

ADVANCE PROGRAM

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



November 27- 29, 2001

**33 Years of Progress
1969-2001**

**Hyatt Regency Hotel
Long Beach, California**

The Schedule

Monday, November 26, 2001

0800-1300	Exposition Set-Up of Booths for Exhibitors
0800-1600	Tutorials
1300-1700	Exhibitor Set-Up
1700-1830	Icebreaker - Exhibit Area
1830-2100	Exhibitor Set - Up
1900-2100	Registration - PTTI Meeting*
1900-2100	Committee on GPS and GLONASS Time Transfer Standards

Tuesday, November 27, 2001

0700-0800	Speakers' Breakfast
0700-0800	Speakers' Room
0700-0800	Attendees' Breakfast
0800-1600	Registration - Grand Ballroom Foyer
0800-0835	Opening Session
0800-1700	Technical Exhibits
0835-0940	Session I - PTTI Vendor Presentations
0940-1000	Intermission - Exhibits Area
1000-1140	Session II
1140-1320	Attendees' Lunch
1320-1500	Session III
1500-1520	Intermission - Exhibits Area
1520-1700	Session IV
1800-1930	Reception

Wednesday, November 28, 2001

0700-0800	Speakers' Breakfast
0700-0800	Speakers' Room
0700-0800	Attendees' Breakfast
0800-1600	Registration
0800-1700	Technical Exhibits
0800-0940	Session V
0940-1000	Intermission - Exhibits Area
1000-1120	Session VI
1120-1300	Attendees' Lunch
1300-1520	Session VII
1520-1540	Intermission - Exhibits Area
1540-1700	Session VIII
1730-1830	Joint Executive and Advisory Board Meeting

Thursday, November 29, 2001

0700-0800	Speakers' Breakfast
0700-0800	Speakers' Room
0700-0800	Breakfast
0800-1430	Registration
0800-0940	Session IX
0940-1000	Intermission - Pre-Function Area
1000-1120	Session X
1120-1300	Attendees' Lunch
1300-1400	Session XI
1400-1440	Session XII
1440-1500	Intermission
1500-1620	Session XII (continued)
1620-1640	Discussion
1640-1650	Close of Meeting

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

**REGISTRATION CARD
THIRTY THIRD ANNUAL
PRECISE TIME AND TIME INTERVAL
SYSTEMS AND APPLICATIONS**

NOVEMBER 27-29, 2001

NAME _____
First _____ Initial _____ Last _____

AGENCY _____
Company or Organization _____

ADDRESS _____
Street _____

City, State or Country _____

TELEPHONE _____ FAX _____

E-MAIL _____

Registration (will pay on-site) †‡

Registration Amount Enclosed †‡ No. _____ \$ _____

† \$250.00 if postmarked on or before November 9; \$275.00 thereafter.

(Covers entry to all sessions, one Icebreaker ticket, one reception ticket, three breakfasts and three lunches, 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 sessions and exhibits **only**.)

Additional Reception Tickets (\$30 each) No. _____ \$ _____

Breakfast Tickets (\$20 each) No. _____ \$ _____

Lunch Tickets (\$25 each) No. _____ \$ _____

Tutorial (\$200) No. _____ \$ _____

Proceedings (Costs on Page ix) No. _____ \$ _____

Total Amount Enclosed \$ _____

Mark here if purchasing Proceedings only

Make checks payable to Treasurer, PTTI; we cannot accept payment by credit card unless registering online at the PTTI Web Site.

Speaker

Exhibitor

Session Chairman

Questions? Contact Ms. Jardine at 202-762-1414 or
jardine.nicolette@usno.navy.mil

**Mail this card to Ms. Jardine at the address on
Page iv**

ADVANCE PROGRAM

THIRTY-THIRD 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

November 27-29, 2001



Hyatt Regency Hotel
Long Beach, California

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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;
 - Provide an opportunity for an active exchange of new technology associated with PTTI.
- =====

This year, PTTI 2001 addresses:

- Commercial Timing Dissemination and Performance
- Clocks for Space
- GPS Timing Performance
- Two-Way Satellite Time and Frequency Transfer
- GPS Common View and Carrier Phase Time and Frequency Transfer
- Timing Receivers
- Time Scales and Algorithms
- Timing Laboratory Activity Updates
- PTTI Vendor Presentations

WELCOME TO PTTI 2001

MEETING INFORMATION

Registration

Please send the PTTI registration form and, if not registering on line, check to:

Ms. Nicolette Jardine
PTTI Registration
U.S. Naval Observatory
Time Service Department
3450 Massachusetts Avenue, N W
Washington, D.C. 20393-5420
202-762-1414
FAX 202-762-1511
e-mail: jardine.nicolette@usno.navy.mil

The registration fee is \$275.00. Note: If payment is received postmarked before 9 November 2001 the cost is \$250.00.

The full registration fee includes entry to all the sessions, the exhibit area, a copy of the Proceedings, an icebreaker on 26 November, the welcoming reception, breakfast and lunch each day. Guest tickets are \$30.00 for the reception, \$20.00 for breakfast 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 the exhibit area only. It does not include a copy of the Proceedings, entry to breakfasts, lunches, or the reception.

Please make checks payable to: **Treasurer, PTTI**. This year PTTI will accept credit card payments **ONLY** through the PTTI Web site. Please see the Web site for details. **Credit cards CANNOT be accepted at the registration desk.** Attendees, including presenters and exhibitors, must register and receive a badge and badges must be worn for admission to all sessions and functions. Badges for registered 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 16, 2001. On or after November 16th there is a \$140.00 cancellation fee. Refunds are not given for "no shows", but substitutions are allowed.

PTTI 2001 Home Page

Access the PTTI 2001 Home Page from the World Wide Web at:
<http://tycho.usno.navy.mil/ptti.html>

PTTI 2001 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 registration fee.
Payment has to be postmarked by November 9, 2001.

PTTI 2001 Tutorials

Tutorials take place prior to PTTI 2001 on Monday, November 26, 2001 from 0800 to 1600. For detailed information regarding the tutorials, please contact Mr. S. Clark Wardrip via e-mail at skyclark@aol.com, or the PTTI Home Page at: <http://tycho.usno.navy.mil/ptti.html>. The fee for the all day tutorials is \$200.00. Breakfast and lunch are included. Please register using the attached "Registration Card" or "on-line" at the above Web address.

The tutorial topics are as follows:

- 1) Atomic Frequency Standards, Dr. Robert Tjoelker, NASA Jet Propulsion Laboratory
- 2) Statistics Processes – A Graphic Tutorial, Dr. Victor Reinhardt, Boeing Space Systems
- 3) Precision Measurement of Oscillators, Dr. Sam Stein, Timing Solutions Corp.
- 4) Crystal Technology, Dr. John Vig, U.S. Army CECOM
- 5) Time and Frequency Synchronization and Measurement Techniques, Mr. Don Mitchell, TrueTime, Inc.
- 6) Time Synchronization Techniques, Dr. Paul Koppang, U.S. Naval Observatory

Questions

Please contact the following people for information on:

Technical/scientific questions: Dr. Joseph White, 202-767-5111
or white@juno.nrl.navy.mil

Exhibiting: Mr. Don Mitchell, 707-528-1230 x118
or dmitchell@trueitime.com

General: Mrs. Sheila Faulkner, 703-532-6411
or bopenyan@aol.com

Registration: Ms. Nikki Jardine, 202-762-1414
or jardine.nicolette@usno.navy.mil

Registration Desk Hours

The registration desk will be open during the following hours:

- 26 November, Monday, 1900-2100
- 27 November, Tuesday, 0700-1600
- 28 November, Wednesday, 0700-1600
- 29 November, Thursday, 0700-1430

Hotel Reservations

Mail or fax the hotel reservation card (found in the back of the book) to:

The Hyatt Regency Hotel
(PTTI 2001 Meeting Room Block)
200 South Pine Avenue
Long Beach, California 90802 USA
Telephone 562-491-1234 Fax 562-432-1972

Hotel Reservations (Continued)

When reservations are made, mention PTTI 2001 to receive the group sleeping room rate for single and double occupancy. Be prepared to show identification or pay with the government credit card. The PTTI rate is available from November 23 through December 2, 2001.

Check-in time is 1500 and checkout time is Noon. **Rooms are held until 1600 (4:00 p.m. EST if not guaranteed for late arrival by a credit card or one night's deposit)**. The block of reserved rooms will be released 1 November, so register 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 Hyatt, you will be charged an early departure fee**. The area offers a wide range of restaurants and shops within walking distance or by the Long Beach Roundabout (bus and trolley system).

Directions to the Hyatt Regency Hotel Long Beach

From the Los Angeles International Airport

- Exit the Airport terminal onto Sepulveda Blvd., going South towards the 105 Freeway.
- Take the 105 Freeway going East.
- Transition onto the 405 Freeway South.
- Continue south on the 405 Freeway approximately 20 miles until you reach the 710 Freeway.
- Transition onto the 710 Freeway South.
- Continue south on the 710 Freeway until you come to the Shoreline Drive/Aquarium exit (on the left). Take this exit.
- Continue on Shoreline Drive until you reach Pine Ave.
- Turn left onto Pine Ave.
- The Hyatt is immediately on the right side at 200 S. Pine Ave.

From the John Wayne Airport

- Exit the airport terminal by following the signs towards the 405 Freeway North.
- Make a left onto Mac Arthur Blvd. which will access the 405 Freeway North.
- Transition onto the 710 Freeway South
- Continue south on the 710 Freeway until you come to the Shoreline Drive/Aquarium exit (on the left). Take this exit.
- Continue on Shoreline Drive until you reach Pine Ave.
- Make a left turn onto Pine Ave.
- The Hyatt is immediately on the right side at 200 S. Pine Ave.

Directions to the Hyatt Regency Hotel (Continued)

- Take Interstate 5 to the 710 Freeway South.
- Continue south on the 710 Freeway about 20 miles until you come to the Shoreline Drive/Aquarium exit (on the left).
- Continue on Shoreline Drive until you reach Pine Ave.
- Take a left onto Pine Ave.
- The Hyatt is immediately on the right side of 200 S. Pine Ave.

Airlines

United Airlines has been chosen as the official carrier for **PTTI 2001** and is pleased to offer the best available airfares and schedules that fit your travel needs.

To obtain the best fares or schedule information, please call United's Meeting Desk at 1-800-521-4041. Reservation agents are on duty 7 days a week from 0700 to Midnight EST. Please be sure to **reference ID number 556XF**. The fares are available from 25 November through 3 December 2001. You or your travel agent should call without delay, as seats may be limited.

Rental Car

Avis has been chosen as the official rent-a-car company for **PTTI 2001**. 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 2001 - J628452**. Special meeting rates are available from November 20 through December 6, 2001 and include unlimited free mileage.

Airport Shuttle

Hotel shuttle service is available from Los Angeles Airport, Orange County Airport, and Long Beach Airport.

Parking

Self and valet parking is available at the hotel. Self-parking for an overnight guest is \$9.00; valet parking is \$13.00 with in and out privileges. Self-parking for the day is \$6.00 and \$9.00 overnight.

Messages

Messages may be left for PTTI attendees through the hotel's telephone number at: 562-491-1234.

Exhibit Information

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

Don Mitchell
TrueTime, Inc.
3750 Westwind Boulevard
Santa Rosa, California 95403
707-528-1230
Fax 707-527-6640
e-mail: dmitchell@truetime.com

List of Potential Exhibitors for PTTI 2001

Allen Osborne Associate
Arbiter Systems, Inc.
Brandywine Communications
Datum, Inc.
• Irvine
•Timing, Test and Measurement
End Run Technologies
ESE
Femtosecond Systems
Frequency Electronics, Inc.
GPS World
Guide Technology
Magellan Ashtech Products
Motorola
NovAtel Communications, Ltd.
Oscilloquartz
Perkin Elmer
Quartzclock, U.K., Ltd.
Spectracom Corp.
SpectraDynamics, Inc.
Spectrum Instruments, Inc.
Stanford Research Systems
Symmetricom
Synergy System
Syntomics LLC
TEMEX Time and Frequency
Timing Solutions Corp.
TIME TECH GmbH
TRAK Com
Trimble Navigation
TrueTime, Inc.
U.S. Naval Observatory
Zyfer Precision Time Division

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 27 November unless prior arrangements have been made with him. For paper style, see the Author's Kit on the Web at http://tycho.usno.navy.mil/ptti/ptti2001/author_kit.html.

Proceedings

The proceedings will be mailed to the attendees in 2002. If you cannot attend, but wish to reserve a copy of the Proceedings, please return the Registration Card with a check for \$135.00 made out to Treasurer, PTTI. Please note on the card that you are not attending. Your reserved copy will then be sent to you. If you wish extra copies, they will also be available at \$135.00.

PTTI 2001 proceedings will be provided on a CD in Adobe Acrobat (PDF) format. For those wishing to have a hardcopy version instead, a printed copy may be requested for an additional \$35.00 at the time of registration.

Temperature

The climate during late November and early December in the Long Beach area could be cool. A light coat or raincoat is recommended.

Thirty-fourth Annual PTTI Meeting

The 34th Annual PTTI Meeting will be held at the Hyatt Regency Hotel, Reston Town Center, Reston, Virginia, on December 3-5, 2002.

PTTI EXECUTIVE COMMITTEE

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U.S. Naval Research Laboratory

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Ms. Francine M. Vannicola
U.S. Naval Observatory

(Vacant)
Defense Information Systems Agency

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NASA Jet Propulsion Laboratory

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U.S. Naval Observatory (Retired)

1995

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National Institute of Standards and Technology (Retired)

1996

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and
Istituto Elettrotecnico Nazionale Galileo Ferraris

1997

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Paris Observatory

1998

DR. JACQUES VANIER
National Research Counsel (Retired)

1999

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Agilent Technologies

2000

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	DR. ANDY WU The Aerospace Corporation

PTTI 2001 SESSION CHAIRS

SESSION I - PTTI VENDOR PRESENTATION

MR. PETE LOPEZ
TrueTime, Inc.

SESSION II - CLOCKS FOR SPACE

DR. BERNARDO JADUSZLIWER
The Aerospace Corporation

SESSION III - TIME TRANSFER I

MS. LISA NELSON
National Institute of Standards and Technology

SESSION IV - TIME TRANSFER II

MR. EDWARD POWERS
U.S. Naval Observatory

SESSION V - CARRIER PHASE

DR. THOMAS PARKER
National Institute of Standards and Technology

SESSION VI - COMMUNICATION

MR. DON MITCHELL
TrueTime, Inc.

SESSION VII - TIMING LABORATORIES REPORTS

DR. FRANÇOISE BAUMONT
Observatoire de la Côte d'Azur, France

SESSION VIII - POSTER SESSION

MR. JAY OAKS
U.S. Naval Research Laboratory

SESSION IX - RECEIVERS

DR. VICTOR REINHARDT
Boeing Space Systems

SESSION X - ANALYSIS

DR. LEONARD CUTLER
Agilent Technologies

SESSION XI - TIME SCALES

DR. RICHARD SYDNOR
Jet Propulsion Laboratory

SESSION XII - GPS TIMING PERFORMANCE

MR. STEVEN HUTSELL
U.S. Air Force

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

TUESDAY, NOVEMBER 27, 2001

- 0800-0805 OPENING**
Dr. Paul Koppang, U.S. Naval Observatory
- 0805-0815 OPENING REMARKS**
Captain B. J. Jaramillo, U.S. Naval Observatory
- 0815-0830 DISTINGUISHED PTTI SERVICE AWARD**
Presented by: Dr. Joe White, U.S. Naval Research Laboratory
- 0830-0835 CALL TO SESSION**
Dr. Andy Wu, The Aerospace Corporation
- SESSION I PTTI VENDOR PRESENTATIONS**
0835-0940 Chairman: Mr. Pete Lopez, TrueTime, Inc.
- 0940-1000 INTERMISSION**
- SESSION II CLOCKS FOR SPACE**
Chairman: Dr. Bernardo Jaduszliwer, The Aerospace Corporation
- 1000-1020 Paper 1: SPACE CLOCKS, WHY THEY ARE DIFFERENT**
J. White and R. Beard, U.S. Naval Research Laboratory
- 1020-1040 Paper 2: OPTICALLY-PUMPED CESIUM BEAM FREQUENCY STANDARDS FOR GPS-III**
R. Lutwak, D. Emmons, M. Garvey, and P. Vlitas, Datum - Timing, Test and Measurement

TUESDAY, NOVEMBER 27, 2001

1040-1100 **Paper 3: COMPACT, CONTINUOUS BEAM COLD ATOM CLOCK FOR SATELLITE APPLICATIONS**
W. Buell and H. Wang, The Aerospace Corporation

1100-1120 **Paper 4: MERCURY TRAPPED ION FREQUENCY STANDARD FOR GPS**
R. Tjoelker, E. Burt, S. Chung,
R. Glaser, R. Hamell, L. Maleki,
J. Prestage, N. Raouf, T. Radey,
G. Sprague, B. Tucker, and B. Young,
NASA Jet Propulsion Laboratory

1120-1140 **Paper 5: AN EVALUATION OF VARIOUS SPACE CLOCKS FOR GPS IIF**
V. Nuth, W. Feess, and A. Wu, The Aerospace Corporation

1140-1320 **ATTENDEES LUNCH (Provided)**

SESSION III **TIME TRANSFER I**
Chairman: Ms. Lisa Nelson, National Institute of Standards and Technology

1320-1340 **Paper 6: COMPARISON OF TIME TRANSFER TECHNIQUES**
D. Matsakis, K. Senior, E. Powers,
and J. DeYoung, U.S. Naval Observatory

1340-1400 **Paper 7: SOLAR FLARES AND PRECISE SATELLITE TIMEKEEPING**
J. Camparo and S. Moss, The Aerospace Corporation

1400-1420 **Paper 8: RESULTS FROM THE NATIONAL PHYSICAL LABORATORY GPS COMMON-VIEW TIME TRANSFER SERVICE**
J.A. Davis and J.D. Clarke, National Physical Laboratory, United Kingdom

TUESDAY, NOVEMBER 27, 2001

**1420-1440 Paper 9: CAPABILITIES OF THE
WAAS AND THE EGNOS FOR TIME
DISTRIBUTION AND FREQUENCY
TRANSFER**

W. Klepczynski, ISI; P. Fenton, NovAtel, Canada; E. Powers, H. Chadsey, D. Matsakis, and F. Vannicola, U.S. Naval Observatory; M. Weiss, National Institute of Standards and Technology; W. Lewandowski, BIPM, France; and M. Brunet, CNES, France

**1440-1500 Paper 10: REAL TIME ULTRA-
PRECISE TIME TRANSFER TO UTC
USING THE NASA DIFFERENTIAL
GPS SYSTEM**

E. Powers, K. Senior, U.S. Naval Observatory; Y. Bar-Server, W. Bertiger, R. Muellerschoen, and D. Stowers, NASA Jet Propulsion Laboratory

1500-1520 INTERMISSION

SESSION IV TIME TRANSFER II
**Chairman: Mr. Edward Powers, U.S.
Naval Observatory**

**1520-1540 Paper 11: ESTIMATION OF THE
UNCERTAINTY OF TWO-WAY
SATELLITE TIME AND FREQUENCY
TRANSFER**

W. Klepczynski, Innovative Solutions International; D. Kirchner, Technische Universität, Graz, Austria; G. de Jong, NMi Van Swinden Laboratorium, The Netherlands; W. Lewandowski and J. Azoubib, Bureau International des Poids et Mesures, France; J. DeYoung, U.S. Naval Observatory; J. Davis, National Physical Laboratory, Teddington, United Kingdom; F. Baumont, Observatoire de la Côte d'Azur, France; and M. Imae, Communications Research Laboratory, Japan

TUESDAY, NOVEMBER 27, 2001

1540-1600 **Paper 12: LEAST SQUARES ANALYSIS OF TWO-WAY SATELLITE TIME AND FREQUENCY MEASUREMENTS**

J. Davis, P. Harris, S. Shemar, and M. Cox, National Physical Laboratory, United Kingdom

1600-1620 **Paper 13: PRECISION TIME VIA TWO-WAY SATELLITE TIME TRANSFER (TWSTT) FOR MULTI-PLATFORM PASSIVE EMITTER LOCATION**

J. Romberg, Boeing; and E. Powers, U.S. Naval Observatory

1620-1640 **Paper 14: COMMON-VIEW TIME TRANSFER USING THE TWO-CHANNEL FAST-SEQUENCING GPS RECEIVER K+K GPS6-2K**

P. Hetzel, T. Polewka, Physikalisch-Technische Bundesanstalt, Braunschweig, Germany; and W. Klische, K+K Messtechnik GmbH, Germany

1640-1700 **Paper 15: A STUDY OF TWO COMMERCIAL RECEIVERS AND NBS-TYPE RECEIVERS FOR COMMON-VIEW TIME TRANSFER**

M. Weiss and M. Jensen, National Institute of Standards and Technology

1800-1930 **RECEPTION**

WEDNESDAY, NOVEMBER 28, 2001

SESSION V CARRIER PHASE
Chairman: Dr. Thomas Parker,
National Institute of Standards and
Technology

0800-0820 **Paper 16: ACCURACY AND PRECISION OF CARRIER PHASE CLOCK ESTIMATES**

K. Senior and J. Ray, U.S. Naval Observatory

WEDNESDAY, NOVEMBER 28, 2001

- 0820-0840 **Paper 17: GLOBAL TIME TRANSFER CAPABILITY USING GPS CARRIER PHASE DATA**
R. Dach, S. Schaer, and
T. Schildknecht, Astronomical Institute,
University of Berne, Switzerland; and G.
Dudle, Swiss Federal Office of
Metrology and Accreditation, Switzerland
- 0840-0900 **Paper 18: GPS CARRIER PHASE FREQUENCY TRANSFER ON THE NIMA MONITOR STATION NETWORK**
B. Tolman and D. Munton, Applied
Research Laboratory, University of
Texas
- 0900-0920 **Paper 19: MONITORING THE REMOTE PRIMARY CLOCK BY USING GPS CARRIER PHASE**
S.-S. Chen, H.-M Peng, and C.-S. Liao,
Chunghwa Telecom Co., Taiwan
- 0920-0940 **Paper 20: MITIGATING MULTIPATH EFFECTS FOR CARRIER PHASE TIME-TRANSFER**
A. Bilich, J. Plumb, K. Larson, and
P. Axelrad, University of Colorado
- 0940-1000 **INTERMISSION**
- SESSION VI COMMUNICATION**
Chairman: Mr. Don Mitchell,
TrueTime
- 1000-1020 **Paper 21: THE PERMEATION OF TIME IN MODERN NETWORKS**
D. Arnold and P. Skoog, TrueTime, Inc.
- 1020-1040 **Paper 22: A SET OF SCALEABLE MASTER CLOCK SYSTEMS BASED ON COMMERCIAL OFF THE SHELF (COTS) PRODUCTS**
G. Shaton, U.S. Department of Defense

WEDNESDAY, NOVEMBER 28, 2001

1040-1100 **Paper 23: DEVELOPMENT OF TIMING ARCHITECTURE FOR A SECURE GLOBAL COMMUNICATIONS NETWORK**
G. Shaton, U.S. Department of Defense

1100-1120 **Paper 24: A NEW CLASS OF PRECISION UTC AND FREQUENCY REFERENCE USING IS-95 CDMA BASE STATION TRANSMISSIONS**
B. Penrod, EndRun Technologies

1120-1300 **ATTENDEES LUNCH (Provided)**

SESSION VII TIMING LABORATORIES REPORTS
Chairman: Dr. Fran oise Baumont,
Observatoire de la C te d'Azur,
Grasse, France

1300-1315 **Paper 25: TIME AND FREQUENCY ACTIVITIES AT THE UNITED STATES NAVAL OBSERVATORY**
D. Matsakis, U.S. Naval Observatory

1315-1330 **Paper 26: TIME ACTIVITIES IN ARGENTINA**
C. Mondinalli, J. Osorio, J. Amenna and
C. Esper n, Observatorio Naval Buenos
Aires, Argentina; J. Pablo Soria and
C. Kurtz, Instituto Geogr fico Militar
Argentino, Argentina; and
E. Felicitas Arias, Bureau International
des Poids et Mesures, France

1330-1345 **Paper 27: PRIMARY FREQUENCY STANDARDS AT NIST**
R. Drullinger, National Institute of
Standards and Technology

1345-1400 **Paper 28: TIME AND FREQUENCY ACTIVITIES AT THE JET PROPULSION LABORATORY**
R. Tjoelker, NASA Jet Propulsion
Laboratory

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- 1400-1415 **Paper 29: UPDATE ON TIME AND FREQUENCY ACTIVITIES AT PTB**
P. Hetzel and A. Bauch, Physikalisch-Technische Bundesanstalt, Germany
- 1415-1430 **Paper 30: RECENT IMPROVEMENTS ON TIME AND FREQUENCY AT CSAO**
S. Dong, Shaanxi Astronomical Observatory (CSAO), China
- 1430-1445 **Paper 31: TIME AND FREQUENCY ACTIVITIES AT CRL**
Y. Hanado, M. Hosokawa, M. Imae, N. Kurihara, and T. Morikawa, Communications Research Laboratory, Japan
- 1445-1500 **Paper 32: NATIONAL TIME AND FREQUENCY STANDARD OF KAZAKHSTAN REPUBLIC: PRELIMINARY RESULTS**
B.Gaigerov, N.Koshelyaevsky, V.Nestouley, S.Poushkin, and V.Tatarenkov, Institute of Metrology for Time and Space, GP "VNIIIFTRI", Russia
- 1500-1520 **Paper 33: PROJECT GALILEO: AN OVERVIEW**
S. Leschiutta^o and P. Tavella^o, ^oPolitecnico di Torino, ^oIstituto Elettrotecnico Nazionale, Torino, Italy
- 1520-1540 **INTERMISSION**
- SESSION VIII POSTER SESSION**
Chairman: Mr. Jay Oaks, NRL
- 1540-1700 **Poster 1: GPS-BASED ADAPTIVE ESTIMATING OF TIME ERROR FOR CLOCK SYNCHRONIZATION WITH FIR FILTER**
Y. Shmaliy, R. Rojas-Laguna, and O.Ibarra-Manzano, Guanajuato University, Mexico; A. Marienko, "Sichron" Center, Kharkiv, Ukraine

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**Poster 2: THE INFLUENCE OF LASER
NOISE ON THE OPTICALLY-PUMPED
ATOMIC-BEAM CLOCK**

J. Camparo, The Aerospace Corporation

**Poster 3: A NEW DIGITAL PHASE
MEASUREMENT SYSTEM**

G. Landis, SFA/U.S. Naval Research
Laboratory; I. Galysh, U.S. Naval
Research Laboratory; and
T. Petsopoulos, Praxis/U.S. Naval
Research Laboratory

**Poster 4: A NEW SYNCHRONIZED
MINIATURE RUBIDIUM OSCILLATOR
WITH AUTO-ADAPTIVE DISCIPLINING
FILTER**

P. Rochat and B. Leuenberger, Temex
Neuchâtel Time SA, Switzerland

**Poster 5: DEGREES OF FREEDOM
AND THREE-CORNERED HATS**

C. Ekstrom and P. Koppang, U.S. Naval
Observatory

**Poster 6: RESULTS OF RADIO
METEOR COMPARISON OF SCALES
OF THE RUSSIAN UTC(SU) AND
UKRAINIAN UTC(UA) TIME
STANDARDS**

V. Bavikina, Y. Koval, and A. Tkachuk,
Kharkov State Technical University of
Radioelectronic (KTURE), Ukraine

**Poster 7: THE MICROCOMPUTER
COMPENSATED CRYSTAL
OSCILLATOR - PRACTICAL
APPLICATION OF DUAL-HARMONIC
MODE QUARTZ THERMOMETRY**

E. Jackson, Q-Tech Corporation

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**Poster 8: RESEARCH OF
PARAMETERS OF THE TIME
SCALES, WHICH FORMED BY
RECEIVERS OF SIGNALS OF
SATELLITE RADIONAVIGATION
SYSTEM GPS**

S. Trambovetskiy, J. Koval, V. Bavykina,
and A. Tkachuk, Kharkov State
Technical University of Radio
Electronics (KTURE), Ukraine

**Poster 9: THE PHASE RADIO
METEOR EQUIPMENT FOR TIME AND
FREQUENCY STANDARDS
COMPARISON**

V. Bavykina, Yu. Koval, S. Kundjukov,
and S. Trambovetskiy, Kharkov State
Technical University of Radioelectronics
(KTURE), Ukraine

**Poster 10: PASSIVE METEORIC
SYNCHRONIZATION OF TIME
SCALES**

I. Antipov, V. Bavikina, Y. Koval, and G.
Nesterenko, Kharkov State Technical
University of Radioelectronics (KTURE),
Ukraine

**Poster 11: ROBUST GPS-BASED
SYNCHRONIZATION OF CDMA
MOBIL NETWORK**

D. Schneuwly, Oscilloquartz SA,
Switzerland

**Poster 12: STATUS REPORT OF
TIME AND FREQUENCY ACTIVITIES
OF NATIONAL PHYSICAL**

LABORATORIES, NEW DELHI, INDIA
P. Banerjee, National Physical
Laboratory, New Delhi, India

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SESSION IX RECEIVERS

Chairman: Dr. Victor Reinhardt,
Boeing Space Systems

**0800-0820 Paper 34: CGGTTS GUIDELINES FOR
MANUFACTURERS OF GNSS
RECEIVERS USED FOR TIMING**

W. Lewandowski, Bureau International
des Poids et Mesures, France;
J. Levine, National Institute of Standards
and Technology

**0820-0840 Paper 35: USE OF GEODETIC
RECEIVERS FOR TAI**

P. Defraigne, Royal Observatory of
Belgium; G. Petit, Bureau International
des Poids et Mesures, France; and
C. Bruyninx, Royal Observatory of
Belgium

**0840-0900 Paper 36: SIMULTANEOUS
ABSOLUTE CALIBRATION OF THREE
TIMING RECEIVERS**

J. Plumb and K. Larson, University of
Colorado; J. White and R. Beard, U.S.
Naval Research Laboratory; and
E. Powers, U.S. Naval Observatory

**0900-0920 Paper 37: FAST "DIRECT-P(Y)" GPS
SIGNAL ACQUISITION USING A
SPECIAL PORTABLE CLOCK**

H. Fruehauf, Zyfer, Inc.

**0920-0940 Paper 38: A SYSTEM TO COMPARE
AND EVALUATE THE QUALITY OF
PRECISE FREQUENCY AND TIMING
SYSTEMS**

W. Lange, Lange-Electronic GmbH,
Germany

0940-1000 INTERMISSION

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SESSION X ANALYSIS

Chairman: Dr. Leonard Cutler, Agilent Technologies

- 1000-1020 Paper 39: A MULTICHANNEL DUAL-MIXER STABILITY ANALYZER: PROGRESS REPORT**
C. Greenhall, A. Kirk, and G. Stevens,
NASA Jet Propulsion Laboratory

- 1020-1040 Paper 40: CLOCK REQUIREMENTS AND TRADE-OFF FOR SATELLITE-BASED NAVIGATION SYSTEMS**
E. Detoma, AleniaSpazio, Corso
Marche, Italy; and A. Godone, Istituto
Elettrotecnico Nazionale "G. Ferraris"
(IENGF), Italy

- 1040-1100 Paper 41: EFFECTS OF PARAMETER ESTIMATION AND CONTROL LIMITS ON STEERED FREQUENCY STANDARDS**
J. Skinner and P. Koppang, U.S. Naval Observatory

- 1100-1120 Paper 42: PRACTICAL PROBLEMS INVOLVING PHASE NOISE MEASUREMENTS**
W. Walls, Femtosecond Systems, Inc.

- 1120-1300 ATTENDEES LUNCH (Provided)**

SESSION XI TIME SCALES

Chairman: Dr. Richard Sydnor, NASA Jet Propulsion Laboratory

- 1300-1320 Paper 43: A KALMAN FILTER FOR ATOMIC CLOCKS AND TIMESCALES**
L. Breakiron, U.S. Naval Observatory

- 1320-1340 Paper 44: KALMAN PLUS WEIGHTS: A TIME SCALE ALGORITHM**
C. Greenhall, NASA Jet propulsion Laboratory

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1340-1400 **Paper 45: STUDIES OF AN OPTIMALLY UNBIASED MA FILTER INTENDED FOR GPS BASED TIMEKEEPING**

Y. Shmaliy, O. Ibarra-Manzano, and R. Rojas-Laguna, Guanajuato University, Mexico

SESSION XII GPS TIMING PERFORMANCE
Chairman: Mr. Steven Hutsell. U.S. Air Force

1400-1420 **Paper 46: GLOBAL POSITIONING SYSTEM (GPS) MODERNIZATION — A REVIEW AND UPDATE FOR THE PTTI COMMUNITY**

Major M. Hedgepeth and Major S. Rajotte, USAF, GPS Joint Program Office, Los Angeles AFB; and D. Latterman, Science Applications International Corporation (SAIC)

1420-1440 **Paper 47: ONE-WAY GPS TIME TRANSFER: 2001 PERFORMANCE**
S. Hutsell, Captain M. Rivers and 1Lt T. Kelkenberg, 2d Space Operations Squadron, Schriever AFB

1440-1500 **INTERMISSION**

1500-1520 **Paper 48: PERFORMANCE OF GPS BLOCK II/IIA/IIR ON-ORBIT NAVSTAR CLOCKS**

J. Oaks, T. McCaskill, and M. Largay, U.S. Naval Research Laboratory; and J. Buisson, AEI

1520-1540 **Paper 49: MANAGEMENT OF PHASE AND FREQUENCY FOR GPS IIR SATELLITES**

M. Epstein and T. Dass, ITT A/CD

1540-1600 **Paper 50: OBSERVABLE RELATIVISTIC FREQUENCY STEPS INDUCED BY GPS ORBIT CHANGES**
M. Epstein, E. Stoll, and J. Fine, ITT A/CD

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1600-1620 Paper 51: USING LAGRANGE
PERTURBATION THEORY TO
PREDICT RELATIVISTIC FREQUENCY
CHANGES IN SV CLOCKS DUE TO
EARTH'S OBLATENESS, AND TO
ORBIT CHANGES

N. Ashby, University of Colorado

1620-1640 DISCUSSION, Dr. Joe White, U.S.
Naval Research Laboratory

1640-1650 CLOSE OF MEETING