

Calculation of the JULD_START_TRANSMISSION and JULD_ASCENT_END for APEX floats

Michel Ollitrault,
Edited by Ann Thresher
Edited by Claudia Schmid
Edited by Jean-Philippe and Thierry (21/08/2009)

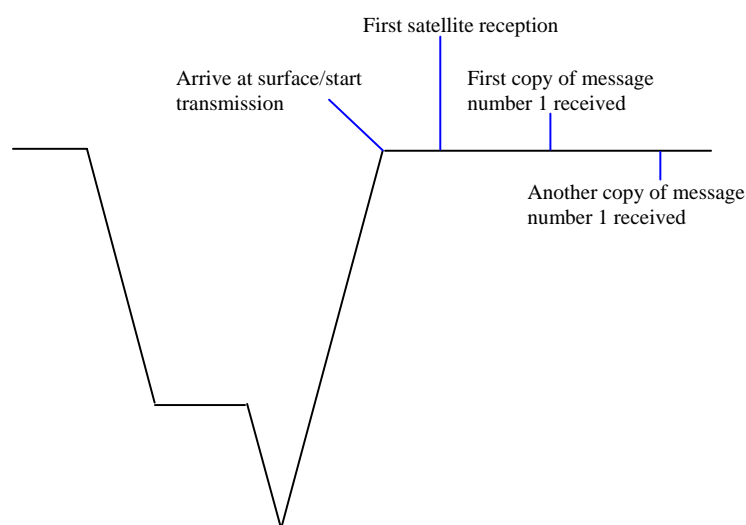


Figure 1: Float cycle showing transmission

After the float arrives at the surface, it begins transmitting. Because a satellite may not immediately see the float, typical satellite capture begins within minutes or even hours after the float surfaces.

Starting when the float arrives at the surface, M messages making up one complete profile are transmitted sequentially (from #1 to # M) and repeatedly until the end of the UP TIME period. One complete set of M messages makes up one Block of data. Thus B blocks of M messages are transmitted. These messages are received whenever a satellite 'sees' the float, therefore the blocks are not necessarily complete.

To find out when the float arrived at the surface and began transmission, it is necessary to use the information provided in 'Message 1' (APEX floats) of the profile which reports how many times the complete set or 'Block' of messages has been transmitted since the float arrived at the surface.

There are two methods that can be used to calculate surface arrival time. The preferred method, developed by Jean-Philippe Rannou, relies entirely on information provided in the transmissions received from the float. The second requires metadata.

The preferred method requires that two copies of message 1 from different blocks are received. The surface arrival time is then calculated as follows:

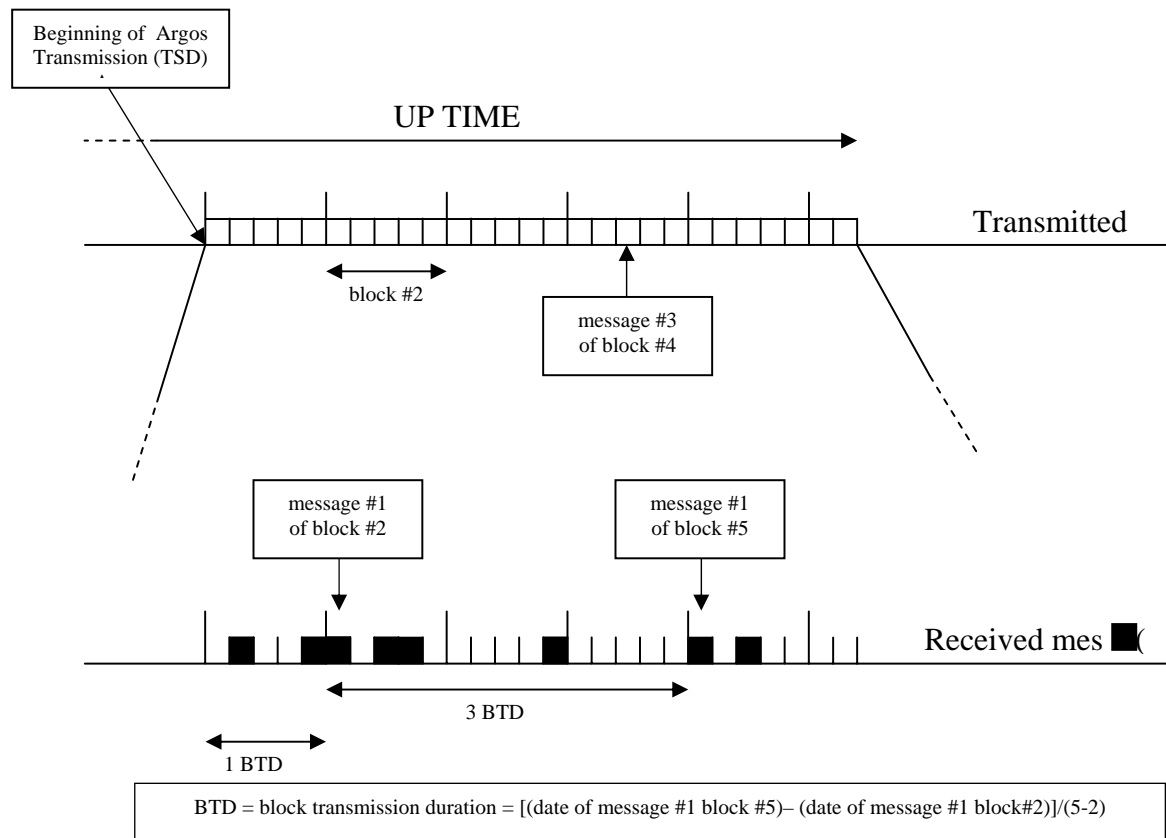


Figure 2. The preferred and more accurate method for estimating surface arrival time of the float

This method relies on receipt of TWO copies of Message 1 which passed the cyclic redundancy check. Using the time of each transmission from the Argos report, and the message block number contained in each message 1, you can calculate the amount of time it takes to transmit a complete block of M messages containing the entire profile.

This is calculated as shown, where $N1$ is the earlier block number, $N2$ is the later block number, and all times are in Julian days:

$$\text{BTD} = \text{block transmission duration} = \frac{[(\text{time of message with } N2) - (\text{time of message with } N1)]}{[N2-N1]}$$

Following from this, Surface Arrival Time, or JULD_START_TRANSMISSION is calculated as follows:

$$\text{JULD_START_TRANSMISSION} = \text{time of message with } N1 - [(N1 - 1) * \text{BTD}]$$

Only blocks with a valid CRC for message 1 should be used in these calculations but, because there are other unusual problems that can occur, the BTD should be calculated using multiple "time of message" pairs. The median value is then used to calculate JULD_START_TRANSMISSION. The same process can be used to calculate the median JULD_START_TRANSMISSION from multiple blocks, if available.

Warning : if the float transmits more than 255 blocks (this may happen with a shallow profile or on surface drift), to avoid a modulo error the N1 and N2 "time of message" pairs have to belong the same batch of 255 transmissions.

If only one copy of message #1 is received for a profile, then you must use the less reliable method. For this method, you must know the 'transmission repetition rate' for the Argos transmitter on the float AND the number of *M* messages in a complete block for the profile. The transmission repetition rate can be derived from the transmissions themselves in most cases. The way to do this is to find the smallest time differences with a window of +/- 1 second (since the transmission repetition rate is usually a floating point number). Once these time differences are identified one can take the mean. Caution: we have seen floats for which the transmission repetition rate of cycle 0 is different from the transmission repetition rate of the other cycles.

This method relies on the estimation of *M* from the length of the profile given in message 1. This makes the method less reliable because length of the profile could be wrong.

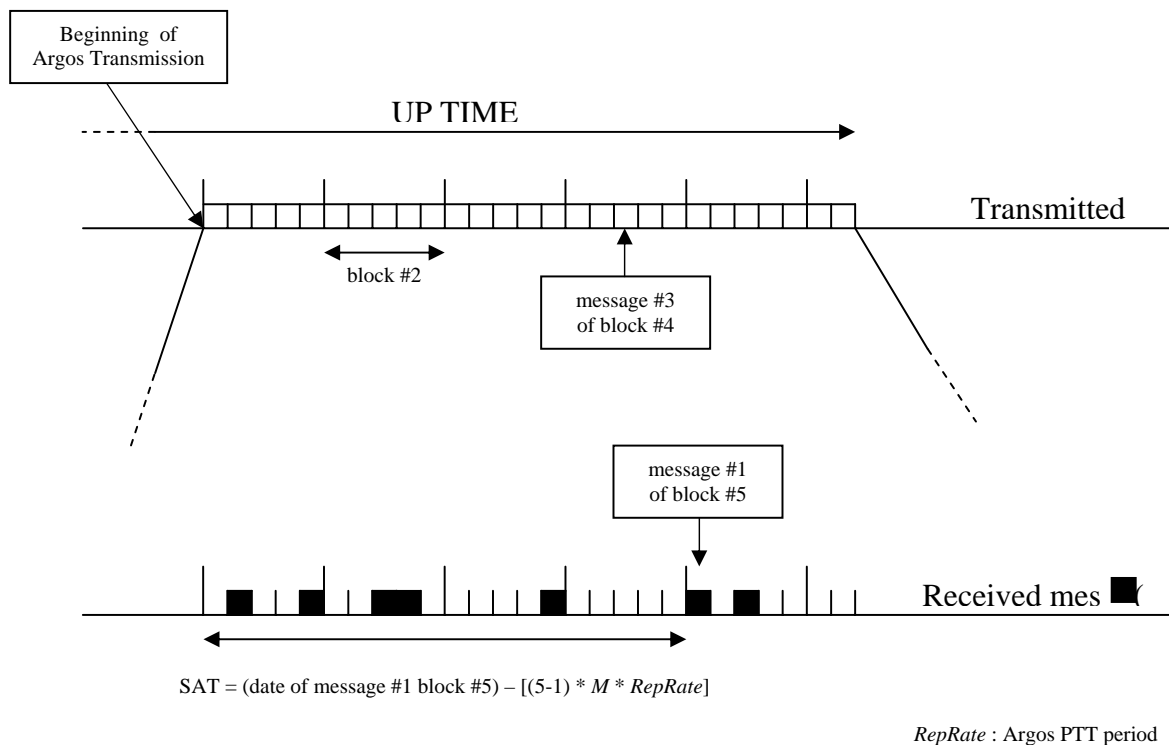


Figure 3. The second, less reliable method for estimating surface arrival time of the float

Surface Arrival Time (SAT in the figure above), or JULD_START_TRANSMISSION, for this method are calculated as follows where N is the block #, M is the total number of messages in one block, RepRate is the transmission repetition rate (seconds) of the Argos transmitter on the float and time is in Julian days:

$$\text{JULD_START_TRANSMISSION} = (\text{time of message with N}) - [((N-1) * M * \text{RepRate}/86400)]$$

In practice, this last term must be expressed in terms of fraction of a day so we divide by 86400 (number of seconds in a day).

If you DO NOT receive a message #1 from a profile, then it is impossible to calculate surface arrival time. The best you can do then is to use the first date from the first message received as the approximate JULD_START_TRANSMISSION.

Suggestion: in this case JULD_START_TRANSMISSION and JULD_ASCENT_END should be fill value. They can be filled in the delayed-mode QC process based on the complete record.

JULD_ASCENT_END calculation

According Webb Research (the Apex floats manufacturer), the end of the float ascent occurs 10 minutes before the data transmission starts. Therefore :

JULD_ASCENT_END = JULD_START_TRANSMISSION - 10 minutes or:
JULD_ASCENT_END = JULD_START_TRANSMISSION - 0.00694444 (which is the Julian value of 10 minutes)

FOR ALL OTHER FLOAT TYPES, THE DELAY MUST BE DETERMINED AND SUBTRACTED FROM JULD_START_TRANSMISSION