Time Management WG teleconference
11/21/2019

**Agenda**

* Announcements
	+ 34th European Frequency and Time Forum
		- <https://atpi.eventsair.com/QuickEventWebsitePortal/eftf2020/web>
		- 21-23 April 2020
		- Noordwijk, Netherlands – ESA/ESTEC
		- Abstract submission deadline extended: now 26 November 2019
* Minutes of face-to-face meeting
* Definitions for review/discussion (Pitts)
* Survey results (Pitts)
* Time correlation (Sank)
* Green book status/inputs
* To discuss in January: meeting dates/times for March and April 2020

Attending:

Jon Hamkins
Lee Pitts
Beau Blanding
Christian Stangl
Yukio Yamamoto
Brent Andres
Zhang Cuitao
Sinda Mejri
Victor Sank
Brent Andres

* Definitions (presentation by Lee Pitts)
	+ Definitions shown. Some had been previously discussed in group.
	+ Lee took action to merge previous terms discussed by the group with the list he presented today. The goal will be to use terms with standard definitions from NIST/BIPM, and add additional terms as needed
* Mission survey (presentation by Lee Pitts)
	+ Mission survey from 2007
	+ Topics: mission name, objectives, destination, comm modes, time precision, navigation precision, time correlation
	+ Reached out to 180 spacecraft, winnowed down to 48 missions – NASA, ESA, JAXA
	+ Working group agreed to include mission survey in Green Book
	+ Lee to work on updated survey to discuss at next meeting
* Maintaining UTC on the spacecraft (presentation by Victor Sank)
	+ Wanted to avoid counter roll-over issue.
	+ Math needed to resolve time drift and offsets was described; clock correlation by frequency adjust

**Discussion on Green Book outline**

Actions for Jan or Feb teleconference noted in red.

Editor/book construction – J. Hamkins

* Definitions – L. Pitts (present at January teleconference; coordinate with others as appropriate)
* Background –
	+ Frequency standards, x-ray pulsars, clocks, etc. (general knowledge about time/time management)
		- NTP – P. Shames
		- Terrestrial timing standards / atomic clocks across world – S. Mejri (present in Jan.)
		- Leap seconds, epochs, time scales, etc. – S. Mejri (present in Jan.)
		- Network considerations – Earth receive time, network delay, DTN, etc. – V. Sank (status/partial in Jan., but Vic not present in Jan.)
	+ GNSS systems
		- GPS (E. Pitts/B. Blanding) – (present in Jan.; will coordinate with V. Sank)
		- Galileo (M. Rovatti) – (status in Jan.)
		- BEIDOU (Z. Yuxia) -
		- GLONASS (S. Mejri (TBR)) – (present in Jan.)
	+ References to time code formats, coding, ranging, etc.
* Mission survey of time requirement (Lee Pitts)
* Time distribution and correlation for space applications
	+ Concept
		- Architectural considerations
		- Spacecraft design (time calibration system design)
		- Ground design
	+ How it is done
		- Method 1 a, b, c (NASA – DSN, SN, NEN) – J. Hamkins – (present in Jan.)
		- Method 2 (ESA) – S. Mejri/M. Rovatti – (present in Feb.; coordinate with C. Stangl)
		- Method 3 (CAST) – Z. Cuitao
		- Method 4 (DLR) – C. Stangl – (present Jan. or Feb.)
		- Method 5 (JAXA) – Y. Yamamoto
* Time Synchronization for space applications
	+ Concept
	+ How it is done
		- Method 1 a, b, c (NASA – DSN, SN, NEN) – J. Hamkins
		- Method 2 (ESA) – S. Mejri/M. Rovatti
		- Method 3 (CAST) - Zhang
		- Method 4 (DLR) – C. Stangl
		- Method 5 (JAXA) – Y. Yamamoto
* Applications (draw on existing documentation)
	+ Science activities
		- Enumerate examples as they relate to timing accuracy/resolution needed
	+ Entry/Descent/Landing (Lunar, Mars, etc.)
	+ Docking
	+ Commanding of spacecraft actions (comm, antenna pointing, heaters, etc.)
	+ Ranging / Doppler
	+ Spacecraft maneuvers
	+ Multiple spacecraft coordination
* SANA, and patent considerations – J. Hamkins – (complete with first draft of GB by May 2020)