

SPACE SHUTTLE NATURAL ENVIRONMENT ANALYSIS

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FINAL REPORT

For the Period

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May 2, 1988

Prepared For

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1.0 GENERAL

There were five major tasks: 1) Development of detailed wind profile measurements for Kennedy Space Center (KSC) and Vandenberg Air Force Base (VAFB); 2) Development of software to construct meteorological data tapes for use in STS Post Ascent Analysis; 3) Development of storage, access, and utilization codes for Global Cloud Cover Data; 4) Development of software and meteorological data bases to establish launch delay risks at KSC and VAFB; 5) Development of the Meteorological Tower 301 climatological data base at VAFB.

2.0 OVERALL PROGRESS FOR THE PERIOD

2.1 PERFORMANCE

2.1.1 Development of Detailed Wind Profile Measurements for KSC and VAFB

One hundred twelve pairs of South Vandenberg Wondsondes were received and processed through Phase I. Fifty 3-hour pairs for winter, summer, and transition seasons were selected and processed for simulation use.

Approximately 381 new profiles of VAFB jimspheres were received to be used to increase the seasonal data base.

The KSC/ETR 3.5 hour jimsphere pairs for the winter season was expanded to include all of the STS launch profiles. Analysis was performed to create a totally new 2.0-hour/100-minute jimsphere pairs data base for KSC/ETR.

Approximately 269 new KSC time sequential profiles were received to be used to increase these data bases.

A new radar comparison data base was created to be used for additional analysis of the FPQ-14 and FPS-16 radars.

2.1.2 Development of Software to Construct Meteorological Data
Tapes for Use in STS Post Ascent Analysis

An effort was accomplished to enhance the Jacchia 1970 model atmosphere. The enhancements are as follows:

- o Substitute the US Standard Atmosphere '76 data for the '62 data in GRAM86
- o Add pressure computation
- o Identify constituent output by proper units
- o Change reference heights to 160 km and 170 km
- o Correct the 500 km helium interpolation procedure
- o Incorporate Davis changes
- o Allow exospheric temperature as an input
- o Allow both log and anti-log output of constituents.

An effort was accomplished to convert both the software and data bases necessary for post STS ascent analysis from the Univac 1183 system to the Engineering Analysis and Data System (EADS). They are as follows:

- o STS Q-LOOK
- o STS TRANSLATE/DECODE
- o STS TAPGEN
- o STS MET
- o STS JSCTAPE
- o STS PRAG63 COMP
- o STS GRA
- o STS INPLANE/OUT-OF-PLANE
- o STS EMERGENCY MET
- o STS DESCENT MET
- o KSC MASTER
- o VAFB MASTER
- o WSMR MASTER
- o WALLOPS MASTER
- o KSC 150/MONTH
- o KSC SEASONAL
- o KSC 3.5 HOUR PAIRS
- o VAFB 150/MONTH
- o VAFB SEASONAL
- o VAFB 3.5 HOUR PAIRS

A total of 108 programs were converted to EBCDIC on the UNIVAC 1100. This was required before programs could be loaded on the EADS for conversion.

2.1.3 Development of Storage, Access, and Utilization Codes for Global Cloud Cover Data

All Southern Hemisphere tapes received from the National Climatic Center were translated, compressed, and edited. Merging single month data into the standard archival quarterly format has progressed smoothly with data that have been received to this date.

2.1.4 Development of Software and Meteorological Data Bases to Establish Launch Delay Risks at KSC and VAFB

Implementation was accomplished on three options to be added to the Mission Analysis System. They are as follows:

- o The capacity to analyze combined sites for RTLS. The basic concept is that, if there is a GO condition for launch at the launch site and a NO-GO condition for RTLS at the launch site, an alternate RTLS site must be analyzed for the specified time.
- o The capability to analyze RTLS probability at a site other than the launch site for simultaneous observations. If there is a GO condition for launch then the specified RTLS site must be analyzed for the specified time.
- o Incorporate the following sites as possible landing options:

DAKAR
MORON
MARAKESCH
AGADIR
CASABLANCA
ZARAGOSA
BEN GUERIR
GUAM
RAMAQ
WAKE ISLAND

Analysis was performed to produce peak wind speed profile envelopes for the following:

- o 10-percent risk value of exceeding the 10-m level peak wind speed for various reference periods of exposure for Kennedy Space Center.
- o 5-percent risk value of exceeding the 10-m level peak wind speed for various reference periods of exposure for Kennedy Space Center.

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- o 1-percent risk value of exceeding the 10-m level peak wind speed for various reference periods of exposure for Kennedy Space Center.

Analysis was performed to produce 10-min mean wind speed profile envelopes for the following:

- o 10-percent risk value of exceeding the 10-m level mean wind speed for various reference periods of exposure for Kennedy Space Center.
- o 5-percent risk value of exceeding the 10-m level mean wind speed for various reference periods of exposure for Kennedy Space Center.
- o 1-percent risk value of exceeding the 10-m level mean wind speed for various reference periods of exposure for Kennedy Space Center.

2.1.5 Development of the Meteorological Tower 301 Climatological Data Base at VAFB

Analysis was accomplished on the VAFB launch complex meteorological data. We have received a total of 320 Tower 301 data tapes to date. Two of the tapes did not contain any data and were returned. There have been 228 days of launch complex ISS climatological data recorded on ANALOG tapes.

A total of 312 analog tapes were received containing 32 data measurements for January 8, 1986, and through June 16, 1986, from the ISS climatological data and the SSME exhaust duct data. All 312 of these tapes were digitized to date.

2.2 PROBLEMS ENCOUNTERED

No major problems were encountered during the reporting period.

2.3 PERFORMANCE PLAN FOR NEXT REPORTING PERIOD

The total cumulative cost incurred as of April 30, 1988, is \$764,154 or 100 percent of the contract budget. One hundred percent of the contract has been completed.

4.0 NEW TECHNOLOGY

A continuous effort has been made during this reporting period to review the status and identify of the technical work performed to ascertain whether an item exists which is reportable under the New Technology Clause of the contract. A final report has been submitted.