Paper for Consideration by S100WG

Time reference in S-100

Submitted by:	NIPWG
Executive Summary:	A short review of time reference in S-100
Related Documents:	S-100, S-101, IHO Resolution 7/2009
Related Projects:	NIPWG action item 4/01)

Introduction / Background

One of the tasks of NIPWG is to periodically review the resolutions in M-3, which are related to Nautical Publications. It was decided that the recommendation should be further reviewed against current and drafted S-100 standards.

As also nautical information provision in the future will be based on S-100 compliant products, it was decided that in order to ensure similarity and a smooth transition to encoded products in the future, the proposed amendment of Resolution 7/2009 in M-3 should be reviewed against S-100 specifications.

The current resolution 7/2009 and the proposed amendment:

Current;
It is resolved that all references to time in nautical publications should be referred to the Universal Time Co-ordinated (UTC) standard, e.g. 1537 (UTC), 1637 (UTC+1), etc. If considered necessary, a note may be included indicating that UTC has replaced GMT.

Proposed amendment.
Time in nautical publications should be expressed as Universal Time Co-ordinated (UTC):
Example 13:21 (UTC).
Alternative time references may be used, as follows:
1. *Local time with offset: Example 13:21 (UTC + 3)*
2. *Unspecified local time: Example 13:21 (Local Time) if time zone reference is provided within the publication.*

Analysis/Discussion

ISO 8601 is an international standard that defines methods of representing dates and times in textual format, including specifications for representing time reference. Using this standard, the notation of time is hh:mm:ss, with an example being 23:59:59. Omitting the separators and expressing time as 235959 is also allowed, and called "basic format".

In order to indicate that a time is measured in UTC, a trailing capital letter Z is used, like 23:59:59Z or 235959Z. The Z- (zero / zulu) time zone representing UTC is the only "named" zone used in ISO 8601. Time zones are sometimes provided using alphabetic abbreviations such as "EST", "WST", and "CST" to indicate the time zone, but these abbreviations are not part of the international time and date standard ISO 8601, and their use to indicate offset from UTC is discouraged. In ISO 8601 local time offsets from UTC are optional. If added, these are written as hours or hours and minutes ahead or behind UTC, as 23:59:59+04:00 or 235959+0400.

ISO 8601 practically allows three different ways of representing time.

Type of representation	Shown with separators	Shown as 'Basic format'
As undefined local time	23:59:59	235959
As UTC- time	23:59:59Z	235959Z
As local time with offset	23:59:59+04:00	235959+0400

S-100 3.0 includes a normative reference *to ISO 8601:2004(E), Representation of dates and times*. S-100 declares Primitive Types Time and DateTime, both including a reference to the complete, basic, local time format

in ISO 8601. This means that a Time shall include hours, minutes and seconds and shall be encoded into a character-string without the use of separators. Even though *local time format* is referenced in S-100, all the possible examples of encoding (183059 or 183059+0100 or 183059Z) are included in S-100 as examples.

Time	A time is given by an hour, minute and second. Character encoding of a time is a string that follows the local time (complete representation, basic format) format defined in ISO 8601. Time zone according to UTC is optional. EXAMPLE 183059 or 183059+0100 or 183059Z The complete representation of the time of 27 minutes and 46 seconds past 15 hours locally in Geneva (in winter one hour ahead of UTC), and in New York (in winter five hours behind UTC), together with the indication of the difference between the time scale of local time and UTC, are used as examples. Geneva: 152746+0100 New York: 152746-0500
DateTime	A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601 (see above). EXAMPLE: 19850412T101530

Definition of Primitive Type Time and DateTime in S-100

S-101 DCEG 0.0.2 dated 03/2017 includes the object Service Hours (DCEG 24.2). This object contains attributes for start- and end- times with a separate enumeration *Time reference* used to determine time reference. Options are Local time and UTC. Attributes *Time start* and *Time end* has been replaced by attributes *Time of day start* and *Time of day end.* The definitions of both the replaced and replacing attributes include a mandatory format for time being: *hhmmss*.

S-102 (2.0 working draft) has a normative reference to ISO 8601:2004. The temporal reference for time is defined as UTC, using the 16-character format yymmddThhmmssZ.

Conclusions

The current resolution 7/2009 demands all times in nautical publications to be referred to UTC. Practically, this wording does not allow the use of "undefined local time", where the offset to UTC is not included.

The proposed amendment to resolution 7/2009 and the reviewed S-100 drafts do allow the use of "undefined local time". The mandatory format restriction on the attribute-level in S-101 (*hhmmss*) even removes the possibility to add offsets to local times in S-101.

The use of "undefined local time" simply by marking LT, is conformant with ISO 8601. This notation implies that the actual time-zone is described elsewhere or apparent within the context. As S-100 define encoding, and resolution 7/2009 recommends formats for display of time in traditional publications, the current visual appearance and notation as such is deemed outside the scope of this review. As time zones represented by an alphabetic abbreviation generally are not supported by current ISO 8601, it could be noted that any such notation would need to be converted into a representation of "undefined local time" or a representation with offset hours and minutes according to UTC, if transferred into S-100 encoding.

Time definitions in S-100 are based on ISO 8601, but the use of the standard seem slightly ambiguous. In ISO 8601, time reference is encoded as a part of the character-string. Definitions in S-100 makes it unclear, whether only a subset of the standard shall be used (local time representation for all times), or whether the time reference should be encoded into the string.

There are seemingly different approaches in S-101 and S-102 regarding inclusion of time reference. S-101 defines the mandatory format for attributes *Time of Day Start* and *Time of Day End* as (hhmmss). Depending on a separate indicator, these could indicate either local times or UTC. S-102 has defined all temporal reference to be in UTC, and the reference (a trailing Z) according to ISO 8601 also to be encoded as a part of the string *(hhmmssZ*).

Recommendations
Compared to the current resolution, the amended wording allows for "unspecified local time" in accordance with ISO 8601. This means the time zone could be defined elsewhere if not apparent within the context. In order to fully embrace the references supported by ISO 8601, and additionally discourage the use of "named" local time zones, a clarification of the amended wording could be made.

It is also recommended that the encoding of times in S-100 is clarified. Reviewing S-100 documentation did not make it clear how the time reference indication in ISO 8601 shall be used within S-100. There is an internal mechanism for indicating time reference as part of the encoded string in ISO 8601. In S-101 this mechanism is disregarded, and the reference for times (LT / UTC) is separately indicated using an external enumeration attribute. In S-102 times are encoded including the time reference mechanism of ISO 8601.

Action Required of S100WG
The S100Wg is invited to:

a. Note the paper
b. Discuss whether a clarification and a common approach of encoding times in S-100 and S-100 compliant product specifications is needed