THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

10th Wernher von Braun Memorial Symposium
October 24 – 26, 2017

American Astronautical Society

Marshall Enriched Storable Oxidizer

R. Dalton Hicks - UAH Propulsion Research Center

Overview

Based on previous work for DARPA with NASA MSFC, it was discovered Nitrous Oxide (N_2O) can be dissolved into Nitrogen Tetroxide (N_2O_4), resulting in a non-cryogenic, storable oxidizer with favorable performance characteristics and with minimized toxicity and minimized detonation attributes over nitrous oxide alone.

Past Findings

The concept for this oxidizer mixture originated at the NASA MSFC via a collaboration between Robert Sackheim (NASA Chief Engineer for Propulsion) and Roger Herdy.

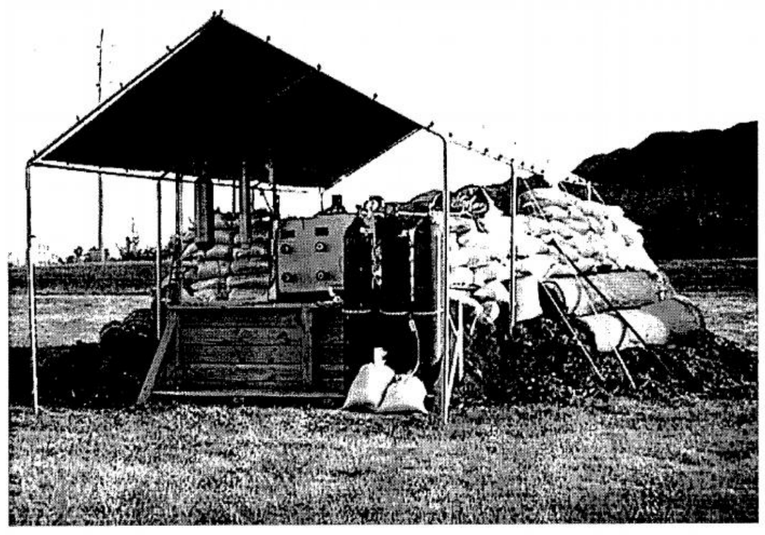

Figure 3: Original Test Stand at UAH PRC[1]

Current Research

Current Research is into the use of MESO as an alternative to Mixed Oxides of Nitrogen (MON) and pure Nitrogen Tetroxide (NTO) in upper stage propulsion systems. Nitrous Oxide acts to both depress the freezing point of NTO, reduce its volumetric toxicity, and increase its vapor pressure.

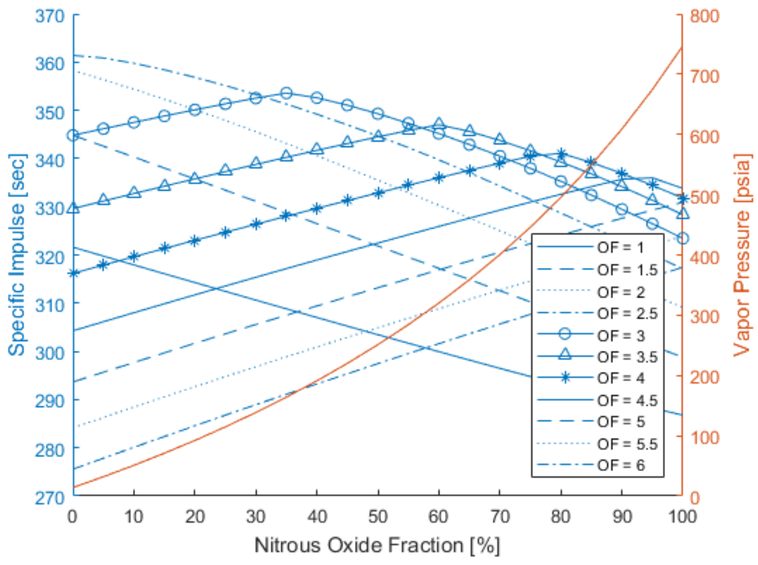

Figure 1: N_2O Fraction Effects

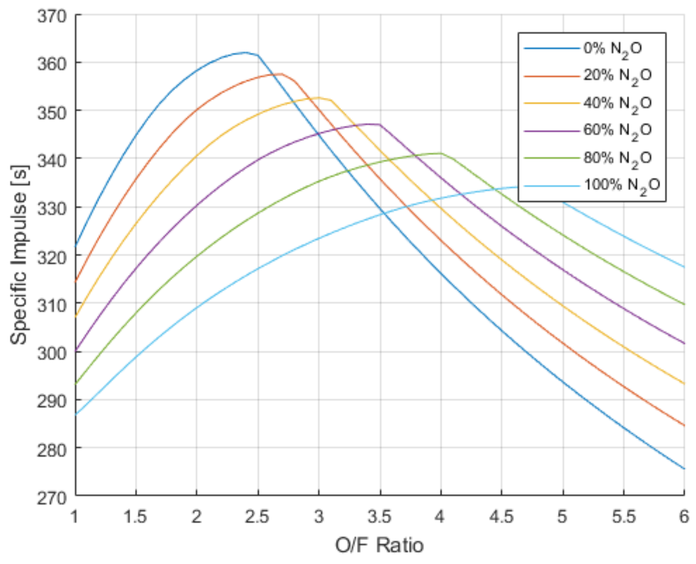

Figure 2: O/F Ratio for different Fractions

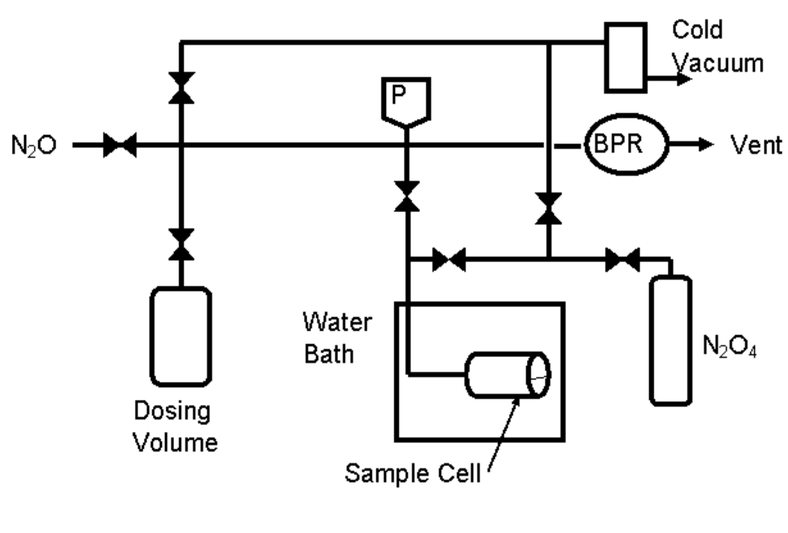

Figure 4: Solution Synthesis Apparatus[1]

Impact & Conclusions

The impact of this oxidizer development is advances in upper stage propulsion systems and future low structural mass upper stages with increased performance for longer deep space missions and novel propulsion system design.

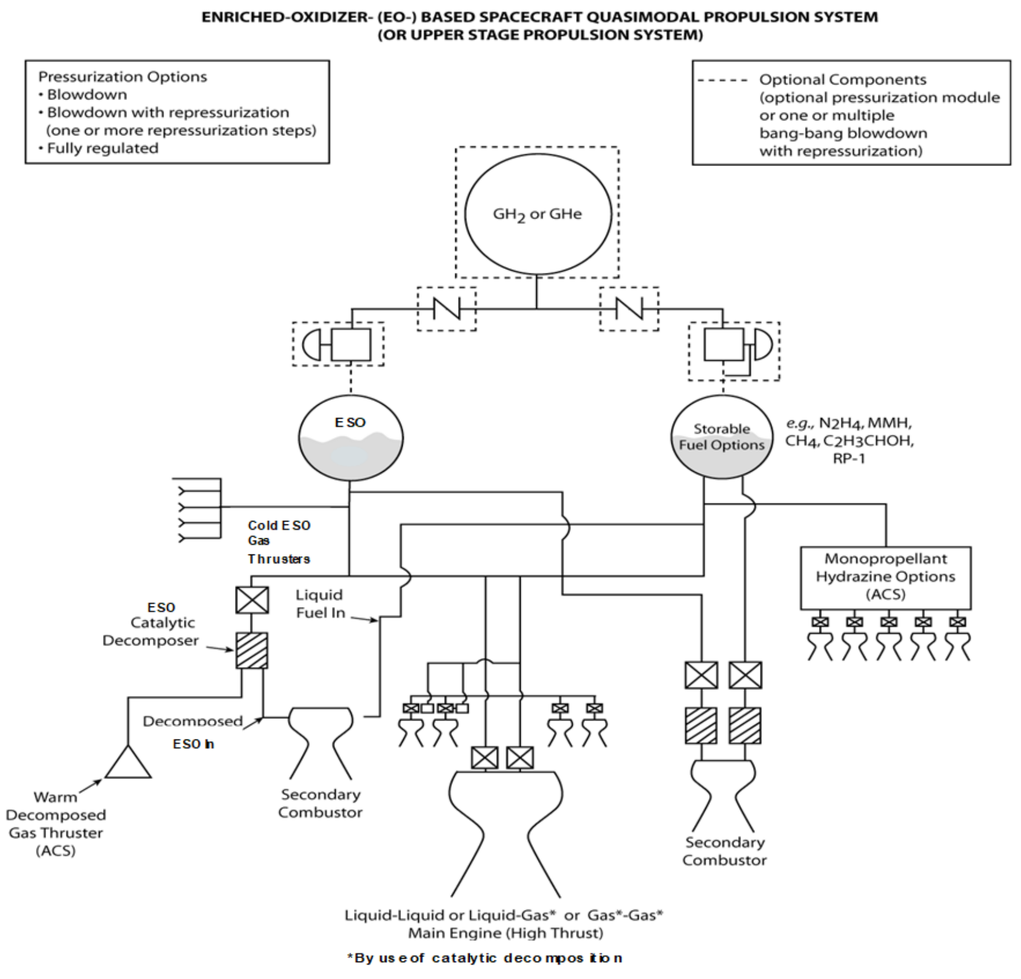

Figure 5: Multi-Modal Propulsion System[1]

Acknowledgements

I would like to thank the following for their continued aid with this research.

- Alabama Space Grant Consortium
- UAH College of Engineering
- UAH Propulsion Research Center
- [1]Roger Herdy of GES Inc.
- Patton Downey of Marshall Spaceflight Center
- Dr. Robert Frederick

ALABAMA SPACE GRANT CONSORTIUM — NASA — INDUSTRY — UNIVERSITY — COMMUNITY — 1989

COLLEGE OF ENGINEERING
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

UAH PROPULSION RESEARCH CENTER