

Sunday, 17th September, 2006 Fairborn OH

Electronic Evidence and Physiological Reasoning Identifying the Elusive Vowel “a” in Neil Armstrong’s Statement on First Stepping onto the Lunar Surface

by Peter Shann Ford

Abstract: Electronic voice signal analysis of Astronaut Neil Armstrong’s statement on first stepping onto The Moon reveals the presence of an “a” sound after his words, “That’s one small step for”. Physiological reasoning describes the expression of this vowel sound in the lingual-buccal-labial transition from the terminal consonant “r” in “for” to the initial consonant “m” in “man”.

Evidence and Reasoning:

Excerpts of a NASA recording of the Apollo 11 mission lunar landing are available on the internet at http://www.nasa.gov/mission_pages/apollo/apollo11_audio.html, titled “Sounds from Apollo 11”. A 259 kilobyte, 24.113 second duration WAV file is downloadable from that page.

Figure 1 shows GoldWave v5.14 digital sound editing software displaying the WAV file’s time-based amplitude and frequency variations consistent with the words and sounds uttered by Neil Armstrong as he first stepped from the Lunar Excursion Module (LEM) onto the surface at Tranquility Base. (Appendices 1 to 17 contain page-sized versions of each Figure).

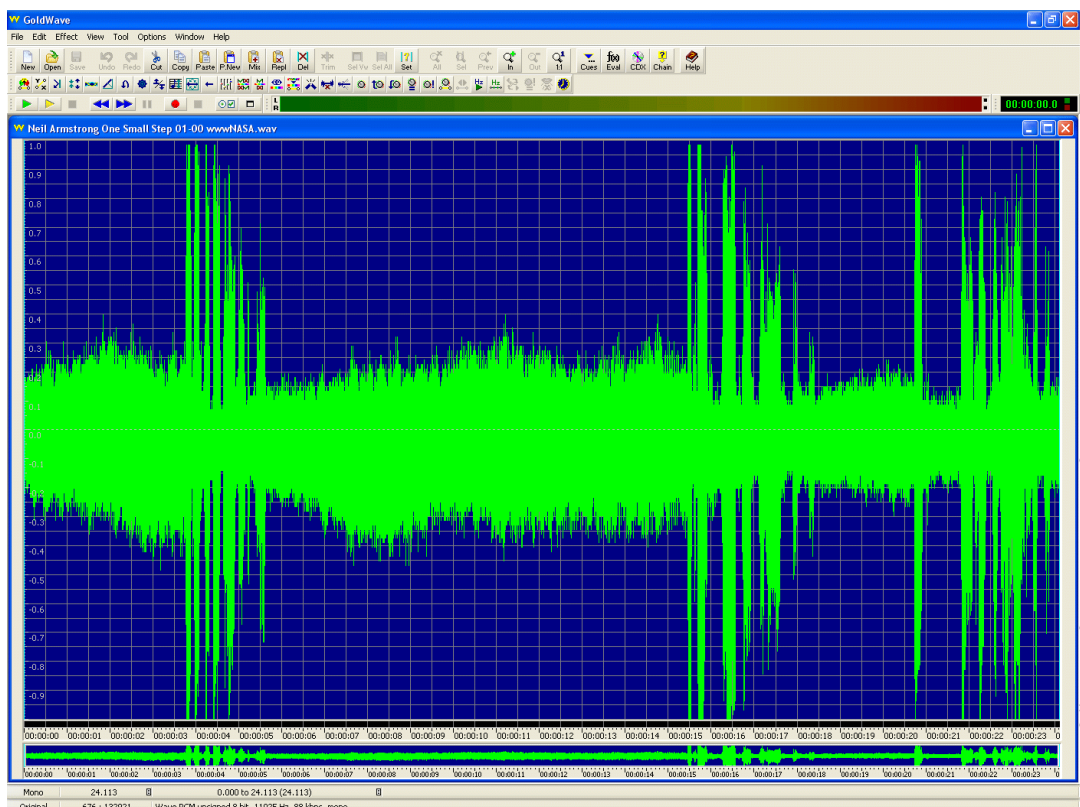


Figure 1: NASA WAV file of Neil Armstrong's first words stepping onto lunar surface

Figure 2 shows annotations and correlation with Neil Armstrong's words, "I'm gonna step off the LEM now" and, "That's one small step for a man, one giant leap for mankind". Appendix 1 contains a full-sized image of Figure 2.

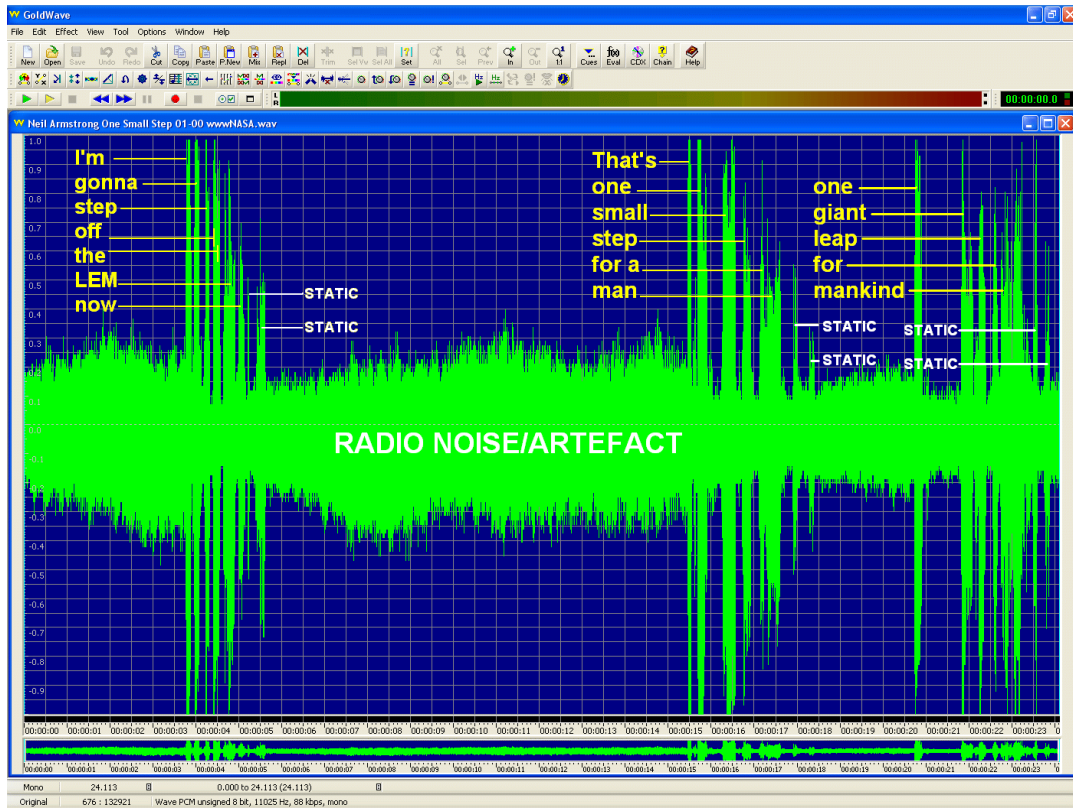


Figure 02 Annotated image of 241 second WAVE file of Neil Armstrong

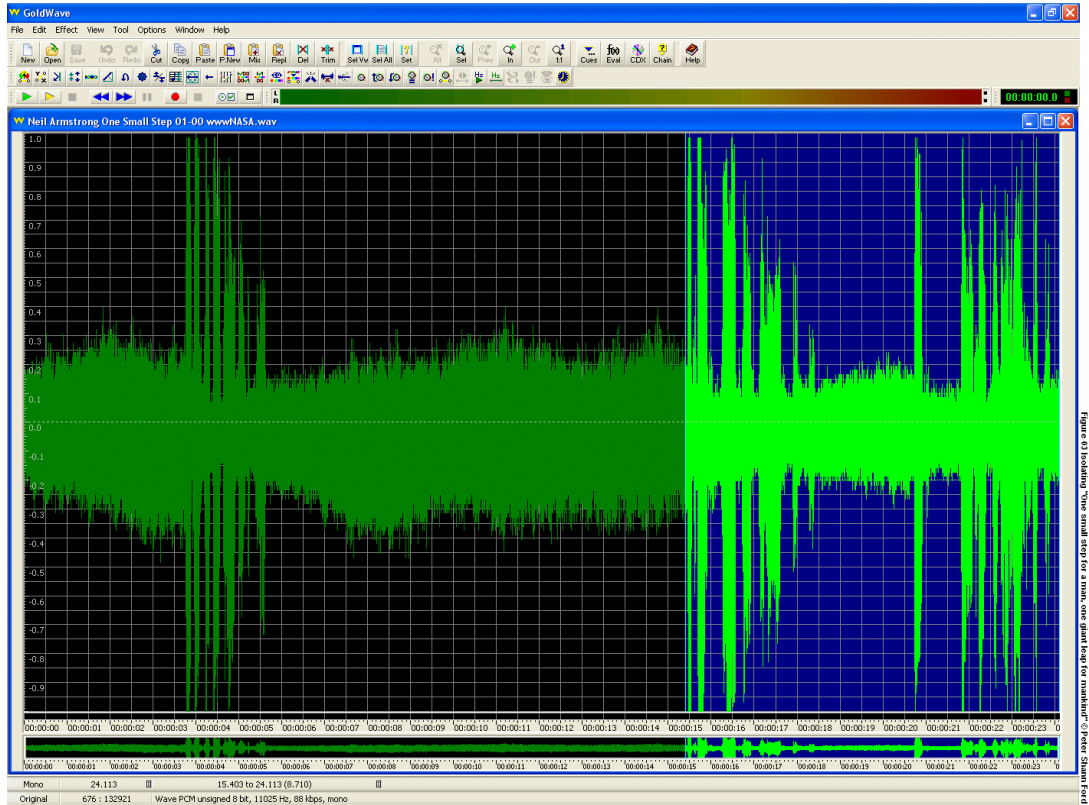
The Editor:

The GoldWave editor displays two graph areas: the larger upper area with a dark blue background, grey graph coordinate lines and green plot lines; and the smaller narrow area with similar colour scheme below it.

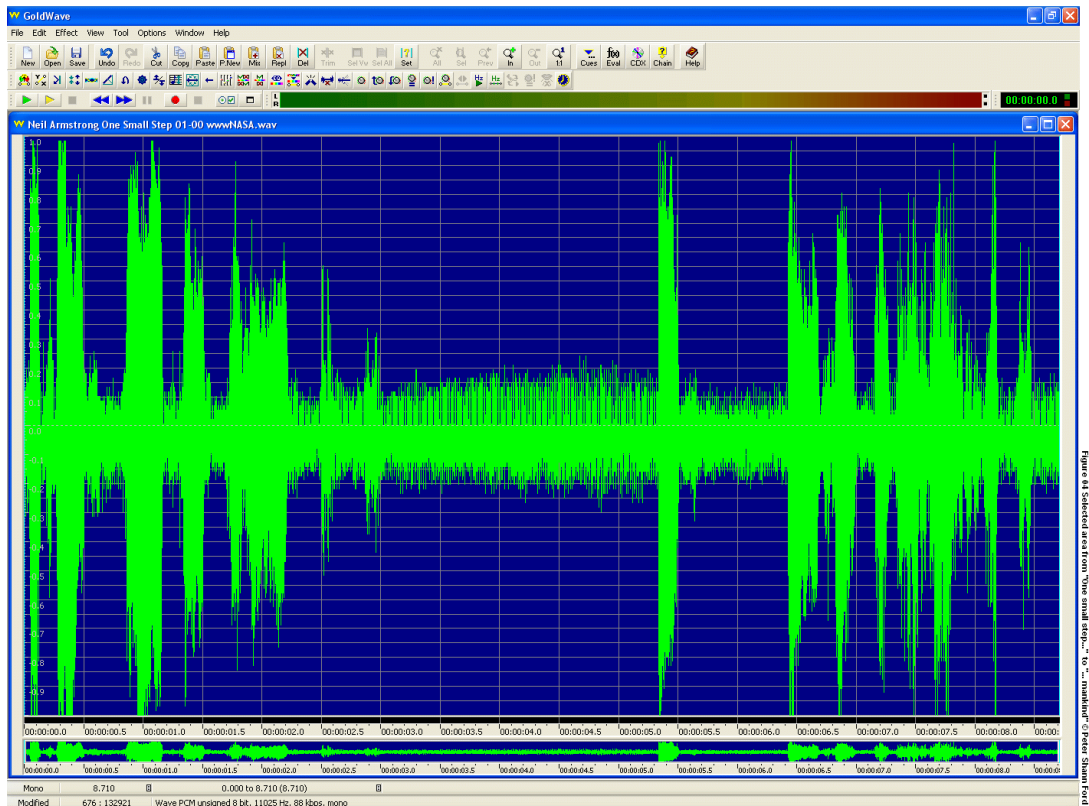
The recorded sounds, including radio noise and electronic artefact including bursts of static, and words, are represented by the irregular vertical narrow green lines stretching to the top and the bottom area of the dark blue graphs. The irregular broad green strip running horizontally from left to right across the midline of both graphs represents background electronic noise and artefact from the radio communications link between the LEM and Mission Control in Houston. (For more on the radio links for video and sound via Parkes Observatory, Australia and Goldstone, California see Appendix 18).

The numbers displayed immediately below each graph area represent elapsed time, in hours, minutes and seconds, displayed at one second intervals. These two numerical displays always indicate elapsed time but their scale changes according to the magnification of the graph, determined by the size of the data area selected. The numbers on the row second from the bottom indicate that this is a monophonic recording (Mono), that the cursor which moves as sound is played back is at elapsed time 24.113 seconds, and that this selection runs from Zero (0.000) to 24.113 seconds. The numbers on the bottom line indicate the source, amplitude magnification and digital size, frequency and digital sampling rate of the WAV file.

By highlighting the right portion of the graph, the sentence, “That’s one small step for a man, one giant leap for mankind” can be isolated. Figure 3 illustrates this.



Using the editor’s “Trim” function on the darkened area leaves the highlighted area displayed across the editing screen. It thus appears horizontally stretched. Figure 4 illustrates this.



Using the editor to highlight a 1.573 second sample of electronic artefact at a break in Neil Armstrong's words enables the editor to capture data ranges for removal. Figure 5 illustrates this.

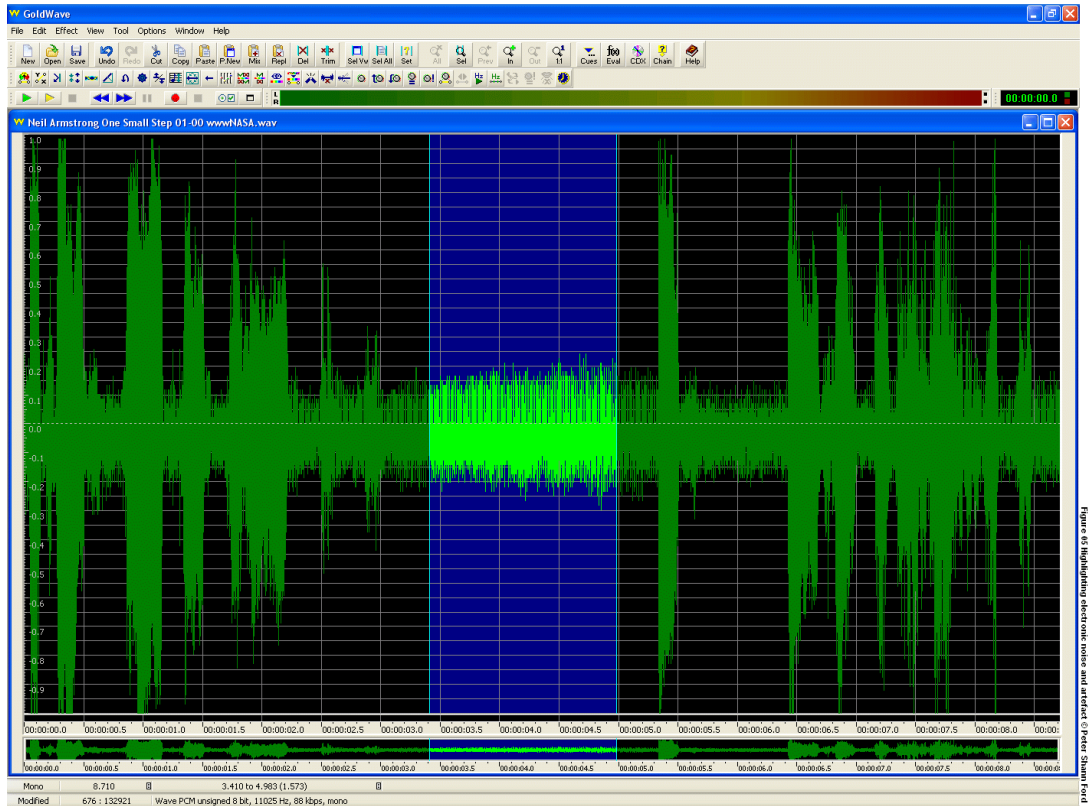


Figure 5: Highlighting electronic noise and artefact of Peter Sharron Ford

The editor eliminates this data range from the screen, leaving Neil Armstrong's words more clearly discernible. This action does not change critical voice characteristics. Figure 6 illustrates this.

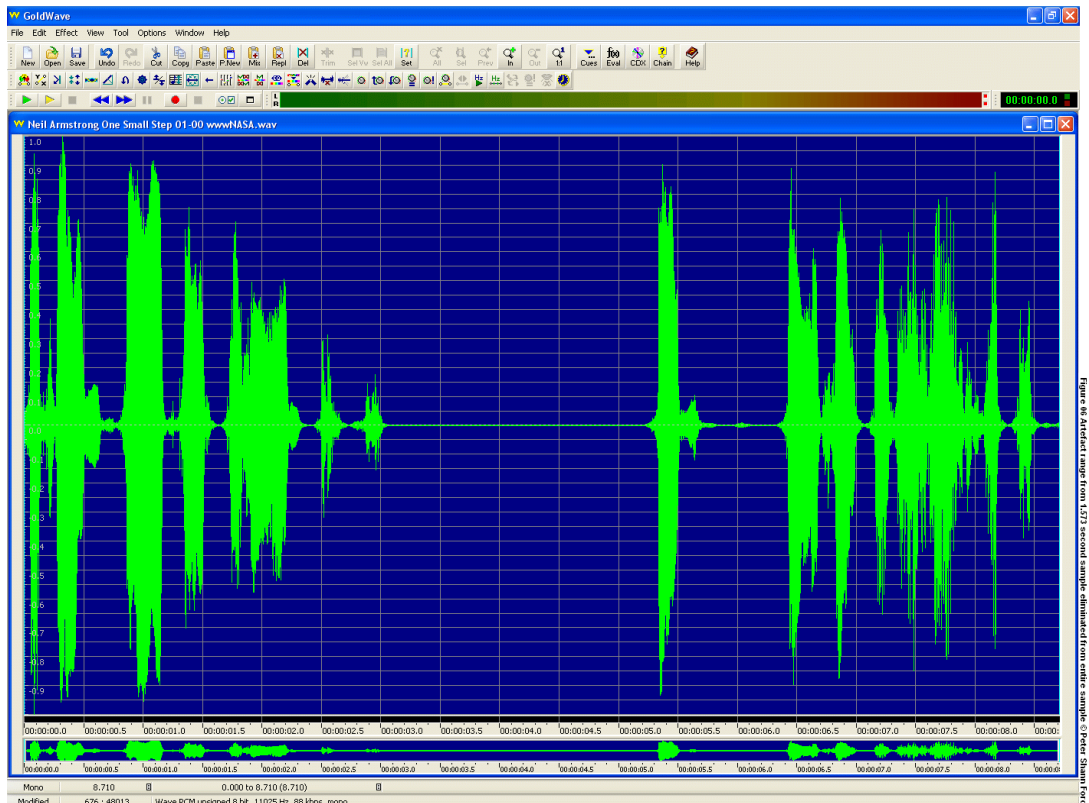


Figure 6: Artefact sample from 1.573 second sample eliminated from entire sample of Peter Sharron Ford

Figure 7 shows the same sound graph annotated.

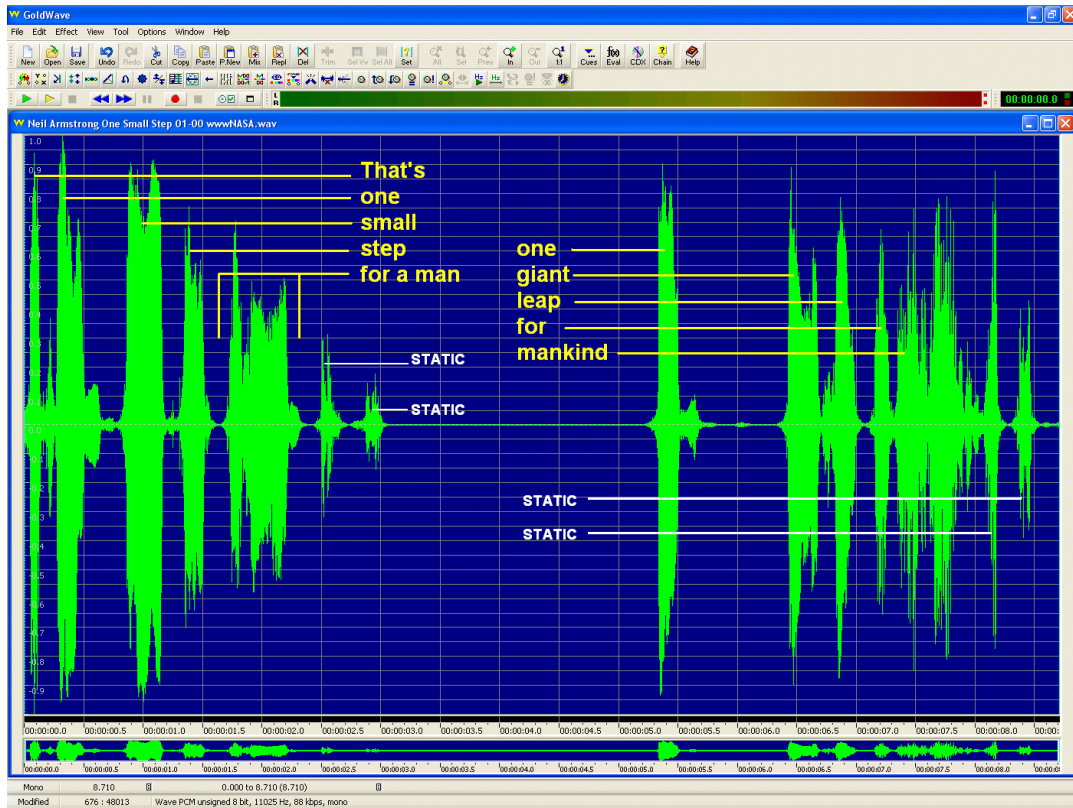


Figure 7: Annotated waveform - Annotated by Peter Sharratt

Figure 8 illustrates using the editor to Trim the phrase “for a man”.

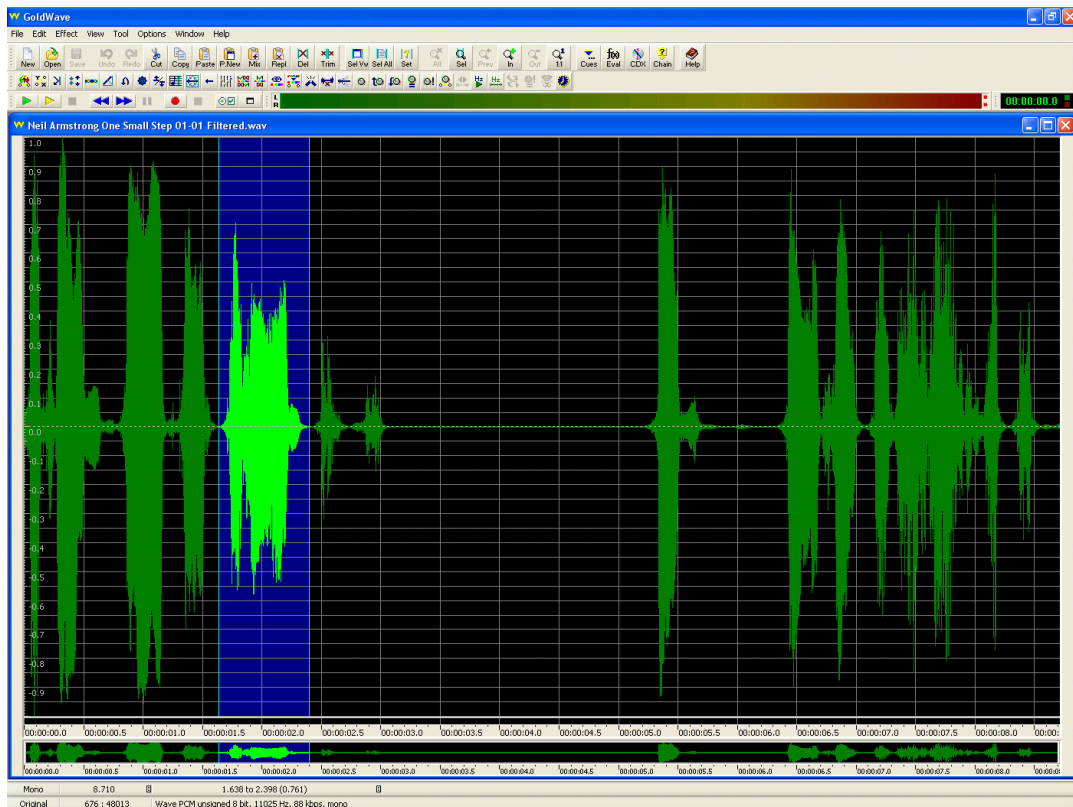


Figure 8: Trim 'for a man' - Peter Sharratt

Figure 9 illustrates the graph expansion isolating the phrase “for a man”.

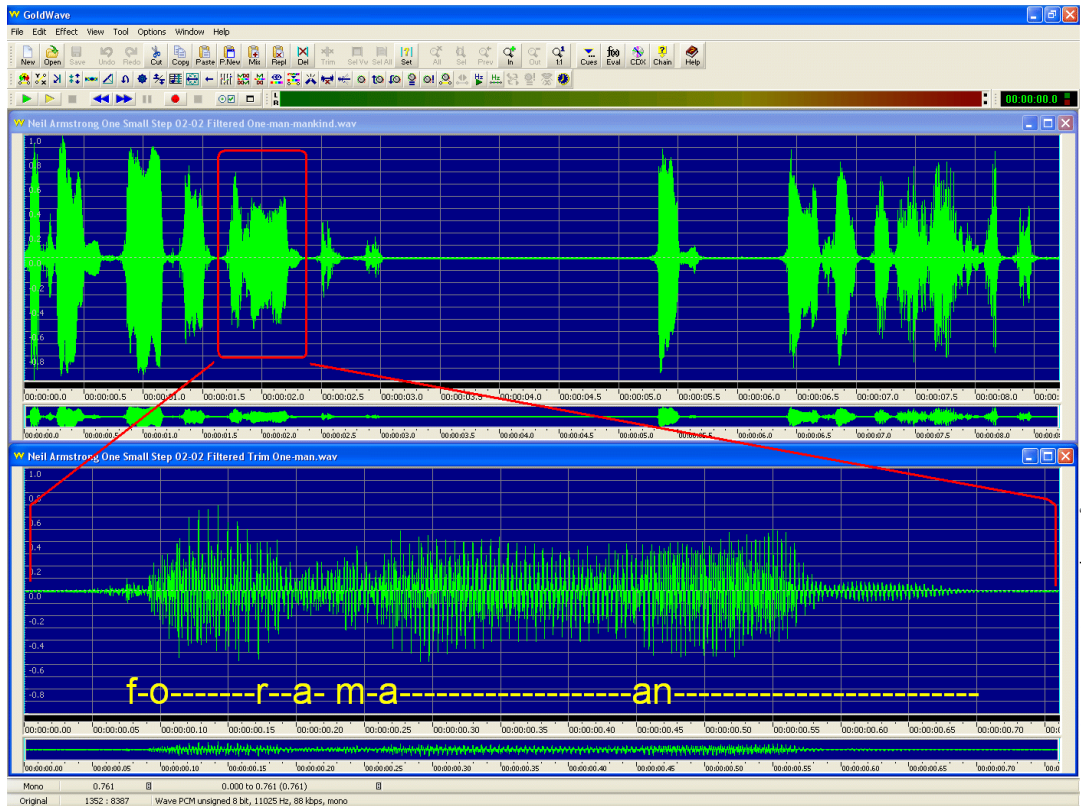


Figure 9: Comparison of isolation of "for a man" - © Peter Sharratt Ford 2004

Figure 10 illustrates the annotated file after the Trim function to isolate the phrase “for a man”..

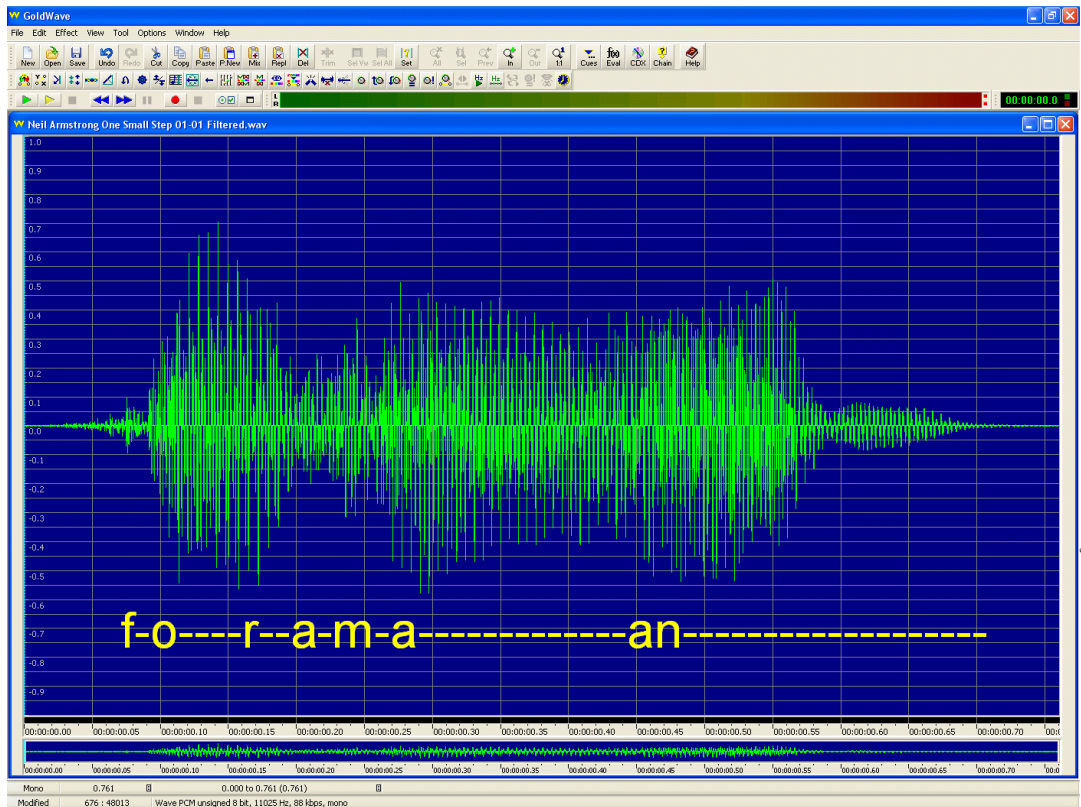


Figure 10: "for a man" - Filtered - Isolated - © Peter Sharratt Ford 2004

Neil Armstrong says “for” in a clearly graphed sound wave. He says “man” in two syllables, beginning with an introductory pressure wave on “m”, through an “a-a” extension which decays toward

a final pressure wave at the conclusion of “n”. An additional sound wave exists between “for” and “man”, defined in the following figures.

Figure 11 illustrates highlighting from the onset of the “for” sound wave to the final decay of the “man” sound wave. The highlighted sample is 0.638 seconds in duration (see Appendix 11).

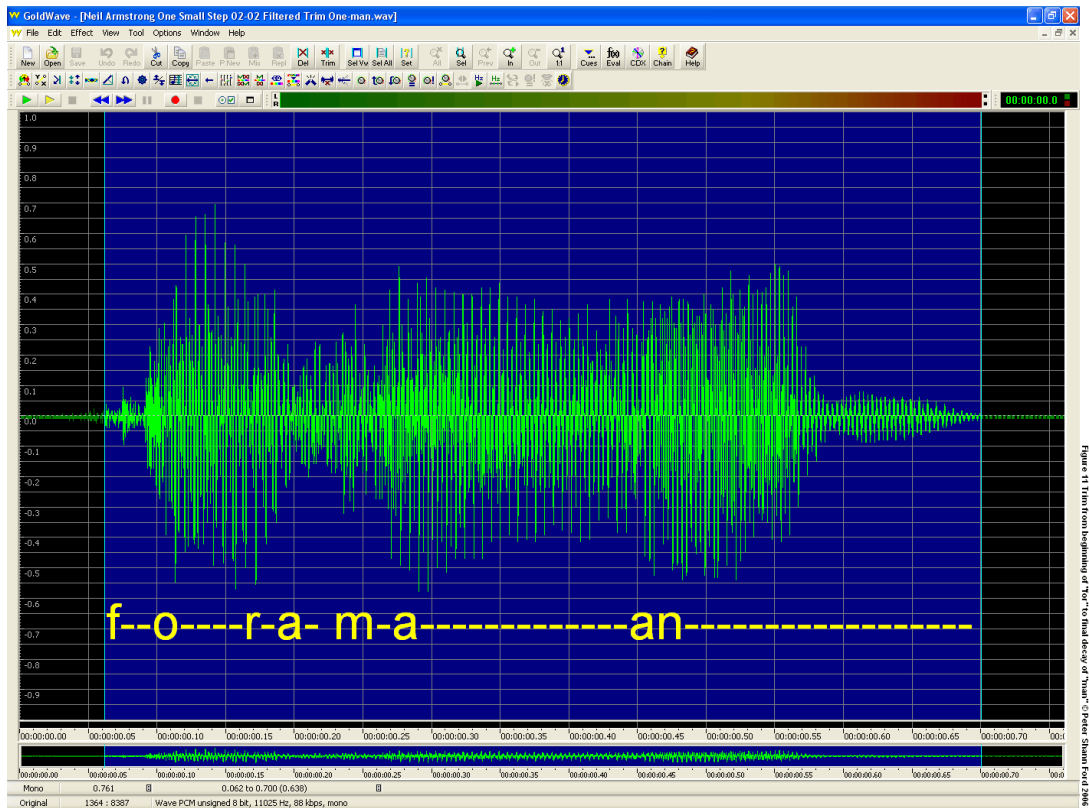


Figure 12 illustrates the isolated 0.638 second sample “for a man” full-screen and annotated.

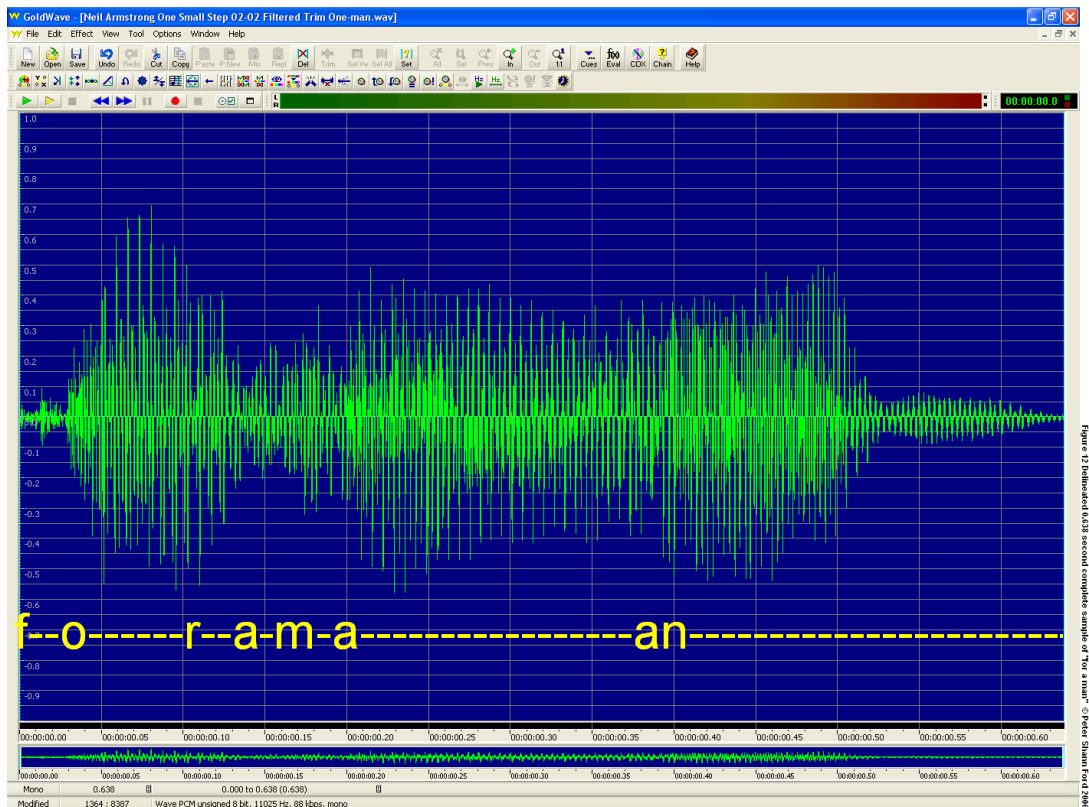


Figure 13 illustrates the onset of the “for” sound wave at 0.000 seconds in this sample, and its minimum point of decay at 0.136 seconds into the sample: it additionally illustrates the onset of the “man” sound wave at 0.171 seconds into the sample and its final decay at 0.638 seconds.

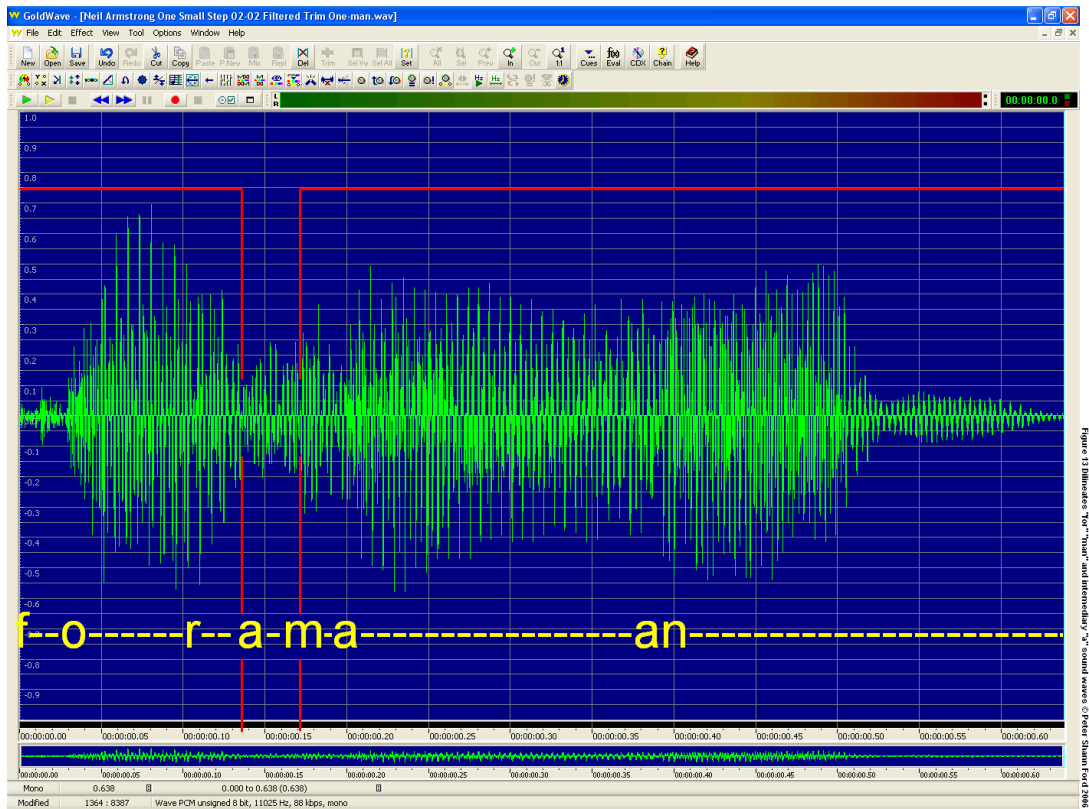


Figure 13 Illustrates "for", "man", and intermediately "a" sound waves © Peter Shamus Ford 2006

Figure 14 illustrates a magnification of the sound wave between the minimum point of decay of “for” at 0.136 seconds and the point of onset of “man” at 0.171 seconds. This 0.035 second sound wave is the elusive “a” - thirty-five thousandths of a second in duration.

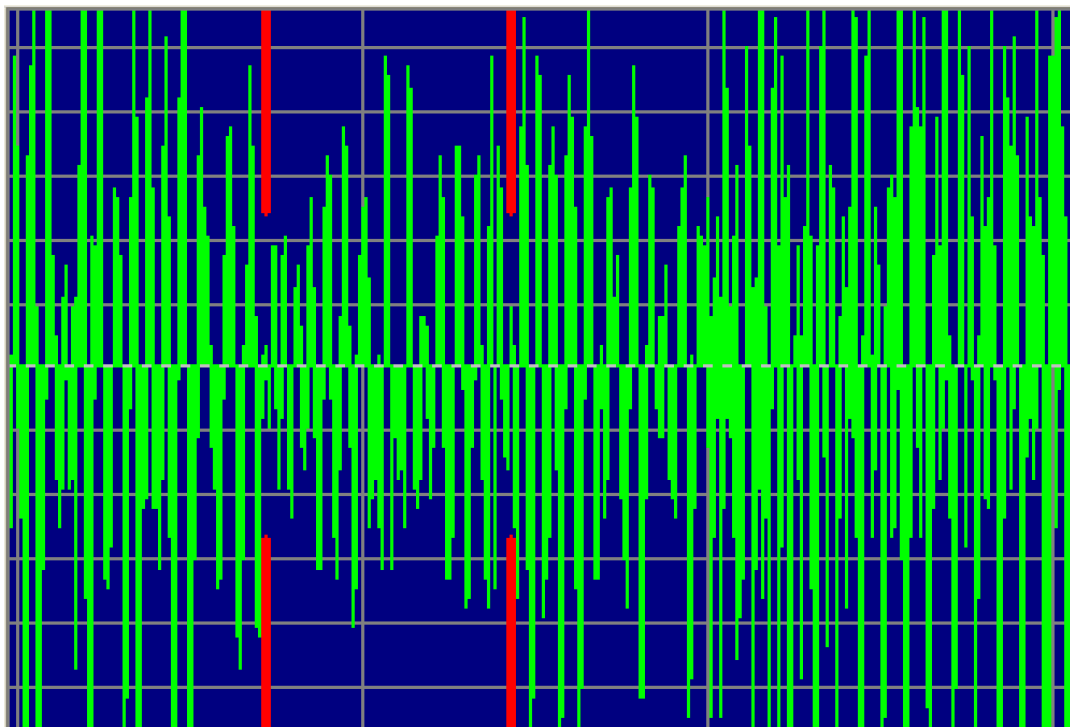


Figure 14 Illustration between "a" sound wave © Peter Shamus Ford 2006

Figure 15 annotates this magnified sample.

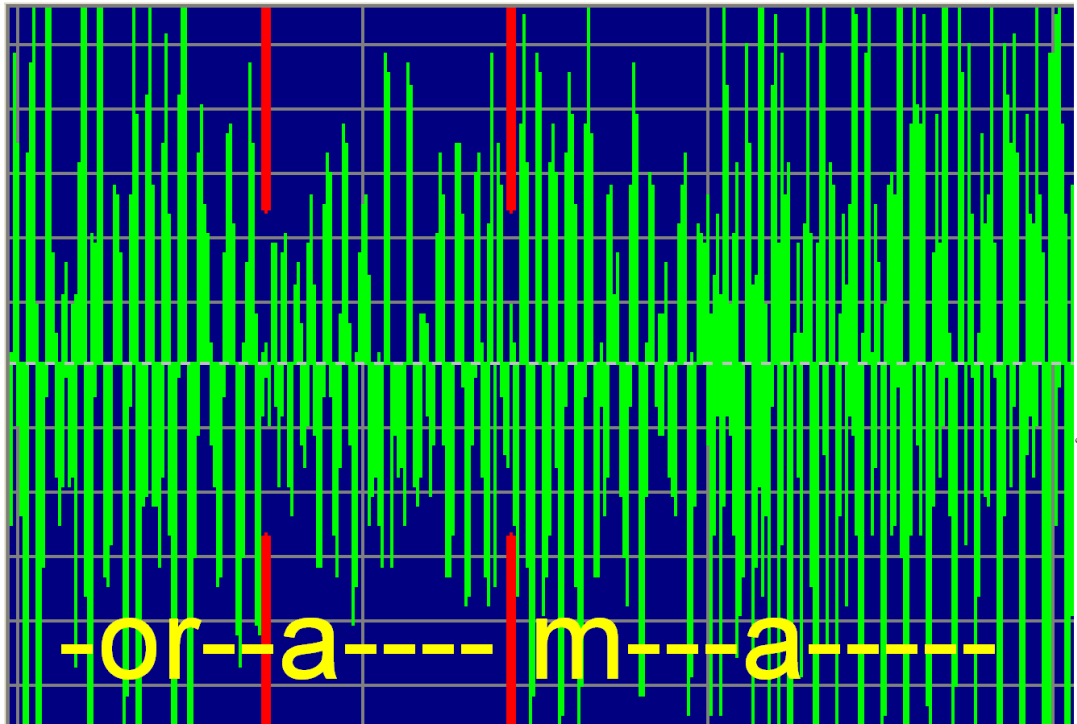
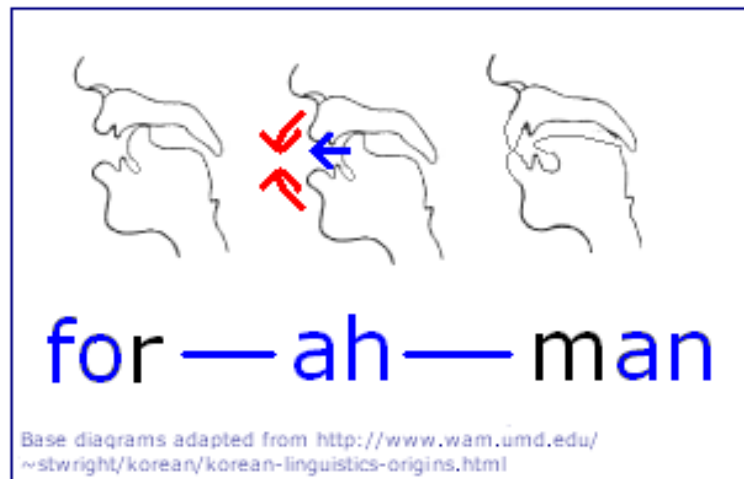


Figure 15: Dominated "r" sound Annotated © Peter Shumford 1996

This 0.035 second sound wave is consistent with the sound made in the lingual (tongue) buccal (mouth) labial (lips) transition from the terminal consonant “r” in “for” to a vowel “a” to the introductory “m” in “man”. It is not consistent with the sound made in the lingual-buccal-labial transition from the terminal “r” in “for” directly to the introductory “m” in “man”, as in “for man”.

Figure 16, illustrates the sequence of both transitions.



Adapted from a diagram at www.wam.umd.edu

In the transition from “for” to “a” to “man” the tongue is curled into the terminal “r” of “for” and uncurls for the “a” before the lips close for “m” in “man” creating a pressure wave consistent with the 0.035 second sound wave Figure 13.

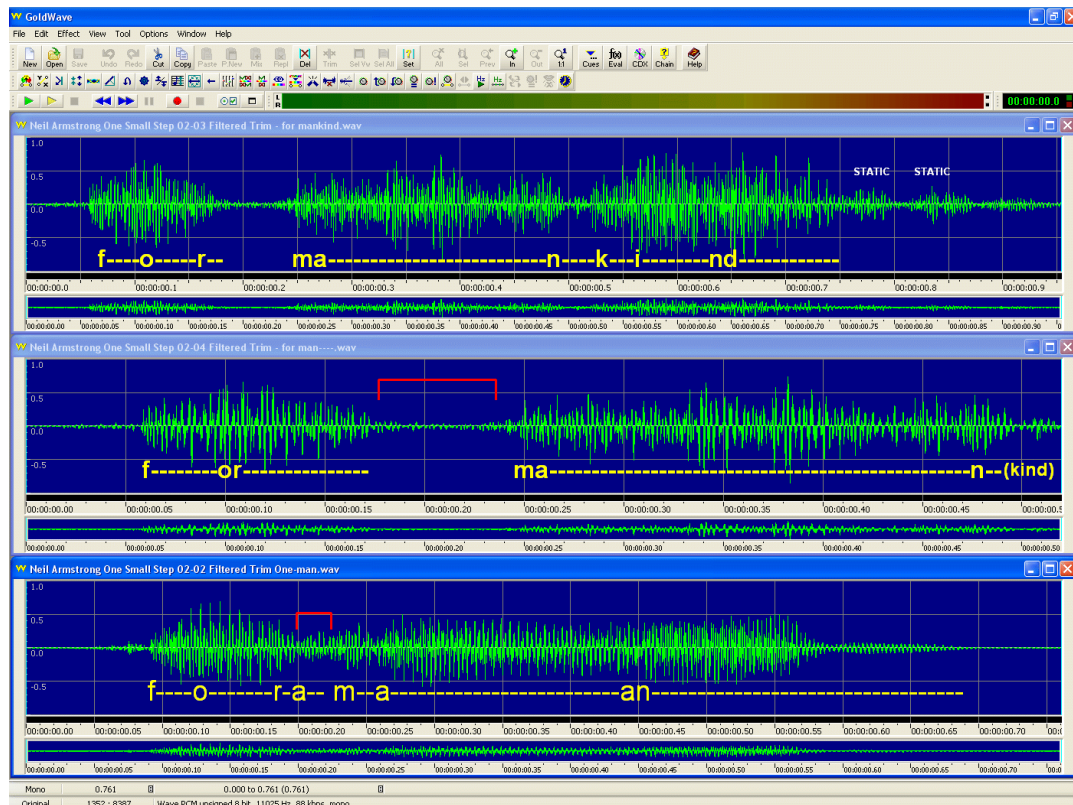
In the transition from “for” to “man” (as in the statement “for man”) the lips close for the “m” of “man” while the tongue is still curled for the “r” of “for” precluding the creating of the pressure wave consistent with the sound wave of “a”.

Control Comparison.

This illustration could be tested and further verified if there were a control phrase in the same sentence with which to compare the phrase “for a man”.

In reviewing this paper, Ms. Rano Singh, a Physiotherapist with a Masters in Biomechanics has noted that the graphs shown above indicate an inconsistency in the sound waves representing Neil Armstrong’s phrases “for a man” in the first part of the sentence and “for mankind” in the second part.

Figure 17 illustrates this inconsistency. If the phrase “for mankind” (shown in the top third of Figure 17) may be used as a control, a comparison with the phrase “for a man” (in the bottom third of Figure 17) shows the clear presence of an additional sound wave between “for” and “man” in the phrase “for a man” and the absence of any such sound wave between “for” and “mankind” (shown in the middle third of Figure 17).



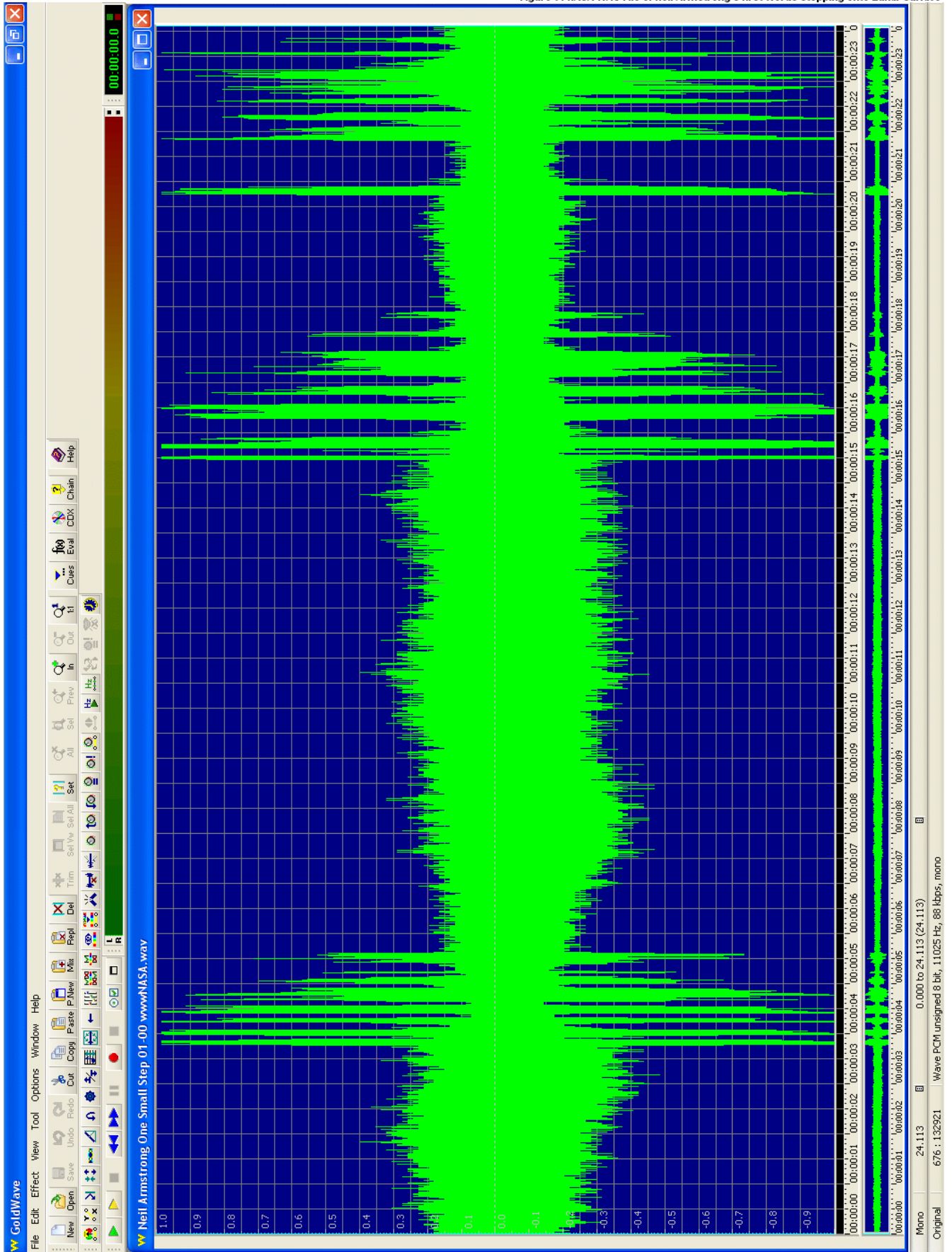
Conclusion: Astronaut Neil Armstrong’s arrival on the moon followed a distinguished career as a combat pilot, test pilot, commander of Gemini VIII for the first docking in space, and backup commander for Apollo 8. His professionalism, precision and coolness under pressure were established long before and highlighted when he took control of the lunar landing from the autopilot, flew beyond a hazardous area and landed Eagle manually. He recalls he formulated the sentence, “That’s one small step for a man, one giant leap for mankind” in the LEM in the hours between landing and stepping onto the lunar surface. It is a concise, eloquent statement for the ages at a unique milestone for our species. It seemed highly unlikely that he would utter it incorrectly. This paper proves, with an analysis and results that are independently repeatable, that he did indeed say the sentence completely and correctly.

Appendices 1-17: Full sized displays of Figures 1-17

Appendix 18: References, Notes and Edits.

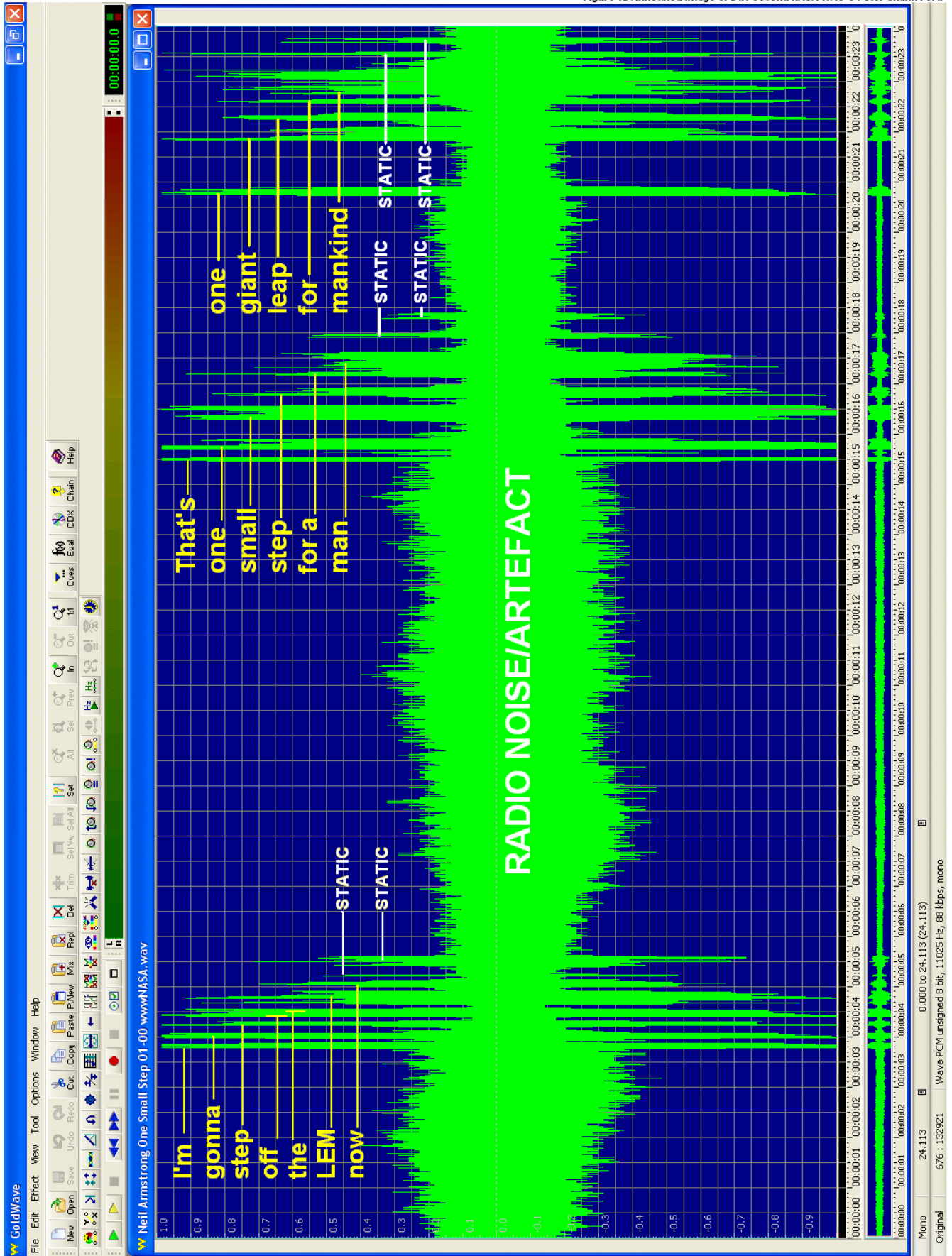
Appendix 1 - Figure 1

Figure 01 NASA WAV File of Neil Armstrong's first words stepping onto Lunar Surface



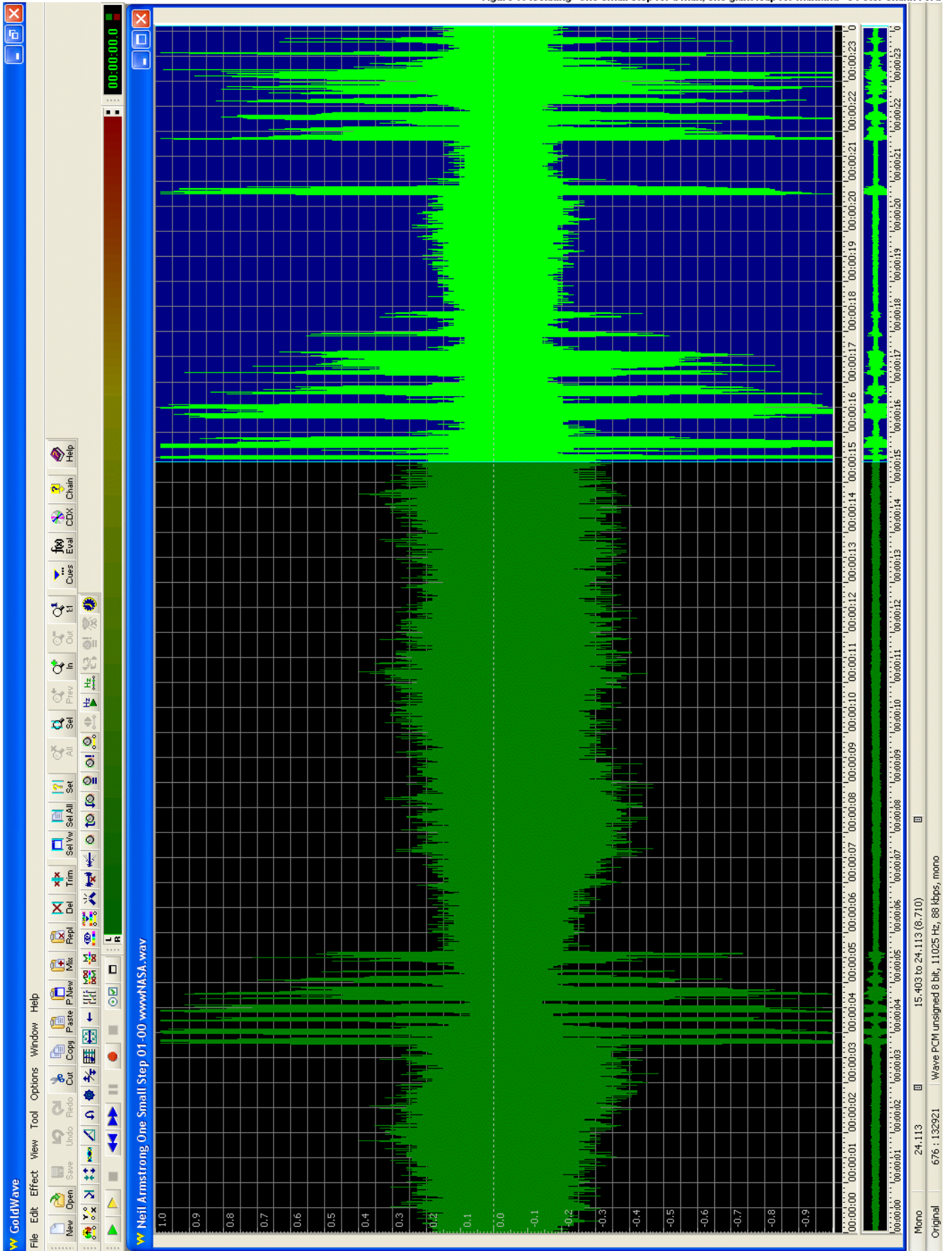
Appendix 2: Figure 2

Figure 02 Annotated image of 24.1 second NASA WAV © Peter Shann Ford



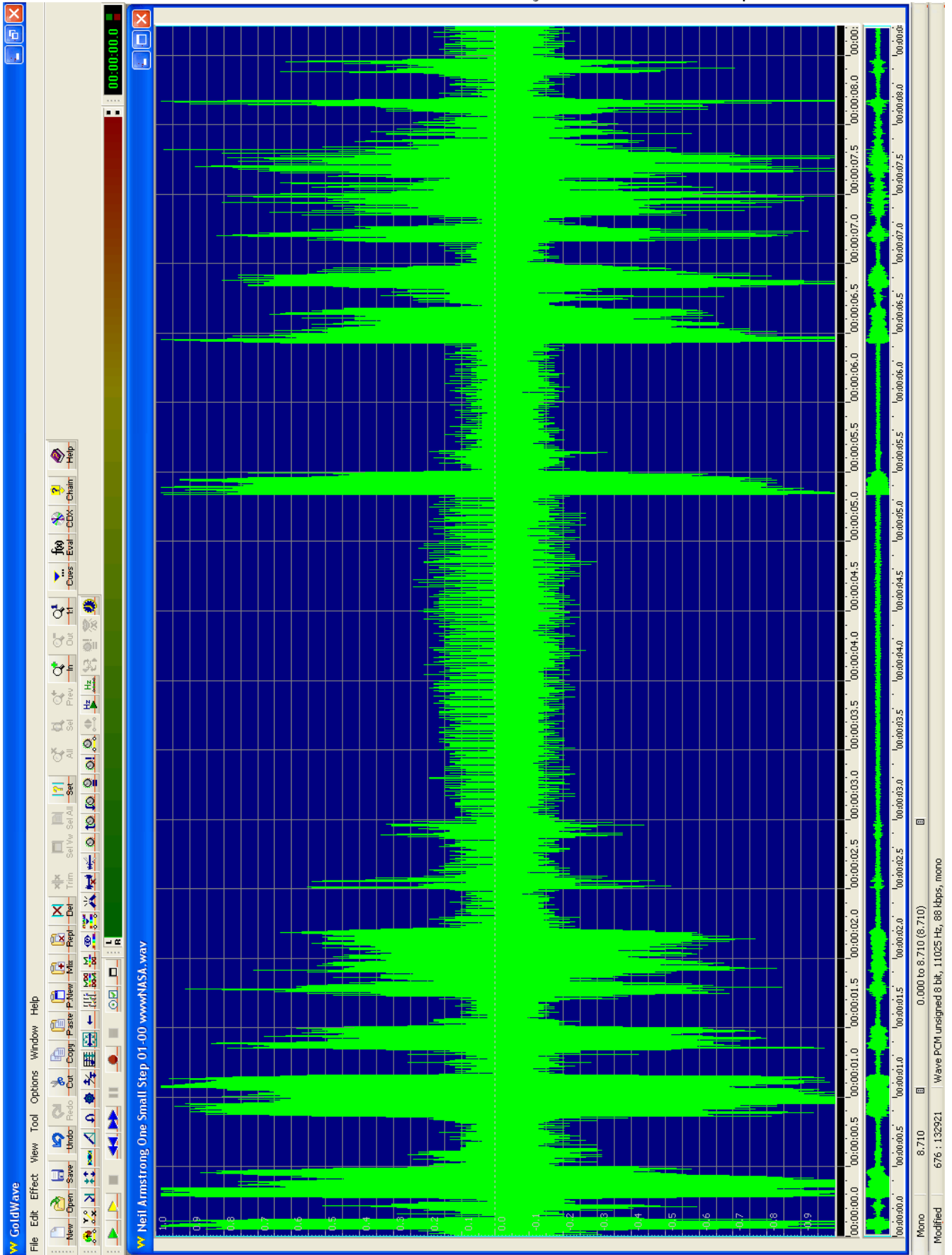
Appendix 3: Figure 3

Figure 03 Isolating "One small step for a man, one giant leap for mankind" © Peter Shann Ford



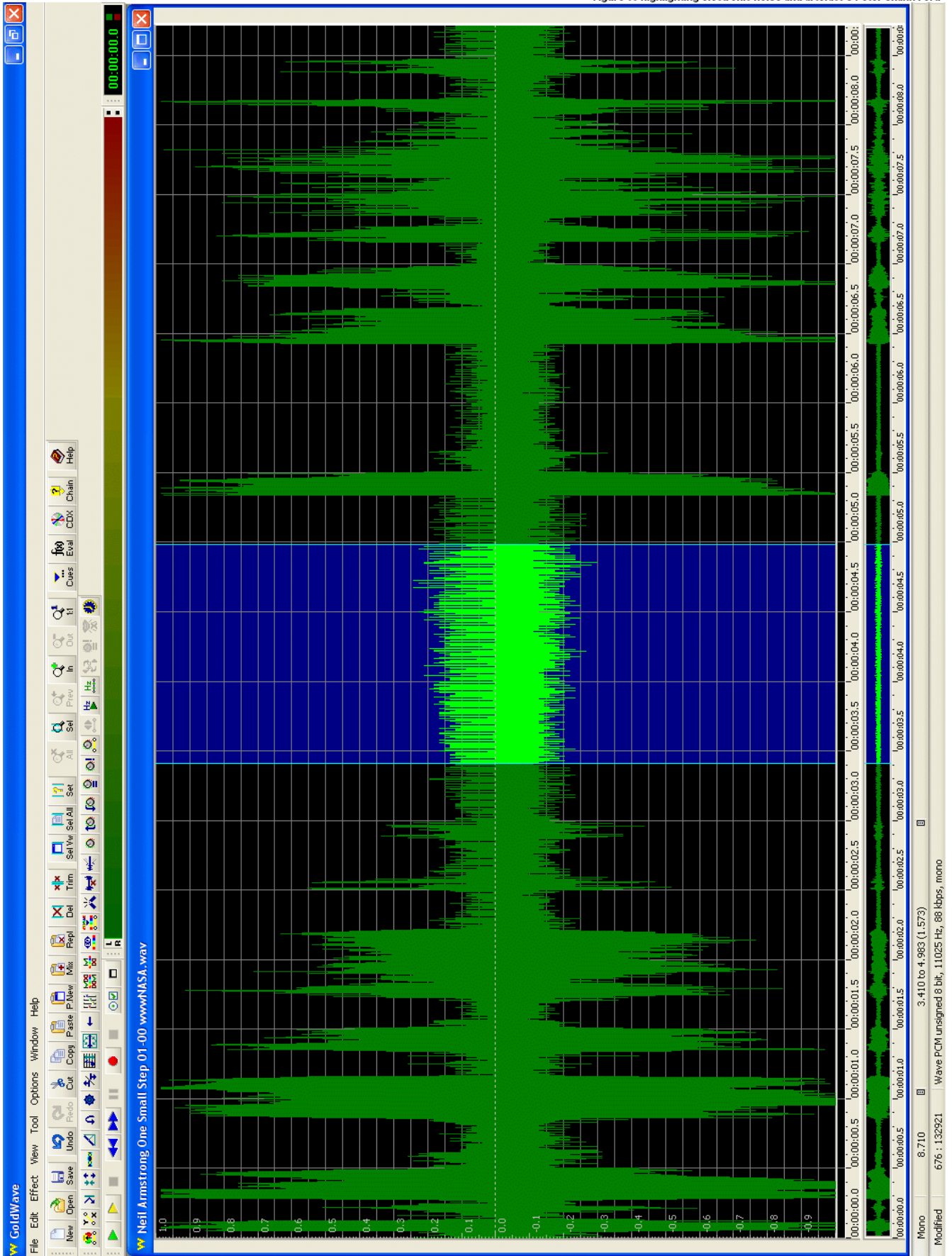
Appendix 4: Figure 4

Figure 04 Selected area from "One small step..." to "... mankind" © Peter Shann Ford



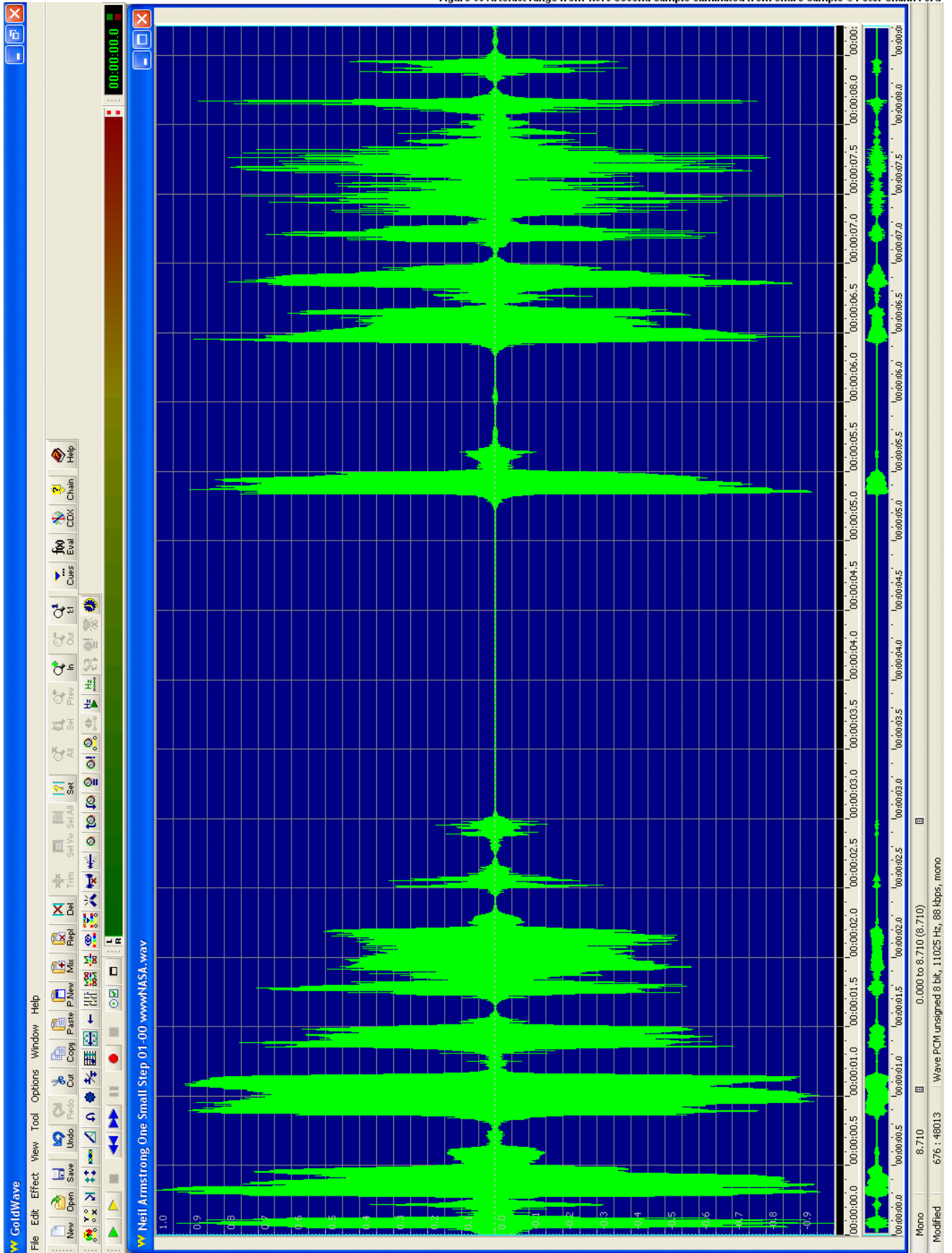
Appendix 5: Figure 5

Figure 05 Highlighting electronic noise and artefact © Peter Shann Ford



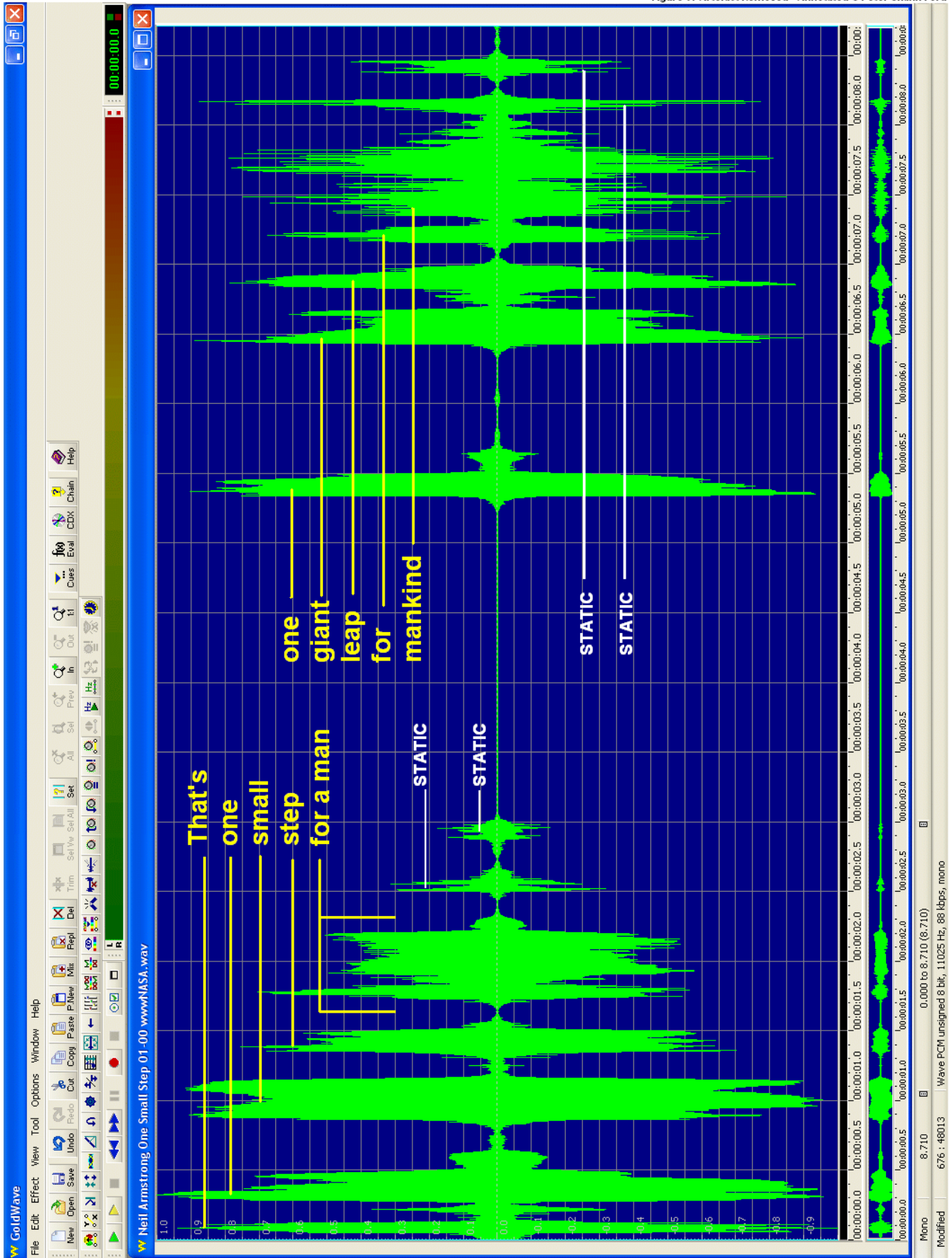
Appendix 6: Figure 6

Figure 06 Artefact range from 1.573 second sample eliminated from entire sample © Peter Shann Ford



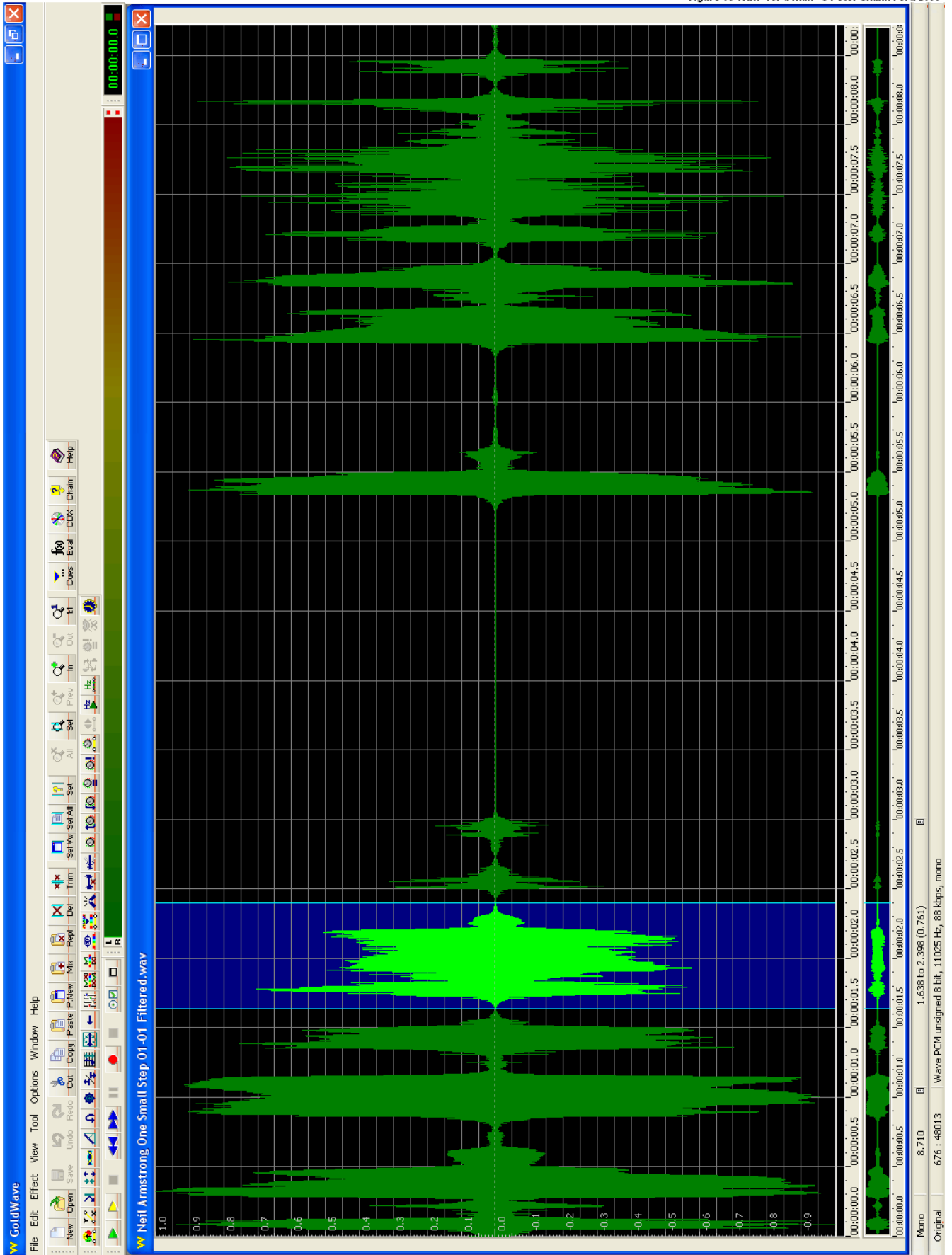
Appendix 7: Figure 7

Figure 07 Artefact Removed - Annotated © Peter Shann Ford



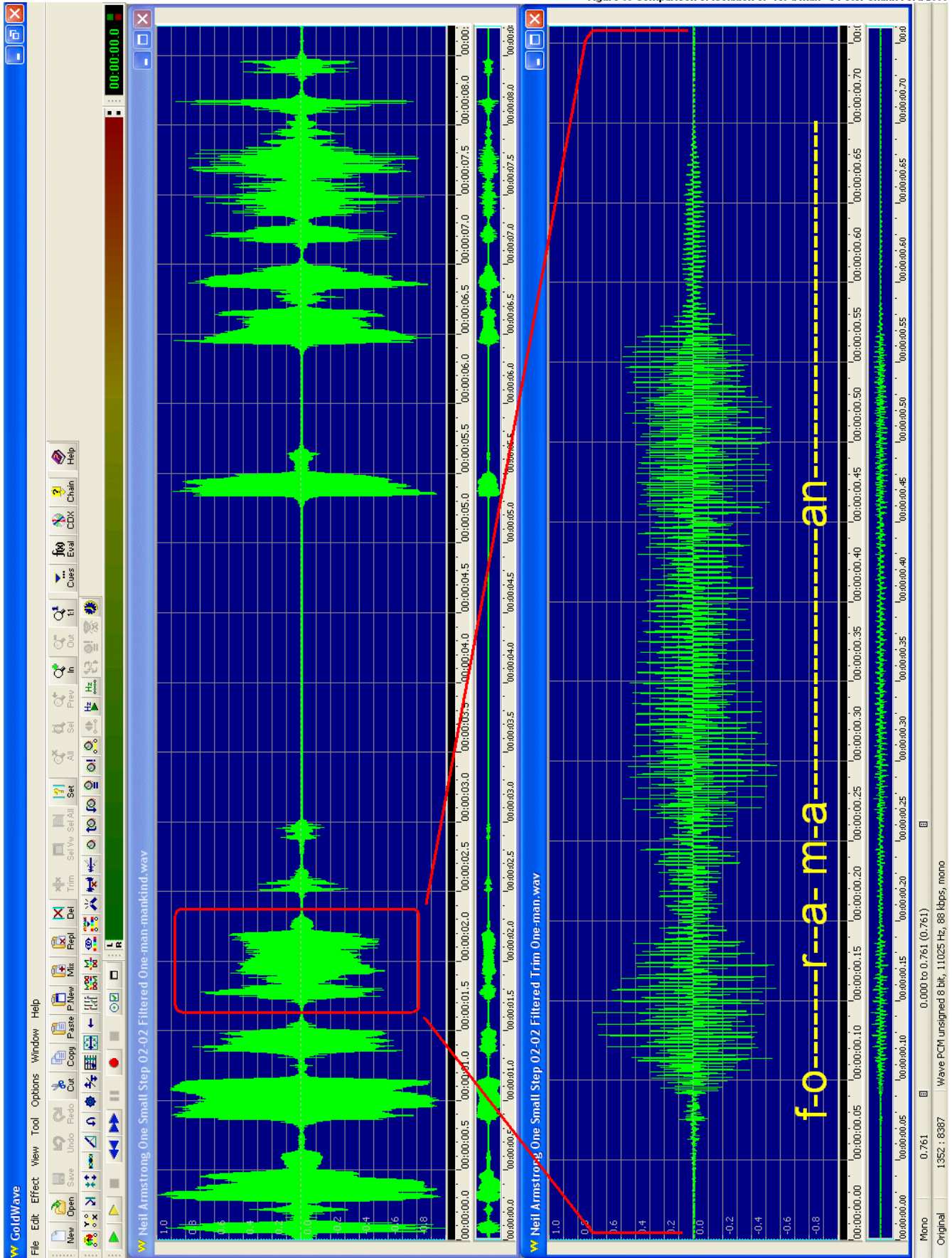
Appendix 8: Figure 8

Figure 08 Trim 'Tor a man' © Peter Shann Ford 2006



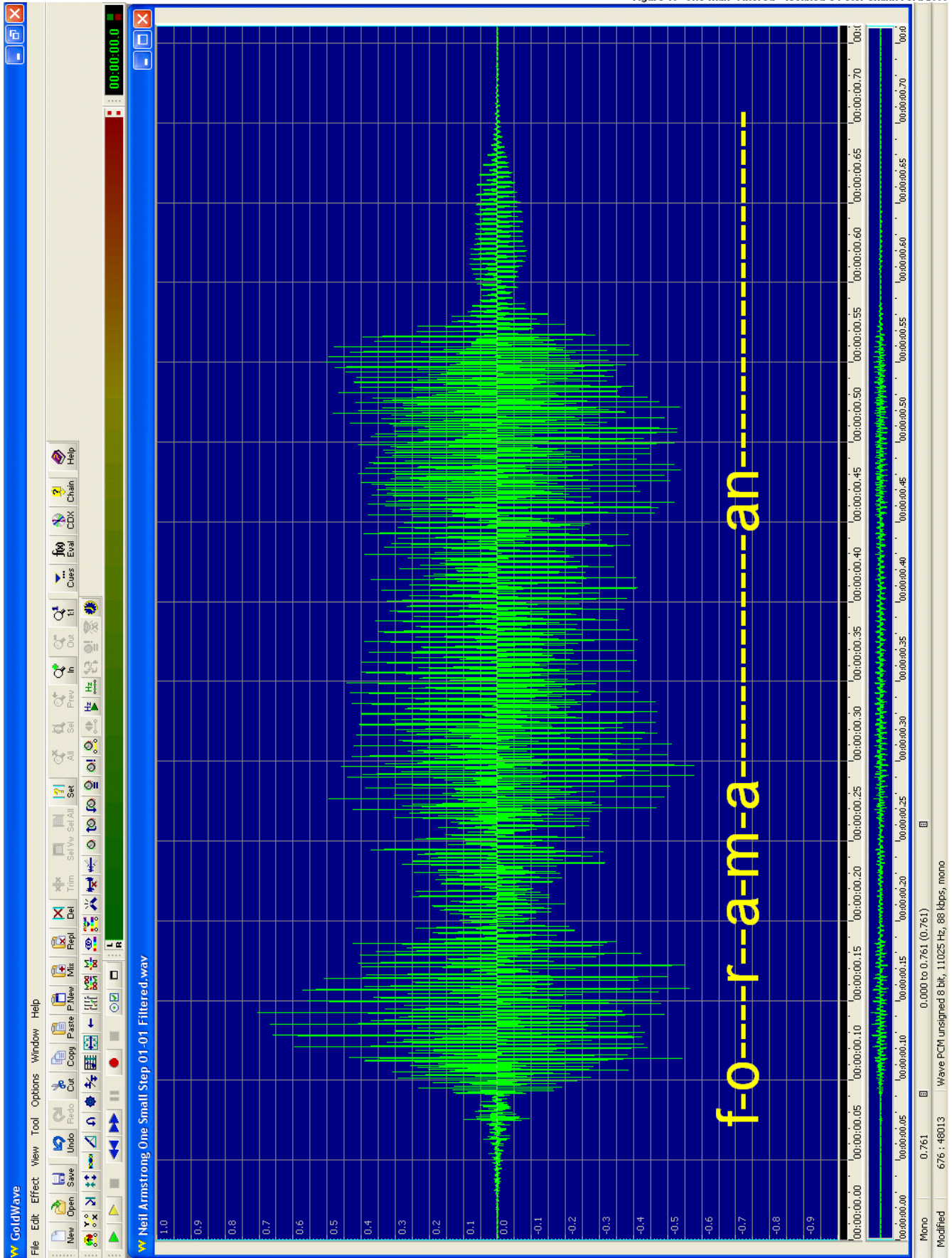
Appendix 9: Figure 9

Figure 09 Comparison of isolation of "for a man" © Peter Shann Ford 2006



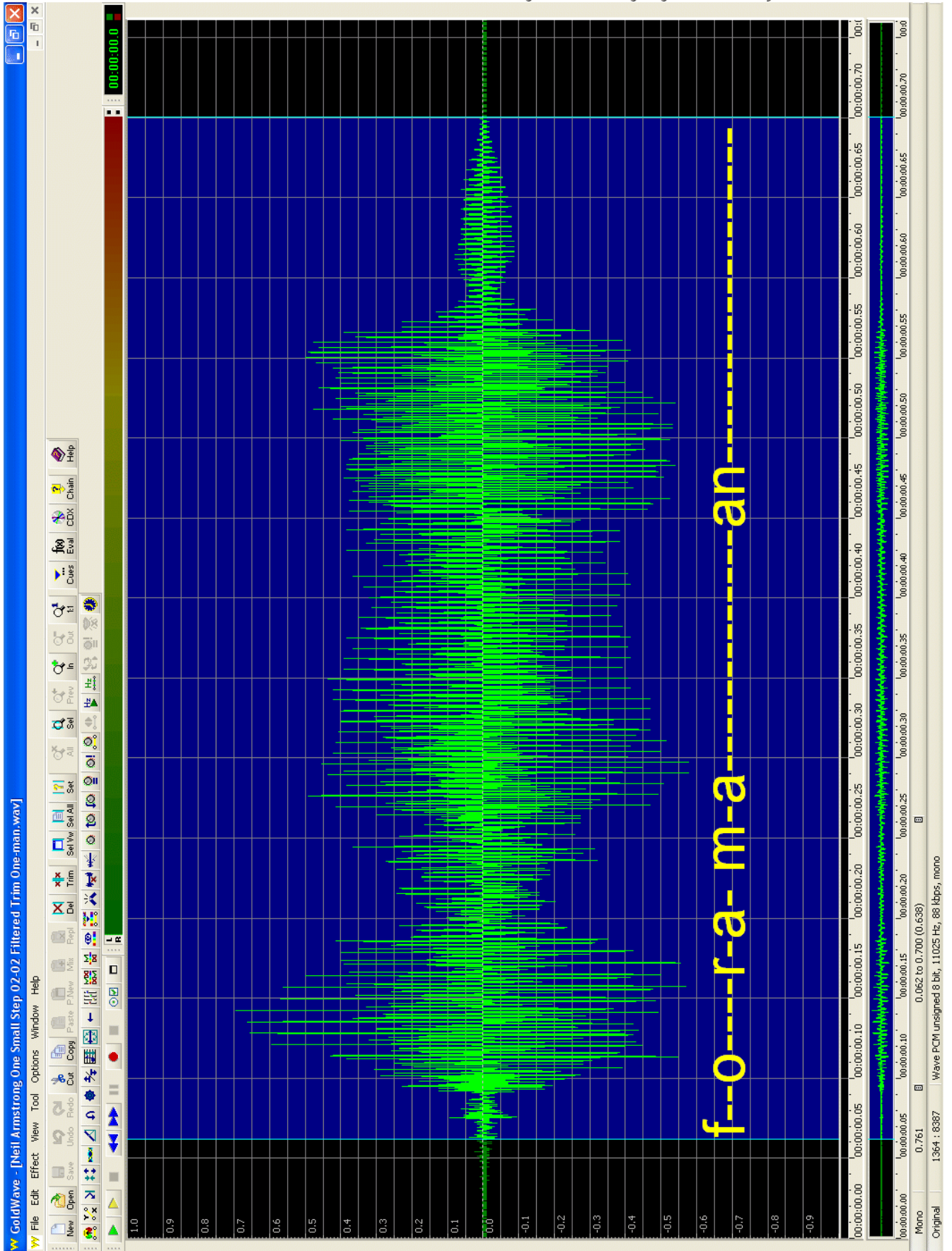
Appendix 10: Figure 10

Figure 10 "One-man" Filtered + Isolated © Peter Shann Ford 2006



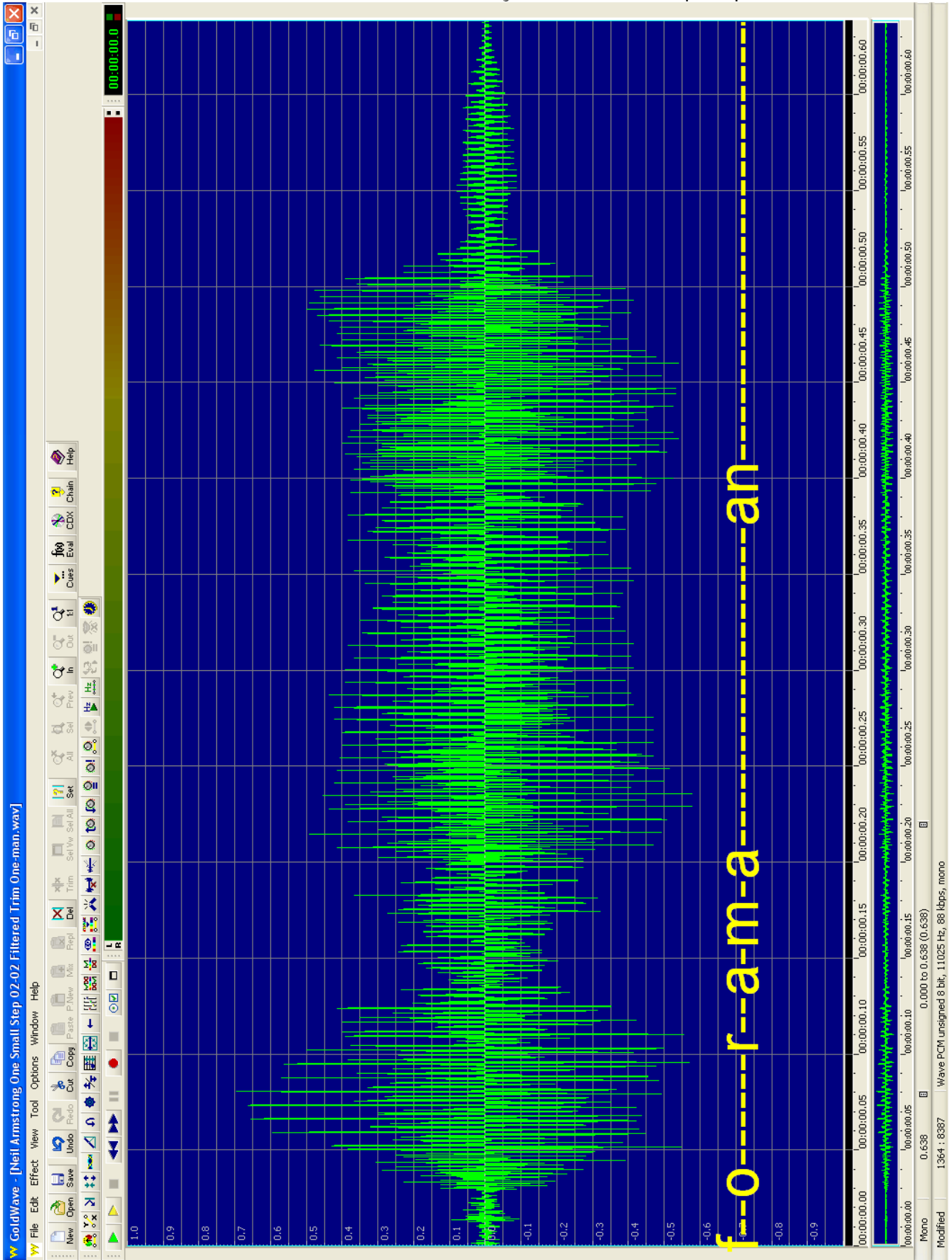
Appendix 11: Figure 11

Figure 11 Trim from beginning of "Tor" to final decay of "man" © Peter Shann Ford 2006



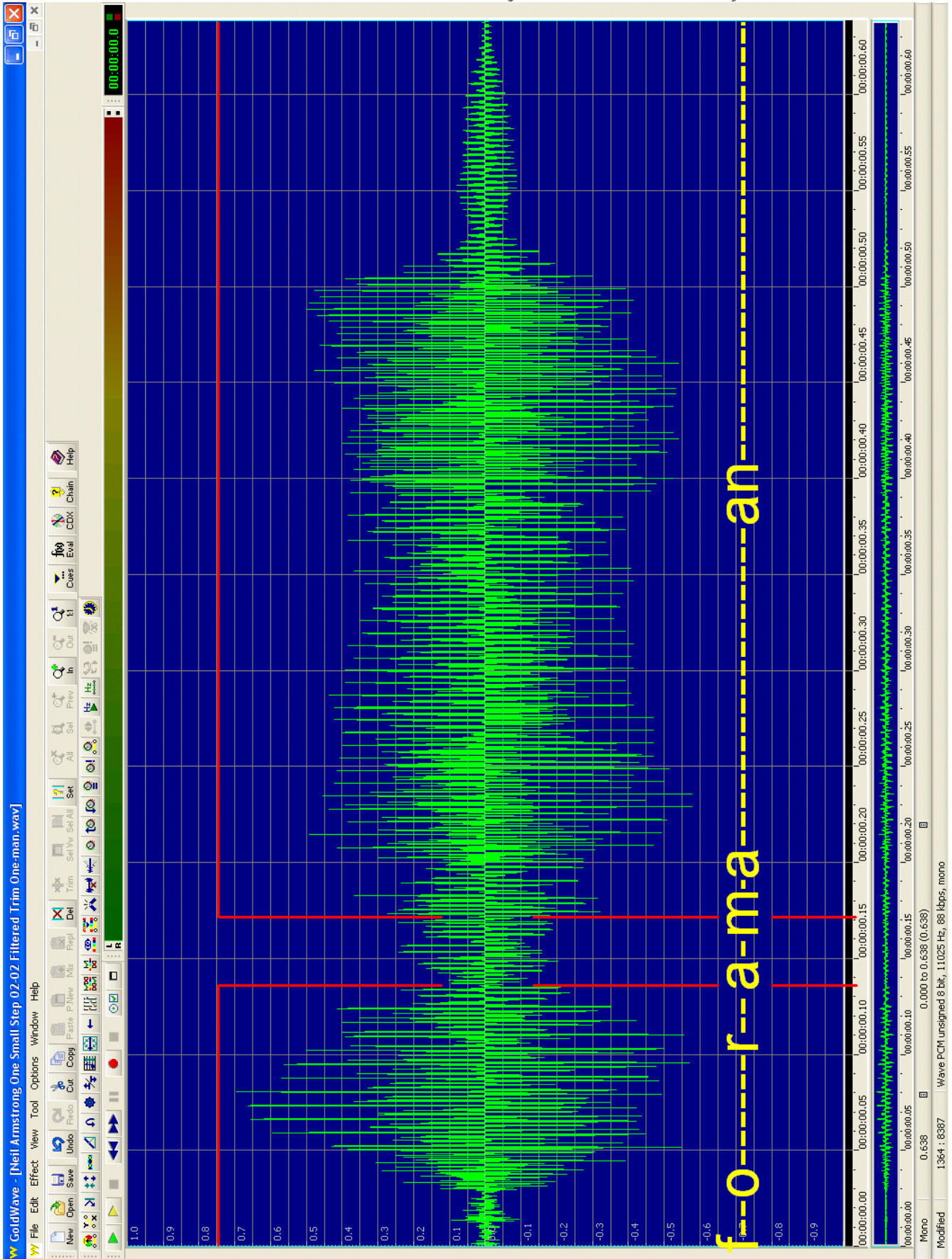
Appendix 12: Figure 12

Figure 12 Delineated 0.638 second complete sample of "Tor a man" © Peter Shann Ford 2006



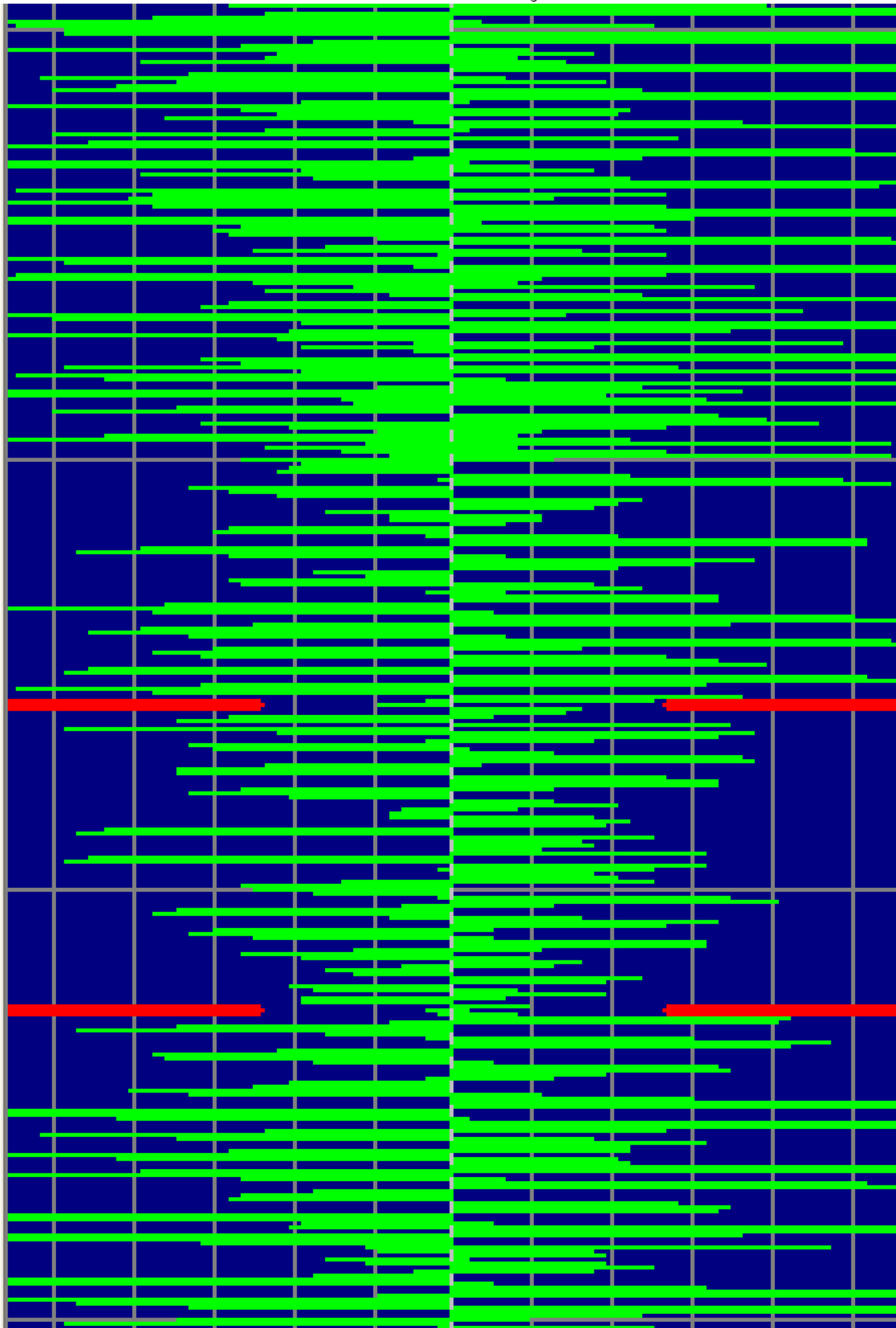
Appendix 13: Figure 13

Figure 13 Dilineates "for" "man" and intermediary "a" sound waves © Peter Shann Ford 2006



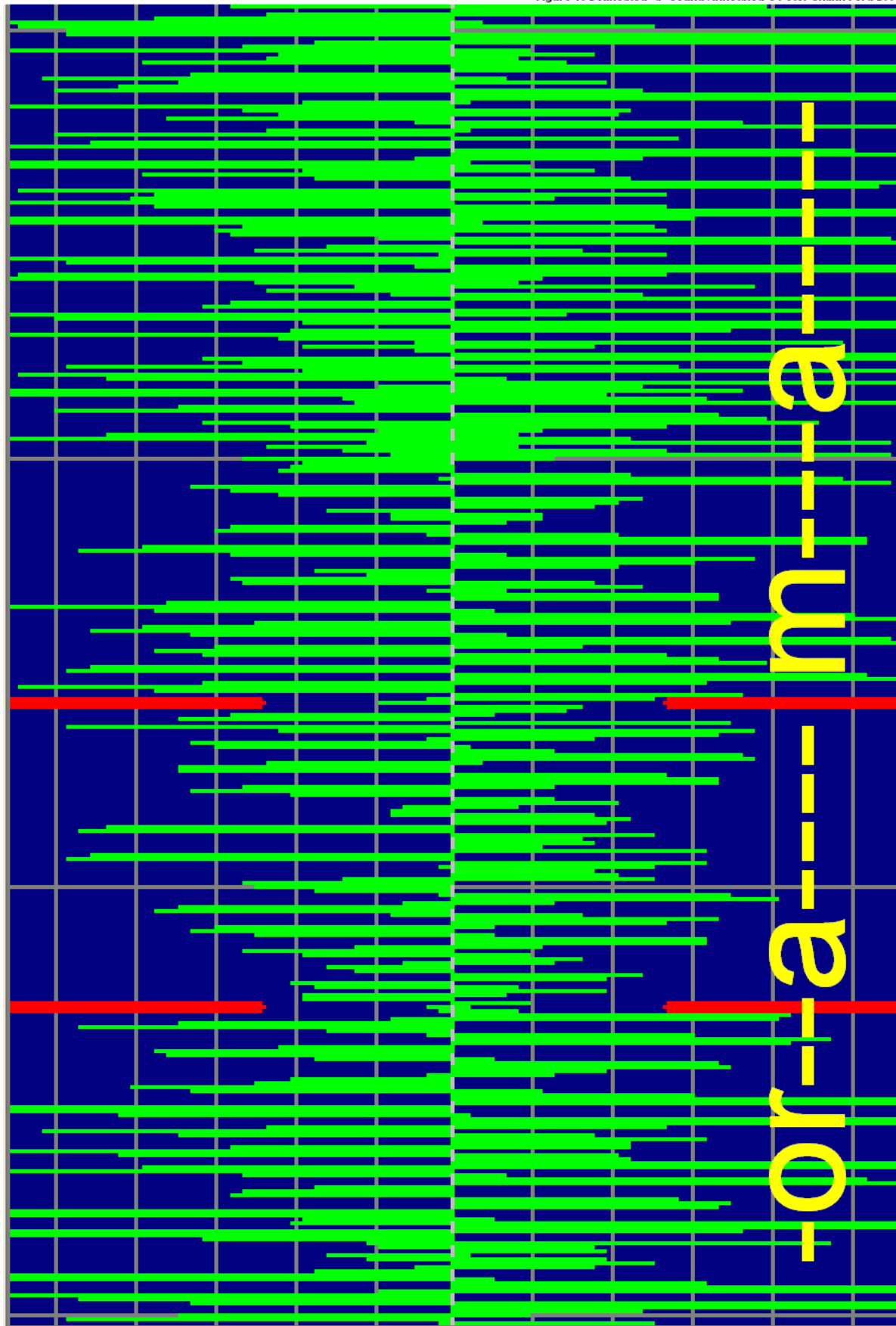
Appendix 14: Figure 14

Figure 14 Delineation leaves "a" sound wave ©Peter Shann Ford 2006

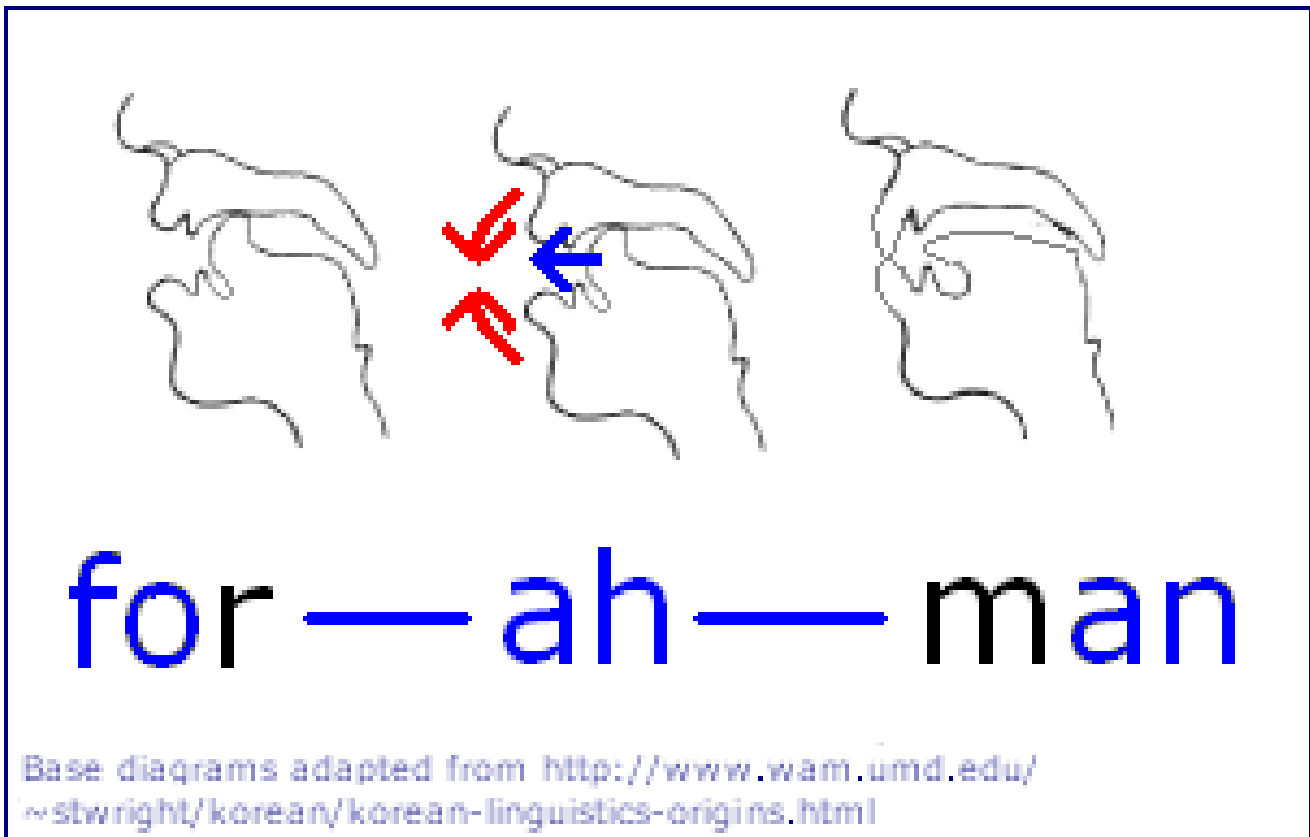


Appendix 15: Figure 15

Figure 15 Delineated "a" sound Annotated © Peter Shann Ford 2006



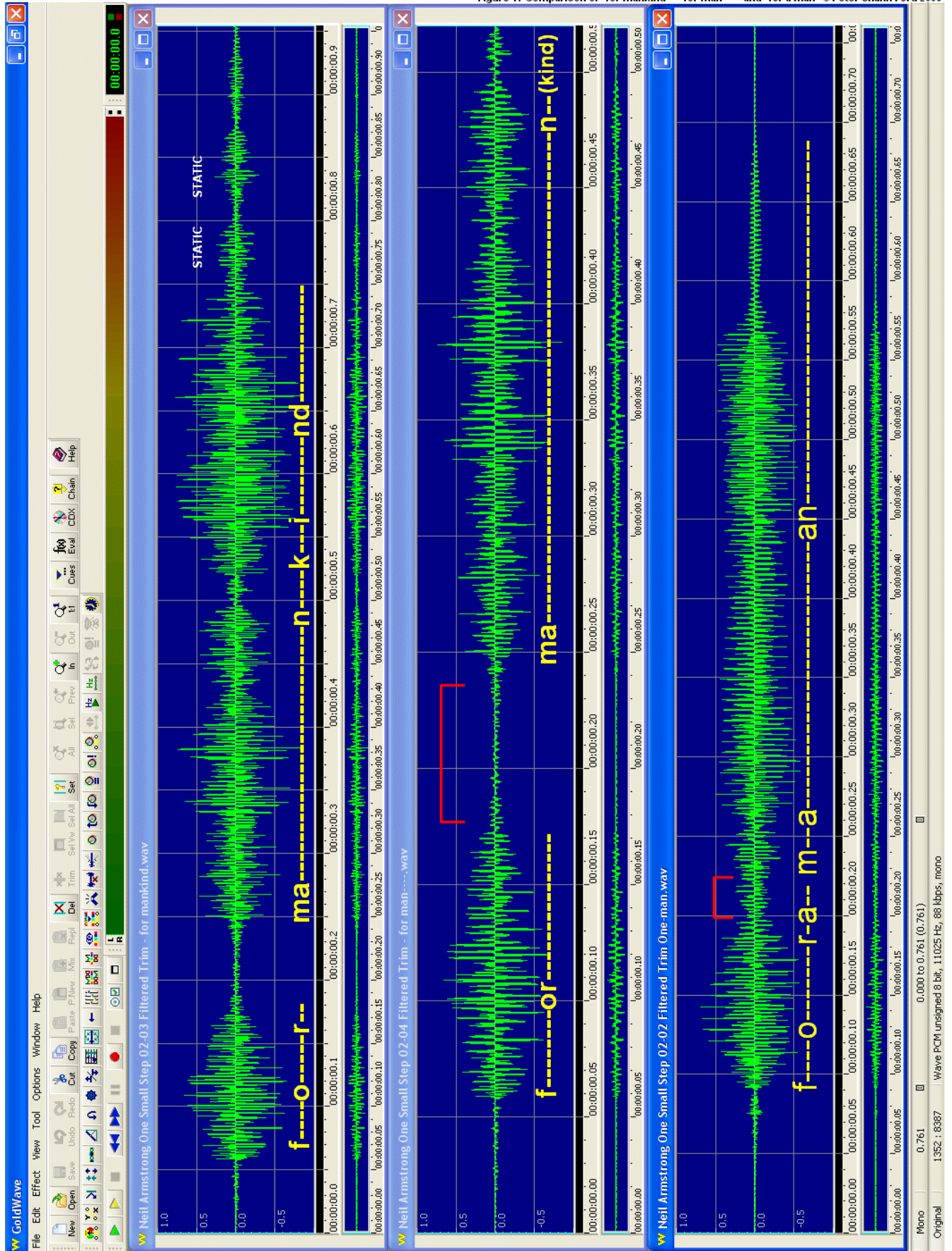
Appendix 16: Figure 16



Adapted from a diagram at www.wam.umd.edu

Appendix 17: Figure 17

Figure 17 Comparison of "for mankind", "for man----" and "for a man" © Peter Shann Ford 2006



Appendix 18: References, Notes and Edits.

1. Notes on the video and radio downlink from Tranquility Base to Mission Control, Houston during the first EVA onto the lunar surface, provided here by John Sarkissian, Operations Scientist at the Parkes Radio Observatory, Australia.

“The full spectrum of the radio signal transmitted to the Earth contained both the telemetry and the TV separately. The TV was frequency modulated (FM) on the carrier, and the subcarriers, which were phase modulated (PM) at several different frequencies, and contained the telemetry information including the audio. So, while the majority of the TV of the moonwalk broadcast to the world was via the 64m Parkes Radio Telescope, Australia, the audio downlink broadcast to the world (and recorded) was exclusively via the 64m Goldstone, California antenna.

Three tracking stations were receiving the signal simultaneously - Goldstone, Parkes, and Honeysuckle Creek also in Australia. A controller at Mission Control in Houston would select the TV that would be broadcast to the world. During the first 8 minutes and 51 seconds of the TV broadcast, the source of the TV that was broadcast to the world alternated between the Goldstone and Honeysuckle Creek tracking stations. The grainy TV images of Armstrong stepping onto the Moon was sourced from the NASA tracking station at Honeysuckle Creek outside Canberra. At 8 minutes and 51 seconds into the broadcast, the TV was finally switched to Parkes. Since the Parkes TV picture quality was superior to the other two stations, NASA remained with Parkes as the source of the TV pictures for the remainder of the over 2.5 hour broadcast. Now, while the TV was through Parkes (and the other stations at the beginning) the audio downlink used for the broadcast was exclusively via the Goldstone station throughout. Therefore, the audio you used to analyse Armstrong's words were most likely sourced from Goldstone and not Parkes. That is, the TV pictures and the audio were sent separately on the one signal transmitted from the Moon.”

2. Notes on the diagram of the mouth and the physiology of consonants “r” and “m” sequenced with vowel formation