How to decode the Thargoid Probe tightbeam transmission

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Disclaimer: *this is just a guide to decode the signal, all the following knowledge has been reverse-engineered by other commanders, among which CMDR Wace did most of the job to the best of our knowledge.*

Setup

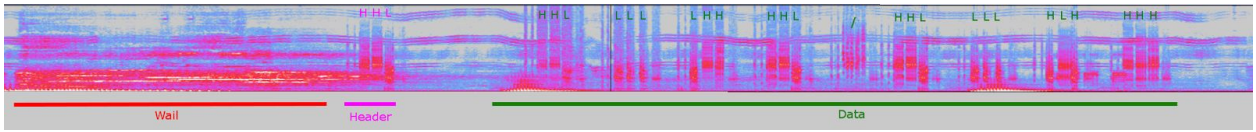
For the purposes of this tutorial, we'll use the transmission emitted by the probe when jettisoned within the SOI of NGC 7822 Sector GR-W d1-1 8. All the following examples refer to this transmission, that can be downloaded here**.** The file has been edited to cut a lot of silence out.

Intercepting the tightbeam

To intercept the transmission, your ship needs to be placed between the TP and the Merope system (or, if you're within Merope, between the TP and Merope 5 C). Select Merope from the galaxy map and use the nav marker to align yourself properly so that you face the probe and have merope right behind you. Alternatively, just keep an eye on where the bigger head orientates itself and place yourself right in front of it. The more precise you are, the better signal you get.

Tightbeam transmission composition and transcription

To understand how to transcribe the transmission we suggest looking this video tutorial: https://www.youtube.com/watch?v=IegLKMISkuA
While the information contained in the transmission used for the tutorial are radically different (since it's dedicated to the TL transmission), the encoding is the same: triplets of high-low audio signals possibly separated by a separator signal. As an example, we'll decode the first part of the transmission here (hi-res https://imgur.com/a/AI18XAN).



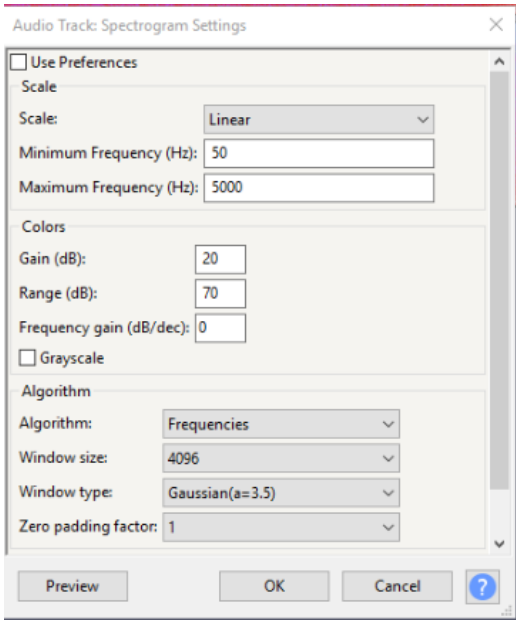
The whole transmission is divided into 5 chunks of different length, all similarly encoded as:

```
Wail | Header | Data
```

except for the 5th chunk that has no header. The header encodes the chunk number, for example in the image above, it is HHL, i.e., 1, since it's the first chunk being transmitted. The data for this chunk follows the header and can be transcribed as follows:

```
hhl lll lhh hhl / hhl lll lhl hhh
001 111 100 001 / 001 111 101 000
```

The following 4 chunks s can be transcribed similarly to this one.
The spectrogram above is obtained with Audacity with the following settings:



Decoding the transmission

As briefly mentioned above, the transmission is divided in 5 parts. In this section we describe how to decode each one, and what's its purpose. To facilitate the reading, we report here both the values of the target body and those of Merope 5C:

Chunk #1: Temperature - 00:00

The first chunk encodes the temperature value for the body being scanned. The temperature is expressed as a fraction and as a portion of Merope 5 C temperature (M_T). In our leading example:

```
001 111 100 001 / 001 111 101 000
993/1000 = 0.993
0.993 * M_T = 0.993 * 297K = 294.921K
```

Chunk #2: Gravity - 00:26

The second chunk encodes the gravity of the body being scanned. The gravity is expressed as a fraction and as a portion of Merope 5 C gravity (M_G). In our leading example:

```
001 110 111 111 001 / 001 111 101 000
7673/1000 = 7.673
7.673 * M_G = 7.673 * 0.18 = 1.38G
```

We can see that in this case there is a slightly higher approximation error, but Thargoids are well-known for such errors.

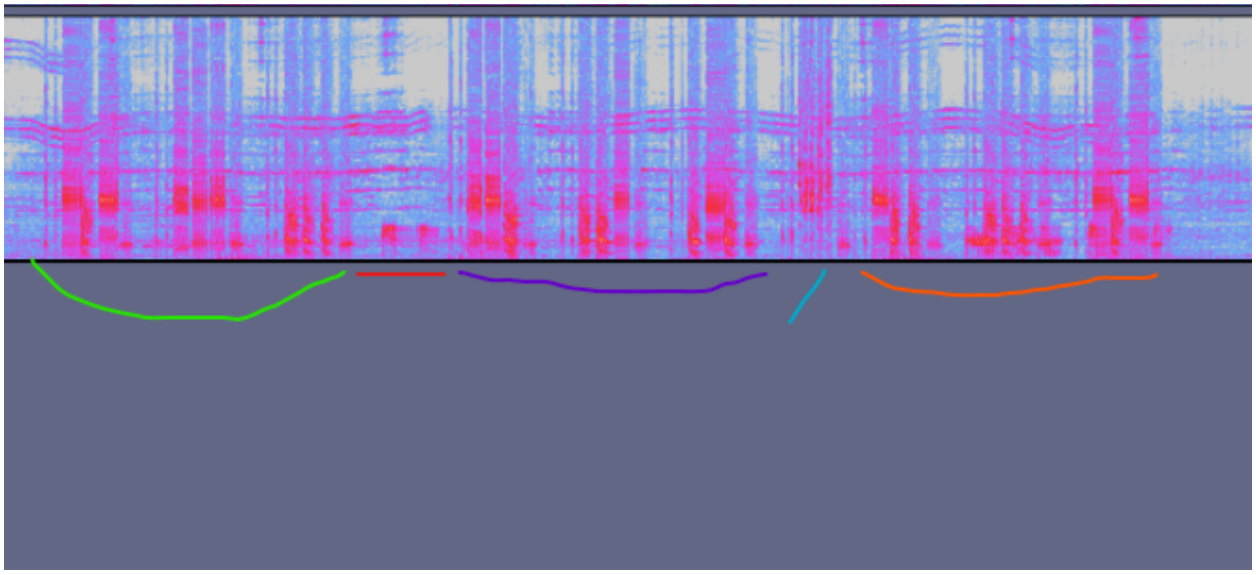
Chunk #3: Radius - 00:53

The third chunk encodes the radius of the body being scanned. The radius is expressed as a fraction and as a portion of Merope 5 C radius (M_R). In our leading example:

```
111 101 101 / 011 100 100
493/100 = 4.93
4.93 * M_R = 4.93 * 1478Km = 7286Km
```

Chunk #4: Atmospheric Composition - 1:16

The 4th chunk encodes information about the atmospheric composition of the body being scanned. This chunk is the biggest, if the body has any atmosphere (otherwise it's empty), and is encoded slightly differently than the others. As we can see in this image:



There's a first set of triplets (green) followed by a short silence (red) and, subsequently, by a standard set numerator, separator, denominator. This schema will repeat for each element that composes the atmosphere of the target body, and can be decoded as follows.

The first set of triplets indicates the element (or molecule), in particular: the first triplet indicates the numeric index and the following 2 triplets indicate the atomic number of the element. For example, the first set in our leading example (also in the image above) is:

```
010 | 000 111 = 2 | 7 = N2
```

The second set encodes the percentage of this element in the overall atmospheric composition. The full decoding for our leading example is the following (the | and - separators are placed manually to help decoding the element, there's **no** corresponding element in the audio):

```
010 | 000 111 = 2 | 7 = N2
P1: 001 110 101 / 011 111 010 = 117/250 = 0.468

010 | 001 000 = 2 | 8 = O2
P2: 110 101 / 011 111 010 = 53/250 = 0.212

010 | 000 001 - 001 | 001 000 = 2 | 1 - 1 | 8 => H2O
P3: 001 / 110 010 = 1/50 = 0.02
```

So far, the decoding tells us that the target's atmosphere is made up of Nitrogen, Oxygen, and Water. To get the portion of each element, just sum up the values encoded in the transmission right after each element:

```
P1 + P2 + P3 = 0.70
0.468/0.70 = 0.668 = 66.8% Nitrogen
0.212/0.70 = 0.302 = 30.2% Oxygen
 0.02/0.70 = 0.028 =  2.8% Water
```

Chunk #5: Distance from Col 70 Sector FY-N c21-3 - 2:16

The fifth and final chunk encodes the distance of the system in which the scanned body is from Col 70 Sector FY-N c21-3. Keep in mind that this chunk has no header, so the data transmission will begin right after the wail. The distance is expressed as a fraction and in Thargmeters (Th), where 1 Thargmeter is the distance between Merope and Col 70 Sector FY-N c21-3. The details of how this was reversed are greatly interesting, but out of the scope of this tutorial, the interested readers can refer to https://jubjubnest.net/~wace/elite/trilateration-math.html for a thorough explanation.

```
111 011 001 101 / 001 111 101 000
3789/1000 = 3.789
3.789Th = 3.789 * 871.014 = ~3300Ly
```