# INTRODUCTORY COMMENTS

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The first two days of the workshop will consist of data gathered from the first three flights of the Space Shuttle. In order to limit the scope of the meeting, only summary data will be presented in two areas; the vibroacoustic and thermal environments. More extensive presentations of data in these areas are being planned for the near future. The emphasis of the meeting will be the characterization of the particulate, gaseous, and electromagnetic emissions associated with the Shuttle flight. Data as generated through the use of the Induced Environment Contamination Monitor (IECM) presents the largest base since it was collected on STS-2, STS-3, and STS-4 flights and therefore, a large portion of time has been allocated for these presentations. As an aid in interpeting other results, a short summary of measurements of "vehicle glow" light emissions and material effects (mass loss) due to the low earth environment interactions with the Shuttle vehicle will be presented.

An important consideration in planning the workshop was to schedule it as soon as possible after flight to allow as much time as possible for future payload planning. As a result, the presentations are in viewgraph form. Also, be aware that a large portion of the data to be presented is preliminary since a considerable amount of data analysis remains to be completed.

# MEETING DEFINITION

- OBJECTIVE-PRESENTATION OF DATA WHICH RELATE TO DEFINITION OF ENVIRONMENT ASSOCIATED WITH SHUTTLE FLIGHT AS DERIVED FROM FOUR SHUTTLE FLIGHTS
- EMPHASIS
  - MAJORITY OF DATA PRESENTED WILL ADDRESS THE OPTICAL ENVIRONMENT (MOLECULAR AND PARTICULATE)
  - SUMMARY OF VIBROACOUSTIC, ELECTROMAGNETIC INTEREFERENCE AND THERMAL MEASUREMENTS MADE USING DEVELOPMENT FLIGHT INSTRUMENTATION*
  - PAYLOAD MEASUREMENTS OF SOME THERMAL AND ELECTROMAGNETIC ENVIRONMENT
  - BRIEF DESCRIPTION OF AMBIENT OXYGEN EFFECTS PRESENTED AS AID IN INTERPRETATION OF OTHER MEASUREMENTS

* NOTE: SUMMARY OF ALL ENVIRONMENTAL DATA TO BE ADDRESSED AT MEETING TO BE HELD EARLY NEXT YEAR

In the 1974 timeframe, a set of contamination requirements/goals were developed for the Shuttle by two working groups; the Particles and Gases Contamination Panel and the Contamination Requirements Definition Group. These two charts summarize the requirements that were developed. The requirements will not be discussed in detail here but are presented as a reference and to point out that considerable planning was conducted to ensure that the Shuttle would provide an acceptable measurement platform for a large majority of payloads.

## SUMMARY OF CONTAMINATION SPECIFICATIONS AND MEASUREMENTS REQUIREMENTS

### PRELAUNCH THROUGH ASCENT

| CONTAMINATION SPECIFICATION | SPEC. REF. | MEASUREMENT REQUIRED | REQUIREMENT REF. |
|---|---|---|---|
| AIR TEMPERATURE 70°± 5°F | A,B | TEMPERATURE AND HUMIDITY | C,D,E |
| HUMIDITY 30–50% | A,B | TEMPERATURE AND HUMIDITY | C,D,E |
| PURGE GAS CLASS 100, GUARANTEED CLASS 5000, LESS THAN 15 PPM HYDROCARBONS | A,B | TRACE GAS ANALYSIS<br>AEROSOL COUNT AND SIZE DISTRIBUTION | C,D,E |
| PURGE GAS PRODUCE LESS THAN $10^{-6}$ gm/cm² CONDENSIBLES ON SURFACES | B | NON–VOLATILE RESIDUE INVRJ DEPOSITION | C,D,E |
| CONTROL WORK DISCIPLINE TO MAINTAIN SURFACE CLEANLINESS AT LEVEL 300 A (VISIBLY CLEAN WITH LESS THAN $10^{-6}$ gm/cm² NVR) | A,B | AEROSOL COUNT AND SIZE DISTRIBUTION<br>*DUST FALL MEASUREMENTS*<br>NON–VOLATILE RESIDUE NVR DEPOSITION | C,D,E<br>D,E<br>E |
| MAINTAIN PARTICLE COUNT LESS THAN 100K IN VICINITY OF P/L | B | AEROSOL COUNT AND SIZE DISTRIBUTION | C,D,E |

REFERENCES:
A. JSC 07700, VOL. X, PARAGRAPHS 3.8.12.2.4.1–.5
B. CRDG REQUIREMENTS DOCUMENT, PARAGRAPHS 4.1.2–.10
C. JSC 08576, FTR 84VV011
D. SPACELAB FLIGHT NO. 1 VFT/VF1 REQUIREMENTS DEFINITION, CON–02
E. CRDG REQUIREMENTS DOCUMENT, PARAGRAPH 6.1.1

## SUMMARY OF CONTAMINATION SPECIFICATION AND MEASUREMENT REQUIREMENTS ON ORBIT

| CONTAMINATION SPECIFICATIONS | SPEC. REF. | MEASUREMENT REQUIRED | REQUIREMENT REF. |
|---|---|---|---|
| MOLECULAR COLUMN DENSITY LESS THAN | | | |
| $10^{12}$ $H_2O$/cm² | A | MOLECULAR COLUMN DENSITY | C,E |
| $10^{11}$ $H_2O$ + $CO_2$/cm² | B | | |
| $10^{13}$ $N_2$ + $O_2$/cm² | B | | |
| $10^{10}$ OTHER MOLECULES/cm² | | | |
| SCATTERED/EMISSION LIGHT BACKGROUND LESS THAN | | | |
| $m_v$ = 20 STAR/SEC² (10⁻¹² BO IN U.V) | A | BACKGROUND SPECTRAL INTENSITY | C,E |
| $10^{-14.2}$ BO IN VISIBLE | B | | |
| $10^{-14.0}$ BO IN ULTRAVIOLET | B | | |
| $10^{-11}$ WATTS/m²/μ/nm $\lambda < 30\ \mu$ | B | | |
| $10^{-10}$ WATTS/m²/μ¹/nm $\lambda > 30\ \mu$ | B | | |
| FEWER THAN ONE 5 μ PARTICLE PER ORBIT IN 1 5 X 10 5 STERADIAN FIELD–OF–VIEW | A,B | PARTICLE SIZE AND VELOCITY DISTRIBUTION (2.2.8) | C,D,E |
| MOLECULAR RETURN FLUX SUCH THAT: | | | |
| $H_2O < 10^{12}$ MOLECULES/cm²/sec | A | MOLECULAR RETURN FLUX | |
| DEPOSITION $10^{-7}$ gm/cm² 30 DAYS 0.1 sr on 300°K surface | B | MOLECULAR DEPOSITION ON AN AMBIENT SURFACE | C, D,E |
| DEPOSITION $10^{-5}$ gm/cm²/ 30 DAYS 2 π sr on 300°K SURFACE | B | MOLECULAR DEPOSITION ON AN AMBIENT SURFACE | C,D,E |
| DEPOSITION $10^{-5}$ gm/cm²/ 30 DAYS 0.1 sr ON 20°K SURFACE | B | MOLECULAR DEPOSITION ON A CRYOGENIC SURFACE | C,D,E |
| DEGRADATION OF OPTICS 1% | A | DEGRADATION OF OPTICAL SURFACES | C,D,E |

REFERENCES:
A. JSC 07700, VOL. X, PARAGRAPH 3.8.12.2.4.6
B. CRDG REQUIREMENTS DOCUMENT, PARAGRAPH 4.2
C. JSC 08576, FTR 84VV011
D. SPACELAB FLIGHT # 1 VFT/VFT REQUIREMENTS/DEFINITION, CON–01
E. CRDG REQUIREMENTS DOCUMENT, PARAGRAPH 6.1.2

Essentially, all data interpretations to be presented in the workshop are dependent upon mission/vehicle parameters. This chart summarizes the major parameters for the STS-1 through STS-4 flights. Acronymn definitions are as follows: -ZLV, -Z-axis of vehicle pointed to the earth (payload bay to the earth); Y-POP, y-axis perpendicular to the orbital plane; -XSI, -x-axis solar inertial; PTC, passive thermal control attitude (vehicle rotating about x-axis at 4 RPH).

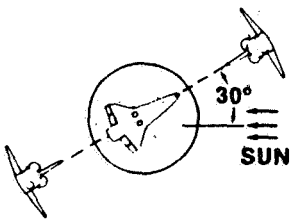
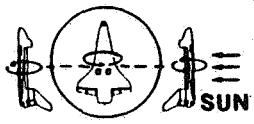
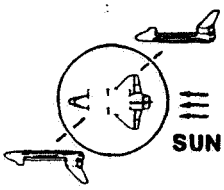
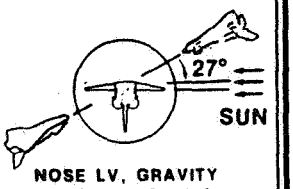
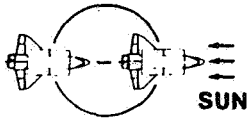
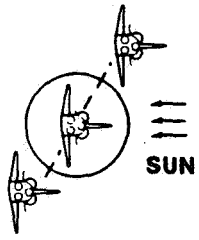
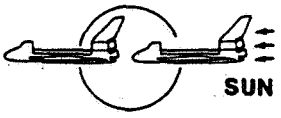
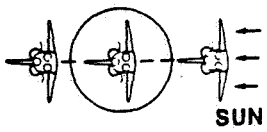
## STS MISSION DESCRIPTION

| MISSION / PARAMETER | STS-1 | STS-2 | STS-3 | STS-4 |
|---|---|---|---|---|
| LAUNCH DATE | 4-12-81 | 11-12-81 | 3-22-82 | 6-27-82 |
| DURATION (HOURS) | 54 | 54 | 192 | 168 |
| INCLINATION/ BETA ANGLE | 40 °/-26° TO -19° | 38°/-50° TO -45° | 38°/-36° TO -23° | 28.5°/-1° TO +20 |
| ALTITUDE km(N. MI.) | 240-278 (130-150) | 222-259 (120-140) | 241 (130) | 306 (165) |
| MAJOR ATTITUDE(S) | -ZLV, Y-POP PAYLOAD BAY TO EARTH | -ZLV, Y-POP | TAIL TO SUN -X SI<br>NOSE TO SUN 3 AXIS SI<br>BAY TO SUN 3 AXIS SI<br>PASSIVE THERMAL CONTROL PTC | TAIL TO SUN 3 AXIS SI<br>BOTTOM TO SUN 3 AXIS SI<br>TOP TO SUN 3 AXIS SI<br>-ZLV<br>PTC<br>GRAVITY GRADIENT |
| PAYLOAD(S) | DEVELOPMENT FLIGHT INSTRUMENTATION (DFI) | OSTA-1, IECM + DFI | OSS-1, IECM AND DFI | DOD 82-1, IECM AND DFI |

This chart contains pictorial descriptions of the major attitudes used during STS-1 through STS-4. This chart along with the mission description and STS flight mission timeline charts are to be used as references for the other presentations during the workshop.

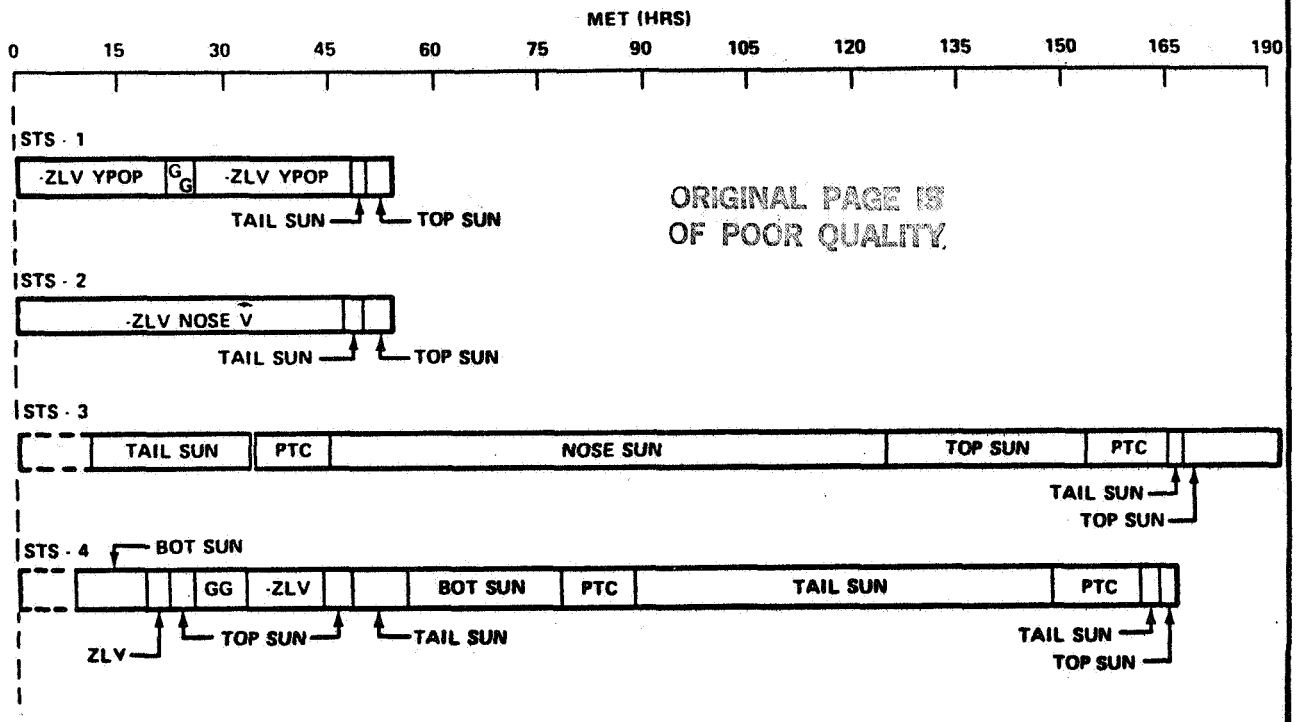


## ORBITER ATTITUDES

| | | | |
|---|---|---|---|
|  TOP LV, β = 30° (-ZLV, +XV̄) |  PTC, β = 0° (X ROLL, X INERTIAL) |  TAIL SUN, 1 REV/ORB., β = 45° (-X SOLAR, -Z SPACE) |  NOSE LV, GRAVITY GRADIENT, β = 30° WING ROLL OUT ORBIT PLANE 27° CW (+XLV, +YV̄ ROLL CW 27°) |
|  NOSE SUN, β = 0° (+X SI, Y POP) |  TOP SI, β = 60° (-Z SI) |  TAIL SI, β = 0° (-X SI, Z POP) |  BOTTOM SI, β = 0° (+Z SI, Y POP) |

Additional detail of vehicle attitude is presented in this chart. Essentially, all of the attitudes for STS-1 through STS-4 were selected for system performance assessment rather that payload peculiar measurements. As such, these attitudes and other operational conditions do not represent the best conditions (low contamination) possible.

# STS FLIGHTS MISSION TIMELINE
## SUMMARY



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