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Office of Inspector General,
NASA Headquarters / Code W,
Washington DC,
20546-0001,

USA.

Calum Eric Douglas

(Attn: Information Quality Correction Request)

23rd November 2009

Dear Sir/Madam,

I am writing to make a request for correction under *NASA Quality Guidelines*:

"Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies"

"Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554; H.R. 5658)"

This is regarding the following NASA Technical Report:

NASA Technical Paper 1622
Technical Report 79-46
"Spur-Gear-System Efficiency at Part and Full Load"
Neil E. Anderson and Stuart H. Loewenthal
AVRADCOM Research and Technology Laboratories
Lewis Research Center,
Cleveland,
Ohio.

Date of publication: 1980

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There are no such disclaimers in the aforementioned paper, thus (according to *NASA Quality Guidelines*) it represents the official the views of NASA and not just the of authors Anderson & Loewenthal. Thus I claim the paper does not fit the exemption criteria from the *NASA Quality Guidelines*, and so is open for a request for correction.

Effects of errors

The corrections required alter some results calculated by an order of magnitude and are certainly outside the boundaries of "*acceptable degree of imprecision*" as stated in *NASA Quality Guidelines.*

Suggested means of correction & current place of document storage.

I would suggest that the correction be made by the addition of an appendix page to the .pdf stored in the NTRS; containing the corrections suggested here.

Specifics of corrections.

I have located several typographic errors that lead to erroneous results. This violates the quality guidelines under the section of "reproducibility". I hope they might be corrected to render the paper more useful to research students learning about gearing, in an otherwise excellent publication.

At present I had to spend several days tracing through the fairly lengthy calculations in the paper trying to reproduce the results given in Table III of Appendix B.

1. **Page 30, Para. 2, line 2. Reads:** "μ_0, 0.05N sec/m^2"
   a. Should read "μ_0, 50 cP"
   b. (although converts as the same relative magnitude; the formula does not function using N sec/m^2 as the SI unit; as suggested in the paper)

2. **Page 30, Para 2, line 2. Reads:** "ν_B, 0.60 cm^2/sec"
   a. Should read: "ν_B, 60 cSt"
   b. Comments as above in correction 1.

3. **Page 30, formula for variable X_A, Reads:** $X_A = (Dp + Dg) \times Sin\ \theta / 2$

   a. Should read: $$X_A = \frac{(Dp + Dg) \times Sin\theta}{2}$$

   b. This expression should be clarified with additional parenthesis or as above by clearly showing that the denominator for the entire expression is two, rather than just regarding the final term as suggested by the original format.

4. **Page 30, formula for variable X_P, Reads:**

$$X_P = X_1 + C_{10} \times \left\{ \sqrt{\left(\frac{2 + Np \times mg}{2 \times \mathcal{P}} \right)^2 - \left(\frac{Np \times mg \times Cos\theta}{2 \times \mathcal{P}} \right)^2} \right\} - C_{10} \times Np \times mg \times Sin\ \theta / 2 \times \mathcal{P}$$

Most conventions for trigonometric formula would show the above as representing this:

$$X_P = X_1 + C_{10} \times \left\{ \sqrt{\left(\frac{2 + Np \times mg}{2 \times \mathcal{P}} \right)^2 - \left(\frac{Np \times mg \times Cos\theta}{2 \times \mathcal{P}} \right)^2} \right\} - C_{10} \times Np \times mg \times Sin\ (\theta / 2 \times \mathcal{P})$$

However in fact the $2 \times \mathcal{P}$ term is not affiliated with the Sine term and for clarity should read corrected as below:

$$X_P = X_1 + C_{10} \times \left\{ \sqrt{\left(\frac{2 + Np \times mg}{2 \times \mathcal{P}} \right)^2 - \left(\frac{Np \times mg \times Cos\theta}{2 \times \mathcal{P}} \right)^2} \right\} - \frac{C_{10} \times Np \times mg \times Sin\theta}{2 \times \mathcal{P}}$$

   b. Comments as per correction 3.

5. **Page 32, formula for variable V_S, Reads:**

$$0.0147 \times (1 + m_g) \times n_p \times (X - X_P) / m_g$$

Should read:

$$0.1047 \times (1 + m_g) \times n_p \times (X - X_P) / m_g$$

b. Mistake in coefficient. The first '1' has been moved in error one decimal place to the right.

Supporting evidence.

I have verified the above by constructing a simple excel sheet to attempt to reproduce the 'worked example' in its entirety as provided in *Table III* of *Appendix C* (pages 30-33) of this paper. Only by making the above alterations can Anderson & Loewenthal's results be reproduced.

For example in the case of *Sliding Velocity* V_S. (Ref correction 5)

The final output given by Anderson & Loewenthal on page 32 is 1.608m/sec at X=L1.

The results of the formula as published and as corrected are shown below:

$$0.0147 \times (1 + 1.666) \times 2000 \times (0.0212 - 0.02603) / 1.666 = |0.227|$$

$$0.1047 \times (1 + 1.666) \times 2000 \times (0.0212 - 0.02603) / 1.666 = |1.618|$$

This shows I believe that the deviation from the correct figures is more than significant enough to warrant a correction.

On pages 31 & 33 the results that Anderson & Loewenthal obtained are given as below left. The values I obtained after correcting the typographic errors are shown on the right:

Gear windage loss = 0.0164 kW	0.0164 kW
Pinion windage loss = 0.0084	0.0084
Total bearing loss = 0.1194	0.122
Sliding power loss =0.1511	0.169
Rolling power loss = 0.0823	0.086
Total system loss = 0.3776	0.401
System efficiency = 99.34	99.29

I hope the information is useful to you even though it is perhaps one of the older papers stored on the NTRS. The Anderson & Loewenthal paper has been invaluable to the

writing of my thesis, and would certainly be very valuable as a resource for students and academics researching gearing efficiency losses.

There are several dozen papers stored on the NTRS that have also been extremely valuable to my thesis work and I hope the minor corrections I suggest here might save considerable time in the future for others also reading it.

At present, unless they take the time to carefully attempt to reproduce the lengthy example and locate the errors as I have, there may be many people using these formulas to produce inaccurate results that are a long way from 'acceptable accuracy' as set out in *NASA Quality Guidelines.*

I would very much appreciate a written response to the address at the start of this letter to inform me of your decision on the matter.

Best Regards

Calum E. Douglas