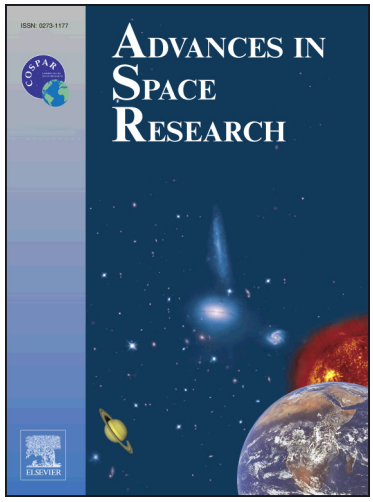
Accepted Manuscript



Numerical Study for Flame Deflector Design of a Space Launch Vehicle

Hwayoung Oh, Jungil Lee, Hyungsik Um, Hwanil Huh

PII: S0273-1177(17)30001-7
DOI: http://dx.doi.org/10.1016/j.asr.2016.12.038
Reference: JASR 13037

To appear in: *Advances in Space Research*

Received Date: 24 October 2016
Revised Date: 27 December 2016
Accepted Date: 29 December 2016

Please cite this article as: Oh, H., Lee, J., Um, H., Huh, H., Numerical Study for Flame Deflector Design of a Space Launch Vehicle, *Advances in Space Research* (2017), doi: http://dx.doi.org/10.1016/j.asr.2016.12.038

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Numerical Study for Flame Deflector Design of a Space Launch Vehicle

Hwayoung Oh[a], Jungil Lee[b], Hyungsik Um[c] and Hwanil Huh[d,*]
Korea Aerospace Research Institute, Daejeon, 34133, Republic of Korea

Abstract

A flame deflector is a structure that prevents damage to a launch vehicle and a launch pad due to exhaust plumes of a lifting-off launch vehicle. The shape of a flame deflector should be designed to restrain the discharged gas from backdraft inside the deflector and to reflect the impact to the surrounding environment and the engine characteristics of the vehicle. This study presents the five preliminary flame deflector configurations which are designed for the first-stage rocket engine of the Korea Space Launch Vehicle-II and surroundings of the Naro space center. The gas discharge patterns of the designed flame deflectors are investigated using the 3D flow field analysis by assuming that the air, in place of the exhaust gas, forms the plume. In addition, a multi-species unreacted flow model is investigated through 2D analysis of the first-stage engine of the KSLV-II. The results indicate that the closest Mach number and temperature distributions to the reacted flow model can be achieved from the 4-species unreacted flow model which employs H_2O, CO_2, and CO and specific heat-corrected plume.

Keywords: exhaust gas, flame deflector, multi-species unreacted flow model, plume

Nomenclature

A	=	pre-exponential factor (m^3·mol/s)
A_e	=	nozzle exit area (m^2)
A_t	=	nozzle throat area (m^2)
a	=	acoustic velocity (m/s)
C_p	=	constant pressure specific heat (J/kg·K)
D	=	nozzle exit diameter (m)
d	=	separation distance (m)

[a] Senior researcher, Launch Complex Team, Korea Aerospace Research Institute, 169-84 Gwahak-ro, Yuseong-Gu.
[b] Senior researcher, Energy Research Department, Hyundai Heavy Industries, 1000 Bangeojinsunhwan-doro, Dong-Gu, Ulsan, 44032, Republic of Korea.
[c] Senior researcher, Energy Research Department, Hyundai Heavy Industries, 1000 Bangeojinsunhwan-doro, Dong-Gu, Ulsan, 44032, Republic of Korea.
[d],* Corresponding author, Tel.: +82-42-821-6687, Fax : +82-42-825-9225, E-mail address : hwanil@cnu.ac.kr, Professor, Department of Aerospace Engineering, Chungnam National University, 99 Daehak-ro Yuseong-Gu, Daejeon 34134, Republic of Korea.

Download English Version:

https://daneshyari.com/en/article/5486542

Download Persian Version:

https://daneshyari.com/article/5486542

Daneshyari.com