



The Consorzio Torino Time scientific and industrial activities

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ICG-5 – Torino, 20 October 2010. GNSS technology in the era of multi-systems:
the impact of GNSS interoperability on Timing and other user applications.



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1. CTT mission, motivation and values

2. CTT projects activities



Consorzio Torino Time Background

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



CTT values (2/4)

The public **institutional** associates:

Finpiemonte



Fondazione Torino Wireless



- *Strategic role for the support and promotion of CTT initiatives.*



CTT values (3/4)

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***



CTT values (4/4)

: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



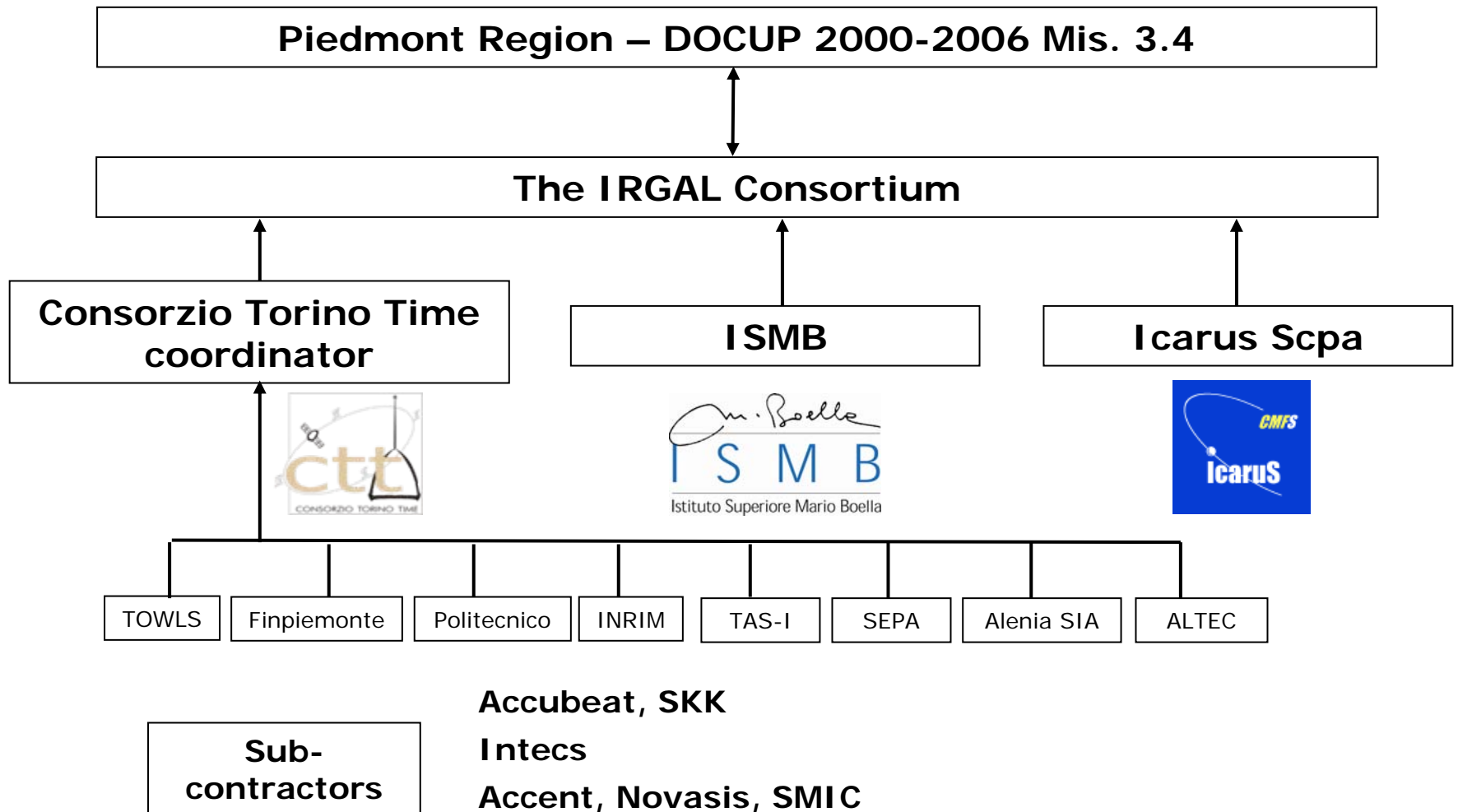
CTT Scientific and Technological projects

IRGAL (Innovation and Research on GALileo) Funding: (Eu-Piedmont Region)

- *enabling technologies on GNSS Timing and Receivers*



The IRGAL Consortium





IRGAL Major Objectives

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 0.13 μ m 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.*



PTF, the Time of Galileo (1/2)

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

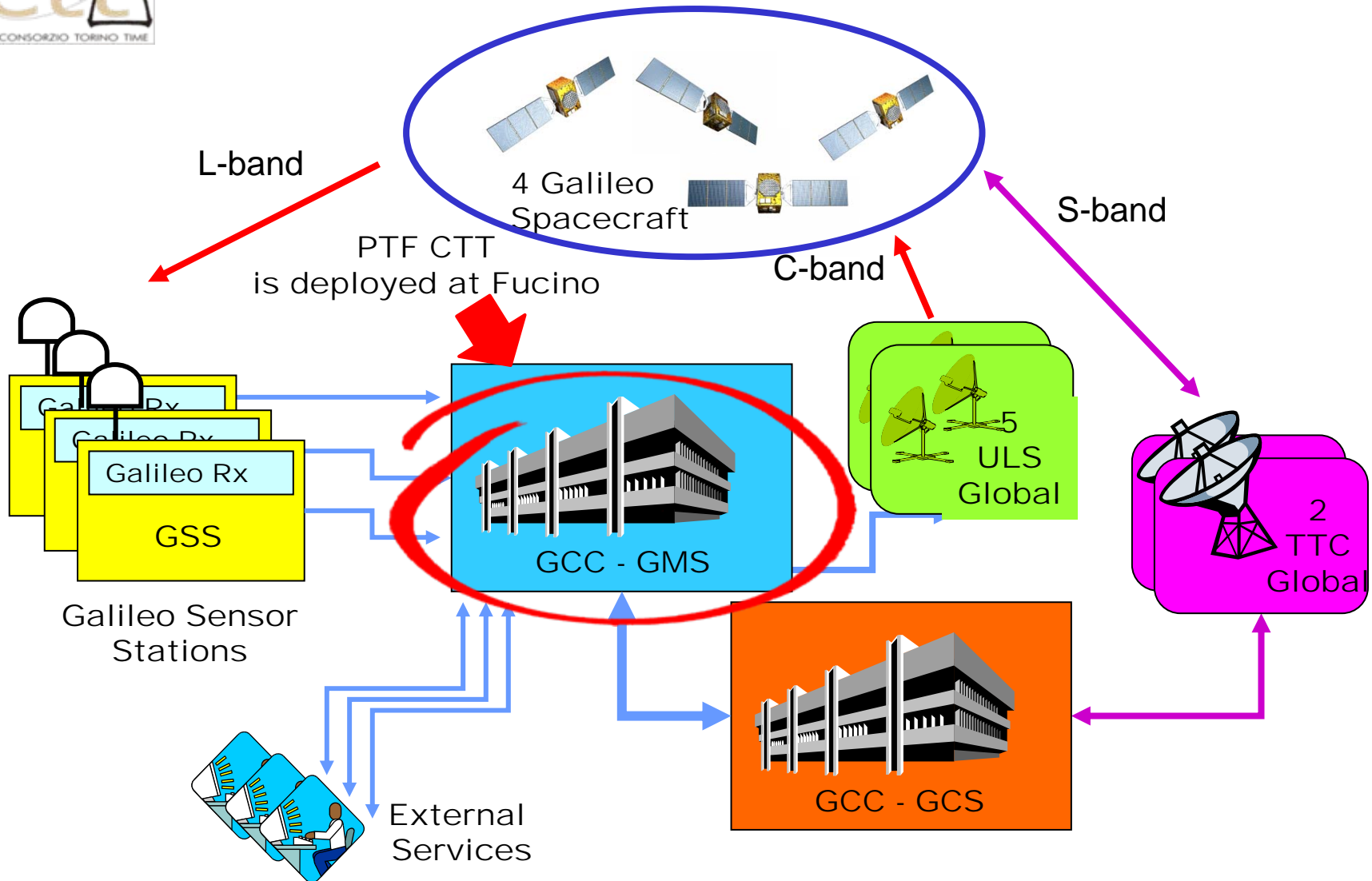


PTF, the Time of Galileo (1/2)

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

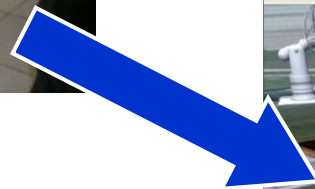
The PTF CTT in the Galileo IOV scenario



The PTF deployment



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



...to the Fucino Galileo Control Centre





CTT Application and Services Project

HARRISON

Funding: Galileo Supervisory Authority

- *Galileo Time & Synchronisation Applications*



Harrison: Timing and Synch. applications and services

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:

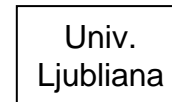
- the User Community Analysis
- the development of pilot demonstrators
- the field trials of the demonstrators



Harrison project activities (1/2)

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: synchronisation of base stations
 - 4) Railways applications

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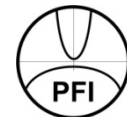
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Rail



- 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

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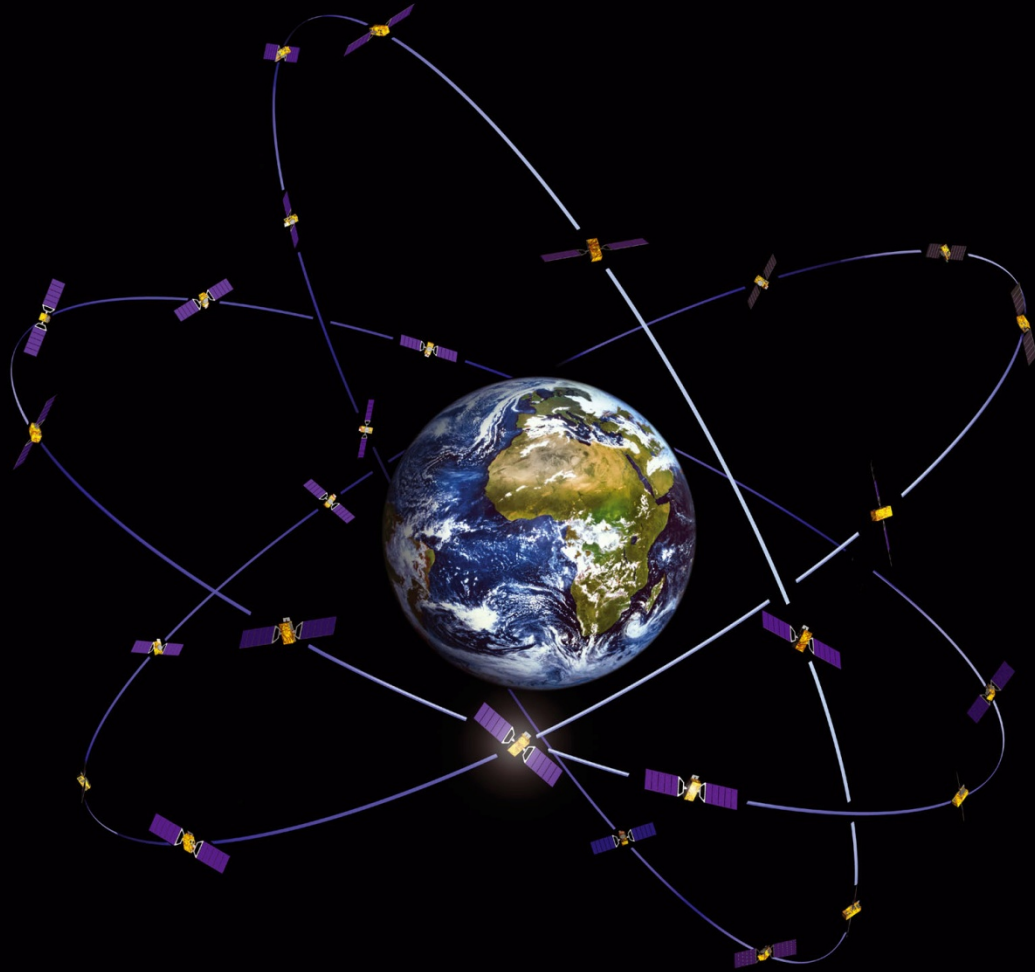
- Project Coordination





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!