Street
Reston, Virginia, USA 20190
703-709-1234, Fax 703-925-8295

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Name on Card _______________________________________

Number ____________________________________________

Expiration Date _____________________________________

CCV _______________________________________________