The Consorzio Torino Time scientific and industrial activities

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Contents

1. CTT mission, motivation and values

2. CTT projects activities
Established in Torino on the 2th of April 2004

CTT shareholders:

- Finpiemonte S.p.A
- Fondazione Torino Wireless
- INRiM (was IEN Galileo Ferraris)
- Politecnico di Torino University
- SEPA S.p.A.
- Alenia SIA Sp.A.
- Thales Alenia Space Italia S.p.A.
- Altec S.p.A.
Mission and Motivation

Mission

• Non-profit organization;
• Founded to participate in the Galileo Time Programs and to set up related activities in the Turin area;
• The first achievement has been the IOV Galileo PTF;
• After the successful PTF deployment, CTT will be a candidate for the supply of the Time Services needed for the Galileo System operations;

Motivations

• Galileo is one of the biggest Aerospace European projects;
• Will create new opportunities and job positions;
• GNSS System Providers are making significant investments;
• It is an opportunity for growth of the Piedmont Region, in the field of Aerospace, Timing, ICT at national and international level.
CTT values (1/4)

Synergy between research and industry,

between public and private sectors
The public **institutional associates:**

- **Finpiemonte**
- **Fondazione Torino Wireless**

- Strategic role for the support and promotion of CTT initiatives.
The public scientific associates:

**INRIM (was IEN Galileo Ferraris):**
- WW recognised in the Time e Frequency Metrology

**Politecnico di Torino:**
- WW recognised in the *Education* and *Research* fields w/specific *excellence* in GNSS
- Joint initiatives w/ISMB – *Istituto Superiore Mario Boella*:
  - *Galileo Lab*
  - *Master on Navigation and related applications*
The private industrial associates

**Thales Alenia Space Italia (TAS-I):**
- Leading manufacturer in Space Systems and Applications

**Altec:**
- Hi-tech services for space missions (e.g. ISS)

**SEPA:**
- HW & SW hi-tech solutions provider for Timing applications

**Alenia SIA:**
- SW Engineering for aerospace applications

- Provide industrial processes based on Space Standards.
2. CTT Projects activities
IRGAL (Innovation and Research on GALileo)
Funding: (Eu-Piedmont Region)

- enabling technologies on GNSS Timing and Receivers
The IRGAL Consortium

Piedmont Region – DOCUP 2000-2006 Mis. 3.4

The IRGAL Consortium

Consorzio Torino Time coordinator

ISMB

Icarus Scpa

TOWLS Finpiemonte Politecnico INRIM TAS-I SEPA Alenia SIA ALTEC

Accubeat, SKK Intecs Accent, Novasis, SMIC

Sub-contractors
The project is divided in two major WPs, with different scientific objectives

**WP - Timing**

**Strengthen Torino Research and Industrial community in GNSS Time field**

- Development of an innovative CPT based atomic Caesium clock prototype;

- Integration of an additional H-Maser clock at INRiM premises to enhance the UTC time scale performance;

- Design and realization of a Fiber Optic link for the Time & Frequency transfer between remote sites;

- Development of a Time Measurement Analysis software for the implementation of a Test Station for timing systems.

**WP - Receivers**

**Development of GNSS Receivers**

- Design and development of GNSS receiver in Software Radio Technology
  - Fully software receiver
  - Receiver on hybrid FPGA+ARM board;

- Design and development of a RF multifrequency GNSS front end:
  - Lab prototype with discrete components;
  - Galileo/GPS front end in 0.13µm RFCMOS;

- Definition of the architectural block diagram of the “Galileo receiver” on chip
CTT Industrial Project

Galileo Precise Timing Facility (PTF) for IOV: Customer: ESA, Thales Alenia Space France

• A key element of the Ground Galileo Mission Segment.
The PTF generates the physical time scale of Galileo with two main purposes:

- **Navigation Timekeeping**: Time stability is a critical issue for Satellite Navigation System

- **Metrological Timekeeping**: to link the Galileo System Time to the UTC time reference. This is done in cooperation with Time Service Provider (TSP), UTC(k) Labs and BIPM
PTF, the Time of Galileo (1/2)

The key PTF Requirements are:

• Generation of the Galileo System Time with state-of-the-art performances

• Support to the **interoperability** with GPS by evaluating the GPS-Galileo Time Offset

• Unmanned operations

• Design for Reliability, Maintainability, Safety and Galileo SW Standards
The PTF CTT in the Galileo IOV scenario

PTF CTT is deployed at Fucino

L-band

S-band

C-band

4 Galileo Spacecraft

Galileo Rx

GSS

Galileo Sensor Stations

External Services

Galileo Rx

GCC - GMS

GCC - GCS

5 ULS Global

2 TTC Global
The PTF deployment

From the PTF Integration room in Altec Torino....

...to the Fucino Galileo Control Centre
HARRISON
Funding: Galileo Supervisory Authority

- Galileo Time & Synchronisation Applications
Project purpose is to study the benefits on society of Time and Synchronization opportunities offered by GNSS and Galileo

A wide potential user community has participated to the project

The project is arranged in three phases:
- the User Community Analysis
- the development of pilot demonstrators
- the field trials of the demonstrators
User Community analysis:

- **Scientific and Time Applications**
  1) Astronomy and astrophysical applications
  2) Quantum Cryptography

- **Industrial and Transport Applications**
  1) Application on Electrical and Power Industry,
  2) Sync in Data Networks with Quality of Service (QoS) guarantee
  3) Mobile and cellular Networks: synch of base stations
  4) Railways applications

- **Economics Financial/Banking Applications**
  1) Banking application, anti money laundering
  2) Cryptography, security protocols for time stamping.
Harrison project activities (2/2)

- Service definition and standardization
- Market analysis
- ACTS (Authenticated and Certified Time Solution) Demonstrator Development
- Field Trials
  - Power and Energy
  - Transient propagation on power lines
  - Astronomy and Quantum Cryptography
  - Cryptography
- Project Coordination
Conclusion

• CTT model: synergy between research and industry, between public and private sectors.

• CTT projects covered layers:
  • scientific and technology layers;
  • industrial layer;
  • applications and services layer.

• PTF support Galileo-GPS interoperability by evaluating the GPS-Galileo Time Offset.
Thank you!