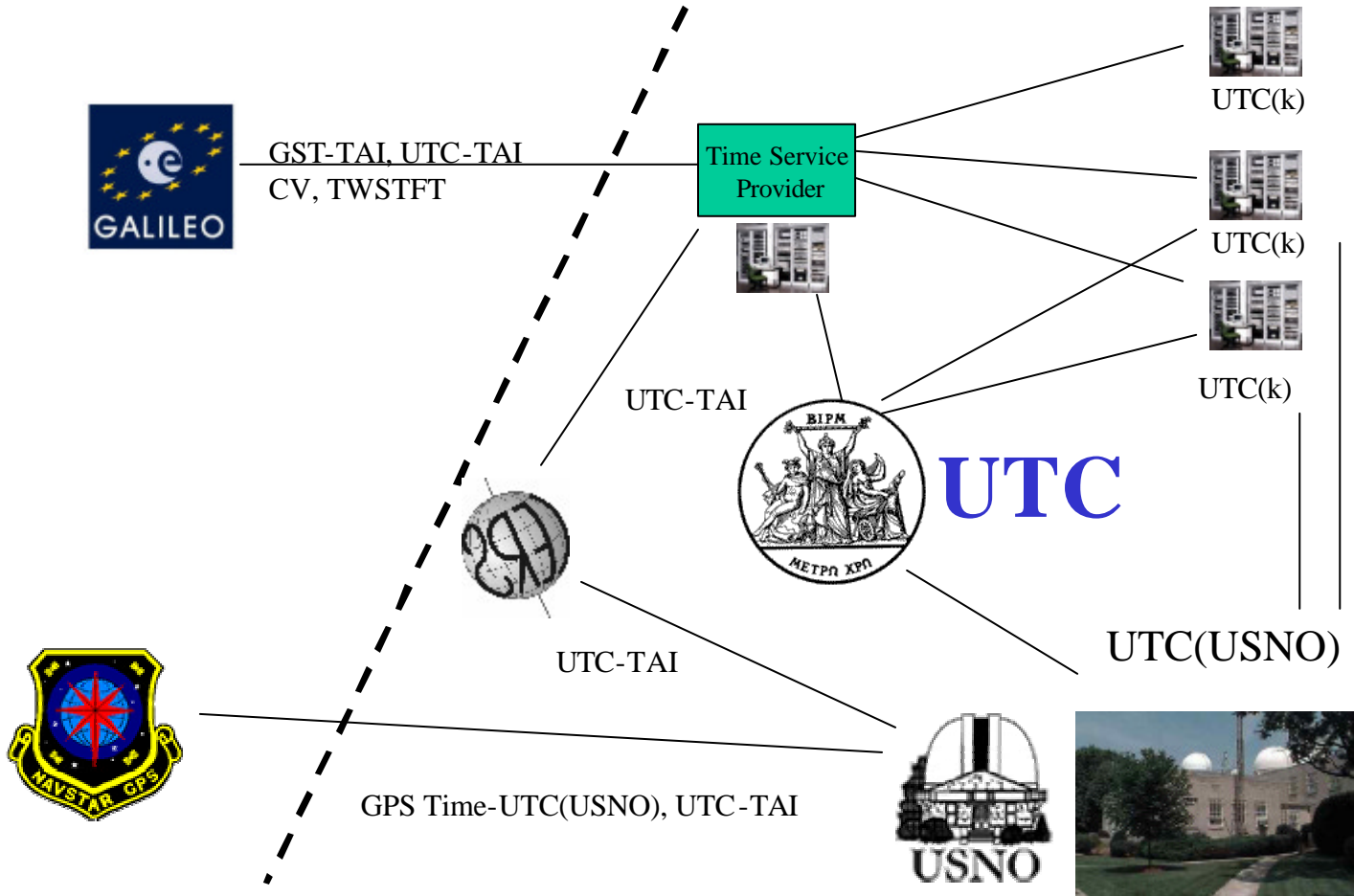


# GPS/Galileo Interface to UTC Time Services



# GPS/Galileo Timekeeping Function

Twofold:



Navigation Service

- **Navigation Timekeeping:**  
critical for navigation mission, needed for orbit determination/prediction and internal satellite clock synchronisation, not intended for timing applications.
- **Metrological Timekeeping:**  
not critical for navigation, but needed to provide TAI and UTC timing services (time dissemination) to support communication systems, banking, power grid management, etc ...



Timing Service

# Benefits of Navigation Time Scale Interoperability

- In the future navigation users could benefit from a combined GPS/Galileo navigation solution (from 12 to more than 20 SV in view)
  - This requires knowledge of GPS/Galileo system time difference or
  - Solving for GPS/Galileo time difference in receiver  
Which requires a fifth satellite and the loss of one SV in solution.
  - Loss of one SV is an Important consideration for
    - Urban Canyons
    - E-911
    - Anti-jam and interference

# How to account for the GPS / GALILEO system time

Options to produce Galileo to GPS time offset:

## 1. Determination of Time Difference by:

- The underlying GPS and Galileo system time could be physically measured by traditional time transfer techniques (Two-way, common view, etc...) and included in the systems navigation data.
- The difference could be precisely estimated in near real time using combined GPS/Galileo monitor station receivers and included in the systems navigation data.

## 2. Offset estimated in GPS-Galileo user equipment at the cost of one SV tracked

## Scope

The purpose of the draft Galileo to GPS timing ICD is to provide a starting point for developing an ICD that will allow for inclusion in each system's navigation message the offset between GPS and Galileo System Time.

## Activity Objectives

- #1: Produce a Draft GPS/Galileo Time Offset ICD (GGTO-ICD) including options for Time Offset computation, coordination and broadcast through Galileo and GPS.
- #2: This draft document is being jointly coordinated between GPS and Galileo representatives, aiming at consolidation into a first version 1.0 this spring.

## Document History

- Drafting started beginning of December 2002
- Draft document circulated to the European experts
- Comments received in early January, and considered in the document
- The agreed Draft 1.4 was sent to the US (Jan 17) for consolidation of the document prior to submission of Issue 1.0 to the GPS-Galileo TWG
- USNO forwarded the draft ICD to the US TWG team members
- USNO consolidated the comments received from GPS-JPO and NASA in preparation for the 28/29 Jan. 2003 meeting
- The GGTO preparatory meeting was held and the Draft 1.5 produced which included US comments
- ICD concept briefed as part of GPS ICE Industry day (Feb 2003).

## Requirements Outline

This Draft ICD defines the key requirements and describes the interfaces between GPS and Galileo for the provision of this functionality:

- Functional
- Performance
- Interface
- Implementation
- Verification
- Operational
- Expandability
- Reliability, Availability



Using the Draft ICD as the baseline the US and European representatives quickly came to a unified position on all major technical points.

- Agreed on Requirements, identified interfaces and high level concept of operations
- Agreed on a list of certain implementation issues that need to be clarified which are reflected in action items
- Agreed on first jointly consolidated Draft for submission to the TWG

***The participants concluded that a lot of progress has been achieved and the work should continue.***

## Action Items

A number of Actions Items have been identified and are related to implementation details, such as:

- legacy / backward compatibility
- range / resolution of the GGTO message
- update frequency / repeatability of the message
- implementation schedule
- proper documentation references

## Next Steps (...3 months)

- Both sides will work on relevant action items
- A common work plan synchronized to GPS and Galileo Programmes schedules will be drafted
- Version 1.0 issue of the ICD will be produced