REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*

2. REPORT DATE
September 10, 1996

3. REPORT TYPE AND DATES COVERED
Final

4. TITLE AND SUBTITLE
Modeling Unlikely Space-Booster Failures in Risk Calculations

5. FUNDING NUMBERS
C: FO4703-91-C-0112
TA: 10/95-77

6. AUTHOR(S)
James A. Ward, Jr.
Robert M. Montgomery

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Research Triangle Institute *
3000 N. Atlantic Avenue
Cocoa Beach, FL 32931

ACTA, Inc. **
Skypark 3
23430 Hawthorne Blvd., Suite 300
Torrance, CA 90505

8. PERFORMING ORGANIZATION REPORT NUMBER
RTI/5180/77-43F

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Department of the Air Force (AFSPC)
30th Space Wing
Vandenberg AFB, CA 93437
Mr. Martin Kinna (30 SW/SEY)

Department of the Air Force (AFSPC)
45th Space Wing
Patrick AFB, FL 32925
Louis J. Ullian, Jr. (45 SW/SED)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
30SW-TR-96-12

11. SUPPLEMENTARY NOTES
* Subcontractor
** Prime Contractor

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Distribution authorized to US Government agencies and their contractors to protect administrative/operational use data, 10 September 96. Other requests for this document shall be referred to the 30th Space Wing (AFSPC) Safety Office (30 SW/SE), Vandenberg AFB, CA 93437, or 45th Space Wing (AFSPC) Safety Office (45 SW/SE), Patrick AFB, FL 32925.

12b. DISTRIBUTION CODE
C

13. ABSTRACT *(Maximum 200 words)*

Missile and space-vehicle performance histories contain many examples of failures that cause, or have the potential to cause, significant vehicle deviations from the intended flight line. In RTI's risk-analysis program, DAMP, such failures are referred to as Mode-5 failure responses. Although Mode-5 failure responses are much less likely to occur than those that result in impacts near the flight line, risk-analysis studies are incomplete without them. This report shows how impacts from Mode-5 failures are modeled in program DAMP. The impact density function used for this purpose contains two shaping constants that control the rate at which the density function drops in value as the angular deviation from the flight line and the impact range increase. Certain Mode-5 malfunctions are simulated, and the two shaping constants then chosen by trial and error so that impacts from the simulated malfunctions and the theoretical density function are in close agreement. An appendix to the report contains a listing and brief narrative failure history of the Atlas, Delta, and Titan missile and space-vehicle launches from the Eastern and Western Ranges from the beginning of each program through August 1996. Each entry gives the vehicle configuration, whether the flight was a success, the flight phase in which any anomalous behavior occurred, and a classification of vehicle behavior in accordance with defined failure-response modes.

14. SUBJECT TERMS
launch risk, unlikely failure modeling, booster failure probabilities

15. NUMBER OF PAGES
180

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT
Unclassified

18. SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

19. SECURITY CLASSIFICATION OF ABSTRACT
Unclassified

20. LIMITATION OF ABSTRACT
SAR