Summary

Setterfield and Norman have made a major contribution to science and creationism. They are to be commended for their perseverance in compiling, analyzing and documenting an enormous quantity of data from many different sources. Although the report needs additional information on time-clocks used in various tables and a more cohesive explanation of gravity, it contains a wealth of data to support the hypothesis that c is time dependent. The statistical evidence provided here unequivocally supports the Setterfield hypothesis and its consequences to c-dependent physical values. Critics have been unable to establish a major point of refutation. Humphreys' suggestion that Setterfield should provide a statistically oriented report to establish the basic hypothesis and follow it with another on the geological, physical and astronomical consequences in a later report is still valid. There remains much theory to settle once the statistical justification is solidly established.

I am indebted and grateful to Stephen Cheesman for clarifying many of the issues involving energy density, wave amplitude and time dilation. I would also like to thank Lambert Dolphin for his encouraging words.

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CRSQ—Creation Research Society Quarterly

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SPEED OF LIGHT STATISTICS

R. H. BROWN*

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Abstract

This is a response to the Alan Montgomery article (CRSQ 26:138-42), and also a supplement to my earlier article (Brown, 1988).

The academic community is deeply indebted to Trevor Norman and Barry Setterfield (1987) for the information regarding the propagation speed of electromagnetic radiation which they have brought together and made conveniently accessible. They and others who share a similar commitment deserve particular commendation for effort to establish an uncompromising and sound coordination between the testimony of Scripture and information which comes under the classifications of natural science.

Readers who wish to get a complete perspective on the Montgomery manuscript, and the issues it treats, should carefully reread the earlier Aardsma (1988), Humphreys (1988) and Brown (1988) manuscripts. The conclusions from an analysis such as that presented by Norman and Setterfield, or by Montgomery, must be kept subject to a rigid evaluation of the applicability of the technique employed. The papers by Aardsma and Humphreys clearly indicate that Norman, Setterfield, and Montgomery have reached unwarranted conclusions. Figure 1 in each of these papers gives adequate support for an assertion that within the available experimental data there is *no* evidence for a significant change in the propagation speed of electromagnetic radiation. Any claim that such change has occurred is a purely theoretical or philosophical proposition, regardless of the mathematical adornment with which it is presented.

Before becoming aware of the analyses made by Aardsma and Humphreys, I had prepared for private distribution an evaluation of the Norman and Setterfield report. When my analysis was published as part of the symposium on the speed of light, I was certain that some readers who had strong reasons for proposing a major decline in the speed of light would object to my handling of the square root of n factor (Brown, 1989). My position in that analysis was to advocate only views which were consistent with a sound unbiased data evaluation such as may readily be made from the Aardsma and Humphreys Figure 1 plots.

I thank Alan Montgomery for the impetus to share a statistical treatment which I had considered including with my 1988 feature. This is a regression confidence limits analysis of the data from which the Aardsma and Humphreys Figure 1 plots were made. In my data set I use the corrected Roemer value, as discussed by Humphreys (1988) and I omit the Cassini value on the basis of the evidence that it is in need of correction, but adequate information with which to make a reliable correction is lacking (Humphreys, 1988). Any analysis of 163 data points that is *critically* affected by discarding any one point is not a sound analysis. In statistical analysis of data it is standard practice to discard outlyers as far removed from the data trend as is the Cassini value—a practice which is justified as long as such outlyers are rare, their rejection is acknowledged, and can be defended.

During the time that was available to me for preparation of this response, I did not have access to computer facilities that were capable of plotting a regression analysis for the entire data set as a unit. Because

*R. H. Brown, Ph.D., Geoscience Research Institute, Loma Linda University, Loma Linda, CA 92350.

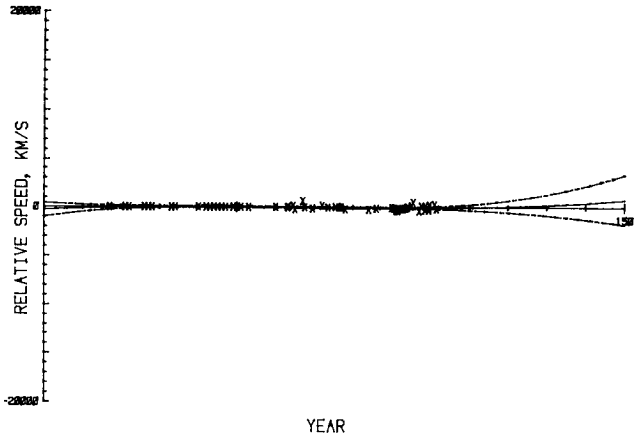

Figure 1. Plot of data from 1983 to 1898.5. Year scale values are 2000 minus the date of measurement. See text for explanation.

of this limitation I have divided the data into two equal-sized groups, one covering years 1983 back to 1898.5 (Figure 1), and one covering 1898 to 1675 (Figure 2). To further reduce data processing demands, all speed of light values for any specific time reference (year, month, or decimal year) were averaged to provide a single entry for each time reported. There were 30 averages of two, 7 averages of three, and 2 averages of five data values as a result of this reduction. This is no different than was done to varying degree by the publishers of the original reports, except in the few cases in which results obtained by different techniques were averaged. All points were weighted equally, regardless of the above averaging and the probable error reported by the investigator.

Since regression analysis is most readily interpreted if the data treatment is based on the terminal region which has the least scatter, I have reversed Figure 1 as given by Aardsma and Humphreys and used age measured into the past as the independent variable. In my Figure 1 the year value is 2000 minus the measurement date, and the plotted data range from AD 1983 to AD 1898.5 (total scale 150 years). In my Figure 2 the year value is 1900 minus the measurement date, and the plotted data range from AD 1898 to AD 1675 (total scale 270 years). In both figures the ordinate

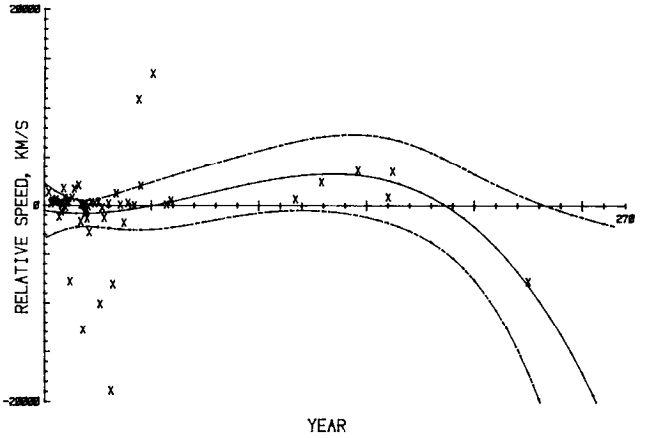

Figure 2. Plot of data from 1898 to 1675. Year scale values are 1966 minus the date of measurement. See text for explanation.

scale is the same, expressing kilometers per second difference from the AD 1983 value for the speed of light.

The solid curved line in each figure is the best third degree (cubic) polynomial regression fit to the data. It is drawn to assist with a visualization of the data trend. The dot-dash curved lines designate the region within which one can have 95% confidence (certainty) that the "true" trend of data falls. If the two plots had been combined in one statistical treatment, the dot-dash lines at the right side of the data region in Figure 1 would have diverged more rapidly, and those at the left side of the data region in Figure 2 would have diverged less to make a smooth junction between them.

From Figure 2 it is clearly evident that prior to AD 1889 the data is characterized by wide scatter (the first low value at slightly less than -8000 km/s is for AD 1888, 12 years further into the past beyond the AD 1900 reference for Figure 2). But the data continue to cluster around the 1983 value for the speed of light (zero relative speed). Throughout the entire range of the available data, including the AD 1675 Roemer value, the 95% confidence band includes a straight regression line at zero relative speed. Consequently I can with full confidence reaffirm that there is no sound statistical support for speculation that the propagation speed of electromagnetic radiation has changed significantly over the time that attempts have been made to measure it. On the basis of the statistical evidence at hand, the only statement that can be justified concerning the future beyond 1983, or the past before 1675, is that most probably this speed will be and has been the same as the reference value for Figures 1 and 2.

To individuals who wish to become better acquainted with regression analysis I heartily recommend Mendenhall, *et al.,* 1981.

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QUOTE

The sage knows that life begins and ends in mystery. And he apprehends the end of genuine learning, which begins in the fear of God. That end is to know God and enjoy him forever.

Thus is the sage oriented. The fundamental purpose of learning for us creatures here below is to orient ourselves, that we may take our bearings in the midst of divine creation.

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