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Direct Simulation Monte Carlo Prediction Of On-Orbit Contaminant Deposit Levels For HALOE

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ABSTRACT

A three-dimensional version of the direct simulation Monte Carlo method is adapted to assess the contamination environment surrounding a highly detailed model of the Upper Atmosphere Research Satellite. Emphasis is placed on simulating a realistic, worst-case set of flowfield and surface conditions and geometric orientations for the satellite in order to estimate an upper limit for the cumulative level of volatile organic molecular deposits at the aperture of the Halogen Occultation Experiment (HALOE). Results pertaining to satellite environment are presented regarding contaminant cloud structure, cloud composition, and statistics of simulated molecules impinging on the HALOE aperture, along with data related to code performance. Using procedures developed in standard contamination analyses, along with many worst-case assumptions, the cumulative upper-limit level of volatile organic deposits on the HALOE aperture over the instrument's 35-month nominal data collection period is estimated at about 13,350Å.

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NOMENCLATURE

CCM	Coarse Cartesian Mesh
CLAES	Cryogenic Limb Array Etalon Spectrometer
CO_2	carbon dioxide
DSMC	direct simulation Monte Carlo
FCM	Fine Cartesian Mesh
FNUM	ratio of real to simulated molecules
GMW	gram molecular weight
HALOE	Halogen Occultation Experiment
HGA	High Gain Antenna
IM	Instrument Module
LDEF	Long Duration Exposure Facility
MLI	Multi-Layered Insulation
MMS	Multi-mission Modular Spacecraft
Ne	neon
NEPS	Nadir Energetic Particle Spectrometer
0	monatomic oxygen
SP	Solar Panel
SI	International System of metric units
SSPP	Solar/Stellar Positioning Platform
SWF	species weighting factor
Т	absolute temperature [K]
UARS	Upper Atmosphere Research Satellite
V_x, V_y, V_z	directed velocities
X, Y, Z	coordinate directions
ZEPS	Zenith Energetic Particle Spectrometer
1	length scale [Å]
n	number density $[m^{-3}]$
t	relative temperature [° C]
Δt	time increment [sec]
Ω	solid angle [steradians]
α	HALOE azimuth angle

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β	angle describing UARS-Sun relationship
θ	HALOE elevation angle
au	period [min]
$\dot{\phi}$	mass flux rate $[gm/cm^2/sec]$
ω	exponent in power-law viscosity-temperature relationship

Subscripts:

j	species index
8	satellite condition
\$\$	steady state condition
∞	freestream condition

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1.0 INTRODUCTION

The Upper Atmosphere Research Satellite (UARS) was designed to collect data on various aspects of Earth's upper atmosphere to help characterize global atmospheric changes that are thought to be occurring. Figure 1 depicts the UARS model used in this investigation. One instrument carried on board the currently-operational satellite is the NASA Langley Halogen Occultation Experiment (HALOE). During each sunrise and sunset experienced by the satellite, the HALOE instrument peers at the Sun through the atmosphere and measures solar infrared energy absorption over a range of wavelengths. With this information, vertical distributions for concentrations of trace gases such as HF, HCl, and O_3 are deduced.¹

In order to obtain precise measurements, HALOE optical surfaces must be kept extremely clean. Experience shows that even minute amounts of contamination can seriously degrade the spectral transmissivity and reflectivity of optical surfaces.² Although atmospheric density is extremely low at the satellite orbit altitude of 600km, there are many potential sources of contamination contained on board UARS itself, ranging from light gases to heavy, long-chain polymers. Volatiles outgassed from certain materials used in satellite construction, gases vented from the interior of the satellite and cryogenically-cooled experiments, and effluents exhausted from attitude thrusters, all contribute to a gas cloud that envelops the vehicle.

Previous analyses have indicated that the cumulative level of deposits on critical HALOE optical surfaces over its nominal 35 months of operation could exceed maximum acceptable levels by over an order of magnitude.³ While UARS instrument managers specified a goal of no more than 100Å of cumulative deposits at the HALOE aperture, analyses predicted for its original set of orientations that it would receive about 32,170Å.³ A recommended change adopted in stowing positions for HALOE reduced that estimate to about 6188Å.³ These analyses utilized SPACE2⁴ and MOLFLUX,⁵ which are standard engineering codes developed for estimating fluxes on target surfaces due to outgassing. These codes either assume no intermolecular collisions within the gas cloud or employ first-collision theory.

Because of the important effect of contamination on the success of the HALOE data collection effort, detailed characteristics of the gas cloud in the vicinity of the HALOE aperture are needed to accurately estimate incident contaminant fluxes and to help define criteria for optimal operation of the instrument. In order to facilitate this goal, a study of the contamination environment surrounding UARS was performed using the direct simulation Monte Carlo (DSMC) technique.^{6,7}

This report describes details of the investigation, emphasizing methods used and assessment of input data and assumptions. First, a discussion of issues important to satellite contamination is presented, followed by a general description of the DSMC method and preprocessors specifically developed to handle various necessary input conditions and geometric orientations required for the investigation. This discussion is then followed by a description of specific data pertinent to contamination of the HALOE instrument on board UARS. Results include simulated flowfield species number density maps describing the overall gaseous environment surrounding UARS, and statistical details regarding the fluxes intercepted at the HALOE aperture. Also, results regarding predictions of cumulative contaminant deposit levels are presented and interpreted, and code performance statistics are mentioned.

2.0 CONTAMINATION ISSUES

Satellites tend to surround themselves with their own artificial atmosphere through surface outgassing, equipment venting, and attitude thruster firing. This artificial atmosphere typically has very low density, and its overall distribution is usually anisotropic and non-Maxwellian. It is composed of species having a wide range of molecular weights, including massive, long-chain, volatile organic compounds, and is characterized by a wide range of concentrations, with some important species present only at trace levels.

The molecular flux of contaminants incident on a spacecraft surface has traditionally been subdivided into two categories: direct and return flux. Freestream or outgassing molecules directly impinging on a critical target surface that may have encountered prior collisions with other surfaces, but no intermolecular collisions with other gas species, belong to the direct flux. Outgassing molecules having undergone intermolecular collisions before reaching the target surface belong to the return flux. Direct flux computation is relatively straightforward for diffuse surfaces (geometric viewfactors or particle tracing), but return flux computation, which requires an integrated knowledge about the contaminant cloud structure and collision physics, is intrinsically more complex. It also requires that a relatively large computational domain surround the satellite to ensure that the simulation satisfactorily accounts for virtually all molecules which can return to the vehicle surface, regardless of how far they ventured away from the satellite before being scattered back.

The physics involved in contamination processes, such as surface desorption, reflection, absorption, adsorption, etc. are very complex. The experimental database is presently insufficient to devise accurate models to simulate mechanisms such as surface outgassing (flux magnitude as a function of surface temperature and material composition, emitted angular velocity distribution, and species composition), surface deposition and polymerization (effects of ultraviolet radiation, atmospheric monatomic oxygen flux, and surface material), and surface reflection (momentum and energy accommodation, reflected angular velocity distribution). Reliable estimates of the contamination environment surrounding future spacecraft will therefore require improving the present state of knowledge. The molecule-based DSMC algorithm is readily amenable to incorporate new physical models as these become available. DSMC could therefore be used to evaluate these models and foster new research in this field.

3.0 NUMERICAL TOOLS

In this section, the method used to investigate HALOE on-orbit instrument contamination is presented, along with preprocessing routines developed to assimilate data concerning geometric configurations and outgassing required to provide detailed simulations. First, a general description of the DSMC method is presented, followed by a brief presentation describing the various preprocessing routines used, many of which have been specifically developed to handle outgassing emission data.

3.1 DSMC METHOD

The direct simulation Monte Carlo method has been steadily gaining acceptance as an approach to solving problems related to fluid dynamics when the effects of rarefaction become important and the gaseous medium no longer behaves as a continuum.⁸ In contrast to the approach of Computational Fluid Dynamics (CFD), where the gas is treated as a continuum mathematical fluid, macroscopic flowfield properties are calculated based on the interactions of many thousands or millions of particles that behave as molecules at the microscopic level.⁸

In the DSMC method, the simulated flowfield volume is discretized into a network of subcells, and the ensemble of particles constituting the gas is allowed to develop in time, where time is discretized into small increments over which the processes of molecular collisions and molecular motion are decoupled. The subcells are used to help identify nearest-neighbor prospective collision partners. The flowfield evolves in time from an initial, specified configuration, and once it reaches steady state, cumulative statistics on the gas are kept by the computer for small numbers of subcells grouped together to form cells. By specifying the intermolecular potential governing the behavior of collisions between the simulated molecules, or "particles," and by using concepts of kinetic theory and statistical mechanics to sample the flowfield at the subcell or cell level, one can establish macroscopic flowfield characteristics.

Although the true intermolecular potential for most interactions are unknown, a number of simple models are available which give reasonably accurate macroscopic behavior. The potential commonly used in contemporary DSMC applications is the Variable Hard Sphere (VHS) model.⁸ In this model, the hard-sphere assumption of uniform, isotropic scattering is retained, but collision cross-sections become proportional to the relative velocities between molecules.⁸ The VHS model has been employed in this investigation.

The DSMC outgassing model has been widely used in other applications,^{9,10} and is assumed to be valid in this investigation. It assumes that molecules of an outgassing species are emitted from specified surfaces at given rates, with velocities sampled from a drifting Maxwellian velocity distribution at a given temperature.

The DSMC code used in the present study was devised by Bird¹¹ and modified by Rault.^{6,7,12} High com-

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putational efficiency is achieved with this code through the use of an unstructured cell network overlaid on a cubic Cartesian subcell mesh. Two levels of subcells are employed in this particular code. A fine scale mesh (FCM) is used to resolve high flowfield gradients that often occur near windward-side surfaces, and a coarser mesh (CCM) is used farther away to conserve computational resources and to improve statisticallybased calculations in regions where overall density levels are low. The individual subcells at the FCM level are referred to as "pixels." When available, comparisons between results generated with this code and experimental measurements regarding surface and flowfield properties for flows around a wide variety of vehicles have yielded excellent agreement.^{12,13} The code has recently been optimized for vector architecture supercomputers, and has been complemented with a set of utilities for diagnosis, preprocessing, postprocessing, and grid adaptation.¹² Grid adaptation of the cell network with respect to certain variables can enhance resolution of flowfield phenomena as well as surface fluxes.

Special coding has been developed to collect information regarding particles striking the HALOE aperture. Such data include particle velocity, position where the aperture plane has been struck, species type, etc. In order to distinguish molecules belonging to the direct flux or the return flux, a parameter has been added to the run code to store the number of surface and intermolecular collisions each particle encounters prior to reaching the aperture. An additional parameter, storing information identifying the originating surfaces of these outgassed molecules, helps indicate which surfaces dominated the influence of volatile species fluxes at the aperture plane.

A novel additional capability featured in this simulation is the introduction of a parallel processing technique to separate the flowfield into two domains. This option allows higher resolution in the inner domain, combined with a larger outer domain for computing return flux, than would be possible if the resources of only a single computer were available. Implementation of this technique is discussed further in Section 4.2.

3.2 PREPROCESSOR ROUTINES

3.2.1 Geometry Definition

To define and input the inherently complex geometry of typical satellites, the interactive three-dimensional CAD preprocessor developed by Rault is used.^{6,7} This preprocessing utility relies on the fact that even a very complex body geometry can be decomposed into a series of simple geometric primitives, such as spheres, cylinders, planes, etc. or portions thereof.^{6,7} The current set of 16 basic primitives is presented in Table 1. UARS is modeled using 385 of these primitive subelements, and the resulting geometric model is displayed in Fig. 1. Also shown in the figure is the relative coordinate system used in this investigation, and details of the HALOE instrument in Figs. 1b-1d. As described in Ref. 6, properties of these subelements are entered

into the preprocessor code through an input file. Typical input data are presented in Table 2. After listing data associated with the overall configuration of the flowfield volume, a series of fields describe the type of each subelement, its dimensions, location, and orientation. Since the DSMC code assumes SI units, use of any other system requires conversion using the "scale" factor. In Table 2, lengths had been measured and entered in inches, requiring "scale" to be set to 0.0254.

Other entries displayed in Table 2 also require further explanation. Certain types of geometric elements can be completely described by quadratic functions. These elements are categorized under "quadrics," and are handled analytically by the DSMC code. Other planar surfaces, such as rings and disks, where limits cannot adequately be described by quadrics, are simply referred to as "planes," and are stored as a number of points with high resolution. This resolution must be higher than that used to discretize the surfaces for incorporation into the DSMC code for high fidelity.^{11,12} In this study, these two groups encompassed all types of subelements used. In other studies, nonplanar surfaces of arbitrary complexity are defined in similar fashion to the rings and disks used here.¹²

Since subassemblies or components constituting the satellite are represented in the code by groups of geometric subelements, these subelements may be linked by a common "component number." Defining a unique color to represent each component number can be useful in geometry visualization to highlight or otherwise distinguish individual components. References to "limit planes" in Table 2 pertain to the fact that these surfaces are discretized within the DSMC framework and replaced by small cubes.¹¹ Along certain edges where surfaces should intersect, small gaps may occur as a result of the discretization process. This problem occurs most frequently where surfaces intersect at oblique angles. Since the flowfield cell network is built up in layers from surfaces, these gaps will allow the interior to be filled with flowfield cells, which consumes computational resources and may lead to confusing errors.¹² Limit plane displacement lengthens or widens the original subelement to eliminate those gaps. Finally, the entry fields identified as "F3I limits" refer to a subordinate volume contained within the flowfield where the particular subelement lies. This information is used to speed up the discretization process by telling the code to check for a particular surface only within that subvolume instead of searching the entire flowfield.

Dimensions and locations for various facets of the UARS satellite have been obtained from engineering drawings provided by HALOE instrument managers, and a complete listing of the data entered for the baseline geometric representation is presented in Table 3. Code has been developed to alter subassemblies of the geometric UARS model by taking the baseline geometry file listed in Table 3, and rotating the required subelements about a given axis at a given point. The input files for cases studied are displayed in Table 4, and the output resembles Table 3, except that values for the affected subelements have been duly altered.

3.2.2 Outgassing Inputs

Code has been developed to process information pertaining to individual outgassing surfaces for incorporation into the general DSMC run code. These input files include subelement-level information pertaining to the outgassing flux at a given reference temperature, and the molar composition of the outgassing flux. Table 5 is an example of typical outgassing information, and Table 6 is a reproduction of the input file for outgassing information used in this investigation. The values listed before each outgassing rate are species mole fractions for each of the six species modeled.

The preprocessor code contains enough flexibility to process information on whether or not an individual subelement is composed of several regions outgassing different species at different rates. This capability has been used to create vent sources on certain surfaces of the Instrument Module (IM) by superimposing vent locations, flux rates, and gas constituents on existing larger elements. An example is illustrated in the data fields associated with the first geometric element in Table 6. Since outgassing rates are strongly dependent on surface temperature, additional coding has been developed to assign a unique value to each satellite surface. A listing of subelement-level temperatures in $^{\circ}C$ is presented in Table 7.

3.2.3 Vent Plume Modeling

In addition to outgassing information, a preprocessing routine for handling jet-like vent plumes from sonic orifices has been developed. Whereas effluents outgassed from surfaces and exiting most vents diffuse into the flowfield with modeled velocity distributions resembling drifting Maxwellian distributions at $T_{surface}$, "jet" sources represent relatively high mass flux rates exiting small orifices as choked, uniform flow at a supplied exit temperature T_{exit} . The data necessary to recreate such sources are shown in Table 8.

3.2.4 Global Resolution

Finally, Table 9 lists inputs used by the DSMC code in order to initialize the overall simulation. Some of the input variables are simply switches used to tailor the code to the problem at hand with respect to where high grid resolution is needed, sizing maximum lengths for Fortran arrays, information required for setting reasonable estimates for DSMC simulation parameters, flow direction with respect to the body, and the like.¹²

4.0 APPLICATION TO UARS/HALOE CONTAMINATION

4.1 UARS/HALOE DESCRIPTION

UARS was placed in orbit in September 1991 to probe Earth's upper atmosphere and characterize global atmospheric changes which are thought to be taking place. It operates at a roughly circular 600km altitude orbit with a 96-minute period (τ). Depicted in Fig. 1, UARS is about 10.3m long, 5.9m high, 3.2m wide, and its solar panel (SP) measures 13.3m by 3.3m.

Several instruments have been mounted on the Instrument Module (IM), including HALOE, (an occultation viewing radiometer that requires part per million signal precision and characterization¹), the Cryogenic Limb Array Etalon Spectrometer (CLAES), and the Nadir and Zenith Energetic Particle Spectrometers (NEPS and ZEPS). The High Gain Antenna (HGA) receives signals from UARS mission controllers, and the Solar/Stellar Positioning Platform (SSPP) assists in navigating the satellite. The Multi-mission Modular Spacecraft (MMS) is used to periodically boost or maneuver the satellite in accordance with mission guidelines.

UARS is designed to always keep the side with HALOE and the SP facing the Sun when it is over the horizon, but HALOE only takes measurements during sunrise and sunset, which occur once every period. At other times, whether the Sun is above or below the horizon, HALOE is stowed facing away from the freestream direction and the bulk of the satellite. Even though HALOE's stowed position has been chosen to minimize contamination from surface outgassing, it will periodically have substantial viewfactors from the continuously-rotating solar panel.

4.2 PARALLEL CODE SCHEME

As described in Section 3.1, the flowfield has been separated into two domains in order to increase grid resolution near the satellite and to create a large outer domain for computing return flux. Figure 2 shows a schematic representation of the computing arrangement. A different processor computes the solution in each domain independently, and Parallel Virtual Machine software from Oak Ridge National Laboratories has been implemented to allow the processors to communicate data between one another.¹⁴

The potential utility of this parallel routine software has been demonstrated even though an outer domain was not considered necessary for the scope of this particular investigation. Although the effect of return flux on HALOE is deemed insignificant, this feature could be useful in other contamination studies (at lower altitudes, for instance), where the far-field effect could play a more significant role. In this investigation, the inner domain takes on the shape of a right parallelepiped with dimensions slightly larger than the maximum dimensions of UARS, and the outer domain is a cube. During a given timestep Δt , particles reaching or passing through the interface boundary separating the domains are moved to the boundary, and information required by the other processor for these entering particles is stored in a buffer. Data include particle position and velocity information, remaining fraction of Δt , individual species codes, and individual tag parameters. The buffer file is transmitted as a message to the other processor once each timestep.

It is reasoned advantageous to size the domains using the following equation:

$$\frac{FNUM_i}{FNUM_o} = \frac{\Delta t_i}{\Delta t_o} = \frac{V_i}{V_o} \propto \left(\frac{l_i}{l_o}\right)^3.$$
(1)

Concentrating on the first equality in Eq. (1), the need to clone or remove particles at the interfaces to ensure correct transmitted species flux levels is obviated. The second equality is an attempt to achieve roughly equal numbers of particles in each domain, a desirable feature which could result in roughly equal processor loadings under certain circumstances. One compromise inherent in Eq. (1) requires finding suitable timesteps for the different domains, such that when adequate temporal resolution in the inner domain is obtained, particles do not travel too quickly through the outer domain. Of course, shorter timesteps translate into longer run times.

4.3 SPECIES WEIGHTING FACTORS

Due to the large variation in species concentrations within a contaminant cloud, "species weighting factors" (SWF) have been implemented to artificially enhance minor species concentrations. Important species, such as the organic volatiles most likely to deposit and remain on critical surfaces, are usually present in trace amounts, and statistical sample sizes concerning these molecules would therefore be inadequate without the use of these weighting factors. The DSMC code has been modified by artificially increasing the outgassing flux of trace species by a species weighting factor, which in effect enables one to specify species-dependent values of FNUM to obtain reasonable numbers of each representative simulated species within the flowfield for better statistical property measurement. The only aspects of the simulation affected by this artifice are collision rates and quantities associated with flowfield sampling. These aspects may be accounted for by reducing bimolecular collision probabilities and cumulative species sampling summations by the same factors within the code.

The conditions under which SWF's may be applied should be considered carefully, since mean free path lengths of trace species may be artificially increased when intermolecular collisions become important. Such an approximation is not considered a problem for the simulated UARS/HALOE environment.

5.0 COMPUTATIONAL CONDITIONS

This section describes details concerning the application of the tools mentioned above to the analysis of the UARS/HALOE contamination environment. First is a description of the geometric configurations that were considered to provide realistic worst-case estimates for deposits at the HALOE aperture, followed by assumed freestream and outgassing conditions.

5.1 GEOMETRIC CONSIDERATIONS

5.1.1 Configurations

For the set of assumptions associated with this approach, a realistic, conservative estimate for the cumulative level of contaminants deposited at the HALOE aperture must recognize that certain instruments rotate with respect to the rest of UARS over time. The solar panel (SP) continuously tracks the Sun, and the Solar/Stellar Positioning Platform (SSPP) undergoes limited movement as it alternately tracks the Sun and certain stars. HALOE faces the Sun during sunrise and sunset every 96-minute orbital period. Otherwise, it is stowed facing away from the freestream direction with severely restricted views of the rest of the satellite.³ Three different configurations have been chosen, representing a realistic worst case set of orientations. Two of these represent the beginning and end of the HALOE data collection period considered most deleterious with respect to contamination, and one represents the instrument in its stowed position after this data collection period.

Since the direct flux of outgassed molecules intercepted by a target surface is strongly dependent on the solid angle Ω subtended by the originating surfaces within the target's line of sight (viewfactor), cases have been chosen where HALOE collects data facing the -X-direction (toward the Multi-mission Modular Spacecraft (MMS)). In this orientation, viewfactors subtended by the SP and the bulk of the satellite are maximized. In addition, since both the SP and HALOE track the Sun during HALOE data collection periods, the SP presents a large frontal area to the oncoming freestream, which could potentially contribute to increased overall number flux levels at the HALOE aperture. Movement of the SSPP has been ignored.

The angle between the HALOE aperture normal and the UARS body axis during data collection periods is equal to β , the angle between the Earth-Sun line and the plane of the satellite orbit.³ Angle β also plays a role in outgassing, since satellite surface temperatures are directly proportional to local surface inclination with respect to the Sun. For this particular orbit ($0^{\circ} \leq \beta \leq 80^{\circ}$), temperatures of influential surfaces are generally maximized when $\beta = 80^{\circ}$. One important exception is that trends for the SP surface temperatures run counter to the other objects. Due to the glancing angle it makes with the Sun at $\beta = 80^{\circ}$, SP surface temperatures, and hence its outgassing rates, are minimized there. Conversely, SP surface temperatures are maximized when $\beta = 0^{\circ}$. The large SP surface area and its orientation with respect to HALOE make it a formidable influence on the latter's contamination environment. Another influential factor is that although the temperatures of the many influential outgassing surfaces are minimized at $\beta = 0^{\circ}$, their viewfactors are maximized with respect to HALOE for this orientation.

The three sets of geometric orientations studied in this investigation are listed below in expected descending order of severity. Angle α represents azimuth angle with respect to the UARS X axis, and θ represents elevation. Case 1 assumed $\alpha = -180^{\circ}$ and $\theta = 6^{\circ}$ (end of sunrise data collection period); Case 2 assumed α $= -180^{\circ}$ and $\theta = -23.6^{\circ}$ (beginning of sunrise data collection period); and Case 3 assumed $\alpha = 45^{\circ}$ and θ $= -25^{\circ}$ (stow position immediately prior to $\beta = 0^{\circ}$ sunset data collection period). Views of the geometric configurations for these cases are depicted in Fig. 1. Note that the SP location in Fig. 1c lies behind the HALOE aperture plane. The visual absence of that large, relatively high-temperature, outgassing object nearby should have a significant impact on the Case 2 contamination environment.

During each orbit at $\beta = 0^{\circ}$, HALOE collects data for a maximum total of 15 minutes (7.5 min. during each sunrise and sunset), and is stowed during the remainder of that period. Assuming that only the volatile species accumulate on critical optical surfaces, the average mass flux rate ϕ per orbit per species j may be estimated by

$$\overline{\phi}_{j,\text{sunrise}} = \frac{\phi_j|_{\theta=6^\circ} + \phi_j|_{\theta=-23.6^\circ}}{2},\tag{2}$$

$$\vec{\phi}_{j,\text{orbit}} = \left(\frac{\tau_{\text{sunrise}}}{\tau_{\text{orbit}}}\right) \vec{\phi}_{j,\text{sunrise}} + \left(\frac{\tau_{\text{sunset}}}{\tau_{\text{orbit}}}\right) \vec{\phi}_{j,\text{sunset}} + \left(\frac{\tau_{\text{stow}}}{\tau_{\text{orbit}}}\right) \dot{\phi}_{j,\text{stow}}.$$
(3)

In Eq. (2), linear behavior of $\dot{\phi}_j$ is assumed between the two cases, and in Eq. (3) for conservative estimates, $\vec{\phi}_{j,\text{sunset}} = \vec{\phi}_{j,\text{sunrise}}$, even though satellite IM-area viewfactors are lower for sunset viewing periods.

The probability that a contaminant molecule adheres to a critical surface is determined by its "sticking coefficient," a probabilistic parameter dependent on the combined effects of individual contaminant/surface material pairing, energy differences between contaminant molecules and the surface, and photopolymerization,¹⁵ among other things. Multiplying Eq. (3) by the number of orbits in the 35-month nominal HALOE lifespan and the area of the HALOE aperture, an upper bound for the total mass accumulated for each species may be calculated, assuming a sticking coefficient of unity. Neglecting the effects of highly-reactive O atomic flux on removing these deposits, such an assumption may be valid during data collection periods due to photopolymerization of volatile compounds on optical surfaces, but may considerably overestimate the mass accumulated while HALOE is stowed facing away from the Sun. Assuming values for the mass and volume associated with each species, one can make a crude estimate for the depth of deposits at the aperture for each species. The total thickness becomes the summation of the contributions from each species.

5.1.2 DSMC Resolution

Figure 3 illustrates representative cross-sections of the inner domain cell network used for the present study after grid adaptation. Figure 3b shows the extent of the solar panel along with the rest of the vehicle. The body geometry is discretized and stored at the FCM level. Each element is characterized by a wetted surface area and a set of normal direction cosines. Figure 4 shows an XY-planar slice through the discretized geometry using a diagnosis utility developed for use with the DSMC code. In Fig. 4, pixels representing the surface are displayed along with outward direction cosines. Additionally, information on different levels of subcells surrounding the geometry can be represented. To simulate the UARS geometry, about 85,000 pixels have been used (pixel dimension $\approx 5.0 cm$), and the inner domain computational grid is composed of 35,000 cells. All outgassing and venting particles enter the flowfield from positions adjacent to the center of the pixel face closest to the outward normal of the outgassing pixel, about 0.2 percent the distance represented by a pixel length scale inside the flowfield volume. This has been done to eliminate position round-off error. These particles are given velocity components sampled from a drifting Maxwellian at the local outgassing surface temperature.

5.2 FREESTREAM PARAMETERS

Assumed ambient conditions at the satellite operating altitude of 600km consisted of 100 percent atomic oxygen (O) at a nominal number density n_{∞} of 6×10^{12} molecules/ $m^{3.16}$ At this altitude, the density may vary from this standard in either direction by roughly an order of magnitude due to solar activity. In addition, solar activity can cause appreciable helium concentrations to develop at this altitude. For conservative calculations, assuming 100 percent O maximizes its presence, and since O is highly corrosive to certain satellite materials, and may actually reduce the cumulative level of deposits on critical optical surfaces, instrument managers may be interested in its interactions with the satellite. Of course, ambient collision rates are affected by number density and species constituency,¹⁷ however, using a single species to represent the freestream simplifies the simulation process, and it happens that UARS is operating in a period of low solar activity. These reasons may make the assumed level for n_{∞} somewhat conservative. The assumed satellite orbital velocity V_{*} is 7500 m/sec.

5.3 OUTGASSING SPECIES, FLUX RATES, & TEMPERATURES

5.3.1 Outgassing Species

In preliminary calculations,⁶ two ficticious outgassing species were fabricated for demonstration purposes. One, with a gram molecular weight (GMW) of 200, was emitted from all outgassing surfaces. The other, with GMW = 100, was emitted only from the Instrument Module (IM) vent, located above the CLAES experiment.⁶ The GMW's are similar to those used in standard industry contamination codes, and are associated with heavy, volatile, organic compounds.⁵

Further investigation into likely types of outgassing materials covering UARS focused on four different items. These were: Mylar, used in the Multi-Layered Insulation (MLI) covering most of the satellite; Chemglaze Z306, a black paint covering portions of some instruments (as well as the interior of HALOE); S/13G/LO-V10, a white paint covering portions of some instruments as well as the back side of the SP; and adhesives possibly used to affix components to the front of the SP. A report investigating the types and mass fractions of volatile components outgassing from these materials at different temperatures identified compounds such as alkanes, alcohols, organic acids, and aldehydes.¹⁸ Many components remained unidentified; however, taking the highest mass-fraction species identified for the materials listed above, a ficticious molecule with *GMW* close to each calculated average has been generated. Moreover, a ficticious species associated with venting from internally-carried components has been created. The *GMW* assumed for this material is 100, following standard contamination procedures.⁵ Values describing each of these species and their outgassing rates are listed in Table 10.

Collision cross-sections for these species ratioed to that for monatomic oxygen have been assumed to scale with the 2/3 power of the associated mass ratio (see Table 10).¹⁷ The mean viscosity-temperature power-law exponent ω is assumed to be 0.75, a value associated with O, and no chemistry has been considered. This information is contained within the input gas species file used by the DSMC code, which is presented in Table 11. Due to lack of information, it is not clear how well the collision dynamics of heavy, long-chain, polyatomic organic molecules are modeled by these assumptions, but since temperatures are moderate and density levels are extremely low, collision rates are assumed to be negligible.

All surfaces reflected particles diffusely, although evidence suggests incomplete momentum and energy accommodation better represent certain surfaces exposed to the vacuum of space for extended periods.¹⁹ Such behavior could affect the statistics of true fluxes encountered at the instrument aperture.

5.3.2 Mass Flux Rates

Measured mass flux rates associated with materials covering the instruments and subassemblies have been

obtained from Ref. 3, which lists data taken from a month-long bakeout test performed at NASA Goddard Space Flight Center on the completed UARS satellite at 100 $^{\circ}$ C. In that report, rates were assumed for units lacking measured data. It was noted that the rate associated with MLI covering the satellite bus varied from a high initial level to a lower, constant level by the end of the test. In this study the lower, constant value was assumed, since the HALOE aperture remained closed for the first month in orbit as a precautionary measure against the initial, transient levels of MLI outgassing. Unfortunately, no information was given on the relative location of instruments measuring these rates with respect to the satellite, and some subassemblies feature surfaces sporting more than one type of covering. Since only one rate was listed per unit, such information had to be supplemented through judicious interpretation of photographs depicting various UARS subcomponents to determine what surfaces were covered with which material. These photographs were supplied by HALOE instrument managers and personnel at Goddard Space Flight Center. The mass flux rates for surfaces and coatings deduced from Ref. 3 are presented in Table 10.

In addition to outgassing surfaces, other gas-emitting sources have been modeled. The CLAES experiment is cryogenically cooled by gases contained in two separate reservoirs.²⁰⁻²² One reservoir contains Ne, the other CO_2 . After cooling the instrument, these gases are expelled through vents. The CO_2 vent is located at the exit of a 1 *in*-diameter tube intersecting the CLAES shield plate, with direction cosines for the exit plane normal as (-.49, .64, .59) in the X, Y, Z coordinate system indicated in Fig. 1. The Ne vent is located at the end of a short, 2 *in*-diameter tube at the +Z-most section of the CLAES smaller cylinder, directed downward. The flow from these vent exits is assumed to be choked at an estimated temperature of $T_{exit} = 207K$.²² Mass flow rates for the CO_2 and Ne vents have been estimated at 3.65 and 8.39mg/sec, respectively. In this study, these sources have been modeled using the jet-like vent plume routines for sonic orifices mentioned above. Calculated outgassing rates for the CLAES vents are listed in Table 10.

Other vents, such as the IM vent, MLI blanket vents, and those associated with the MMS, released effluents at much lower flux rates, and have been modeled as regular surface-temperature dependent outgassing surfaces. Assumed *GMW*'s and outgassing rates associated with these vents are listed in Table 10.

5.3.3 Temperature Variation

Mass flux rates given in Ref. 3 for the bakeout test have been adjusted to reflect levels associated with realistic operating temperatures through use of the following empirical relationship, formulated to characterize generic mass flux behavior of polymeric materials on Skylab^{4,5} (t in $^{\circ}C$):

$$\frac{\dot{\phi}_{j}(t)}{\dot{\phi}_{j}(t=100 \ \text{eC})} = \exp\left(\frac{t-100}{29}\right). \tag{4}$$

This formula has been used to adjust all volatile organic compound outgassing rates. Although actual material outgassing rates probably deviate from Eq. (4), this formula is the only one available for use in

this investigation. Surface temperatures associated with various components have been estimated using data contained within Ref. 3, with one exception. UARS instrument managers provided solar panel operating temperatures which were measured in orbit. For $\beta = 0^{\circ}$, SP temperatures oscillate on orbit between -60°C and 30°C. The maximum SP temperature has been assumed for all cases, and values for other subassembly surfaces are listed in Table 7.

5.3.4 Species Weighting Factors

Upon commencement of the first DSMC computations, problems were encountered obtaining volatile fluxes at the HALOE aperture, because the outgassing rates associated with those species created flowfield number density levels orders of magnitude lower than those associated with the freestream and the CLAES vent species.⁷ In a single timestep, about 3300 simulated monatomic oxygen molecules would enter the upstream boundary (area $\approx 110m^2$), 30 simulated volatile, organic molecules of all types outgassed from the satellite (surface area $\approx 230m^2$), and 200,000 particles exited the CLAES vents (total vent exit area = $2.5 \times 10^{-3}m^2$). The number flux of volatiles in the inner domain is therefore about two billionths of that for the CLAES vent species. Thus, by adjusting computational resources to adequately simulate the dominant CO_2 and Neenvironment, keeping the computational size of the simulation large enough to simulate $\sim 10^6$ particles, the simulation would completely lose track of the volatile species whose development was the motivation for engaging in this investigation.

The solution adopted has been to implement the species weighting factors discussed in Section 4.3. First, a simulation was run without the contributions of the CLAES vents in order to assess the ratio of volatile, organic species number density levels to the freestream. Another simulation included CLAES vent contributions in order to determine those density levels relative to those from the freestream as well. With information on the relative species number density levels, simulated fluxes of the various species have been altered using arbitrary *SWF*'s in order to obtain roughly equal orders of magnitude for numbers of each simulated species in the computational volume. The weighting factors used for O, Ne, CO_2 , and the volatile, organic species with $GMW = 100, 150, and 200 are 40, 1, 1, 10^3, 10^4, and 5 \times 10^3$, respectively.

5.4 CODE SETUP

The methodology adopted for this study is to initially run the code for each set of conditions in a free molecule (collisionless) mode. Due to the large size of the satellite and the low thermal velocity of the heavy outgassing molecules, the approach to steady state is slow $(N_{ss} \cong 10^4 \Delta t, \text{ where } \Delta t \approx 7 \mu \text{sec})$. Figure 5 shows the number of particles in the inner and outer domains versus number of elapsed timesteps. Depending on

the type of problem being studied, the region where the curves flatten out may mark the onset of steady state. (While this rule-of-thumb may usually be adequate for measuring surface quantities, it is no panacea. For example, wakes behind bodies evolve over a long period of time without perceptible change in overall density levels.) Since exploratory calculations^{6,7} demonstrated that the global level of collisions was very low, the simulation is initially run in free molecule mode to reach an approximate steady state more quickly than if intermolecular collisions were allowed. After grid adaptation, each adapted cell contains roughly the same number of molecules (about 10 for the inner domain), as shown in Fig. 6. The code is then run with intermolecular collisions until a new steady state is reached. Subsequently, molecules incident on the HALOE aperture are counted, sampled, and written to a data file.

For the inner domain, high spatial resolution is necessary, since UARS is very complex and quite large $(\sim 10m)$, and the HALOE aperture is only 22.9cm (9in) in diameter. At the CCM level, the inner domain is composed of $74 \times 46 \times 104$ equal subdivisions of 15.1cm on a side. Each FCM subcell consisted of pixels having lengths three times smaller than the CCM level, resulting in a surface resolution of 5.0cm. Since overall density levels are lower in the outer domain, the physical domain could be simulated with much coarser resolution. The outer domain is a cube measuring 21.2m on a side, composed of $70 \times 70 \times 70$ subcells at the CCM level, with each FCM subcell having resolution equal to the CCM level.

6.0 RESULTS AND DISCUSSION

The wealth of information obtainable within a DSMC simulation will clearly be demonstrated in this section, as surface flux information is obtained along with flowfield behavior within the three-dimensional solution volume. First species number density contour maps will be presented, describing concentration levels surrounding the satellite, followed by results characterizing the fluxes incident on the HALOE aperture. The latter includes statistics concerning prior collisions, velocity distribution functions, and mass flux rates associated with simulated molecules impinging upon the aperture. This last item is manipulated to obtain a cumulative contamination deposit level. Finally, this cumulative level is compared to that of Ref. 3, and some code performance measurements are presented.

6.1 SPECIES NUMBER DENSITY

Figures 7-15 depict number density contour maps for each of the six gaseous species in the entire simulated flowfield surrounding UARS, ratioed to the freestream ambient number density, $n_{O,\infty}$ using a \log_{10} scale. This information is presented in two planes that capture information concerning the majority of the flowfield physics in the three-dimensional volume. One plane runs longitudinally, parallel to the main body axis, while the other runs normal to it and the freestream direction.

For the first set of figures concerning Case 1 (Figs. 7-12), a longitudinal solution plane has been chosen that runs through the vehicle coincident with its main body axis (X-axis), while the transverse solution plane coincides with the streamwise location of the center of the CLAES Ne vent in order to capture a cross-section of the plume emanating from it. These planes have been picked to present the overall physical environment. For the remainder of these number density maps, planes have been chosen that better reflect the environment in the vicinity of the HALOE instrument.

The black outline surrounding UARS denotes the boundary separating inner and outer domains. While contributions of each species are presented separately, they co-exist simultaneously within the simulation.

6.1.1 Case 1

In Figs. 7a and 7b, contours for freestream species monatomic oxygen are presented for Case 1. In Fig. 7a, an expected buildup of O is observed on UARS windward side components. However, in initial DSMC calculations omitting the CLAES vents,⁶ and in subsequent calculations prior to grid adaptation, when intermolecular collisions have been disallowed, the maximum density level peaked at about 25 times the freestream level on the cylindrical face of the MMS.⁶ After grid adaptation and allowing intermolecular collisions to occur, the maximum density ratio there becomes roughly 50 times the freestream level. It seems apparent that this density level increase is due to interaction of the freestream with the gases emitted from the CLAES vents. Even though the global level of intermolecular collisions is low (about 130 collisions per timestep over 740,000 simulated molecules), the CLAES vent plumes create an effectively larger frontal area for UARS with respect to the freestream and scatter O out of the streamwise direction. An advantage of presenting these maps with a logarthmic scale is that the diminished levels of O in the wake of the vehicle are clearly evident. Figure 7b depicts the same set of contours viewed from the opposite side of the domain. The large, dark parallelogram jutting out from behind the transverse plane is the SP, canted 6° upward for this case.

In Figs. 8 and 9, number density contour maps are depicted for CLAES Ne and CO_2 vent gases. In Fig. 8a, the plume developing from the Ne vent exit is clearly captured. In the transverse plane, one can observe a sizable amount of upward scattering although the vent is pointed directly downward. This is likely the result of diffuse surface scattering from surfaces of the CLAES experiment, due to its proximity to the Ne vent. Figure 8b reveals that very little of the Ne plume extends into the -Z regions. In Figs. 9a and 9b, the plume associated with the CO_2 vent is also clearly defined, although its axis is directed at oblique angles to both the streamwise and transverse planes.

In Figs. 10-12, number density contour maps are presented for the outgassing species. In Figs. 10a and 10b,

the entire vehicle is surrounded by outgassing of species with GMW = 100. The streamwise plane contour map above UARS is dominated by outgassing from the IM vent (located just above CLAES on the +Z side of the satellite bus and angled 45° upward), although much of the concentration extending in front of the satellite is due to outgassing of adhesive material from the cell side of the SP (see Fig. 10b). The minor contribution to the flowfield from surfaces outgassing Chemglaze Z306 is shown in Figs. 11a and 11b (GMW= 150). These clouds originate chiefly from surfaces located on NEPS and ZEPS, although the interior of HALOE outgasses this material through its aperture. In Figs. 12a and 12b, GMW = 200 concentrations are presented. In the streamwise plane, the highest density levels are found near the HGA dish, although most of the outgassed material originates from the back side of the SP (Fig. 12b).

Results for this identical case are shown using two other planes that better depict the HALOE environment. The HALOE instrument is located in the center of each figure. In Fig. 13a, a buildup of O is clearly seen in front of HALOE and its mount. One also notices that the highest levels are found before the SP as it plows through the rarefied atmosphere. In Fig. 13b, even though the vast majority of Ne is directed downward on UARS' other side, there is a slight presence of that species in the vicinity of HALOE through a combination of surface and intermolecular collisions. As for CO_2 , in comparing streamwise plane results for Fig. 13c with Fig. 9b, where the former is displaced approximately 1m closer to HALOE than the latter in Fig. 9b, density levels for that species have abated by roughly an order of magnitude. No CO_2 flux was detected at the HALOE aperture.

Comparing streamwise planes from Fig. 13d with Fig. 10b for the GMW = 100 material, it becomes clear that the influence of the IM vent is greatly diminished over that 1m separation distance, and the local flowfield is dominated by the influence of the SP. In Fig. 13e, the contribution of the GMW = 150 material is globally quite minor, yet there is a relatively high concentration of it at the HALOE aperture, thanks to its own contribution. Finally, the concentrations of GMW = 200 material at the aperture are shown in Fig. 13f to be about an order of magnitude higher than for the previous figure, which is a consequence of the high concentrations of this material from the back side of the solar panel and the -Z side of the Instrument Module.

6.1.2 Case 2

Planes chosen to represent the Case 2 flowfield solution (Figs. 14a-14f) are identical to those depicted in the last subsection, emphasizing the HALOE environment. The number density contour maps for this case are similar to those presented in the preceeding two paragraphs. Besides the obvious repositioning of the SP and the HALOE instrument (-23° inclination versus 6° above), the most striking difference is in the map for the GMW = 200 material (Fig. 14f vs. Fig. 13f). The difference in SP inclination accounts for a dramatic decrease of this material in the vicinity of HALOE.

6.1.3 Case 3

The general features presented in Figs. 15a through 15f are similar to the other two cases. Although the SP front face and HALOE no longer face the freestream, the SP rear face now opposes it. In Fig. 15a, the solar panel still impedes the motion of freestream O, but the position of the transverse planar solution cut reveals the wake behind it. In Fig. 15b, Ne is still present around HALOE, but HALOE's orientation 25° away from the body axis toward -Z effectively shields its aperture from this gas. No Ne or CO_2 was detected at the aperture for this case (Figs. 15b and 15c).

Because the SP is roughly aligned with the +X direction, the GMW = 100 contour density map in Fig. 15d shows a striking difference from the analogous Case 1 solution depicted in Fig. 13d above, where it is roughly aligned in the opposite direction. There is a reversal of which portions of the flowfield are densely and sparsely populated with this material. Even though HALOE is stowed, its viewfactor of the SP approaches that for Case 1 ($\Omega_{SP}|_{Case 3} = 0.412$ steradians versus $\Omega_{SP}|_{Case 1} = 0.527$ steradians). It will be shown shortly that in this configuration, there is still a surprisingly significant level of contaminant flux at the instrument aperture, mostly due to the SP. Fig. 15e shows the contribution from GMW = 150 material for this case, with local concentration maxima emanating from the HALOE aperture, NEPS, and ZEPS. Finally, in Fig. 15f, number density contours for the GMW = 200 material are presented, where once again, a reversal in high and low concentrations of this material are evident compared to Case 1 results in Fig. 13f.

6.2 CAPTURED MOLECULES-PRIOR COLLISIONS

There are a variety of statistics one can glean from simulated molecules striking the HALOE aperture. Two sets of information are presented in this section and the next. First, for each case, the history of each impinging simulated molecule is presented with respect to number of prior collisions it has suffered before reaching the aperture. Second, histograms are generated, representing the X, Y, and Z velocity probability distribution functions (PDF) for these same particles.

6.2.1 Case 1

In Figs. 16a-16c, plots are presented depicting the number of surface collisions prior to reaching the aperture for each species in each case. For Case 1, depicted in Fig. 16a, nearly 90 percent of O atoms reach the aperture directly from the freestream with no prior surface collisions. In contrast, all Ne atoms suffer at least two surface collisions before reaching this location. Outgassing molecules with GMW = 100 and 150 tend to encounter multiple surfaces before arrival, while most GMW = 200 material deposits directly from the back side of the SP and the -Z side of the IM.

6.2.2 Case 2

In Fig. 16b, Case 2 collision history statistics for O are similar to those for Case 1. However, Ne atoms collected encountered at least five prior surface collisions before impinging on HALOE. This could be because the solar panel lies behind it in this run, and in its visual absence (zero viewfactor from the HALOE perspective), many other surfaces are required to facilitate the presence of neon. Again, outgassing molecules tend to encounter multiple reflections before arriving at the aperture, except for the GMW = 200 material. This material tends to collect from direct viewing of the -Z side of the IM.

6.2.3 Case 3

Figure 16c shows that no O atoms directly encounter the aperture; most reflect once off the SP instead. Also, due to HALOE instrument orientation, no *Ne* is detected at all. *GMW* = 100 and 150 materials also tend to reflect once off the SP before impinging, but as in Case 1, *GMW* = 200 material emitted from the back side of the SP tends to arrive directly.

These figures do not reveal all information pertinent to O, whose distributions contain a rather long tail of multiply-reflected particles. The highest number recorded is 114 prior surface collisions for Case 1.

6.3 CAPTURED MOLECULES-

VELOCITY PROBABILITY DISTRIBUTION FUNCTIONS

6.3.1 Case 1

Figure 17 depicts Case 1 histograms representing the X, Y, and Z PDF for particles striking the aperture. Only Ne contributes any return flux; all other species have been deposited as the result of direct flux. Beginning with the X, or streamwise direction in Fig. 17a, notice that $PDF(V_x)$ for O is bimodal. One mode, a full Maxwellian distribution centered at $V_x = V_s$, represents molecules having suffered no previous surface collisions. The other mode, corresponding to a drifting Maxwellian distribution near $V_x = 0$, represents molecules having previously collided with the satellite at least once. Figure 17b shows PDF behavior for V_x near the origin for better detail. In this figure, the volatile outgassing species have a streamwise PDF corresponding to drifting Maxwellian distributions whose shapes differ from one another due to individual GMW's. These distributions have been checked and compare favorably with theoretical calculations, but for clarity's sake the theoretical functions for PDF (V_x) have been omitted from the figure. However, the Ne distribution does not conform to any simple theoretical model because the majority of Ne samples had experienced intermolecular collisions. In Figs. 17c and 17d, probability density functions are presented for the Y and Z, or transverse, directions. The O distributions behave as expected, as they are dominated by contributions from the freestream mode, and compare quite well with theory. Due to the complicated nature of the geometric setup, no comparisons between these histograms and theoretical PDF's have been attempted in these directions.

6.3.2 Case 2

Figure 18 depicts Case 2 velocity PDF histograms. The X direction plot (Fig. 18a), generally appears similar to that for Case 1. However, the origin detail displayed in Fig. 18b shows that some portion of the flux has $V_x < 0$. Figs. 18c and 18d show that although O behaves as in Case 1, other species PDF's tend to be narrower and more peaked than in the previous case. This may be because overall viewfactors for HALOE are lower than Case 1, and impinging molecules come from a smaller, more select group of surfaces.

6.3.3 Case 3

In Case 3, there is no contribution from directly-impinging, freestream O atoms, so the distinct, bellshaped Maxwellian mode associated with that species for Figs. 17a and 18a is not present in Fig. 19a. Although the mass flux associated with O still dominates the HALOE aperture environment, it is nearly two orders of magnitude lower than for the first two cases. The contribution from GMW = 150 molecules come entirely from the aperture itself, where emitted molecules reflect off the SP back towards HALOE. In Figs. 19b and 19c, most of the O flux has $V_y < 0$ and $V_z > 0$, indicating that it is constituted mostly from simulated atoms scattered downward and toward UARS from the SP, since that is the only assembly occupying -Z space relative to HALOE.

6.4 MASS FLUX RATES

Individual species mass flux rates impinging on the HALOE aperture are presented in Table 12. Accuracy of these results rests heavily on the reliability of values for surface outgassing flux rates at the bakeout temperature, the use of Eq. (4) to adjust those rates for surface temperature, and the relative orientation and proximity of HALOE to the contributing surfaces. The rate for O has been subdivided into those atoms coming directly from the freestream and those having suffered prior surface collisions. Since a substantial portion of impinging Ne is attributed to return flux, while the rest reaches HALOE through surface collisions alone, two entries have been listed for Ne as well. Notice that fluxes from the outgassing species are orders of magnitude less than the others. Without using SWF's, much longer run times would be required to achieve a reasonable sample sizes—possibly by a factor of many thousand.

Tables 13a-13c relate the relative contributions of different surfaces to the mass flux rates presented in Table 12. The SP is the chief progenitor of the HALOE contamination environment for all three cases. This is because it apparently attains the highest temperatures of any surface expected on the satellite for $\beta = 0^{\circ}$ (see Table 7), it is large, and it is located relatively near the HALOE aperture. The -Z side of the IM (second largest contributor), also represents a large outgassing surface near HALOE, but its contributions are diminished because its outgassing rates are lower than those of the SP, and its surface normal does not oppose the HALOE aperture.

Flux rates for Case 2 are significantly less than Case 1 due to reduced viewfactors of the main contributing outgassing surfaces. Included in Tables 13a-13c are viewfactors ([solid angle Ω] = steradians out of 2π) of the SP and the -Z side of the IM experienced by the HALOE aperture. Ironically, Case 3 demonstrates that while a stowed HALOE instrument is exposed to very little direct flux from the bulk of UARS, it is sometimes prone to relatively high viewfactors of the continuously-rotating SP, periodically enhancing the pernicious contamination environment surrounding HALOE.

Also enhancing this environment is a contribution from the Chemglaze-painted surfaces within its interior, whose effluents are allowed to escape out through the aperture. Some of these molecules strike other surfaces and return to the HALOE aperture, and are counted along with the other contaminants.

6.5 CUMULATIVE DEPOSIT LEVELS

Eqs. (2) and (3) may be used to estimate an upper-bound cumulative total level of deposits at the HALOE aperture. Assuming that only volatile, organic molecules accumulate (with a sticking coefficient of unity), and each occupies the space of a cube of length l, where l equals the particular species diameter listed in Table 10, a deposit depth of ≈ 3550 Å is estimated. If standard contamination procedures are followed, and l = 10Å is assumed regardless of species diameter,³ that estimate increases to $\approx 13,350$ Å. If the contribution HALOE receives while stowed is disregarded (sticking coefficient of zero), these estimates fall to ≈ 650 Å and ≈ 2650 Å, respectively.

Tables 14 and 15 show the species-level contributions from each run to the final, averaged estimates quoted above. It is interesting to observe how GMW factors into the second estimate described, which is a standard procedure in the contamination community.³ A greater number of lighter GMW species molecules are required for a mass flux equal to that of a heavier GMW species. Since the deposit depth of contaminant molecules only depends on the number that accumulate, it becomes important to accurately assess the GMW's of the accumulated molecules. Also, the true sticking coefficient is not known, and can be much less than unity under certain conditions (small gas/surface temperature differences, absence of direct sunlight, etc.).¹⁵ Finally, the effects of scrubbing from the high monatomic oxygen flux on reducing the level of accumulants is not clear.

The effect of this predicted cumulative buildup on instrument performance is not clear. At this time, UARS has been in orbit for over two years, and the instrument has shown negligible loss in performance.

HALOE instrument managers have provided figures quantifying performance degradation in terms of signal strength attenuation for different species concentration measurements over the first year of operation. Signal voltages obtained over the first two months of operation were used to compute a standard expected signal voltage strength per channel, with instrument temperature corrections. Subsequent voltage strengths were measured and compared to the standard. Figures 20a and 20b show signal loss correlations for HF and HClchannel measurements, respectively. For initial standard voltages of ≈ 3.3 volts and ≈ 3.45 volts, after one year's operation, HF and HCl signal strengths have apparently been attenuated by 0.02 volts and 0.004 volts, respectively. This level of voltage attenuation is indicative of measurements made for the other channels used by HALOE as well. This may suggest that the concentrations of contaminants in the vicinity of the HALOE instrument have been overestimated in this as well as in previous studies, or that the effects of contamination from the types of outgassing materials carried on board UARS are relatively benign. Perhaps better understanding of volatile *GMW*'s, outgassing rates, temperature dependence on outgassing rates, gas/surface sticking coefficients, the cleansing effects of atomic oxygen, and light attenuation and scattering due to outgassing contaminants will come from the current examination of samples carried aboard the Long Duration Exposure Facility (LDEF).²³

6.6 COMPARISON WITH PREVIOUS ANALYSES

It is difficult to make detailed comparisons with the results described in Ref. 3 for a number of reasons. First, in Ref. 3, the orientations of the SP and HALOE were decoupled. The SP cellside surface was pointed downward at HALOE, minimizing the distance between the two objects. Meanwhile, HALOE was allowed to assume various orientations associated with data collection periods as well as possible stow positions. In reality, HALOE would be stowed pointing away from the SP when its cell side faces downward. Second, the earlier contamination analyses³ assumed a constant solar array surface temperature of 100 °C. This investigation benefitted from on-orbit data measured directly on the SP which indicate that $\beta = 0^{\circ}$ surface temperatures are cyclic with each orbit over a range of -60 °C to 30 °C. For the 30 °C value used in this study, Eq. (4) predicts that the SP would outgas only 9 percent of the value expected at 100 °C. Third, the earlier analyses assumed only one outgassing species (GMW = 100) to relate cumulative depth to mass fluxes. Obscuring detailed comparisons further, the earlier analyses could not take into account the fact that after the Goddard bakeout test, MLI blankets covering the instrument module surface on the -Z side had themselves been covered with panels of S/13G/LO-V10 (which outgasses at mass flux rates one to two orders of magnitude higher than MLI—see Table 10). This had the impact of increasing assumed flux levels from those surfaces to HALOE. Finally, the geometry used in Ref. 3 was somewhat less detailed than in the present study. Taking these differences into consideration, it seems that the results of this investigation tend to confirm those contained within Ref. 3 nevertheless.

6.7 CODE PERFORMANCE

The DSMC code is run simultaneously on two Sun SPARC 2 workstations with 64MBytes memory (RAM) each. Statistics concerning memory requirements, number of particles, weighting factor *FNUM*, timestep Δt , and overall computational volumes for the cases studied are listed in Table 16.

Regarding values for CPU time spent processing each region, it should be noted that *FNUM* and Δt could have been adjusted to create better load balancing between the inner and outer domain processors. This was not a major goal of the study, however.

Computational performance for simulations using particle methods is often measured in terms of average CPU time taken to process the state of an average particle per timestep. Using this metric, levels of approximately 29 μ sec/particle/timestep and 44 μ sec/particle/timestep have been obtained in the outer and inner domains, respectively, with the difference chiefly due to handling outgassing surfaces in the latter. This is a fairly exotic application for DSMC however, and it may be difficult to compare this performance estimate to other results in a straightforward, detailed manner.

7.0 CONCLUDING REMARKS

This report describes the development and application of a DSMC code to study contamination problems on satellites and estimate the effect of outgassing on sensitive instruments. Discussion is included on the development of a number of specially-developed preprocessor routines to incorporate detailed information regarding geometry, outgassing rates and temperature data, different types of outgassing sources, and the use of species weighting factors to enhance the statistical representation of important trace species. In estimating the amount of volatile organic molecular deposits collected at the HALOE aperture, special attention has been given to accurately account for outgassing species characteristics, surface temperatures, and geometric orientation of UARS subassemblies deemed critical to this endeavor. Using the best information available, and neglecting the scouring effects of monatomic oxygen, an upper bound on the cumulative contaminant deposition level at the HALOE aperture has been estimated at 13,350Å. If there is negligible tendency for volatile species to accumulate while HALOE is stored, this value falls to 2650Å. Notwithstanding consideration of important differences in geometric orientation, outgassing species weights and flux rates, and other specific influential input data, it appears that these results tend to confirm the earlier work described in Ref. 3. Although the model for outgassing contained in DSMC has often been compared to other methods,^{9,10,24} it could be instructive to make direct comparisons between results obtained using the DSMC method described in this report for a simple geometry over different ambient conditions with results from industry-standard codes and experimental data when they become available. Also, this study would benefit from better characterization of outgassing materials in terms of average molecular weights, mass flux rates, temperature dependence on mass flux rates, etc.

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Table 1: Library of Geometric Primitives (5 pgs.)
Geometry Definition for X Program: Cylinders

Name	Definition	Variables	Shape
CylinderA	straight cylinder	point A point B radius	V
CylinderB	straight cylinder	point A radius dir. cosine length	A lengt
CylinderC	skewed cylinder	point A point B radius dir. cosine A dir. cosine B	×.

< 14

,m

B

length



Ę	Shape	A C	C		
	Variables	point A point B point C	point A point B point C point D	Disk	centerpoint dir. cosine radius R
	Dennition	triangular plate	four-sided plate (note order of successive pts.)		circular disk
N	Name	PlateA	PlateB		Disk

Geometry Definition for X Program: Rings

Shape	H H	H PO
Variables	centerpoint inner radius r outer radius R dir. cosine	centerpoint radius R dir. cosine half height H / 2 half width W / 2
Definition	concentric circular ring	circular ring with centered rectangular hole
Name	RingA	RingB



Geometry Definition for X Program:

Data	Description
27 347 0.0254 100. 100. 1. -20. -80. 327. -100. 110. -515. 90. 100. 1. -20. 1000. 300.	no. of data planes, quadrics scale origin of axis parallelpiped around body center of gravity reference area and length
'Main block top plate ABCD1' 1	Quadric 1 component to which this quadric belongs
PlateB13. 48.1 -42.5218. 48.1 -42.53. 48.1 2.1218. 48.1 2.1100. $50.$ -20.0.0.0.0.	flow is outward, inward, or on both sides pointA pointB pointC pointD exterior point displacement of limit planes (in pixels)
 'CLAES small cylinder' 3 CylinderA 64.5 2.7 30.6 97.1 2.7 30.6 20.0 0. 0. 0. 6530. 30. 0. 60. 	Quadric 15 component to which this quadric belongs flow is outward, inward, or on both sides pointA pointB radius displacement of limit planes (in pixels) F3I limits
'CLAES Ring' 3 BingA	Plane 1 component to which this quadric belongs
64.5 2.7 30.6 1. 0. 0. 20.0 25.9	pointA direction cosine perpendicular to plane radius A radius B
'CLAES small cap' 3 SphereE	Quadric 16 component to which this quadric belongs
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	flow is outward, inward, or on both sides pointA direction cosine perpendicular to plane radius displacement of limit plane (in pixels)
64. 11820. 25. 0. 55.	F31 limits

Table 2: Geometry Input Data Spreadsheet

Table 3: Input Data Listing-Geometric Model (29 pgs.)

30 355 0 255	Number of data plant	es, quadrice	218.0 -30.2 2.1	pointD: actual point G0
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1		flow on ext., int. or both	-332.2 -43.0	points: actual point Bl pointC: actual point Di
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.91 48.	1 2.1	points: actual point BU bointC: actual point DO		Exterior point
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	•	(STRYIN UIT) . (STRAID)	2 D] - t - D	Component no.
'Main block	side Zmax DCHG0'	Quadric 2	riaceb 1	flow on ext int or both
1		Component no.	3. 32.2 -43.0	pointA: actual point El
PlateB			3. 32.2 28.7	pointB: actual point F1
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			¢ PlateB	component no.
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L Plater		Component no.	-332.2 -43.0	pointA: actual point D1
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218.0 48.	1 -42.5	pointB: actual point B0	05020.	Exterior point built di
330. 218.0 -30	2 -42.5	pointC: actual point E0	0. 0. 0. 0.	limit plane disp. (in pixels)
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			PlateB	component no.
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	2.1	pointC: actual point E00 pointD: actual point E00	0. 0. 0. 0.	limit plane disp. (in pixels)
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		- 20.	-20.	60.		Exterior point
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7				flow on ext., int. or both		0.0	-43.5 C		pointB: actual point P3
-58.3	-40.3	-21.0		pointA: actual point Q3		2.01-	- 21 0		cointC: actual point B3
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-58.3	39.8	23.6		PULICAT ACTUAL POINT GJ DOINTR: ACTUAL DOINT TI	0.0	。 。			limit plane disp. (in pixels)
-58.3	14.5	-23.6		pointC: actual point M3	- n.us-	2- 0-0	- 0-52 0.4	25.0 25.0	F3I limits
-58.3	39.8	-23.6		pointD: actual point K3	'Batterv	win 2MM	ne horrom'	£	
-100.	0.0	0.0		Exterior point	5			1,	Idne / Component no
	.0	.0	0	limit plane disp. (in pixels)	Disk				
'Batterv	Dackade	s side MOAC	13 lower Y'	Citada 20	-79.4		0.	<u>а</u> ,	ointA
4				Component no.	-1.	.0	0.	יטי	irection cosine normal to disk
PlateB								Li I	adlus
-58.3	14.5	-23 K		flow on ext., int. or both	HALOE mo	unt ABC	4 '	Ō	uadric 35
-58.3	0.0	-43.5		POLINEA: ACTUAL POINT MJ PolintB. actual moint ol					Component no.
-58.3	-28.0	.0		pointC: actual point A3	PlaceA			i	
-58.3	-40.3	-21.0		pointD: actual point Q3	171.4	30.8	-42.5	μî	low on ext., int. or both
-100.	0. 0 0	0.0		Exterior point	171.4 -	30.2	-42.5	Ϊ	ointB: actual point R4 ointB: actual point R4
	;			umut prane disp. (in pixels)	136.3 -	23.6	-66.9	, <u>ŏ</u> ,	ointC: actual point C4
'Battery	package	i side BDHF	3 higher X	. Quadric 30	150.	0	-80.0	ធ	xterior point
4				Component no.				ļ	umut plane disp. (in pixels)
PlateB 1					'HALOE mo	unt ACD4		õ	uadric 36
- 	-28.0	0.		LIOW ON EXT., INT. OF DOTA Thointa. artinal moint R3	9			1	Component no.
	-39.2	21.5		points actual point D3 Doint8: actual point D3	PlateA				
	14.6	23.6		pointC: actual point H3	250.0	α α	0 00	= 2	low on ext., int. or both
 	2.7	44.6		pointD: actual point F3	251.0	.0.0	81.0	12	olintA: actual point A4 MintB: articl woint A4
0			Ċ	Exterior point	252.0	0.8	80.0	ίŭ	pintC: actual point D4
	e e	,	5	STAVID III . JOID DIBID JUNT	251. 0.	, 1.0	81.0	â	tterior point
'Battery A	package	side HJNL	3 higher X	/ Quadric 31	5			-	umit plane disp. (in pixels)
PlateB				component no.	'HALOE moi	unt CDE4		ð	ladric 37
1				flow on ext., int. or both	PlateA				Component no.

		, ,		•
	39.8	23.6		pointA: actual point H3
	14.5	-23.6		points actual point J3 noints actual noint N3
	39.8	-23.6		pointD: actual point L3
	0.0	0.0		Exterior point
		0.	0.	limit plane disp. (in pixels)
tte]	ry pack	age side	NPBR3 higher	X' Quadric 32
teB				Component no.
	7 4 5	3 5 6 -		flow on ext., int. or both
	0.0	-43.5		pointA: actual point NJ pointB: actual point P3
	-28.0	0		pointC: actual point B3
	-40.3	-21.0		pointD: actual point R3
			0.	limit plane disp. (in pixels)
ter	y packa	age side	AGM3 lower X'	Quadric 33
e				Component no.
				flow on ext. int. or both
m, i	-28.0	0		pointA: actual point A3
m n	14.6	23.6		pointB: actual point G3
۰_		0.62-		pointC: actual point M3
			0.	Exterior point limit plane disp. (in nivels)
Le l	y cyllr	Idrical M	MS .	Quadric 34 Composent no
nde	rB			
	c	c		flow on ext., int. or both
n 0				pointA radius
	0	0.		dircos
				Rlength
-		- 2 D D -		limit plane disp. (in pixels)
5	.	7 0.02-	17 N'67- N'6	o.U F3I limits
ter	y MMS F	lane boti	tom'	Plane 2 Component no.
4	.0	.0		
				point. direction cosine normal to dick
0				radius
ΘE	mount A	BC4'		Quadric 35
ey				Component no.
				flow on ext., int. or both
4 4	30.8	-42.5		pointA: actual point A4
• m	-23.6	-66.99-		pointB: actual point B4
	0.0	-80.0		Exterior boint
	0.	.0	0.	limit plane disp. (in pixels)

flow on ext., int. or both pointA: actual point C4 pointB: actual point D4 pointC: actual point E4 Exterior point limit plane disp. (in pixels)	Quadric 38 Component no. flow on ext int. or both	pointA: actual point B4 pointB: actual point B4 pointC: actual point C4 Exterior point limit plane disp. (in pixels)	Quadric 39 Component no.	flow on ext., int. or both pointA: actual point A5 pointB: actual point B5 pointC: actual point C5 pointD: actual point D5 Exterior point limit plane disp. (in pixels)	Quadric 40 Component no.	flow on ext., int. or both pointA: actual point B5 pointB: actual point F5 pointC: actual point D5 pointD: actual point H5 Exterior point limit plane disp. (in pixels)	Quadric 41 Component no.	flow on ext., int. or both pointA: actual point F5 pointB: actual point E5 pointC: actual point H5 pointD: actual point G5 Exterior point limit plane disp. (in pixels)	Quadric 42 Component no.	flow on ext., int. or both pointA: actual point E5 pointB: actual point A5 pointC: actual point G5 pointD: actual point G5 Exterior point limit plane disp. (in pixels)	Quadric 43 Component no.	flow on ext., int. or both pointA: actual point J5 pointB: actual point L5 pointC: actual point I5 pointD: actual point K5
.0				°.		o		.0		.0		
-66.9 -42.5 -42.5 -80.0 0.	Έ4΄	-42.5 -66.9 -42.5 -50.0		-17.6 -17.6 -15.9 -15.9 -10.		-17.6 11.4 -15.9 -2.1 -30.		4.12.11 4.12.11 0.11.00		1.4 -17.6 -2.1 -15.9 -10.		-15.9 -2.1 -15.9 -2.1
-23.6 30.8 -30.2 0.0	mount BC	-30.2 -23.6 -30.2 -40.0	BCD5'	-38.7 -38.7 -73.2 -73.2 -60. 0.	FDH5'	-38.7 -38.7 -73.2 -73.2 -60.	'EHG5'	-38.7 -38.7 -73.2 -73.2 -73.2 -60.	AGCS '	-38.7 -38.7 -73.2 -73.2 -73.2 -60.	LIK5'	-83.5 -83.5 -83.5 -83.5
0 136.3 101.2 101.2 150. 0.	'HALOE 6 PlateA 0	171.4 136.3 101.2 150.	'NEPS A	PlateB 1 83.7 59.4 79.6 63.7 70.	'NEPS B	PlateB 1 59.4 59.4 63.7 63.7 50.	'NEPS F	Plates 1 59.4 83.7 63.7 79.6 70.	'NEPS E 7 Plater	1 83.7 83.7 79.6 79.6 100.	'NEPS J	FLALED 1 79.6 79.6 63.7 63.7

Exterior point limit plane disp. (in pixels)	Quadric 44 Component no.	flow on ext., int. or both pointA: actual point A6 pointB: actual point B6 pointC: actual point C6 pointC: actual point D6 Exterior point limit plane disp. (in pixels)	Quadric 45 Component no. flow on ext., int. or both pointB: actual point C6 pointC: actual point G6 pointD: actual point 46 Exterior point limit plane disp. (in pixels)	Quadric 46 Component no. flow on ext., int. or both pointB: actual point H6 pointC: actual point B6 pointC: actual point B6 pointD: actual point F6 Exterior point limit plane disp. (in pixels)	Quadric 47 Component no. flow on ext., int. or both pointB: actual point E6 pointC: actual point G6 pointD: actual point G6 pointD: actual point C6 Exterior point limit plane disp. (in pixels)	Quadric 48 Component no. flow on ext., int. or both pointA: actual point A7 pointE: actual point C7 pointC: actual point G7 pointD: actual point G7 Exterior point limit plane disp. (in pixels)	Quadric 49 Component no. flow on ext., int. or both pointA: actual point E7 pointB: actual point F7 pointC: actual point G7 pointD: actual point H7 Exterior point
0.	Jock ABCD6'	.0	Jock CDGH6'	lock DHBF6'	lock EAGC6'	AECG7'	ЕРGH7. 0.
-10. 0.	main b	-25.5 -42.5 -25.5 -42.5 -42.5 -20.	main t - 2.1 - 42.5 - 22.1 - 22.5 - 20.	main H -42.5 -42.5 -42.5 -50. -50.	main t 2.1 2.1 2.1 2.1 2.1 2.1 10. 0.	block 2.1 2.1 2.1 2.1 2.1 10.	block 2.1 -42.5 2.1 -42.5 -42.5 -20.
-90. 0.	ox under	- 30.2 - 30.2 - 38.7 - 38.7 - 35. - 35.	ox under -38.7 -38.7 -38.7 -38.7 -50.	ox under -38.7 -38.7 -30.2 -30.2 -30.2 -35. 0.	ox under -30.2 -30.2 -38.7 -38.7 -35.	der main -30.2 -30.2 -51.0 -51.0 -35.	der main -30.2 -30.2 -51.0 -51.0 -35. 0.
100. 0.	Thin b 8 9 12+cla	1 49.3 49.3 49.3 49.3 0. 0.	'Thin b 8 8 1 49.3 49.3 49.3 176.3 176.3 176.3 176.3	<pre>'Thin b 8 8 1 49.3 176.3 176.3 0. 0.</pre>	'Thin b 8 PlateB 1 176.3 49.3 49.3 176.3 0.	<pre>'Box un 9 1176.3 176.3 218.0 218.0 218.0 200.</pre>	'Box un PlateB 1 218.0 218.0 218.0 218.0 218.0 250.

oint H6 oint H6	p. (in pixels)	t. or both bint D6 bint H6 bint B6 bint F6	p. (in pixels)	t. or both bint E6 bint A6 bint G6 bint C6	p. (in pixels)	:. or both bint A7 bint E7 bint C7 bint G7	p. (in pixels)	:. or both bint E7 bint F7 bint G7 bint H7	o. (in pixels)

'Box under main block BFDH7'	Quadric 50	1
6	Component no.	123.3 -38.7 6.1
risted -	flow on ant fut on but	104.7 -38.7 6.1
1 1761 - 307 - 47 E	LIOW ON EXC., INC. OF DOCH	123.3 ~61.4 6.1
218.0 -30.2 -42.5	pointA: actual point 8/ nointB: actual moint 57	
176.3 -51.0 -42.5	points actual point F/ mointf. actual moint D7	11050. 10. 2
218.0 -51.0 -42.5	pointD: actual point H7	v. v. v. v.
2503550.	Exterior point	'HBD1 interformeter AETIO'
0. 0. 0. 0.	limit plane disp. (in pixels)	
'Box under main block IJCD7'	Ouadric 51	PlateB 1
6	Component no.	1 123.3 -38.7 6.1
PlateB		104.7 -38.7 6.1
1	flow on ext., int. or both	123.3 -38.7 2.3
	pointA: actual point I7	104.7 -38.7 2.3
176.3 -38.7 -42.5	pointB: actual point J7	11030. 4.
	pointC: actual point C7	0. 0. 0. 0.
C.74- 0.10- 5.0/T	pointD: actual point D7	
	Exterior point	'HRDI interferometer CDGH8'
	TTWITC DIGINE (III DIXETS)	
'Box under main block CGDH7'	Quadric 52	riaced 1
6	Component no.	123-3 -61-4 6.1
PlateB		123.3 -61.4 -40.4
1	flow on ext., int. or both	104.7 -61.4 6.1
176.3 -51.0 2.1	pointC: actual point C7	104.7 -61.4 -40.4
	pointG: actual point G7	1107020.
1/6.3 -51.0 -42.5	pointD: actual point D7	0. 0. 0. 0.
218.U - 12. U - 42.5	pointH: actual point H7	
	Exterior point	'cylindrical truss #1 at X =
	(STAXId III) . dein aust aumrt	11 Critedory
'HRDI interferometer ABCD8'	Quadric 53	L I
10	Component no.	032.2 0.
rlaceb 1	flow on out int on both	094.0 0.
123.3 -38.7 6.1	bointà: actual point àR	1.5
123.3 -38.7 -40.4	pointB: actual point B8	-2.0 2.0 -100.0 -30.0
123.3 -61.4 6.1	pointC: actual point C8	
123.3 -61.4 -40.4	pointD: actual point D8	'cylindrical truss #2 at X =
	Exterior point Itmit misma dian (in mismic)	
	TTWITE DISTING CIBD. (III DIXETS)	CylinderA 1
'HRDI interferometer BFDH8'	Quadric 54	L 30,9 -40,2
10	Component no.	094.0 0.
PlateB		1.5
ד 1,000 - 1,000 ב 1,000 - 1,000 ב	IIOW ON EXT., INT. OF BOTH	0.0.
104.7 -38.7 -40.4	pointB: actual point PS bointB: actual moint FS	
123.3 -61.4 -40.4	pointC: actual point D8	'cvlindrical trugs #3 at X -
	pointD: actual point H8	11
1105050. 0 0 0 0	Exterior point	CylinderA
v. v. v. v.	Limit plane disp. (in pixels)	1
'HRDI interferometer HGFE8'	Quadric 55	0. 043.0 0. 094.0
10	Component no.	1.5
PlateB 1	flow on ext that or both	0. 0. 2.6 2.6 2.6 2.5
104.7 -61.4 -40.4	pointA: actual point H8	1- 0.7 0.7- 0.7 0.7-
104.7 -61.4 6.1	pointB: actual point G8	'cylindrical truss #4 at X =
104.7 -38.7 -40.4	pointC: actual point F8	11
104.7 -38.7 6.1 100 -50 -20	pointD: actual point E8	cylinderA
0. 0. 0. 0. 0.	Exterior point limit plane disp. (in pixels)	1 0. 29.4 -41.7
'HRDI interferometer AECG8' 10	Quadric 56 Comment no	1.5
PlateB		0. 0. -2.0 2.0 -10.0 40 0 -

flow on ext., int. or both pointA: actual point A8 pointB: actual point E8 pointC: actual point C8 pointD: actual point G8 Exterior point limit plane disp. (in pixels)	Quadric 57 Component no. flow on ext., int. or both pointA: actual point A8 pointC: actual point J8	pointD: actual point I8 Exterior point limit plane disp. (in pixels) Quadric 58 Component no.	flow on ext., int. or both pointA: actual point C9 pointB: actual point D9 pointC: actual point G8 pointC: actual point H8 Exterior point limit plane disp. (in pixels)	Quadric 59 Component no.	flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) 2.0 F3I limits	Quadric 60 Component no.	flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) 2.0 F3I limits	Quadric 61 Component no.	flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) -30.0 F31 limits	Quadric 62 Component no.	flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) -30.0 F31 limits
.0	18,	. , 8H	.0	X = 0.'	30.0 -2.0	X = 0.'	30.0 -45.0	X = 0.'	-100.0	X = 0.'	0 -100.0
6.1 6.1 10.1 0.	meter AEJ 6.1 6.1	2.3 4. 0. meter CDG	-46.1 40.4 46.1 -46.1 -20.4	uss #1 at	· · · · · · · · · · · · · · · · · · ·	uss 62 at	-40.2 0.0	uss #3 at	-43.0 -94.0 -0 2.0	uss #4 at	-41.7 -94.0 .0 40.
-38.7 -38.7 -61.4 -61.4 -50.	interferc -38.7 -38.7 -38.7	-38.7 -30. 0. interferc	-61.4 -61.4 -61.4 -61.4 -70.	drical tr	-32.2 -32.2 -94.0 0. 2.0 -1	årical tr rå	-30.9 -30.9 -94.0 2.0 -1	lrical tr rA	0. 0. 2.0 -2	irical tru rA	29.4 0. 0. 2.0 -10
1 123.3 104.7 123.3 124.7 110.	'HRDI 10 PlateB 1 123.3 123.3	104.7 110. 0. 'HRDI	PlateB 1 123.3 123.3 124.7 104.7 110. 0.	'cyline 11	cyina 1 0. 1.5 0. -2.0	'cylinc 11 Cvlinde	1 0. 1.5 0. -2.0	'cylind 11 Cylinde	1 0. 1.5 0. -2.0	'cylind 11 Cylinde	10. 1.5 -2.0

94	- 		256.9	19.6	18.6		pointB: actual point C10
cylliutical Liuds 7: 11	0 T T T T T	Quadric 53 Component po	225.5	-30.2	18.6		pointC: actual point E10
CylinderA			0			0	Exterior point
, , ,		flow on ext., int. or both					
0. 32.2 0.		pointA	'left/r	ight-han	d HGA-end	box ABFG10'	' Quadric 71
1.5		putte radius	12 Plater				Component no.
0.0.		limit plane disp. (in pixels)	1				flow on extint. or both
-2.0 2.0 30.0	100.0 -2.0	2.0 F3I limits	218.0	31.1	18.6		pointA: actual point A10
'cvlindrical truss #6	at X = 0 .	Quadric 64	232.5	31.1	18.6		pointB: actual point B10
11		Component no.	232.5	1.15	-42.5		pointC: actual point G11
CylinderA			220.	50.			Points accual point All Exterior point
1 0 1 0 1 0		flow on ext., int. or both	0.	0.	0.	0.	limit plane disp. (in pixels)
0. 94.0 0.		point B	1 261 / -	abb ban			
1.5		radius	12	דאוור - וומוז		DIHONE KOR	Vuadric //
0. 0.		limit plane disp. (in pixels)	PlateB				Component no.
-2.0 2.0 30.0	100.0 -50.0	10.0 F3I limits					flow on ext., int. or both
'Sphere junctn betwn	trusses 1-2(X=0	1)' Outadric 65	232.5	31.1	18.6		pointA: actual point B10
11		Component no.	2.007 2.007	17.0	0.81		pointB: actual point C10
SphereA			256.9	9.91	-42.5		pointe: actual point HII pointD: actual point 11;
1		flow on ext., int. or both	250.	75.	.0		Exterior point
094.0 0. 5.0		pointA radius	0.	.0	0.	0.	limit plane disp. (in pixels)
1		5 S # 1 S *	'left-h	and HGA-4	and box CI	4E.110'	Diladric 73
'Sphere junctn betwn	trusses 3-4(X=0)' Quadric 66	12				Component no.
11 Grhoreð		Component no.	PlateB				•
spherea			1				flow on ext., int. or both
L 0 0 01		tiow on ext., int. or both	256.9	19.6	18.6		pointA: actual point C10
	2	potito	256.9	19.6	2.1		pointB: actual point H10
			2.622	2.06-	18.6		pointC: actual point E10
'Sphere junctn betwn	trusses 5-6(X=0)' Ouadric 67	260.	7.06-	2.5		pointu: actual point J10 Evention moint
11 -		Component no.				0.	exterior point limit blane dign. (in nive)s)
SphereA					:	•	(STAVIC DIT) . date anote start
1 0 04 0 0		flow on ext., int. or both	'left/ri	ight-hanc	HGA-end	box DEIJ10'	Quadric 74
5.0		poinca radius	12				Component no.
• • •		2342	riateb				
'left-hand HGA-end bo	x AFDI10'	Quadric 68	218.0	-30.2	18.6		itow on ext., int. of both nointà: artual moint nin
12		Component no.	225.5	-30.2	18.6		pointB: actual point F10
PlateB			218.0	-30.2	-42.5		pointC: actual point J11
1		flow on ext., int. or both	225.5	-30.2	-42.5		pointD: actual point K11
218.0 31.1 18.6		pointA: actual point A10	220.	-50.	0		Exterior point
1.7 1.15 0.817 9 8 6 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5		points: actual point Flu moints: actual moint Plu	.0	.0	.0	0.	limit plane disp. (in pixels)
218.0 -30.2 2.1		pointD: actual point I10	· riaht -	and HCA-	o you pue	, 1 L A L M	Curded of 15
200. 35. 25.		Exterior point	12			TTVOU	Audulic /3
0. 0. 0.	0.	limit plane disp. (in pixels)	PlateB				
the stand of the		constant co	1				flow on ext., int. or both
12 13	X ABULLU	Quadric by Component no	218.0	31.1	-42.5		pointA: actual point G11
PlateB			218.0	2.06-	C.24-		pointB: actual point H11
1		flow on ext., int. or both	225.5	-30.2	-42.5		pointD: actual point K11
		pointA: actual point A10	220.	.0	-50.		Exterior point
0.81 I.IE 2.767 2 81 C 02 C 02C		pointB: actual point B10			.0	0.	limit plane disp. (in pixels)
225.5 -30.2 18.6		points actual point DIV bointD: actual point E10	4- 140 t - 1	-ADH brev	o and bre	. 1 .	
220. 15. 25.		Exterior point	12			1111	Quadric /6 Commont an
0. 0. 0.	0.	limit plane disp. (in pixels)	PlateA				component no.
'left-hand HGA-end ho	K RCE10'	Duradric 20	1 756 0	2 01	•		flow on ext., int. or both
12		Component no.	225.5	-30.2	2.1		pointA: actual point Cll pointB: actual moint Ell
Plat eA		61	256.9	-15.9	2.1		pointC: actual point F11
232.5 31.1 18.6		tiow on ext., int. or worn moint∆, artual boint B10	. ncz		25. 0	c	Exterior point
		DOTING: ACCOUNT PATTIC DIV				.0	limit plane disp. (in pixels)

'r laht	-hand Ho	GA-end hov	. 11 11 1	
12 PlateB			. 111111	Quadri
1 232.5	31.1	-42.5		flow o pointA
256.9	19.6	-42.5		pointB
256.9	-15.9	-42.5		pointC
250.		-75.		Exteri
		.0		limit
'right	-hand HC	3A-end box	CIFL11'	Quadrí
PlateB				EOU
1				flow o
2.96.9	10.41 10.61	1.2		pointA
256.9	-15.9	2.1		putice
256.9	-15.9	-42.5		pointD
270. 0.	35.	55. •	c	Exteri
				1 T W T T
ʻright- 12	-hand HG	A-end box	EFKL11	Quadr1
11 PlateB				E OD
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225.5	-30.2	2.1		pointA
8.0C2	4.01- 200	1.2		pointB
0.624	2.06-	-42.5		pointC
270.				pointD
	0.		.0	limit
'HGA-en	d nose	box CIMN11		
12				
PlateB				linoo
256.9	9 D L			flow or
256.9	19.6	-42.5		pointa
275.9	38.4	-11.4		pointC
275.9	38.4	-18.7		pointD
00.	20.			Exterio
			.0	limit
HGA-en	d nose l	box MNFL11		Quadric
1 ater				Comp
				flow on
275.9	38.4	-11.4		pointA:
275.9	99.90 19.90	-18.7		pointB:
256.9	-15.9	1.2		pointC
00.	- 50			Fut of o
	•		.	limit
HGA-end	i nose b	XX CMF11'		Ouadric
2 lateA				Comp
0 200				flow on
275.9	38.4	1.2 1.1.4		pointA:
256.9	-15.9	2.1		polntC:
.00	35.	50.		Exterio
			0	limit

or point plane disp. (in pixels) or point plane disp. (in pixels) plane disp. (in pixels) plane disp. (in pixels) lane disp. (in pixels) limit plane disp. (in pixels) i ext., int. or both
actual point E11
i actual point F11
i actual point K11
i actual point L11 ext., int. or both actual point C11 actual point 111 actual point M11 actual point M11 ext., int. or both n ext., int. or both actual point Cll actual point Ill actual point Fll actual point Lll ext., int. or both ext., int. or both : actual point H11
: actual point I11 : actual point K11 : actual point L11 actual point N11 actual point F11 actual point M11 pointA: actual point C11
pointB: actual point M11 actual point L11 pointC: actual point F11 Exterior point ponent no. ponent no. onent no. onent no. onent no. nent no. r point Component no r point point c 77 0 c 78 79 80 81 82 Quadric 83

. 0. 0 0 panel mount ABCD12' EFGH12' ò . . 'solar panel mount AECG12' solar panel mount BFDH12' solar panel mount ABEF12' support IJ12' -42.5 -18.7 -42.5 -75. 2.1 2.1 2.1 2.1 2.1 70. -42.5 -42.5 -42.5 -42.5 -70. -42.5 2.1 -42.5 2.1 0. -42.5 2.1 -42.5 2.1 2.1 2.1 0. · · · -42.5 -42.5 <u>.</u> -42.5 -55.5 0 . 0 . mount 19.6 38.4 -15.9 -35. 64.5 64.5 48.1 48.1 50. 0. 64.5 64.5 48.1 50.1 0. 64.5 64.5 48.1 70. 0. 64.5 48.1 70. ÷ panel 48.1 64.5 64.5 64.5 64.5 56.3 56.3 solar panel 0 0. CylinderA 1 256.9 275.9 256.9 300. 142.4 129.7 142.4 129.7 135. 0. 'solar 142.4 142.4 142.4 142.4 142.4 solar PlateB 142.4 129.7 142.4 129.7 PlateB PlateB 129.7 129.7 129.7 129.7 129.7 142.4 129.7 142.4 129.7 135. PlateB PlateB 136.1 136.1 3.5 135. . 。 . 13 . . 13 1 2 2

limit plane disp. (in pixels) pointA: actual point B12 pointB: actual point F12 pointC: actual point D12 pointD: actual point H12 Exterior point limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point 111 pointB: actual point N11 pointC: actual point L11 Exterior point limit plane disp. (in pixels) limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point E12 pointB: actual point F12 pointC: actual point G12 pointD: actual point H12 Exterior point limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point A12 pointB: actual point B12 pointC: actual point E12 pointD: actual point F12 Exterior point limit plane disp. (in pixels) pixels) both flow on ext., int. or both pointA: actual point A12 pointB: actual point B12 pointC: actual point C12 pointD: actual point D12 both flow on ext., int. or both pointA: actual point A12 pointB: actual point E12 pointC: actual point C12 pointD: actual point G12 flow on ext., int. or both flow on ext., int. or both Component no. Component no. Component no. Component no. Component no. Exterior point Component no. Exterior point Quadric 84 Quadric 85 Quadric 86 Quadric 87 Quadric 88 Quadric 89

pointA pointB radius

HGA-end nose box INL11'

PlateA

2

limit plane dísp. (in pixels) F3I limits	Quadric 90 Component no. flow on ext., int. or both pointa dircos radius limit plane disp. (in pixels) F31 limits	Quadric 91 Component no. flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) F3I limits	Quadric 92 Component no. flow on ext., int. or both pointa pointa radius limit plane disp. (in pixels) F3I limits	Quadric 93 Component no. flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) F3I limits	Quadric 94 Component no. flow on ext., int. or both pointA: actual point N12 pointB: actual point 012 pointB: actual point 012 pointB: actual point Q12 pointB: actual point Q12 Exterior point limit plane disp. (in pixels)	Quadric 95 component no. flow on ext., int. or both pointa pointa radius limit plane disp. (in pixels) F3I limits	Quadric 96 Component no. flow on ext., int. or both
0. 0. 100. 150. 40. 8070. 0.	'solar panel support J12' 13 SphereE 1 136.1 56.3 -55.5 13.5 0. 3.5 0. 100. 150. 0. 70.0 -100. 0.	<pre>'solar panel support JK12' 13 CylinderA 1 136.1 56.3 -55.5 136.1 105.79 -70.63 2.4 0. 80. 185. 0. 11010050.</pre>	<pre>'solar panel support JL12' 13 CylinderA 1 136.1 56.3 -55.5 106.28 105.79 -70.63 1.4 0. 70. 2005. 12010050.</pre>	'golar panel support JM12' 13 CylinderA 1 136.1 56.3 -55.5 1165.92 105.79 -70.63 1.4 0. 70. 2005. 12010050.	<pre>'solar panel, NOPQ12' 13 PlateB 0 200.5 105.79 -70.63 71.7 -105.79 -70.63 71.7 -34.55 -529.66 71.7 -34.55 -529.66 150. 100150. 0. 0.</pre>	'solar panel support RS12' 13 CylinderA 1 106.28 105.79 -70.63 106.28 105.79 -70.63 2.4 0. 2.4 0. 70. 2005. 12010050.	'sclar panel support R12' 13 SphereE 1 106.28 105.79 -70.63

dircos radius limit plane disp. (in pixels) . 0. FJI limits	Quadric 97 Component no.	<pre>flow on ext., int. or both pointA dircos radius limit plane disp. (in plxels) . 0. F31 limits</pre>	Quadric 98 Component no. flow on ext., int. or both	pointA pointB radius limit plane disp. (in pixels) 20. F31 limits	Quadric 99 Component no.	flow on ext., int. or both pointA radiusA radiusB Rlength	dircos limit plane disp. (in pixels) . 20. FJI limits	3' Quadric 100 Component no.	flow on ext., int. or both pointA: actual point F13 pointB: actual point G13 pointC: actual point J13 pointD: actual point X13 Exterior point . limit plane disp. (in pixels)	3' Quadric 101 Component no.	flow on ext., int. or both pointA: actual point H13 pointB: actual point L13 pointC: actual point L13 pointD: actual point M13 Exterior point limit plane disp. (in pixels))' Quadric 102 Component no.	flow on ext., int. or both
		-100.	,B13 '	-20.	(C13		-20.	, ETXCD		, EIMJI	0.	, EIIHD	
120.	port S1	-70.63 0. 120.	mount A	-7.2 -7.2 0.	mount B	-7.2	. 0.	mount F	0.7 0.7 -15.1 -15.1 0.	nount H	0.7 0.7 15.1 15.1 0.	Nount F	0.7 0.7 7.0 7.0
2005.	· panel sup E	2 105.79 0. 2005.	telescope : erA	-38.7 -42.7 0. 15080.	telescope I	-54.6	1. -0.5 15080.	telescope 1		telescope n	- 555.6 - 555.6 - 555.6 - 70. - 70.	telescope n	
2.4 0.	solar 3 phere	165.9 1. 2.4 0.	HRDI 4 Ylind	136.3 136.3 8. 0.	HRDI 4	1 136.3 4.2 8. 11.9	 	HRDI 4 A	132.1 140.5 140.5 132.1 140.5 35.	HRDI J	132.1 140.5 132.1 140.5 15.	IRDI (ateB	32.1 40.5 40.5

1 0 1 H 7 8 -- 00

'HRDI telescop 14	e mount	, E TMTI Y ,	Quadric Comp
PlateB 1 13.5.54.6 140.5.554.6 132.1.555.6 140.5.555.6 135.555.6	-15.1 -15.1 -15.1 -15.1 -20.		flow or pointB, pointB, pointC, pointD, Exteric limit
'HRDI telescop 14 20	e mount	CINNI3	Quadric Comp
PlateB 1 140.5 -54.6 140.5 -55.6 140.5 -55.6 140.5 -55.6 15055.	0.7 -15.1 -15.1 -15.1 -20.	.0	flow on pointB: pointB: pointC: pointD: Exteric limit
'HRDI telescop 14 blitth	e mount	FHJL13'	Quadric Comp
132.1 -54.6 132.1 -54.6 132.1 -55.6 132.1 -54.6 132.1 -55.6 10055.	0.7 0.7 -15.1 -15.1 -20.	o	flow on pointA: pointB: pointC: pointD: Exterio limit
'HRDI telescop 14	emount	HIRS13'	Quadric Comp
Plated 1 132.1 -55.6 140.5 -55.6 133.8 -71.3 138.8 -71.3 13570. 0. 0.	0.7 0.7 0.7 0.7 0.7	ò	flow on pointa: pointB: pointC: pointD: Exterio limit
'HRDI telescop 14 Diston	e mount 1	, E TINTON	Quadric Comp
132.1 -55.6 132.1 -55.6 140.5 -55.6 133.8 -71.3 135.8 -71.3 13570 0. 0.	-1.3 -1.3 -1.3 -1.3 -10.0	ċ	flew on pointa: points: pointc: pointb: Exterio: limit
'HRDI telescope 14 Platen	a mount]	, E INSOJ	Quadríc Comp
140.5 -55.6 140.5 -55.6 140.5 -55.6 138.8 -71.3 138.8 -71.3 15070.	-1.3 -1.3 0.7 0.	.0	flow on pointA: pointB: pointC: pointD: Exterioi limit [
'HRDI telescope 14	e mount H	INRT13	Quadríc Compo

plane disp. (in pixels) yr point plane disp. (in pixels) plane disp. (in pixels) br point plane disp. (in pixels) plane disp. (in pixels) plane disp. (in pixels) ext., int. or both actual point N13 actual point 013 actual point T13 actual point U13 ext., int. or both actual point I13 actual point 013 ext., int. or both ext., int. or both ext., int. or both ext., int. or both actual point J13 actual point K13 actual point L13 actual point M13 actual point G13 actual point I13 actual point K13 actual point M13 actual point F13 actual point H13 actual point J13 actual point L13 actual point I13 actual point H13 actual point R13 actual point S13 actual point S13 actual point U13 : 105 bonent no. ponent no. onent no. onent no. onent no. ment no. or point r point point point c 103 : 104 106 107 108 Quadric 109

Component no.

Component no. Quadric 114 Plane 3 Plane 4 point B radius pointA radius pointA radius pointA 20. RSTU13 HRDI telescope mount PQVW13' с. -20. mount LMXY13' . 'HRDI telescope mount QMWY13' . . <u>.</u> HRDI telescope mount knob' 'HRDI telescope mount knob' 'HRDI telescope mount knob' -1.3 -1.3 -1.3 0.7 . -13.1 -13.1 -13.1 -13.1 -15.1 -15.1 -15.1 -15.1 mount -1.3 0.7 -1.3 -1.3 -1.3 3.7 1. -50. 100. 150. -80. 'HRDI telescope HRDI telescope -55.6 -55.6 -71.3 -71.3 -70. 136.3 -71.3 136.3 -71.3 3.5 -71.3 -71.3 -71.3 -71.3 0. **136.3 -71.3** 0. 0. -55.6 -55.6 -55.6 -55.6 -71.3 -71.3 -71.3 -71.3 -90. . . . -70. <u>.</u> . 0 -70. CylinderA 133.8 138.8 138.8 133.8 138.8 135. 0. 132.1 132.1 133.8 133.8 132.1 140.5 133.8 138.8 132.1 140.5 133.8 138.8 138.8 PlateB PlateB 136.3 PlateB PlateB PlateB 100. Disk 3.5 3.5 135. Disk 14 . 14 14

direction cosine normal to disk direction cosine normal to disk limit plane disp. (in pixels) limit plane disp. (in pixels) limit plane disp. (in pixels) F3I limits limit plane disp. (in pixels) limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point H13 pointB: actual point N13 pointC: actual point R13 pointD: actual point T13 Exterior point flow on ext., int. or both pointA: actual point R13 pointB: actual point S13 pointC: actual point V13 pointD: actual point V13 flow on ext., int. or both pointA: actual point P13 pointB: actual point Q13 pointC: actual point V13 pointD: actual point V13 flow on ext., int. or both pointA: actual point L13 pointB: actual point M13 pointC: actual point X13 pointD: actual point Y13 flow on ext., int. or both Component no. Component no. 20.02 Component no. Component no. Component no. Exterior point Exterior point Exterior point Component Quadric 110 Quadric 111 Quadric 112 Quadric 113

7		flow on ext., int. or both	4.0	radius
140.5 -55.6	-13.1	pointA: actual point Q13		
140.55- 2.041 5 5 5 5 5 5 5	1.61-	pointB: actual point M13	'HRDI telescope E13'	Plane 8
138 8 - 71 3	-15.1	pumbers actual point Wis mointly actual moint Viz	14 Dick	Component no.
17070.	-10.	Exterior point	127.9 -787 -7 2	
0.0.	0. 0.	limit plane disp. (in pixels)		punt a dircos
'HRDI telescone	mount PLVX13'	Quadric 115	4.0	radius
14		Component no.	'HRDI telescope box abcd13'	Quadric 119
Plates		61 are are 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	14	Component no.
1 132.1 -55.6	-13.1	rlow on ext., int. or potn pointA: actual point P13	PlateB 1	flow on set int or both
132.1 -55.6	-15.1	pointB: actual point L13	133.0 -74 3 -11 2	riow ON EAC., Inc. Of DOCH rointà. artimal roint all
133.8 -71.3	1.11.	pointC: actual point V13	133.0 -74.3 -3.2	pointB. actual point bl3
133.8 -71.3	-15.1	pointD: actual point X13	137.6 -79.6 -11.2	points actual point of
10070.	-10.	Exterior point	137.6 -79.6 -3.2	pointD: actual point d13
0. 0.	0. 0.	limit plane disp. (in pixels)	10085. 0.	Exterior point
'HPNT telescone	mount Wayyis'	Quadric 116	0. 0. 0. 0.	limit plane disp. (in pixels)
14		Component no.	'HRDI telescope box efgh13'	Quadric 120
PlateB			14	Component no.
-		flow on ext., int. or both	PlateB	1
133.8 -71.3	-13.1	pointA: actual point V13	1	flow on ext., int. or both
138.8 - /1.3	-13.1	pointB: actual point W13	143.3 -65.3 -11.2	pointA: actual point e13
138 8 17- 9 8 1 1	1.51-	points: actual point A13 hointD: actual hoint V13	147.0 - 705.3 - 5.2 147.0 - 70.5 - 11.2	pointB: actual point f13
100100.	-10.	Exterior boint	2 TT - 0.0/- 7.191	pointu: actual point gid mointh: actual moint bid
0. 0.	0.0	limit plane disp. (in pixels)	20050. 0.	Exterior point
			0. 0. 0. 0.	limit plane disp. (in pixels)
'HRDI telescope	mount knob'	Quadric 117		
CvlinderA			THRUL CELESCOPE DOX ACEGL3'	Quadric 121 Component no
1		flow on ext., int. or both	PlateB	
136.3 -71.3	-13.1	pointC: actual point T13	1	flow on ext., int. or both
136.3 -71.3	-18.1	pointD: actual point U13	133.0 -74.3 -11.2	pointA: actual point a13
3.5 0. 0.		radius limit plane disp. (in pixels)	137.6 -79.6 -11.2 143.7 -65.7 -11.2	pointB: actual point c13
100. 15080	. 020. 20.	F3I limits	147.9 -70.6 -11.2	pointD: actual point g13
			2005020.	Exterior point
'HRDI telescope	mount knob'	Plane 5 Commonent no	0. 0. 0. 0.	limit plane disp. (in pixels)
14 Disk			'HRDI telescope box bdfh13'	Quadric 122
136.3 -71.3	-18.1	pointA	14	Component no.
0.	-1.	direction cosine normal to disk	PlateB	4
3.5		radius		flow on ext., int. or both
ubnt telescone	mount knoh'	Diana ƙ	133.0 -74.3 -3.2	pointA: actual point b13
14 Interescope		Component no.	2.62 0.672 0.761 C E E E 29 E ET	pointB: actual point d13
Disk			147.9 -70.6 -3.2	pointD: actual point h13
136.3 -71.3	-13.1	pointA	20050. 20.	Exterior point
0. 0. 3.5	1.	direction cosine normal to disk radius	0. 0. 0. 0.	limit plane disp. (in pixels)
			'HRDI telescope box cdgh13'	Quadric 123
'HRDI telescope	DE13'	Quadric 118		Component no.
14 Cviinderð		component no.	Placeb 1	
cy 1111UELA		flow on ext. int. or hoth	1 137 K - 79 K - 11 2	rlow on ext., int. or both
144.7 -63.988	-7.2	pointA	137.6 -79.6 -3.2	pointB: actual point d13
127.9 -78.7	-7.2	pointB	147.9 -70.6 -11.2	pointC: actual point d13
4.0		radius	147.9 -70.6 -3.2	pointD: actual point h13
0. 0. 100 150 00		limit plane disp. (in pixels)	200250. 0.	Exterior point
08UCL .UUL	. 020. 20.	SJINIT TEA	0. 0. 0.	limit plane disp. (in pixels)
'HRDI telescope	, E 1 Q	Plane 7	'SSPP box ABCD14'	Quadric 124
14 Dist		Component no.	15 PlateB	Component no.
144.7 -63.988	-7.2	pointA	riated 1	flow on ext. int. or both
0.7523 0.6588	· 0.	dircos	276.3 39.2 -61.0	pointA: actual point A14

Exterior point limit plane disp. (in pixels) Quadric 131	Component no.	flow on ext., int. or both pointA: actual point E15	pointC: actual point G15	pointD: actual point H15	Exterior point	umut prane disp. (in pixels)	Quadric 132	Component no.	flow on ext., int. or both	pointA: actual point B15	pointB: actual point F15	pointC: actual point D15	Exterior boint point HIS	limit plane disp. (in pixels)		Quadric 133	component no.	flow on ext., int. or both	pointA: actual point A15	pointC: actual point BIS	pointD: actual point F15	Exterior point	limit plane disp. (in pixels)	Quadric 134	Component no.	flow on ext int or both	pointA: actual point A15	pointB: actual point K15	pointC: actual point E15	PULICU: actual point MIS Exterior point	limit plane disp. (in pixels)	•	Quadric 135 Commont in		flow on ext., int. or both	pointA: actual point C15	pointB: actual point D15	pointD: actual point KIS DointD: artual moint fic	Exterior point	limit plane disp. (in pixels)		Quadric 190 Component no.		flow on ext., int. or both points. actual actual	pointB: actual point GIS	pointC: actual point M15	pointU: actual point N15 Exterior point	limit plane disp. (in pixels)
0.					c									0								a									0.									0.								
80. 0. H15'		-25.5	-25.5	-25.5	. og-		ł15,			11.6	7.7	9.11		0.				:	11.6	2.1	2.1	80. 80.		15'			11.6	11.6	0.07 1.02 1.02		.0				:	0.11 1	11.6	11.6	80.	0	5.	?		-25.5	-25.5	-25.5	- 80.	.0
-20. 0. box EFG		-30.2	-38.7	-38.7	. c		box BFD			-30.2	7.05- 7.05-	- 38 -	-30.	0	how Aper				-30.2	-30.2	-30.2	-20.	5	box AKEM			-30.2	-76.2	- 20.2	-80.	.0		TAN CURL		r 0	-38.7	-76.2	-76.2	-20.	.0	CX GHMN1			-38.7	-38.7	-76.2	-20.	.0
90. 0. 15AMS	PlateB	1 19.8 49.3	19.8	6.9 4			I SAMS	1º PlateB	1	49.3	5.74 5.94	1.64	80.	0.	'T CANC	16	PlateB	1 •	49.3	19.8	49.3	. 06		'I SAMS	10 PlatoR	1	19.8	19.8	19.8			L CANO 1	16 16	PlateB	1	44.8	19.8	44.8	50.	.0	I SAMS 1	16	PlateB 1	19.8	44.8	19.8 44.8	50.	.0
pointB: actual point B14 pointC: actual point C14 pointD: actual point D14 Exterior point limit plane disp. (in pixels)	Quadric 125	Component no.	flow on ext., int. or both DointA: artical moint 514	pointB: actual point F14	pointC: actual point Gid	pointD: actual point H14	Exterior point limit plane dign. (in pixels)		Quadric 126		flow on ext., int. or both	pointA: actual point A14	pointB: actual point B14	pointC: actual point E14 mointD: actual moint E14	Exterior point F14	limit plane disp. (in pixels)	Citation 127	Component no.		flow on ext., int. or both	pointA: actual point C14 bointB: artual moint b14	pointC: actual point G14	pointD: actual point H14	Exterior point limit plane disp. (in pivels)		Quadric 128	component no.	flow on ext int. or both	pointA: actual point B14	pointB: actual point F14	points actual point D14 points, actual moint uta	Exterior point	limit plane disp. (in pixels)	Quadric 138	Component no.		flow on ext., int. or both	pointA: actual point A14	pointies actual point E14 mointry actual modut of a	pointD: actual point G14	Exterior point	limit plane disp. (in pixels)	Quadric 130	Component no.	flow on ext int or both	pointA: actual point A15	pointB: actual point B15	points: actual point D15 pointD: actual point D15
°.							0.																																		,	.0						
-93.8 -61.0 -93.8 -80.	14'		-61.0	-93.8	-61.0	8.69- 08-			. 6 T			-61.0	- 93.8 0 1 9 -	0.10- 8.6-	-80.	0	14'			-61 0	8.69-	-61.0	-93.8	-80.		[4.			-93.8	-93.8 0.60	8.66-	-150.	0	4,				-61.0	-61.0	-61.0	-20.	.0	15,			11.6	11.6	11.6
39.2 -7.2 -7.2 35.	box EFGH		39.2	39.2	-7.2	2.1-			DOX ABEF			39.2	2.95	39.2	50.	0	DOX CDGH			C L-	-7.2	-7.2	-7.2	- 20.		OX BFDH			39.2	2.65	-1.2	-20.		ox AECG1				7.45 C 01	- 1 - 2	-7.2	-20.	.0	DOX ABCD.			-30.2	-30.2	-38.7
276.3 276.3 276.3 300.	ddSS,	15 PlateB	1 230.3	230.3	230.3	200.2			335F	PlateB	1	276.3	C.012	230.3	250.	.0	l ddss,	15	PlateB	276.3	276.3	230.3	230.3	.062 0.		'SSPP L	PlateB	1	276.3	6.062 5.76	230.3	250.		q qqss'	15	PlateB	1	5.012	276.3	230.3	250. 2		I SWWSI,	16 Distan	1	19.8	49.3 19.8	49.3

				ĥ		
CEF17'	0.	H117' 0.	KL17' 0.	-0.	-0.9	o
ount, B	80. 80. 90.	ount, G 2.1 33.4 50.	ount, J 2.1 2.1 33.4 50. 0.	ount, G 2.1 33.4 33.4 50. 0.	ount, Hi 2.1 33.4 33.4 50. 0.	ABCD18' 2.1 2.1 2.1 2.1 2.1 2.1 2.1 2.7 .3 0.
lower m -29.2	-26.2 -26.2 -33.2 -30.	upper m 29.0 29.0 -35. 0.	upper m 32.0 32.0 32.0 50. 0.	upper m 29.0 32.0 32.0 -30. -30.	upper m 29.0 32.0 32.0 32.0	base, 100.00
'CLAES 18 PlateB 1 41.9	63.2 63.2 0.	'CLAES 18 1 1 102.4 41.9 63.2 0.	'CLAES 18 PlateA 1 102.4 41.9 63.2 100.	'CLAES 18 PlateB 1 102.4 63.2 102.4 63.2 100.	CLAES (CLAES 18 18 11 1 41.9 63.2 63.2 50.	WINDII 19 19 11 130.8 157.4 157.4 157.4 157.4 200. 0.

flow on ext., int. or both pointA: actual point H17 pointB: actual point H17 pointC: actual point H17 pointD: actual point L17 Exterlor point limit plane disp. (in pixels) limit plane disp. (in pixels) limit plane disp. (in pixels) Exterior point limit plane disp. (in pixels) limit plane disp. (in pixels) limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point B17 pointB: actual point C17 pointC: actual point E17 pointD: actual point F17 Exterior point flow on ext., int. or both pointA: actual point G17 pointB: actual point H17 pointC: actual point H17 Exterior point flow on ext., int. or both pointA: actual point J17 pointB: actual point K17 pointC: actual point L17 Exterior point flow on ext., int. or both pointA: actual point G17 pointB: actual point J17 pointC: actual point J17 pointD: actual point L17 Exterior point flow on ext., int. or both pointA: actual point A18 pointB: actual point B18 pointC: actual point B18 pointC: actual point D18 Component no. Component no. Component no. Component no. Component no. Quadric 154 Component no. Component no. Quadric 149 Quadric 150 Quadric 151 Quadric 152 Quadric 153 Quadric 155

pointA: actual point 018 pointB: actual point P18 pointC: actual point Q18 pointC: actual point R18 Exterior point limit plane disp. (in pixels)	Quadric 156 Component no. flow on ext., int. or both pointA: actual point D18 pointB: actual point D18 pointC: actual point 018 pointC: actual point 018 pointC: actual point P18 Exterior point	limit plane disp. (in pixels) Quadric 157 Component no. flow on ext., int. or both pointA: actual point A18 pointC: actual point C18 pointC: actual point C18 pointC: actual point Q18 pointC: actual point Q18 Exterior point limit plane disp. (in pixels)	Quadric 158 Component no. flow on ext., int. or both pointA: actual point D18 pointE: actual point C18 pointC: actual point O18 Exterior point limit plane disp. (in pixels)	Quadric 159 Component no. flow on ext., int. or both pointA: actual point C18 pointE: actual point E18 pointC: actual point Q18 Exterior point limit plane disp. (in pixels)	Component no. Component no. flow on ext., int. or both pointA: actual point F18 pointC: actual point O18 Exterior point limit plane disp. (in pixels) Quadric 161	Component no. flow on ext., int. or both pointA: actual point E18 pointB: actual point M18 pointC: actual point Q18 Exterior point limit plane dig. (in pixels)
2.		5 S.		o		.0
9.3 2.1 2.1 2.1 2.1 2.1	DBOP18' 27.3 2.1 9.3 2.1 50.	2. ACRQ18' 2.1 2.1 9.3 2.1 2.1 2.1 2.	DFO18' 27.3 27.3 9.3 50. 2.	CEQ18' 27.3 27.3 50. 2. 2.	27.3 21.8 29.3 50. 2.	27.3 21.8 9.3 50.
-30.2 -30.2 -30.2 -30.2 -30.2	base, 0. -30.2 -30.2	2. base, 0. -30.2 -30.2 2.	base, 0. -22.8 -30.2 50. 2.	base, 0. -22.8 -30.2 50.	-22.8 -36.4 -36.4 -30.2 -50. -50. base, -	-22.8 -36.4 -50.2 -50.2
173.8 173.8 123.8 123.8 123.8 200. -	'WINDII 19 11 167.4 167.4 173.8 173.8 173.8 200.	2. WINDII 19 130.8 130.8 130.8 123.8 123.8 123.8 2.	WINDII 19 19 167.4 167.4 167.4 173.8 200.	WINDII 19 19 130.8 130.8 130.8 123.8 100. 2.	19 1167.4 167.4 162.0 173.8 200. 2. *WINDII	Ly PlateA 1 130.8 136.0 123.8 100. 2.

flow on ext., int. or both

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'WINDII base, F	iEN1 8 '	Quadric 162	173.4 -11.9 46.4	nointB. actual noint 110
19		Component no.	119.7 -45.0 46.4	points accual point us points artial point K18
PlateA			179.7 -45.0 46.4	pointD: actual point L18
I 477 0 32 0		flow on ext., int. or both	20040. 80.	Exterior point
8.77- K./CI	5.12	pointA: actual point H18	0. 0. 0. 0.	limit plane disp. (in pixels)
8.77- 8 ./01	c.12	pointB: actual point F18		
200 - 50	0.12	punct actual point NIS Exterior moint	'WINDII base, HJNL18'	Quadric 169
2. 2.	2. 0.	limit plane disp. (in pixels)	19 PlateB	Component no.
			1	flow on ext. int. or both
'WINDII base, G	;EM1 8 /	Quadríc 163	157.9 -22.8 27.3	pointA: actual point H18
19		Component no.	173.4 -31.9 46.4	pointB: actual point J18
PlateA			162.0 -36.4 21.8	pointC: actual point N18
110 1 100		flow on ext., int. or both	179.7 -45.0 46.4	pointD: actual point L18
8.22- 8.061	6.12 C CC	pointA: actual point G18	200. 100. 50.	Exterior point
8.77- 8.0FT 8.72- 0.951	2/.3 21 D	pointB: actual point E18	2. 2. 2. 2.	limit plane disp. (in pixels)
100 -50.4	8.12	pointte: actual point M18 Exterior moint		
2. 2.	2. 0.	exteriot point limit niane disn (in nivels)	'WINDII base, IGKM18'	Quadric 170
i	5	(around int) there around arms	17 Diaten	component no.
'WINDII base, C	DEF18'	Quadric 164		flow on ext int or both
19		Component no.	124.9 -31.9 46.4	pointA: actual point 118
PlateB			140.4 -22.8 27.3	pointB: actual point G18
1		flow on ext., int. or both	119.7 -45.0 46.4	pointC: actual point K18
150.8 0.	27.3	pointA: actual point C18	136.0 -36.4 21.8	pointD: actual point M18
10/14 U.	6.12 C CC	pointB: actual point D18	100. 100. 50.	Exterior point
167.4 -22.8	C. / 2	pointus actual point El8 nointh: actual noint El9	2. 2. 2. 2.	límít plane disp. (in pixels)
20010.	50.	Exterior point	' PEN-AXIS hase ABCD19'	Ounded of 121
2. 2.	2. 2.	limit plane disp. (in pixels)		Component no
		•	PlateB	
'WINDII base, M	NQ018 '	Quadric 165	1	flow on ext., int. or both
ly Distad		component no.	269.8 -34.6 36.4	pointA: actual point A19
riated 1		flow on ext. int or both	247.1 -34.6 36.4 2630 -346 36.4	pointB: actual point B19
136.0 -36.4	21.8	bointà: actual point M18		puttre: accuat point cla
162.0 -36.4	21.8	pointB: actual point N18	25050 50	pointU: actual point D19 Eviar noint
123.8 -30.2	9.3	pointC: actual point 018		Exterior point
173.8 -30.2	9.3	pointD: actual point 018		TIMIT DIANG AISD. (IN DIXEIS)
200100.	50.	Exterior point	'PEM-AXIS base, EFGH19'	Ouadric 172
2. 2.	2. 2.	limit plane disp. (in pixels)	20	Component no.
WINDIT Pase V	10,1 10,	271 - 155	PlateB	
19	0 1 1 1 1	Component no	1 160 8 32 3 75 1	flow on ext., int. or both
PlateB			247.1 -32.3 36.4	pointA: actual point E19 pointB: actual point E10
1		flow on ext., int. or both	263.9 -32.3 16.8	points: actual point £19 DointC: actual point £19
136.0 -36.4	21.8	pointA: actual point M18	253.0 -32.3 16.8	pointD: actual point H19
162.0 -36.4	21.8	pointB: actual point N18	250. 50. 50.	Exterior point
0.04- /.611	45.4	pointC: actual point K18	0. 0. 0. 0.	limit plane disp. (in pixels)
200100.	.0	Exterior point	'PEM-AXIC hase AFCCIO'	
2. 2.	2. 2.	limit plane disp. (in pixels)		Component no.
			PlateB	
WINULL DAGE, G	.81CTH	Quadric 167		flow on ext., int. or both
ly PlateB		component no.	269.8 -34.6 36.4 260.8 -32.3 24.4	pointA: actual point A19
1		flow on ext., int. or both	263.9 - 14.6 16.8	pointB: actual point E19
140.4 -22.8	27.3	pointA: actual point G18	263.9 -32.3 16.8	pointD: actual point C19
157.9 -22.8	27.3	pointB: actual point H18	30030. 20.	Exterior point
124.9 -31.9 171 A -11 0	46.4	pointC: actual point 118	0. 0. 0. 0.	limit plane disp. (in pixels)
200. 100.	50.	Exterior point use	'DEW.AVIC hase BEDWIG!	
2. 2.	2. 2.	limit plane disp. (in pixels)	20	Quadric 1/4 Component no.
WINDIT base	141.187	Citedation 160	PlateB	
19		Component no.	т 247.1 -34.6 36.4	flow on ext., int. or both pointA: articl roint bio
PlateB			247.1 -32.3 36.4	pointB: actual point F19
1 124.9 -31.9	46.4	flow on ext., int. or both pointA: actual point 118	253.0 -34.6 16.8 253.0 -32.3 16.8	pointC: actual point D19
			0.21 2.41 2.114	poincu: actual point H19

Quadric 181 Component no.		pointA: actual point M19	pointB: actual point N19	pointD: actual point 219 pointD: actual point R19	Exterior point	limit plane disp. (in pixels)	Quadric 182	Component no.	flow on ext., int. or both	poinca radiusA	radiusB	Rlength dirros	limit plane disp. (in pixels)	. F3I limits	Plane 11	Component no.	pointA	dircos	radius	Quadric 183	Component no.		LIOW ON EXT., INT. OF BOTH pointA	pointB	Indius limit mlane dien /in mirale)	. F3I limits		Quadric 184	component no.	flow on ext., int. or both	pointA: actual point A20	points: actual point B20 pointC: actual moint 720	Exterior point	limit plane disp. (in pixels)	Quadric 185	Component no.		flow on ext., int. or both	putnus actual point A20 pointB: actual point B20	pointC: actual point D20	Exterior point	limit plane disp. (in pixels)	Quadric 186	component no.	flow on ext., int. or both	pointA: actual point B20 pointB: actual point B20	pointC: actual point C20 pointC: actual point E20	Exterior point limit plane disp. (in pixels)
'PEM-AXIS base, MNQR19' 20	PlateB 1	253.0 -48.3 31.5	263.9 -48.3 31.5 253 0 -40 3 20 0	263.9 -48.3 20.9	25060. 30.	0. 0. 0. 0.	'PEM-AXIS antenna JI19'	coneD	0 2583 - 44 4 30 0		12.3	15.2 0. 0.5 0.866	0. 0.	200. 30080. 0. 0. 80	'PEM-AXIS antenna J19'	20 District	258.3 -44.4 38.8	0. 0.5 0.866	1:2	'PEM-AXIS base, ST19'	20	Cylingera 1	255.8 19.6 10.4	258.3 -33.0 26.6	2. 00.5	200. 30050. 50. 0. 50.		'PEM-ZEPS base, ABC20' 21	21 PlateA	1	5.9 48.1 -42.5 28.7 40.1 -51.5		30. 10050.	0. 0. 0. 0.	'PEM-ZEPS base, ABD20'	21	PlateA	1 5.9 481 -42 5	28.7 48.1 -51.4	5.9 36.4 -42.5			'PEM-ZEPS base, BCE20' 21	PlateA	1	28.7 48.1 -51.4 42.8 48.1 -42.5	42.8 36.4 -42.5	80. 50100. 0. 0. 0. 0.
Exterior point limit plane disp. (in pixels)	Quadric 175	Component no.	flow on ext., int. or both	pointA: actual point C19	pointB: actual point D19 mointC: actual moint cio	pointD: actual point H19	Exterior point limit plane disp. (in pixels)	Curadric 176	Component no.		flow on ext., int. or both rotation actual rotation	pointB: actual point E19	pointC: actual point B19	poincu: actual point F19 Exterior point	limit plane disp. (in pixels)	Ouadric 177	Component no.	flow on extint. or both	pointA: actual point K19	pointB: actual point 119	pointC: actual point M19 nointD: actual point M19	Exterior point	limit plane disp. (in pixels)	Oundric 178	Component no.		flow on ext., int. or both	pointA: actual point 019 DointB: actual boint P19	pointC: actual point Q19	pointD: actual point R19	Exterior point limit plane disp. (in pixels)		Quadric 179		flow on ext., int. or both	pointA: actual point K19	pulitus actual point ULY bointC: actual point M19	pointD: actual point O19	Exterior point	limit plane disp. (in pixels)	Quadric 180	Component no.	flow on ext., int. or both	pointA: actual point L19	pointB: actual point P19 nointr: actual moint M10	pointD: actual point R19	Exterior point	limit plane disp. (in pixels)
°.															0								.0								0									.0							c	•
20. 0.	CDGH19			16.8	16.8	16.8		AERF19.			36.4	36.4	36.4	50.	0.	, 6 INWIN			31.5	31.5	31.5	50.	•	OPOR19			0 0 0	20.9	20.9	20.9			KOMOI9'		5 60	0.15 0.00	31.5	20.9	30.	.0	LPNR19'			31.5	20.2	20.9		
20030. 0. 0.	'PEM-AXIS base,	20 Disten	1	263.9 -34.6	263.9 -32.3	253.0 -32.3	25030. 0. 0.	'PEM-AXIS base.	20	PlateB	1 269.8 -34.6	269.8 -32.3	247.1 -34.6	25030.	0. 0.	'PEM-AXIS base,	20	riated 1	253.0 -34.6	263.9 -34.6	263.9 -48.3	26040.	0. 0.	'PEM-AXIS base.	20	PlateB 1	1 253.0 -34.6	263.9 -34.6	253.0 -48.3	263.9 -48.3 250 -40	0.		'PEM-AXIS Dase, 20	PlateB	1 7570 346	253.0 -34.6 253.0 -34.6	253.0 -48.3	253.0 -48.3	20060. Ĉ	o.	'PEM-AXIS base,	20 B1 = t = B	riated 1	263.9 -34.6	263.9 -48.3	263.9 -48.3	30060. 0.	

se, BDE20'	Quadric 187 Component no.	13.0 138.6 -43.7 0. 10050. 0. 0. 0. 0.	pointD: actual point N20 Exterior point limit plane disp. (in pixels)
51.4 42.5	flow on ext., int. or both pointA: actual point B20 pointB: actual point D20	'PEM-ZEPS box HILM20' 21 Plater	Quadric 193 Component no.
42.5 00. 0. 0.	pointC: actual point E20 Exterior point limit plane disp. (in nixels)	30.7 150.0 -55.1	flow on ext., int. or both pointA: actual point H20
520'	Quadric 188 Component no	41.2 150.0 -36.9 30.7 138.6 -55.1 41.2 138.6 -36.9	pointB: actual point I20 pointC: actual point L20 pointD: actual point M20
	flow on ext., int. or both	0. 0. 0. 0. 0.	Exterior point limit plane disp. (in pixels)
9.8	point A point B	PEM-ZEPS box IKMO20'	Quadric 194
	radius limit plane disp. (in pixels)	PlateB	Component no.
8090.	0. F3I limits	41.2 150.0 -36.9	flow on ext., int. or both points. actual point 120
20,	Plane 12	24.3 150.0 -26.2	pointB: actual point K20
	Component no.	4.12 139.0 -30.9 24.3 138.6 -26.2	pointC: actual point M20 pointD: actual point O20
19.8 9	pointA	100. 100. 0. 0. 0. 0. 0.	Exterior point limit plane disp (in pivels)
	arreos radius1	'PEM-ZEPS shaft (approx.) PO20'	Olladric 195
	radius2	21 CV1 inder&	Component no.
(20 '	Quadric 189 Commoniant no		flow on ext., int. or both
		2/.1 138.6 -40.65 27.1 55.1 -40.65	point a pointB
5.1	tlow on ext., int. or both bointA: actual point H2D	2.8	radius
6.9	pointB: actual point 120	0. 100. 50. 1505030.	limit plane disp. (in pixels) F31 limits
6.2	pointo: actual point 220 pointD: actual point K20	'MLS gizmo box ABCD21'	Quadric 196
0. 0.	limit plane disp. (in pixels)	22 PlateB	Component no.
20,	Ouadric 190		flow on ext., int. or both
	Component no.		pointA: actual point A21 pointB: actual point B21
	flow on ext., int. or both	175.2 48.1 20.0 217 0 48 1 20.0	pointC: actual point C21
5.1	pointA: actual point L20	217-0 48.1 20.0 200. 50. 40.	pointD: actual point D21 Exterior point
3.7	pointB: actual point M20 pointC: actual point N20	0. 0. 0. 0.	limit plane disp. (in pixels)
6.2	pointD: actual point 020	'MLS gizmo box EFGH21'	Ouadric 197
0. 0.	Exterior point limit plane disp. (in pixels)	22 PlateB	Component no.
, 00	Current 101	1	flow on ext., int. or both
1	Component no.	217.0 73.7 2.1 217.0 73.7 2.1	pointA: actual point E21
		175.2 48.1 2.1	points: actual point F21 pointC: artual point F21
3.7	flow on ext., int. or both neinta, actual noint 120	217.0 48.1 2.1	pointD: actual point H21
2.5	pointB: actual point K20		Exterior point
3.7 6.2	pointC: actual point N20 pointD: actual point 020	Incorporation of the second se	101011 1111 1111 111010 110101
o. o. 0.	Exterior point limit plane disp. (in pixels)	22 Jim DOX EFAD21 22 PlateB	Quadric 198 Component no.
20.	Quadric 192	1 175.2 73.7 2.1	flow on ext., int. or both pointA: artual point 521
	component no.	217.0 73.7 2.1 175.2 73.7 20.0	pointB: actual point F21
5.1	flow on ext., int. or both points: stual point H20	217.0 73.7 20.0 200. 100. 0.	Former actual point A21 pointD: actual point B21 Exterior point
	puinte: actual point uzu pointC: actual point L20	0. 0. 0. 0.	limit plane disp. (in pixels)

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MLS gizmo box	BFDH21'		Quadric 199 Component no.	1 172.7 29.1 9.5	flow on ext., int. or both pointA: actual point 121
			flow on ext int. or both	218.0 29.1 9.5	pointB: actual point J21
.0 73.7	20.0		pointA: actual point B21	218.0 29.1 2.1	pointC: actual point M21 pointD: actual point N21
.0 73.7	2.1		pointB: actual point F21	250. 50. 40.	Exterior point
.0 48.1	20.0		pointC: actual point D21 pointD: actual moint 921	0. 0. 0.	0. limit plane disp. (in pixels)
50.	40.		Exterior point	'MLS cylinder OR21'	Ouadric 206
<u>.</u>	0	.	limit plane disp. (in pixels)	22	Component no.
gizmo box	AECG21'		Quadric 200	CylinderA 1	flow on ext., int. or both
89			Component no.	172.7 24.5 16.0 218.0 24.5 16.0	pointA pointB
			flow on ext., int. or both	5.9	radius
1.51 5	0.02		pointA: actual point A21 pointB: actual point E21	0. 0. 	limit plane disp. (in pixels)
2 48.1	20.0		points actual point 521 points actual point 731	105 .U .UC1 .UC1	0. 40. F3I limits
2 48.1	2.1		pointD: actual point G21	'MLS cylinder end'	Plane 13
. 0	. e	c	Exterior point	22	Component no.
5			limit plane disp. (in pixels)	Disk 2180245 160	
gizmo box	CDGH21'		Quadric 201	1. 0. 0.	direction cosine normal to dish
eB			Component no.	5.9	radius
			flow on ext., int. or both	'MLS LHS box ABCD22'	Ouadric 207
.2 48.1	20.0		pointA: actual point C21	22	Component no.
1.84 0.	20.02		pointB: actual point D21 points: actual point C21	PlateB	
.0 48.1	2.1		points actual point 421 pointD: actual point 421	L 150 4 44 1 35 3	flow on ext., int. or both
-50.	40.		Exterior point	172.7 44.1 35.3	pulitA: actual point A/2 pointB: actual point B/2
.0			limit plane disp. (in pixels)	150.4 3.2 35.3	pointC: actual point C22
box behind	d antenna	13,41,21,	Oundric 202	172.7 3.2 35.3 200 50 40	pointD: actual point D22
4			Component no.	0.00	0. limit plane disp. (in pixels)
R.			flow on ext. Int. or both	WIG THE PORT ABEENT	
.7 29.1	9.5		pointA: actual point 121		Vuauiic 200 Component no.
.0 29.1 7 3.1	<u></u> .		pointB: actual point J21	PlateB	
9.2	n . 6		pointus actual point KZI pointD: actual point 121	1 150 / 24 1 35 3	flow on ext., int. or both
-50.	40.		Exterior point		pointA: accual point A/2
	.0	.	limit plane disp. (in pixels)	150.4 44.1 21.4	pointC: actual point E22 pointC: actual point E22
box hehind	i antenna	, 144, INT.	Charle 203	172.7 44.1 21.4	pointD: actual point F22
			Component no.		Exterior point (in nivels) 0. limit plane disp. (in nivels)
			flow on set int or both		
0 29.1	9.5		pointA: actual point J21	MLS LHS BOX CDGH22'	Quadric 209
0 29.1	2.1		pointB: actual point N21	PlateB	component no.
2.E 0	۰. ۱		pointC: actual point L21	7	flow on ext., int. or both
30.2	2.1		pointD: actual point P21	150.4 3.2 35.3	pointA: actual point C22
		C	Exterior point limit niene dien die nivolai	172.7 3.2 35.3	pointB: actual point D22
5	;	;	(STAVIČ III) - Čein Butti Atwitt	172.7 3.2 21.4	pointC: actual point G22 mointD: actual moint W22
box behind	i antenna	KOLP21'	Quadric 204	20010. 40.	Exterior boint his
8			Component no.	0. 0. 0.	0. limit plane disp. (in pixels)
			flow on ext., int. or both	, MLS LHS box BFDH22	Ouadric 210
	5.6 •		pointA: actual point K21	22	Component no.
7. 7. 7. 7.	1.2		pointB: actual point 021	PlateB	
 	2.1		pointD: actual point P21	L 1727 441 353	flow on ext., int. or both
		4	Exterior point	172.7 44.1 21.4	pointB: actual point B22 pointB: actual point F22
.0	.0	.0	limit plane disp. (in pixels)		pointC: actual point D22
box behind	antenna	, I ZNMUJ	Quadric 205	1/2./ 3.2 21.4 20010. 40.	pointD: actual point H22 Exterior moint
			Component no.	0. 0. 0.	0. limit plane disp. (in pixels)

Quadric 211 Component no.	flow on ext. Int or hoth	pointA: actual point A22	pointB: actual point E22	pointD: actual point G22	Exterior point	limit plane disp. (in pixels)	Quadric 212	component no.	flow on ext., int. or both	pointA: actual point E22	points: actual point F22	pointC: actual point 122 pointD: actual point J22	Exterior point	limit plane disp. (in pixels)	Quadric 213	Component no.	flow on ext., int. or both	pointA: actual point I22	pointB: actual point J22	pointD: actual point V22 pointD: actual point V22	Exterior point	limit plane disp. (in pixels)	Quadric 214	component no.	flow on ext., int. or both	pointA: actual point G22 nointB: actual noint H22	pointC: actual point R22	pointD: actual point L22	exterior point limit plane disp. (in pixels)	Ouadric 215	Component no.	flow on sut int or both	pointA: actual point J22	pointB: actual point K22	pointC: actual point H22	poincu: actual point 422 Evterior moint	limit plane disp. (in pixels)	Quadric 216	Component no.	flow on ext int or hoth	bointA: actual boint 122	pointB: actual point Q22	pointC: actual point G22	pointD: actual point R22	Exterior point limit plane disp. (in pixels)	Tic Jinger	Composite 41/
																						°.							0.								0								0		
cG22'		35.3	21.4	21.4	40.		,2211			21.4	8-17	21.4	0.	.0	QK22'			21.4	21.4		0.	.0	RL22'			8 - 1 Z	9.5	9.5		HL22'			21.4	9.5	21.4			GR22'			21.4	9.5	21.4	9.5		, ((NO	3 7 M O
box AE		44.1	44.1	7.7 9.7	-10.		box EF			44.1	1.99	29.1	50.	.0	LI XOG			29.1	29.1	1.62	50.	0.	box GH		•	7.5	3.2	3.2	.0c- 0.	box JK			29.1	29.1	3.2	2.03-		OI XOU	I		29.1	29.1	3.2	3.2	-50.	NO VOL	
MLS LHS	PlateB 1	150.4	150.4	150.4	100.	.0	SHT STW,	22 PlateB	1	150.4	1.2.1	172.7	200.		SHT STW,	22 Diatar	1	150.4	172.7	172.7	200.	.0	SHT STW.	22 PlateB	1	170.4	169.3	172.7	200. 0.	SHT STW,	22	PlateB	172.7	172.7	172.7	200		SHI SIM,	22	PlateB 1	150.4	169.3	150.4	169.3	100. 0.	. MT C 1 UC	22

1 169.3	29.1	9.5	flow on ext., int. or bot pointA: actual point 022
169.3	1.62	2 ° 0	pointB: actual point K22 mointC: actual moint 023
172.7	29.1	2.1	pointD: actual point M22
100. 0.	50. 0.	0. 0.	Exterior point . limit plane disp. (in pi
SHI SIM.	box RL	PN22,	Quadric 218 Commonent no
PlateB			
1 169.3	3.2	9.5	flow on ext., int. or bot pointA: actual point R22
172.7	3.2	9.5	pointB: actual point L22
169.3	с. г с г	1.2	pointC: actual point P22
100.	-50.		Exterior point
		0.0	. IIMIC PLANE CISP. (IN PI
MLS LHS	box QOI	RP22'	Quadric 219
PlateB			
1 160 3	1 00		flow on ext., int. or bot
169.3	29.1	۰.5 1.2	pointA: actual point Q/2 pointB: actual point O22
169.3	3.2	9.5	pointC: actual point R22
169.3	3.2	2.1	pointD: actual point P22
0.	.06-	0 . 0	Exterior point . limit plane disp. (in pi
'MLS lar	ge antei	nna BCDE24'	Quadric 220
22	•		Component no.
PlateB 1			flow over the transfer
185.0	15.9	26.9	pointA: actual point B24
217.3	15.9	34.8	pointB: actual point C24
186.1	29.8 79.8	33.7 41 0	pointC: actual point D24
200.	50.	100.	Exterior point 524
0.	0.	0.0	. limit plane disp. (in pi
'MLS lar	ge antei	nna DEHI24'	Quadric 221
22 Plater			Component no.
			flow on ext., int. or bot
186.1	29.8	33.7	pointA: actual point D24
216.3	29.8	41.0	pointB: actual point E24
210.7	5.75 5.75	44.0	pointC: actual point H24 pointD: actual point 124
200.	50.	100.	Exterior point
.0	.0	0.	. limit plane disp. (in pi
'MLS lar	ge antei	nna HIL24'	Quadric 222
22 PlateA			Component no.
1 190.6	17.3	7 85	flow on ext., int. or bot pointA. actual point U24
210.7	37.3	44.0	pointB: actual point 124
200.2	42.3	46.2	pointC: actual point L24
200. 0.	50. 0.	100. 0. 0	Exterior point . limit plane disp. (in pi
'MLS lar	ge antei	nna BCFG24'	Quadric 223
22 PlateB			Component no.
1 105 0	15.0	0 90	flow on ext., int. or bot
217.3	15.9	34.8	pointA: actual point 5/4 pointB: actual point C24
186.1	5.5	23.2	pointC: actual point F24

flow on ext., int. or both pointA: actual point Q22 pointB: actual point X22 pointC: actual point X22 pointD: actual point M22 Exterior point limit plane disp. (in pixels) Quadric 218 Component no.	flow on ext., int. or both pointA: actual point R22 pointB: actual point L22 pointC: actual point P22 pointD: actual point N22 Exterior point limit plane disp. (in pixels) Quadric 219 Component no.	flow on ext., int. or both pointA: actual point Q22 pointB: actual point Q22 pointC: actual point R22 pointD: actual point P22 Exterior point limit plane disp. (in pixels)	Quadric 220 Component no.	flow on ext., int. or both pointA: actual point B24 pointB: actual point C24 pointC: actual point D24 pointD: actual point E24 Exterior point limit plane disp. (in pixels)	Quadric 221 Component no.	flow on ext., int. or both pointA: actual point D24 pointB: actual point E24 pointC: actual point H24 pointC: actual point H24 Exterior point limit plane disp. (in pixels)	Quadric 222 Component no.	flow on ext., int. or both pointA: actual point H24 pointB: actual point I24 pointC: actual point L24 Exterior point limit plane disp. (in pixels)	Quadric 223 Component no.	flow on ext., int. or both pointA: actual point B24
	·	.0	.4.	. 0	.4.	.0	-	.0	۲ ۹ ۲	
٥. ٣. ٣.	ហហកក	<u>ю</u> ң <u>ю</u> ң,,,	3CDE	6810	CEHI (r 0 r 0	111.24	107	3CFG2	ە

216.3	5.5	30.5	pointD: actual point G24	22
200. 0.	. o 0.	100. 0. 0	Exterior point). limit plane diam (in mixeds)	PlateE
			(STAVIA III) JOIN SINTA SAME	1 186.1
- FLS 18	irge anci	enna Fujkz4'	Quadric 224	216.3
PlateB				189.5 213.9
1			flow on ext., int. or both	200.
1.001		23.2 20 5	pointA: actual point F24	.0
189.5	-6.1	0.05	pointus actual point G24 mointry actual moint to a	
213.9	-6.1	26.8	puttic: actual point J24 nointD: actual moint P24	I STW.
200.	50.	100.	Exterior boint	22
0.	。	0.0). limit plane disp. (in pixels)	riateA
MLC 1.	rce anto	ACMUT SAME		189.5
22			Component no.	213.9
PlateA				201.6
1			flow on ext., int. or both	. 00.
189.5	-9-1	20.9	pointA: actual point J24	
5.012 201 6	1.0-	8.07	pointB: actual point K24	I STW.
200.	20.4	1.12	PointC: actual point M24 Exterior point	22
. 0		0.	Laterior pound 1. Itmit plane disp (in nivels)	PlateB
			(STAVIA III) . doin anns A anns	1 317 3
'MLS la	rge ante	enna BCDE24'	Back face Quadric 226	217.1
22			Component no.	216.3
PlateB				216.3
1			flow on ext., int. or both	250.
0.081	1 0.4	2.4.2	pointA: actual point B24	.0
1 201		1.25	pointB: actual point C24	
1.001		0.26	pointC: actual point D24	I STM,
2000		C. BC	pointU: actual point E24	22
	; .	.0. 0.	exterior point . limit plane dien (in nivele)	PlateB
			(STAVID III) John Start Ameri	1 1
MLS lai	rge ante	anna DEHI24'	Back face Quadric 227	216.3
22			Component no.	210.7
PlateB				210.7
1061	t 6	0.00	flow on ext., int. or both	250.
L 31C		0.25	pointA: actual point D24	.0
190.6	38.4	0.95	pointB: actual point E24	
210.7	38.4	41.3	points actual point A24 mointly actual moint 134	WLS 1a
200.	50.	-100.	Putation actual pullit 124 Putation moint	22
.0		0. 0.	· limit plane disp. (in pixels)	PlateB
				195 0
'MLS lar	rge antei	nna HIL24'	Back face Quadric 229	185.0
27			Component no.	186.1
riaten 1				186.1
190.6	38.4	36.0	LUW ON EXC., INC. OF DOCH Pointh. active boint 124	100.
210.7	38.4	41.3	points: actual point 124 DointB: actual point 124	0.
200.2	43.6	43.5	pointC: actual point L24	-ר 10 אי
200.	50.	-100.	Exterior point	22
		o. 0.	 limit plane disp. (in pixels) 	PlateR
Tel DIN,	ant art			1
22	ה מוורבו	1119 BCL054	Back Tace Quadric 229 Component no.	186.1
PlateB				1.981
1 185 0	16.4	C #C	flow on ext., int. or both	190.6
217.3	16.4	32.1	pointA: actual point B24	100.
186.1	5.7	20.5	pointf: actual point C24 Dointf: actual moint F24	.0
216.3	5.7	27.8	pointD: actual point 624	
200.	50.	-100.	Exterior point	22 22
.0	.0	0.0	. limit plane disp. (in pixels)	PlateB
'MLS lar	de anten	INA FGJK24'	Rark fare Cuadric 210	1
			Pack Lace Quadric 230	217.3

22 PlateR			Component no.
1			flow on ext . int or both
186.1	5.7	20.5	pointA: actual point F24
216.3	5.7	27.8	pointB: actual point G24
189.5	- 6.3	18.2	pointC: actual point J24
213.9	- 6.3	24.1	pointD: actual point K24
0.	. 0	-100.00-	Exterior point limit plane disp. (in pixels)
22	tge ante	nna JKM24	Back face Quadric 231 Component no.
PlateA			
1 189.5	-6.3	18.2	flow on ext., int. or both pointA: actual moint J24
213.9	-6.3	24.1	pointB: actual point K24
\$01.6 200	-1/.3	18.4	pointC: actual point M24
0.		- 0. 0.	Exterior point limit plane disp. (in pixels)
'MLS la	rge ante	nna CCEE24'	Quadric 232
22 PlateB			Component no.
1			flow on ext., int. or both
217.3	15.9	34.8	pointA: actual point C24
216.3	10.4 29.8	41.0	pointB: actual point C24
216.3	30.7	38.3	pointD: actual point E24
25U.	15. 0	40. D	Exterior point
			ATMAL PIGHE GISP. (IN DIXELS)
'MLS lai	ge ante	nna EEII24'	Quadric 233
PlateB			component no.
1 216 3	9 90	0.5	flow on ext., int. or both
216.3	30.7	38.3	pointA: actual point E24 DointR: artual point E24
210.7	37.3	44.0	pointC: actual point 124
210.7	38.4	41.3	pointD: actual point 124
.0.	.0.	40. 0. 0.	Exterior point limit plane digp. (in pivels)
mus lar 22	ge ancel	nna BBDD24'	Quadric 234
PlateB			component no.
1			flow on ext., int. or both
185.0	4.61 16.4	6.97 C #C	pointA: actual point B24
186.1	29.8	33.7	pointB: actual point B24 pointC: actual moint D24
186.1	30.7	32.0	pointD: actual point D24
. 00.	15.	40. 0	Exterior point
			limit plane disp. (in pixels)
"MLS IAF 22	ge anter	nna DDHH24'	Quadric 235
PlateB			companent no.
1861	9 0 0		flow on ext., int. or both
186.1	30.7	0.55	pointA: actual point D24
190.6	37.3	38.7	pointC: actual point U24 pointC: actual moint U24
190.6	38.4	36.0	pointD: actual point H24
.00.	0.	4 0.	Exterior point
	5	. .	limit plane disp. (in pixels)
MLS lar	ge anten	na ccGG24'	Quadric 236
lateB			component no.
217.3	15.9	34.8	flow on ext., int. or both pointA: actual moint road
			AVIII ALLIAL PULLA

Component no. flow on ext., int. or both pointA: actual point F24 pointC: actual point J24 pointC: actual point J24 pointD: actual point K24 Exterior point limit plane disp. (in pixels)	Back face Quadric 231 Component no.	flow on ext., int. or both pointA: actual point J24 pointB: actual point K24 pointC: actual point M24 Exterior point limit plane disp. (in pixels)	Quadric 212 Component no.	flow on ext., int. or both pointA: actual point C24 pointB: actual point C24 pointC: actual point E24 pointD: actual point E24 Exterior point E24 limit plane disp. (in pixels)	Quadric 233 Component no.	flow on ext., int. or both pointA: actual point E24 pointB: actual point E24 pointC: actual point I24 pointC: actual point I24 Exterior point lat limit plane disp. (in pixels)	Quadric 234 Component no.	flow on ext., int. or both pointA: actual point B24 pointB: actual point B24 pointC: actual point D24 pointD: actual point D24 Exterior point limit plane disp. (in pixels)	Quadric 235 Component no.
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217.3 216.3	16.4 5.5	32.1 30.5		pointB: actual point C24 pointC: actual point C24	100. 0.	4 0.	4 0. 0.
250. 250. 0.	15. 0.	40. 40.		pointu: actual point G24 Exterior point limit plane disp. (in pixels)	'MLS la 22	rge ante	inna JJMM24'
el stm,	irge ante	nna GGKK24'		Quadric 237	PlateB 1		
22 PlateB	1			Component no.	189.5	-6.1	20.9
1 3163	u u	3.06		flow on ext., int. or both	201.6	-16.8	21.1
216.3	5.7	27.8		pointA: actual point 624 pointB: actual point G24	201.6	-17.3	18.4
213.9	-6.1	26.8		pointC: actual point K24	0.		
250.		40.	c	Exterior point	MLS SM	ill ante	nna OPQR24'
		.0		limit plane disp. (in pixels)	22 PlateB		
'MLS la	irge ante	nna BBFF24'		Quadric 238	1		
PlateB				component no.	174.7 183.8	4.6	53.5 55.7
1 1 1 5 0	15 0	76 9		flow on ext., int. or both	175.6	9.1	54.9
185.0	16.4	24.2		pointA: actual point 524 pointB: actual point 524	182.9 200.	9.1	57.1 100.
186.1	5.5	23.2 20.5		pointC: actual point F24	.0	0.	0.
100.	15.	40.		pointus actual point r24 Exterior point	, MLS sma	ill ante	nna ORU24'
0	.0	0.		limit plane disp. (in pixels)	22		1
'MLS la	rge antei	nna FFJJ24'		Quadric 239	PlateA 1		
22 Dlaten				Component no.	175.6	9.1	54.9
1				flow on ext., int. or both	182.9	1.v 13.7	57.8
186.1	5.5	23.2		pointA: actual point F24	200.	.0	100.
186.1	-6.1	20.5		pointB: actual point F24 pointC: actual point .724	.0	.0	0.
189.5	-6.3	18.2		pointD: actual point J24	ews STW,	11 ante	nna OPQR24'
100.			.0	Exterior point limit plane disp. (in pixels)	22 Distor		
					1		
'MLS la	irge ante	nna IILL24'		Quadric 240 Commenter	174.7	4.7	50.8
PlateB					175.6	9.4	52.2
1 210.7	1 11	44.0		Ilow on ext., int. or both meinth. actual meint 124	182.9	9 .4	54.4
210.7	38.4	41.3		pullich: actual point 124 pointB: actual point 124	200. 0.		-100.
200.2	42.3	46.2		pointC: actual point 124			
250.2	4.54 40.	40. 10.		pointU: actual point L24 Exterior moint	MLS SMa	ll antei	nna QRU24'
.0		.0	0.	limit plane disp. (in pixels)	PlateA		
'MLS la	rge antei	nna KKMM24'		Quadric 241	1 175.6	9.4	52.2
22 PlateB				Component no.	182.9	9.4 1 1 1	54.4
-				flow on ext., int. or both	200.		-100.
213.9	-6.1	26.8		pointA: actual point K24	0	0.	0.
201.6	-16.8	21.1		pulitus: actual point M24 pointC: actual point M24	, MI.S. Sma)) ant or	DETTA
201.6	-17.3	18.4		pointD: actual point M24	22		
250.	-20.	4 0.	, o	Exterior point limit plane disn (in pivele)	PlateB		
					174.7	4.6	53.5
лы с 1 а 22	ide allrei	5 77700 DIII		Quadric 242 Component no	183.8	4.6	55.7
PlateB					182.9		54.3
1 190 ƙ	ר 17	18.7		flow on ext., int. or both modula. actual modul UD4	200.		100.
190.6	38.4	36.0		pointB: actual point H24	. >	۰.	о. О
200.2 200.2	42.3 43.6	46.2 43.5		pointC: actual point L24 pointD: actual point L24	'MLS Sma 22	ll anter	ina STV24'

Exterior point limit plane disp. (in pixels)

.

Component no.

Quadric 243

limit plane disp. (in pixels)

.

Component no.

Quadric 244

flow on ext., int. or both pointA: actual point J24 pointB: actual point J24 pointC: actual point M24 pointD: actual point M24 Exterior point

limit plane disp. (in pixels)

.

Quadric 245 Component no.

flow on ext., int. or both pointA: actual point 024 pointB: actual point P24 pointC: actual point 024 pointD: actual point R24 Exterior point

limit plane disp. (in pixels)

Exterior point

0

back plate Quadric 246 Component no.

flow on ext., int. or both pointA: actual point Q24 pointB: actual point R24 pointC: actual point U24

limit plane disp. (in pixels)

0

flow on ext., int. or both pointA: actual point 024 pointB: actual point 224 pointC: actual point 024 pointD: actual point 024 pointD: actual point R24

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flow on ext., int. or both

Component no.

Quadric 248

pointA: actual point 024 pointB: actual point 024 pointC: actual point 224 pointC: actual point 324

Exterior point

. 0

limit plane disp. (in pixels)

Exterior point

. 0

flow on ext., int. or both

pointA: actual point Q24 pointB: actual point R24 pointC: actual point U24

back plate Quadric 247 Component no.

limit plane disp. (in pixels)

Component no.

Quadric 249

51

ät
2

-			flow on ext., int. or both
175.6		52.1	pointA: actual point S24
182.9	•	54.3	pointB: actual point T24
179.25	9.9 -	51.0	pointC: actual point V24
700. 0		100. D. D.	Exterior point limit plane dian (in pivolo)
;	;		TIMIC DIGINA DISD. (IU DIXEIS)
'MLS Ema	ll ante	enna OPST24'	back plate Quadric 250
PlateB			component no.
1 174 7		9 (3	flow on ext., int. or both
183.8		0.12	pointA: actual point 024 mointB: actual moint 024
175.6		4.64	pointC: actual point S24
182.9	•	51.6	pointD: actual point T24
200.		-100.	Exterior point
	0	0.0.	limit plane disp. (in pixels)
'HLS BMA	ll ante	enna STV24'	back plate Quadric 251
22			Component no.
PlateA			
1 175 6	c	1 01	rlow on ext., int. or both
182.9		51.6	pulnch: actual point S24 mointh: actual moint moi
179.25	-4.7	48.3	points: actual point 124 bointC: actual point V24
200.	.0	-100.	Exterior point
.0	.0	0. 0.	limit plane disp. (in pixels)
MLS Ema	ll ante	nna PPRR24'	Ouadric 252
22 Plater			Component no.
1			flow on ext int or both
183.8	4.6	55.7	pointA: actual point P24
183.8	4.7	53.0	pointB: actual point P24
182.9	9.1	57.1	pointC: actual point R24
200.	4 .0	50.	pointD: actual point R24 Exterior point
.0		0. 0.	limit plane disp. (in pixels)
MI.C ema	11 anto	1 Curring d	Citedado 263
7.7 2.7	TT dire	41114 LL 1 1 7 4	Quadric 233 Composet no
PlateB			component no.
1			flow on ext., int. or both
183.8	91	55.7	pointA: actual point P24
182.9		54.3	points: actual point P24 nointr: actual point T24
182.9		51.6	pointD: actual point T24
200.		50. 2	Exterior point
		0. 0.	limit plane disp. (in pixels)
'MLS BMa	ll ante	nna RRUU24'	Quadric 254
22 PlateB			component no.
1			flow on ext., int. or both
182.9	9.1	57.1	pointA: actual point R24
179.55	9.6 7 ~ ~ [54.4	pointB: actual point R24
179.25	14.1	55.1	pointD: actual point U24 pointD: actual point U24
200.	50.	50.	Exterior point
	0.	0. 0.	limit plane disp. (in pixels)
'MLS SMa'	ll ante	nna TTVV24'	Quadric 255
22 PlateB			Component no.
1			flow on ext., int. or both
182.9		54.3	pointA: actual point T24
179.25	- F - C	0.10 51 D	pointB: actual point T24 maintr: actual point 124
71.7.4		0.10	pointus: actual point v/4

pointD: actual point V24 Exterior point limit plane disp. (in pixels)	Quadric 256 Component no.	flow on ext., int. or both pointA: actual point 024 pointB: actual point 024 pointC: actual point 024 pointD: actual point 024 Exterior point limit plane disp. (in pixels)	Quadric 257 component no. flow on ext., int. or both pointA: actual point 024 pointB: actual point 024 pointC: actual point 224 pointD: actual point 224 Exterior point limit plane disp. (in pixels)	Quadric 258 component no. flow on ext., int. or both pointA: actual point U24 pointB: actual point U24 pointC: actual point Q24 pointC: actual point Q24 pointD: actual point Q24 Exterior point limit plane disp. (in pixels)	Quadric 259 Component no. flow on ext., int. or both pointA: actual point S24 pointB: actual point V24 pointC: actual point V24 pointD: actual point V24 pointD: actual point V24 itmit plane disp. (in pixels)	Quadric 260 Component no. flow on ext., int. or both pointA: actual point A25 pointB: actual point B25 pointD: actual point D25 pointD: actual point D25 Exterior point limit plane disp. (in pixels)	Quadric 261 Component no. flow on ext., int. or both pointa pointa radius radius fimit plane disp. (in pixels) F31 limits
0.	24'	. 0	24.	2 4 , 0.	24.00.	BCD25'	F25' 100.
48.3 50. 0.	nna 0000	50.5 50.8 50.2 50.2 50.2 50.2 50.2 50.2 50.2 50.2	na 00SS 53.5 52.1 49.4 50.	na QQUU 57.8 55.1 54.9 52.2 50.	na SSVV 52.1 49.4 51.0 48.3 50. 0.	, RHS A 30.9 30.9 30.9 16.0 16.0 50. 50.	, RHS E1 30.9 30.9 50. 0.
-4.7 -50. 0.	ll anter	446600 4 84	11 anter 4.6 4.7 0.0 0.0	<pre>11 anter 13.7 14.1 9.1 9.4 50. 0.</pre>	11 anten 0. -4.6 -4.7 -50.	anna arm 19.7 30.4 10.3 0. 0.	arma arm 15.0 15.0 0.
179.25 200. 0.	'MLS Bma 22 PlateR	1 174.7 174.7 175.6 175.6 100.	'MLS sma 22 PlateB 174.7 174.7 175.6 175.6 100.	'MLS sma 22 PlateB 1 179.25 175.6 175.6 100.	MLS sma 22 22 1 175.6 175.6 179.25 179.25 100.	MLS ant 22 PlateB 0 218.0 218.0 218.0 218.0 218.0 218.0 218.0 0.	<pre>'MLS ant* 22 Cylinder# 1 218.0 226.8 4.8 0. 200. 300.</pre>

'MLS antenna arm, 22	, RHS E25'	Plane 14 Component no.	22 CvlinderA	Component no.
Disk 218.0 15.0 -1. 0. 4.8	30.9 0.	pointA direction cosine normal to disk radius	1 183.1 30.7 27.7 172.5 9.1 57.0 2.	flow on ext., int. or both pointA pointB radius
'MLS antenna arm, 22 Disk	, RHS F25'	Plane 15 Component no.	0. 0. 150. 300. 0. 50. 0. 100. 'MLS antenna arm, between IL25'	limir plane disp. (in pixels) F31 limits Quadric 269
226.8 15.0 1. 0. 4.8	30.9 0.	pointA direction cosine normal to disk radius	22 CylinderA 1 183.1 5.7 16.8	Component no. flow on ext., int. or both pointA
'MLS antenna arm, 22 CylinderA 1	, back GH25'	Quadric 262 Component no. flow on ext., int. or both	172.5 0. 54.2 2. 0. 54.2 0. 0. 100. 100.	pointB radius limit plane disp. (in pixels) F3I limits
183.1 30.7 216.3 30.7 2. 0.	27.7 35.3	pointA pointB radius limit nlane dien (in nivels)	'MLS antenna arm, side K25' 22 Scharea	Quadric 270 Component no.
150. 300. 0. 5 MLS antenna arm,	50. 0. 50. , back IJ25'	F3I limits Quadric 263	1 172.5 9.1 57.0 3.	flow on ext., int. or both pointA radius
CylinderA 1 183.1 5.7	16.8	flow on ext., int. or both pointA	'MLS antenna arm, side L25' 22 SphereA	Quadric 271 Component no.
216.3 5.7 2. 0. 150.100.0.5	24.8 30. 0. 50.	pointB radius limit plane disp. (in pixels) FII limit a	1 172.5 0. 54.2 3.	flow on ext., int. or both pointA radius
'MLS antenna arm, 22	, back H25'	Quadric 264 Component no.	'HGA-side bracework AB23' 23 CylinderA	Quadric 272 Component no.
SphereE 1 216.3 30.7 98247 0.	35.3 18643	flow on ext., int. or both pointA direos	1 221.0 31.1 0. 221.0 94.0 0. 1.5	flow on ext., int. or both pointA pointB radius
2. 0. 200. 250. 0.	20. 0. 50	radius limit plane disp. (in pixels) . F31 limits	0. 0. 150. 250. 0. 100100. 100	limit plane disp. (in pixels) . F3I limits
'MLS antenna arm, 22	, back J25'	Quadric 265 Component no.	HGA-SIGE DFACEWOFK CB23 23 CylinderA	Quadric 273 Component no.
SphereE 1 216.3 5.7 98247 0.	24.8 18643	flow on ext., int. or both pointA dircos radius	1 221.0 29.6 -41.0 221.0 94.0 0. 1.5 0.	flow on ext., int. or both pointA pointB radius 1 mit plane disn (in nivels)
0. 200. 250. 0.	20. 0. 50	limit plane disp. (in pixels) F31 limits	150. 250. 0. 100100. 100 'HGA-side bracework EB23'	. F3I limits Ouadric 274
'MLS antenna arm. 22 SphereA	, back G25'	Quadric 266 Component no.	23 CylinderA 1	Component no. flow on ext., int. or both
1 183.1 30.7 3.	27.7	flow on ext., int. or both pointA radius	255.4 18.6 0. 221.0 94.0 0. 1.5 0. 0.	pointA pointB radius limit plane disp. (in pixels)
'MLS antenna arm, 22 SphereA	, back 125'	Quadric 267 Component no.	150. 300. 0. 100100. 100 'HGA-side bracework GB23'	FJI limits Quadric 275
1 183.1 5.7 3.	16.8	flow on ext., int. or both pointA radius	23 CylinderA 1 255.4 18.1 -41.0	Component no. flow on ext., int. or both pointA
'MLS antenna arm,	between GK25	Quadric 268	221.U 74.U U.	pointB

dius imit plane disp. (in pixels) I limits	lc 276 Component no.	ow on ext., int. or both IntA IntB Jius Mius plane disp. (in pixels) I limits	le 277 Component no.	W on ext., int. or both IntA IntB Ilus Mut plane disp. (in pixels) : limits	.c 278 Component nc.	w on ext., int. or both ntA ntB lius mit plane disp. (in pixels) limits	c 279 Component no.	w on ext., int. or both ntA ntB ius mit plane disp. (in pixels)	c 280 Component no.	w on ext., int. or both ntA ntB ius mit plane disp. (in pixels) limits	= 281 Component no.	<pre>v on ext., int. or both atA ttA ttB tus tus lius linpic disp. (in pixels) linit = linit.</pre>	: 282 Somponent no.	v on ext., int. or both htA
rad 11 100. F31	Quadri	rad poi poi rad rad 11 100. F31	Quadri	flo poi poi rad rad 11 11 100. F3I	Quadri	fio poli poli rad 111 100. F31	Quadri	flor poli poli radi lir 111	Quadr1c	flov poir poir radi radi 160. F31	Quadric	flow poin poin radi lim 100. F3T	Quadric	flow Poin
00100.	k 1J23'	0. 0. 0100.	K KJ23'	1.0). 0100.	¢ MJ23'	1.0). 0100.	: 0.23		QR23 '	.0 .0 0100.	SR23'	.0 .0 -100.		
0.0.1	e bracewor A	-30.2 -94.0 0100.	e bracewor) A	-28.7 -41 -94.0 (0100.	e bracewor)	A -14.4 -41 -94.0 C 0. 0.	e bracework	A -14.4 0 -94.0 0 0100.	e bracework	29.6 -41 094 0100.10	bracework	28.6 -41 094 0100. 100	unctn 823'	94.0 0.
1.5 0. 150. 30	'HGA-sid 23 Cylinder	1 221.0 221.0 1.5 0. 150. 25	'HGA-sid 23 Cvlinder	1 221.0 221.0 1.5 0. 150. 25	'НGА-в1d 23	Cylinder, 1 255.4 221.0 1.5 0. 150. 300	'HGA-side 23	Cylinder/ 1 255.4 - 221.0 - 1.5 0. 150. 300	'HGA-side 23 CvlinderA	1 221.0 221.0 1.5 0.5 150. 300.	'HGA-side 23 CylinderA	1221.0 - 221.0 - 1.5 0.5 150.300.	'Sphere ji 23 SphereA	221.0

pointA direction cosine normal to disk radius flow on ext., int. or both pointA pointB radius ilmit plane disp. (in pixels) F3I limits pointA direction cosine normal to disk radius Cone half angle Rlength limit plane disp. (in pixels) F3I limits pointA direction cosine normal to disk radius1 radius2 dircos Cone half angle Rlength Limit plane disp. (in pixels) F31 limits flow on ext., int. or both pointA radius flow on ext., int. or both pointA radius flow on ext., int. or both pointA dircos flow on ext., int. or both pointA Component no. Component no. Component no. Quadric 285 Component no. Component no. Component no. Component no. Component no. Quadric 286 Quadric 283 Quadric 284 Plane 16 Quadric 287 Plane 17 Plane 18 radius 0. 0. 100. 150. -50. 0. -100. -50. 0. 0. -90. 0. 0. 90. 0. 50. 0. 50. -39.9 27.1 23.6 -.66446 0.34202 .66446 14.0 21.0 0. 0. -21.4 27.1 23.6 .66446 0.34202 .66446 14.0 21.0 97.5 47.8 15.0 0. 0.8706 0.4921 -94.0 Disk 136.3 -23.8 -60.0 -60.0 -60.0 -26.7 -60.0 -1. 0. 。 . 06 'Sphere junctn R23' 'Sphere junctn J23' 'Dish above CLAES' 'HALOE mount AB27' 'Thrusters, BD26' 'Thrusters, AC26' 'HALOE mount A27' 'HALOE mount B27' 136.3 -23.8 -136.3 -26.7 -10.6 0. 0. -50. 50. 0. .0 -94.0 CylinderA SphereA SphereA 221.0 5.0 221.0 0. 11.4 ConeA ConeA 5.0 10.6 5.0 Disk 26 RingA 136.3 0. 6.7 10.6

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HALOE mount BC27' s rlindera	Quadric 288 Component no.
6.3 -26.7 -60.0 6.3 -28.7 -60.0 7 0. 15050. 010050.	flow on ext., int. or both pointA pointB radius iimit plane disp. (in pixels) F3I limits
ALOE mount C27' 5 1ngA 66.3 -28.7 -60.0 6.3 -1. 0. 5.0 6.7	Plane 19 Component no. pointA direction cosine normal to disk radius1 radius2
AALOE mount CD27' 5 5 6 1 36.3 -33.3 -60.0 2.8	Quadric 289 Component no. flow on ext., int. or both pointA radiusA
	raduse Riength dircos limit plane disp. (in pixels) F31 limits
HALOE mount D27' 6 LingA 36.3 -33.3 -60.0 0. 1. 0. 5.0	Plane 20 Component no. pointA direction cosine normal to disk radius1 radius2
HALOE mount DE27'	Quadric 290 Component no.
VillaerA 36.3 -33.3 -60.0 36.3 -41.0 -60.0 5.0 0. 0. 15050. 010050.	flow on ext., int. or both pointA pointB radius limit plane disp. (in pixels) F31 limits
HALOE mount E27'	Plane 21 Component no.
15K 36.3 -41.0 -60.0 01. 0. 5.0	pointA direction cosine normal to disk radius
HALOE mount FGH127' 6 1ateB	Quadric 291 Component no.
41.3 -34.4 -53.2 41.3 -34.4 -60.0 41.3 -40.6 -53.2 41.3 -40.6 -60.0 5050. 0.0	flow on ext., int. or both pointA: actual point F27 pointB: actual point G27 pointC: actual point H27 pointD: actual point 127 Exterior point limit plane disp. (in pixels)
HALOE mount JKLM27' 6	Quadric 292 Commonent no.

PlateB 1 131 1		5		flow on ext., int. or both
131.3	-34.4	-60.0		pointB: actual point J2/ pointB: actual point K27
131.3	-40.6	-53.2		pointC: actual point L27
50.	-50.	-50.		pointU: actual point M2/ Exterior point
.0	. 0	0.	0.	limit plane disp. (in pixe
HALOE 1	mount F(3JK27'		Quadric 293
26 PlateB				Component no.
				flow on ext., int. or both
141.3	-34.4	-53.2		pointA: actual point F27
141.3	8.80- 8.96-	-60.0		pointB: actual point G27 nointC: actual noint J27
131.3	-34.4	-60.0		pointD: actual point K27
150.	00	-50.	c	Exterior point limit plane disp (in pive
HALOF 1	mount H	T.M27'		Ouadric 294
26				Component no.
PlateB				
1	2 0 7	5		flow on ext., int. or both
141.3	-40.6	7.66-		pointB: actual point HZ/ pointB: actual point T27
131.3	-40.6	-53.2		pointC: actual point L27
131.3	-40.6	-60.0		pointD: actual point M27
.0.	. oc	- 0 c -	.0	Exterior point limit plane disp. (in pix,
' HALOE	mount F	47R27'		Quadric 295
26				Component no.
PlateB				
L 141.3	-34.4	-53.2		riow on ext., int. of both pointA: actual point F27
141.3	-38.8	-49.4		pointB: actual point N27
5.151 5.151	-34.4	-53.2		pointC: actual point J27
150.	8.87- 0.0	- 49.4		pointu: actual point K2/ Exterior point
		-0-5	0.	limit plane disp. (in pix-
HALOE	mount NI	FPQ27'		Quadric 296
26 PlateB				Component no.
_				flow on ext., int. or both
141.3 141.3	- 38.8	-49.4		pointA: actual point N27
141.3	- 50.5	4.64-		points: actual point F2/ pointC: actual point P27
141.3	-50.5	-53.2		pointD: actual point 027
250. 0	-50.	-50.	c	Exterior point limit clane d(m. dh miv
	; .			TTURY FIGURE HISP. (111 DIX
RALUE	שסחתר אי	./ 70.1.0		Quadric 29/ Component no
PlateB				
1 131.3	-38.8	-49.4		flow on ext., int. or both pointA: actual noint 827
131.3	-34.4	-53.2		pointB: actual point J27
131.3	-50.5	-49.4		pointC: actual point T27
50.		-50.		pointu: actual point U2/ Exterior moint
	0.		0.	limit plane disp. (in pixe
'HALOE	mount HI	rouz <i>1 ·</i>		Quadric 298
e PlateB				component no.
, ; ;	9 08-	. []		flow on ext., int. or both
		7.00-		pointA: actual point nz/

flow on ext., int. or both pointA: actual point J27 pointB: actual point L27 pointC: actual point L27 pointD: actual point M27 Exterior point limit plane disp. (in pixels) Quadric 293 Component no. flow on ext., int. or both pointA: actual point F27 pointB: actual point G27 pointC: actual point J27	pointD: actual point K27 Exterior point limit plane disp. (in pixels) Quadric 294 Component no. flow on ext., int. or both pointB: actual point H27 pointC: actual point L27 pointC: actual point L27 pointC: actual point K27	Exterior point limit plane disp. (in pixels) Quadric 295 Component no. flow on ext., int. or both pointA: actual point N27 pointCB: actual point N27 pointC: actual point R27	Exterior point Limit plane disp. (in pixels) Quadric 296 Component no. flow on ext., int. or both pointA: actual point N27 pointC: actual point F27 pointC: actual point P27 pointD: actual point Q27	Exterior point limit plane disp. (in pixels) Quadric 297 Component no. flow on ext., int. or both pointA: actual point 327 pointB: actual point 727 pointD: actual point 727 pointD: actual point U27 Exterior point	limit plane disp. (in pixels) Quadric 298 Commonent por
					.0
0	0	0	o	0	

pointB: actual point L27 pointC: actual point Q27 pointD: actual point U27 Exterior point U27 limit plane disp. (in pixels)	Quadric 299 Component no.	flow on ext., int. or both pointA: actual point N27 pointB: actual point R27 pointC: actual point P27 pointD: actual point T27 Exterior point T27 Limit plane disp. (in pixels)	Quadric 300 Component no. flow on ext., int. or both pointa pointa radius limit plane disp. (in pixels) F31 limit	Plane 22 Component no. pointA direction cosine normal to dis radius1 radius2	Quadric 301 Component no. flow on ext., int. or both pointA pointB radius falue disp. (in pixels) F31 limits	Plane 23 Component no. pointA direction cosine normal to dish radius	Quadric 302 Component no. flow on ext., int. or both pointA: actual point A28 pointB: actual point C28 pointC: actual point C28 pointC: actual point D28 pointC: actual point D28 Exterior point limit plane disp. (in pixels)	Quadric 303 Component no. flow on ext., int. or both pointB: actual point G28 pointB: actual point H28
.0		.0	8030.		.06		o	
-53.2 -53.2 -53.2 -53.2 -100. 0.	КРТ27'		427, -49.4 -56.3	-49.4 -1.	27' -49.4 -47.4	7, -47.4 -1.	28' -66.7 -66.7 -66.7 -66.7 -100.	28' -56.3 -56.3
-40.6 -50.5 -50.5 0.	mount N		mount VV erA -50.5 -50.5 0. 16080	mount V2 -50.5 0.	mount VX arA -50.5 -50.5 0.60.	mount X2 -50.5 0.	box ABCD -52.7 -52.4 -55.4 -55.4 -50.	box GHIJ: -52.7 -52.7
131.3 141.3 131.3 150. 0.	'HALOE 26 Plater	141.3 141.3 141.3 141.3 131.3 250.	<pre>'HALOE 26 CYlind CYlind 1 1 136.3 136.3 136.3 136.3 100.1</pre>	'HALOE 26 Ringa 136.3 0. 1.1 5.0	<pre>'HALOE 26 26 Cylinde 1 136.3 1.1 0. 1.1 100. 1</pre>	'HALOE 26 Disk 136.3 0. 1.1	'HALOE 26 PlateB 11 147.6 1121.0 1121.0 1121.0 1150. 0.	'HALOE 26 PlateB 1 121.0 121.0

normal to disk

147.6	-55.4	-56.3		pointC: actual point 128 pointD: actual point J28
.0c1	.0c- .0		.0	Exterior point limit plane disp. (in pixels)
'HALOE 26 Platen	box BDH.	J28'		Quadric 304 Component no.
1121.0	-52.7	-66.7		flow on ext., int. or both pointA: actual point B28
121.0	-55.4	-66.7		pointB: actual point D28
121.0	-55.4	-56.3		pointC: actual point H28 pointD: actual point J28
50. 0.	-50. 0.	-100. 0.	.0	Exterior point limit plane disn (in nivels)
HALOE	box CDEN	F28'		ouadric 305
26 PlateB				Component no.
				flow on ext., int. or both
147.6	-55.4	-66.7 -66.7		pointA: actual point C28 pointB: actual point D28
145.0	-61.8	-66.7		pointC: actual point E28
133.8	-61.8 -50	-66.7		pointD: actual point F28
		.0.7	0.	Limit plane disp. (in pixels)
'HALOE 26	box IJKI	.28'		Quadric 306 Commonant no
PlateB 1				
147.6	-55.4	-56.3		110W ON EXC., INC. OF DOTH pointA: actual point 128
121.0	-55.4	-56.3		pointB: actual point J28
133.8	-61.8	-56.3		pointD: actual point h28 pointD: actual point L28
	.06-		0	Exterior point limit plane disp. (in pixels)
'HALOE	box CEIK	12.8 '		Ouadric 307
26 PlateB				Component na.
	:			flow on ext., int. or both
147.6	-55.4	-66.7 -66.7		pointA: actual point C28
147.6	-55.4	-56.3		pointC: actual point E28
145.0	-61.8	-56.3		pointD: actual point K28
	.0.1		0.	Exterior point limit plane disp. (in pixels)
HALOE	box EFKL	28'		Quadric 308
o PlateB				Component no.
45.0	-61.8	-66.7		flow on ext., int. or both pointA: articl point 520
133.8	-61.8	-66.7		pointB: actual point F28
33.8	-61.8	-56.3		pointC: actual point K28 pointD: actual moint 120
50.	-100. 0.	 	0.	Exterior point point 120 limit Diame disc. (in nivels)
HALOE	box DFJL	28,		Olladric 100
6 lateB				component no.
21.0	-55.4	-66.7		flow on ext., int. or both
33.8	-61.8	-66.7		points: actual point D28 points: actual point F28
33.8	-61.8	-56.3		pointC: actual point J28 pointD: actual point L28
	-100.	0.		Exterior point

n ext., int. or both
actual point C28
actual point D28
actual point E28
actual point F28
actual point F28
plane disp. (in pixels) n ext., int. or both
a actual point 128
actual point J28
actual point K28
actual point L28
actual point L28
prepoint point l28
prepoint olane disp. (in pixels) lane disp. (in pixels) ane disp. (in pixels) ext., int. or both actual point B28 actual point D28 actual point H28 actual point H28 actual point J28 scrual point J28 ext., int. or both actual point C28 actual point E28 actual point I28 actual point K28 actual point K28 actual point 128 actual point J28 r point J7 onent no. nent no. nent no. nent no. ent no. s 4 ھ

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Matrix for the first of the first			Thirt prane disp. (IU pixels)	26 PlateB	Component no.
Contract	NOP28'		Quadric 310		
(1,1) $(1,1)$ <			Component no.	147.6 -43.7 -66.7	Ilow on ext., int. or both
(***) (*****) (*****) (****			flow on set (nt or but)	131.3 -43.7 -66.7	pointB: actual point B29
(1, 1)points: setui point Ni $(2, 1, 2, 1, 1)$ points: setui point Ni $(3, 1)$ points: setui point Ni $(1, 1)$ $(1, 1$	-49.4		pointA: actual point M28	147.6 -52.7 -66.7	pointC: actual point C29
(1, 0)pentre, entra jent 0, $(1, 0)$ </td <td>-68.7</td> <td></td> <td>pointB: actual point N28</td> <td>150 -52,7 -66,7 150 -50 100</td> <td>pointD: actual point D29</td>	-68.7		pointB: actual point N28	150 -52,7 -66,7 150 -50 100	pointD: actual point D29
(1)Description (1) <th< td=""><td>-49.4</td><td></td><td>pointC: actual point 028</td><td></td><td>EXTERIOR POINT</td></th<>	-49.4		pointC: actual point 028		EXTERIOR POINT
	-68.7		pointD: actual point P28		 limit plane disp. (in pixels)
0. 0. 1. It is that for a dire. (in plasts) $\frac{1}{100}$ $\frac{1}{10$			Exterior point	'HALOF how FECH29'	
Total Description Description <thdescription< th=""> <thdescription< th=""> <thd< td=""><td>.0</td><td></td><td>limit plane disp. (in pixels)</td><td>26</td><td>Quadric 31/ Component 10</td></thd<></thdescription<></thdescription<>	.0		limit plane disp. (in pixels)	26	Quadric 31/ Component 10
	12.87		Oundric 111	PlateB	
(1,1) $(1,2,1)$ $(1,2,1)$ $(2,1)$ </td <td></td> <td></td> <td>Construction of the second sec</td> <td>1</td> <td>flow on ext., int. or both</td>			Construction of the second sec	1	flow on ext., int. or both
(1,1) $(1,2)$ $(1,2)$ $(2,1)$ <				147.6 -43.7 -56.3	pointA: actual point E29
(1,1) $(1,1,1)$ $(2,1,1)$ $(3,1)$ </td <td></td> <td></td> <td>flam an ant firt an tail</td> <td>131.3 -43.7 -56.3</td> <td>pointB: actual point F29</td>			flam an ant firt an tail	131.3 -43.7 -56.3	pointB: actual point F29
3.6.7points, actual point 0.8 11.1 5.7 $5.6.1$ points, actual point 0.8 $0.6.5$ 0.7 0.7 0.7 0.7 0.7 0.7 0.1114 $0.6.7$ 0.7 0.7 0.7 0.7 0.1114 0.1114 0.1114 $0.6.7$ $0.6.7$ 0.7 0.7 0.7 0.1114 0.1114 $0.6.7$ $0.6.7$ 0.7 0.7 $0.6.7$ 0.1114 0.1114 $0.6.7$ 0.7 0.7 0.7 0.7 0.1114 0.1114 $0.6.7$ 0.7 0.7 0.7 0.7 0.1114 0.1114 $0.6.7$ 0.7 0.7 0.7 0.7 0.1114 0.1114 $0.6.7$ 0.7 0.7 0.7 0.7 0.1114 0.1114 0.7 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7 0.7 0.1114 0.7 0.7 0.7 0.7			LIUW UN EXT., INT. OF DOCH	147.6 -52.7 -56.3	pointC: actual point 629
5.0.1DefinitionStreet in pointThree into point<			potnuki actual point Q28	131.3 -52.7 -56.3	pointly actual noint 470
9. 0. <th0.< th=""> 0. 0. 0.<</th0.<>	1.00-		pointB: actual point R28	15050. 0.	Exterior solution 167
10.Definition of the point of	5.00-		pointC: actual point S28	0. 0. 0.	limit plane at an off at a
0. Description Match point Match point <th< td=""><td>-66.7</td><td></td><td>pointD: actual point T28</td><td></td><td></td></th<>	-66.7		pointD: actual point T28		
0. $0.$ $1.$ list place disp. (in places) 2.6 moment in component in	-50.		Exterior point	'HALOF how ABFF70'	
21. Oudric J12 Descent no. 22. Component no. 11/15 6/17 6/17 6/17 0/11/15 <td>.0</td> <td>0</td> <td>limit plane disp. (in pixels)</td> <td></td> <td>Quadric Jis</td>	.0	0	limit plane disp. (in pixels)		Quadric Jis
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CylinderA Component no. 9' Quadric 316 1 flow on ext., int. or borh			limit plane disp. (in pixels)	26	
9' Quadric 316 1 Internation 1 flow on ext. int. or both				(v) indera	component no.
flow on ext., int. or horh	.62		Oundric 316		
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pointA pointB radius (4.5) limit plane disp. (in pixels -40. F31 limite	Plane 24 Component no. pointA direction cosine normal to di	radius Quadric 323 Component no.	flow on ext., int. or both pointA: actual point N29 pointB: actual point 029 pointC: actual point P29 pointD: actual point Q29 Exterior point	Quadric 324 Component no.	flow on ext., int. or both pointA: actual point N29 pointB: actual point N29 pointC: actual point R29 pointD: actual point S29 Exterior point limit plane disp. (in pixels	Quadric 325 Component no.	flow on ext., int. or both pointA: actual point P29 pointB: actual point Q29 pointC: actual point T29 pointD: actual point U29 Exterior point limit plane disp. (in pixels)	Quadric 326 Component no.	flow on ext., int. or both pointA: actual point N29 pointB: actual point R29 pointC: actual point P29 pointD: actual point T29 Exterior point T29 limit plane disp. (in pixels)	Quadric 327 Component no.	flow on ext., int. or both pointA: actual point 029 pointB: actual point 229 pointC: actual point 229 pointD: actual point 229
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-64.9 -64.9 30.	-64.9 -64.9 0.	or NOPQ29	-60.7 -57.9 -60.7 -57.9 -50.7 -50.	or NORS29	-60.7 -57.9 -60.7 -57.9 -50.	or PQTU25	-60.7 -57.9 -60.7 -57.9 -50.	or NRPT29	-60.7 -60.7 -60.7 -60.7 -100.	ər osqu29	-57.9 -57.9 -57.9
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26 Disk	:	:		Component no.
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'SSPP 1 15 Cvlind	support ' erå			Quadric 328 Component no.
253.3 253.3	16.0 16.0	-61.0 -42.5		flow on ext., int. or both pointA pointB
3.4 200.	0. 300. 10.	20	8020.	radius limit plane disp. (in pixels) F3I limits
'ISAMS 16	box DIOP	15,		Quadric 329 Component no.
Plates 1. ates 44.8 57.3 44.8 44.8 57.3 50. 0.	-38.7 -38.7 -61.2 -61.2 -50. 0.	11.6 11.6 11.6 11.6 80. 0.	.0	flow on ext., int. or both pointA: actual point D15 pointB: actual point 115 pointC: actual point 015 pointC: actual point P15 Exterior point limit plane disp. (in pixels)
'ISAMS 16 Distor	рох нлов	15'		Quadric 330 Component no.
1 44.8 57.3 57.3 50. 0.	-38.7 -38.7 -61.2 -561.2 -50.	25.55 25.55 25.55 - 0.	·	flow on ext., int. or both pointA: actual point H15 pointB: actual point J15 pointC: actual point Q15 pointD: actual point R15 Exterlor point limit plane disp. (in pixels)
'ISAMS 16 Plateb	box OPST	15'		Quadric 331 Component no.
1 44.8 57.3 57.3 57.3 57.3 50. 0.	-61.2 -61.2 -76.2 -76.2 -70.	11.6 11.6 7.8 80. 80.	. 0	flow on ext., int. or both pointA: actual point 015 pointB: actual point 715 pointC: actual point 715 pointD: actual point 715 Exterior point limit plane disp. (in pixels)
'ISAMS 16 Distar	box QRUVI	15,		Quadric 332 Component no.
1 44.8 57.3 57.3 50. 0.	-61.2 -61.2 -76.2 -76.2 -70.	-25.5 -25.5 -21.7 -21.7 -21.7 -21.7 -21.7 -21.7 -21.7 -20.	·	flow on ext., int. or both pointA: actual point Q15 pointB: actual point R15 pointC: actual point U15 pointC: actual point V15 Exterior point limit plane disp. (in pixels)
'ISAMS 16 PlateB	box STWX1	15,		Quadric 333 Component no.
0 44.8 57.3 44.8 57.3 50.	-76.2 -76.2 -91.2 -91.2	7.8 7.8 11.6 11.6 80.		flow on ext., int. or both pointA: actual point s15 pointB: actual point T15 pointC: actual point 015 pointC: actual point P15 Exterior point

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0.5 'IM vent ABEF31' 28	PlateB 1	12.0 45.1 2.1 60.0 45.1 2.1	12.0 44.1 3.1	60.0 44.1 3.1 40. 70. 5.	0. 0.	(IN mont CDEE31)		races 1	12.0 43.1 2.1 60-0 43.1 2.1	12.0 44.1 3.1	60.0 44.1 3.1 40 -70 5	0. 0. 0. 0.	1101D4 10000 M11	IM VENC ACEJI	PlateA	12.0 45.1 2.1	12.0 43.1 2.1 12.0 44.1 3.1	-100. 0.0 0.0	0. 0. 0.	'IM vent BDF31'	28 PlateA	1 60.0 45.1 2.1	60.0 43.1 2.1	100. 144.1 J.1 100. 0.0 0.0	0. 0. 0.	'HALOE mount ACFG4'	4 PlateB	0	1/1:4 30.8 -42.5 136.3 -23.6 -66.9	171.4 30.8 -42.25 136 3 -23 6 -66 65	136. 050.	0. 0. 0.	'HALOE mount CDGH4'	4 PlateB	0	101.2 30.8 -42.5		136. 050.	0. 0. 0.		
pointB: actual point b13 pointC: actual point e13 pointD: actual point f13 Exterior point	limit plane disp. (in pixels)	Quadric 346 Component no.		pointA: actual point G27	pointB: actual point 127	pointu: actual point K2/ pointD: actual point M27	Exterior point limit name dien /in niveloi		Quadric 34/ Component no.		pointA: actual point P27	pointB: actual point 027	pointC: actual point T27 pointD: actual point 1127	Exterior point	limit plane disp. (in pixels)	Plane 28	component no.	pointA	dircos radius	Guidric 348	Component no.	flow on ext., int. or both	pointA pointB	radius	limit plane disp. (in pixels) F3I limits	b] and 20	component no.	point R	dircos	radius	Quadric 349	Component no.	flow on ext., int. or both	point C point D	radius dircose	dircosD	limit plane disp. (in pixels) F31 limits	;	Plane JU Component no.		poincu dircosD
c							.0								.0										40. 60.											4	0. 50.				4
-3.2 -11.2 -3.2 -3.2		IKM27'		-60.0	-60.0	-60.0	-90. 0.		1 7017		-49.4	-53.2	-53.2	-50.	o	at A30'		53.0	.0	1 AR30'			53.0 53.0		. 10.	1 B30'	2	53.0	0.		CD30,			26.228	.0	8 0.492	50.	1054	יטנע	26.228	8 0.492
-74.3 -65.3 -65.3 -40.	5	mount G		-34.4	-40.6	-40.6	-36. 0.				-50.5	-50.5		-70.	.0	Neon ver		2.7		Neon ver	rÅ	ł	2.7		0. 8010	Neon ven		1.7	-1.		co2 vent	ų Ľ	• • • •	36.635	-1.	0.586		turi cur	-02 Velli	36.615	0.586
133.0 143.3 143.3 120.		'HALOE 26	PlateB 1	141.3	141.3	131.3	135. 0.	actives	26	PlateB 1	141.3	141.3	131.3	135.	.0	CLAES	Disk	71.0	1.0	CLAES	27 Cvlinde	-	71.0	1.0	60.	CLAFS	27	D16K 71.0	.,	0.1	CLAES	27 Cylinde	1 £7 0	65.092	۰. م	-0.6428	0. 50. 10		27	D1sk 65.092	-0.6428

flow on ext., int. or both pointA: actual point A31 pointB: actual point B31 pointC: actual point E31 pointD: actual point F31 Exterior point limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point A4 pointB: actual point C4 pointC: actual point F4 pointD: actual point G4 Exterior point limit plane disp. (in pixels) limit plane disp. (in pixels) limit plane disp. (in pixels) Exterior point limit plane disp. (in pixels) flow on ext., int. or both pointA: actual point A31 pointB: actual point C31 pointC: actual point E31 Exterior point flow on ext., int. or both pointA: actual point C31 pointB: actual point D31 pointC: actual point E31 pointD: actual point F31 Exterior point flow on ext., int. or both pointA: actual point B31 pointB: actual point D31 pointC: actual point F31 Component no. Component no. Component no. Component no. Component no. Quadric 350 Quadric 351 Quadric 352 Quadric 353 Quadric 354

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flow on ext., int. or both pointA: actual point C4 pointB: actual point D4 pointC: actual point G4 pointD: actual point H4 Exterior point limit plane disp. (in pixels)

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Component no.

Quadric 355

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radius

Data:	
Rot at ion	
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Case	

HALOE rotation (theta = 6 deg)

28 House Forection (checa = 0 deg) 28 325 327 328 329 330 331 332 333 335 335 337 338 339 340 341 342 343 343 353 349 350 351 352 6 8 8 9 940 341 342 343 344 345 346 347 348 349 350 351 352 136.3 -50.5 -56.3 70.4 angle from baseline geometry (deg) 2 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	solar panel rotation (theta = 6 deg) 7 How many subelements? (List follows) 93 94 95 96 97 98 99 Rot. angle from baseline geometry (deg) 136.1 56.3 -55.5 Coords. of rotating origin 2 Axis of rotation	Case 2 Rotation Data:	HALOE rotation (theta = -23.6 deg) 28 HALOE rotation (theta = -23.6 deg) 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 346 347 348 349 350 351 352 -23.6 Rot. angle from baseline geometry (deg) 136.3 -50.5 -56.3 Coords. of rotation z	7 solar panel rotation (theta = -23.6 deg) 7 How many subelements? (List follows) 93 94 95 96 97 98 99 Rot. angle from baseline geometry (deg) 1136.1 56.3 -55.5 Coords. of rotation origin 2 Axis of rotation

Case 3 Rotation Data:

HALOE rotation (theta = -25 deg)

28 How many subelements? (List follows) 325 326 327 328 329 330 331 332 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 -25. Ret. angle from baseline geometry (deg) 136.3 -50.5 -56.3 Coords. of rotating origin z

HALOE rotation (alpha = 45 deg)

+

solar panel rotation (theta = 84 deg)

7 How many subelements (List follows) 93 94 95 96 97 98 99 Rot. angle from baseline geometry (deg) 84. Totating origin 136.1 56.3 -55.5 Coords. of rotating origin 2 Axis of rotation

Table 4: Input Data Listing-Subassembly Rotation Data

Data	Description						
'Main block top plate ABCD1'	Quadric 1						
1	number of outgassing surfaces on object						
PlateB	shape of outgassing surface						
1 0	flow direction code, outgassing index.						
	(0 if entire surface has one rate, or no, of defining points)						
0. 1. $0.6264E+17$ 100.	mole fractions of outgassing species.						
	total outgassing flux [molecules/m ² /sec], ref. temp. [°C]						
'Main block side Zmax CDGH1'	Quadric 2						
2	number of outgassing surfaces on object						
PlateB	shape of outgassing surface #1, entire surface						
1 0	flow direction code, outgassing index.						
	(0 if entire surface has one rate, or no, of defining points)						
0. 1. $0.6264E + 17$ 100.	mole fractions of outgassing species.						
• • • • • • • • •	total outgassing flux [molecules/m ² /sec], ref. temp. [°C]						
PlateB	shape of outgassing surface #2, vent above CLAES						
1 4	flow direction code, outgassing index.						
	(number of defining points)						
1. 0. $0.7649E + 20$ 100.	mole fractions of outgassing species						
	total outgassing flux [molecules/m ² /sec] ref_temp_[°C]						
12. 43.1 2.1	point A for vent						
60. 43.1 2.1	pointB for vent						
12. 45.1 2.1	pointC for vent						
	Pointe ter terre						

Ta	ble	5:	Typical	Elemental	Outgassing	Data		
----	-----	----	---------	-----------	------------	------		
rfaces on object	tgas rate	tgas rate ombined blanket vent	tgas rate ombined blanket vent	rfaces on object igas rate	rfaces on object :gas rate	rfaces on object gas rate	rfaces on object gas rate	rfaces on object
-------------------------------------	--	--	---	---	---	---	---	--------------------------------------
ent outgassing su	62E+14 100. ou'	35E+17 100. ou pointA c pointB pointC pointD	35E+17 100. ou pointA co pointB pointD pointD	ent outgassing su 62E+14 100. out	ent outgassing su 62E+15 100. out	ent outgassing sum 62E+14 100. out	ent outgassing sui 62E+14 100. out	ent outgassing su
op plate ABDCO' Number of differ	. 0. 0. 3. c), ref temp(C)	. 0. 0. 7. :), ref.temp(C) -42.25 -42.5 -42.5 -42.5 -42.5	. 0. 0. 7. :).reftemp(C) -42.25 -42.5 -42.5 -42.5	<pre>cde Zmax DCHG0' Number of differ Number of 0 0.3.; , ref temp(C)</pre>	de Zmin ABEF0' Number of differ , 0. 1. 1. :), ref temp(C)	<pre>bttom EIHJ0' Number of differ 0.0.3.), ref temp(C)</pre>	in ADEHO' Number of differ Number of differ : 0. 0. 3.	Number of differ
'Main block to 3 PlateB	1 0 0. 0. 0. 1. (Number/m2/sec PlateB	1 0 0 1 (Number/m2/sec 4.0 48.1 14.0 48.1 14.0 48.1 14.0 48.1	PlateB 1 4 1. 0. 0. 1. 0. 0. 1. 53.0 48.1 53.0 48.1 53.0 48.1 63.0 48.1 63.0 48.1	'Main block si 1 PlateB 1 0 1. 0. 0. 1. (Number/m2/sec	'Main block si 1 PlateB 1 0 0. 0. 0. (Number/m2/sec	'Main block bo 1 PlateB 1 0 1. 0. 0. 1. (Number/m2/sec	'Main block Xn 1 FlateB 1 0 1. (Number/m2/sec	'Main block Xn 2 PlateB 1 0

0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) 3.62E+14 4.17E+14 4.17E+14 3.62E+14 3.62E+14 'Front small plate Ymin DHCG1' 'Front small plate Zmax BFCG1' 'Front small plate Ymax ABEF1' 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. / (Number/m2/sec), ref temp(C) 0 0. 1. 0. 'CLAES big cap' CylinderA 0. SphereE .0 PlateB .0 PlateB 0 PlateB PlateB 0 . 0 . 0 . 0 . 0 -------

'Front small plate Xmax EFHG1' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'Front small plate Zmin AEDH1' 1 Number of different outgassing surfaces on object 'CLAES fat cylindrical part' 1 'CLAES small cylindrical part' 1 Number of different outgassing surfaces on object rate rate rate rate outgas rate outgas rate outgas rate outgas rate outgas outgas outgas outgas 100. 100. 100. 100. 100. 100. 100. 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) .0 0. 0. PlateB

PlateB

Table 6: Input Data Listing—Outgassing Information (19 pgs.)

outgas rate

100.

4.17E+14

.

.

0. 1.

.0

CylinderA

outgas rate

100.

3.62E+14

0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) PlateB

(Number/m2/sec), ref temp(C)

'CLAES Ring'

RingA

combined blanket vent

pointA pointB pointC pointD

-42.25 -42.5 -42.5 -42.5

43.1 43.1 33.1 33.1

218.0 218.0 218.0 218.0

outgas rate

100.

7.35E+17

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object

outgas rate

4.17E+14 100.

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(c)

'CLAES small cap

'Front small plate Xmin ABDC1' 1 Number of different outgassing surfaces on object

'CLAES shield plate'
'CLAES shield plate'
1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'Battery package EFGH3' 1 Number of different outgassing surfaces on object outgas rate outgas rate outgas rate 4.17E+14 100. outgas rate outgas rate 7.35E+15 100. outgas rate outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate MPS vent MPS vent pointA pointB pointC pointD 100. 7.35E+15 100. pointA pointB pointC pointD 4.17E+14 100. 4.17E+14 100. 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 0. 0. 1. 1.62E+15 (Number/m2/sec), ref temp(C) v. v. 0. 1. 0. 0. 4
(Number/m2/sec), ref temp(C)
PlateB 0. 0. 7 ref temp(C) 0. 0. 7 reftemp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) PlateB 1 0 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) PlateB 'Battery package ABCD3' 'Battery package CDEF3' 10.44 'Battery package GHIJ3' 11.27 27.52 27.07 27.07 10.44 27.52 0. 0. 1. 0 (Number/m2/sec), r -31.12 -33.44 1 -31.12 -33.44 1 -31.12 -33.87 1 -30.18 -33.87 1 0. 0. 0. 1. 0 (Number/m2/sec), r -31.12 -28.28 2 -30.18 -28.28 2 -31.12 -29.10 2 -30.18 -29.10 2 0. 0. 0. 1. 1 SphereE PlateB 0 0 PlateB 1 0 PlateB PlateB PlateB

```
Number of different outgassing surfaces on object
                                                                                                                                                                                                            Number of different outgassing surfaces on object
                                                                                                                                                       outgas rate
                                                                                                                                                                                                                                                            rate
                                                                                                                                                                                                                                                            outgas
                  pointA
pointB
pointC
pointC
                                                                                                                                                    4.17E+14 100.
                                                                                                                                                                                                                                                          100.
                                                                                                                                                                                                                                                     0. 0. 0. 1. 0. 0. 4.17E+14
(Number/m2/sec), reftemp(C)
 ref temp(C)
23.6
23.6
23.6
23.6
                                                                                                                                                   0. 0. 0. 1. 0. 0. 4
(Number/m2/sec), ref temp(C)
                                                                                                                                                                                              'Battery package KLMN3'
                                                                                         'Battery package IJKL3'
                                                                                                                                                                                                                                                                                                    'Battery package MNOP3'
(Number/m2/sec), r
-15.47 27.67 2
-14.53 27.67 2
-14.53 26.73 2
-15.47 26.73 2
-14.53 26.73 7
                                                                                                                                             ° .
                                                                                                                       PlateB
                                                                                                                                                                                                                           PlateB
                                                                                                                                                    0
```

ACS vent

Number of different outgassing surfaces on object outgas rate 4.17E+14 100.

PlateB

Number of different outgassing surfaces on object 'Battery package QRAB3' 2 2 Number of different outgassing surfaces on object 'Battery package side GIMK3 lower X' I Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate rate vent outgas CDH 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 4.17E+14 100. 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) PlateB 7.35E+15 100. pointA pointB pointC 4.17E+14 100. pointD Battery package side AGCE3 lower X' 0. 0. 0. 1. 0. 0. 7. (Number/m2/sec), ref temp(C) -31.12 -34.00 -10.24 -30.18 -34.00 -10.24 -31.12 -34.47 -11.05 -30.18 -34.47 -11.05 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. / (Number/m2/sec), ref temp(C) 'Battery package OPQR3' 0. 1. ° . ° . PlateB PlateB **PlateB** PlateB

'Battery package side MOAQ3 lower X' L Number of different outgassing surfaces on object

PlateB

2.21E+15 100. outgas rate

ACS vent

pointA pointB pointC pointD

0. 0. 0. 1. 0. 0. 2. (Number/m2/sec), ref temp(C) -31.12 27.67 23.6 -30.18 27.67 23.6 -31.12 26.73 23.6 -31.12 26.73 23.6

2.21E+15 100. outgas rate

. .

。

0. 1.

PlateB 1 4 0. 0.

0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), reftemp(C)

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'Battery package side BDHF3 higher X' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'Battery package side AGM3 lower X' 1 Number of different outgassing surfaces on object 'HALOE mount ABC4'
1 Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate rate outgas rate outgas rate outgas rate outgas rate outgas 4.17E+14 100. 4.17E+14 100. 4.17E+14 100. 100. v. v. 0. 1. 0. 0. 1.62E+15 100. (Number/m2/sec), ref temp(C) 100. 100. 100. 'Battery package side HJNL3 higher X' 'Battery package side NPBR3 higher X' 1.62E+15 1.62E+15 0 0 0. 0. 1. 0. 0 1.62E+15 (Number/m2/sec), reftemp(C) . 5 1.62E+15 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 1 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 1 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C) 'Battery MMS plane bottom' 'Battery Cylindrical MMS' 'HALOE mount ACD4' 'HALOE mount CDE4' . . CylinderB PlateB PlateB PlateB 0 PlateA PlateA PlateA PlateA Disk

Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate outgas rate 100. 100. 100. 100. 3.62E+14 3.62E+14 0. 1.62E+15 0. 0. 0. 1. 0. 0. 1 (Number/m2/sec), ref temp(C) 'NEPS ABCD5' 0

Number of different outgassing surfaces on object

PlateA

١

Number of different outgassing surfaces on object 'Thin box under main block CDGH6' 1 'Thin box under main block DHBF6' 1 Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 3.62E+14 100. 100. 3.62E+14 100. 3.62E+14 100. 0. 0. 0. 0. 1. 0. 3.09E+15 (Number/m2/sec), ref temp(C) 'Thin box under main block ABCD6' 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) NEPS JLIKS' 'NEPS BFDH5' 'NEPS FEHG5' 'NEPS EAGC5' • • • . 0 • • • • PlateB PlateB PlateB PlateB PlateB PlateB PlateB .

'Thin box under main block EAGC6' 1 Number of different outgassing surfaces on object 3.62E+14 100. outgas rate . 0 .0 . . . 0 0.0 0.0 PlateB 1 0

outgas rate

0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C)

PlateB

(Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'Box under main block AECG7'

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 1. .0 PlateB

Number of different outgassing surfaces on object 'Box under main block EFGH7'

1 0 0.0.1.0.3 (Number/m2/sec), reftemp(C) 1 PlateB

outgas rate 3.62E+14 100.

'Box under main block BFDH7'

Number of different outgassing surfaces on object outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) PlateB ᇦᅇ

Number of different outgassing surfaces on object 'Box under main block IJCD7' PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

'Box under main block CGDH7' 1 Number of different outgassing surfaces on object PlateB

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) c

Number of different outgassing surfaces on object 'HRDI interferometer ABCD8' 0

'HRDI interferometer BFDH8'
0 Number of different outgassing surfaces on object

'HRDI interferometer HGFE8'

Number of different outgassing surfaces on object 0

Number of different outgassing surfaces on object 'HRDI interferometer AECG8' 0

。 。

'HRDI interferometer CDGH8' 0 Number of different outgassing surfaces on object 0

'cylindrical truss #1 at X = 0.' 1 1 CylinderA

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. <u>3</u> (Number/m2/sec), reftemp(C) 0. 0.

'cylindrical trues #2 at X = 0.' 1 Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), reftemp(C) CylinderA 0.0.

'cylindrical truss #3 at X = 0.' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'cylindrical truss ♦6 at X = 0.' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'Sphere junctn betwn trusses 3-4(X=0)'
0 Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate rate outgas rate outgas rate outgas 100. 100. 100. 3.62E+14 100. 100. 100. 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), ref temp(C) 'Sphere junctn betwn trusses 1-2(X=0)' 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) . 0 'Sphere junctn betwn trusses 5-6(X=0)' 3.62E+14 3.62E+14 3.62E+14 . 'cylindrical trugs #4 at X = 0.' 'cylindrical truss #5 at X = 0.' 'left-hand HGA-end box AFDI10' 'left-hand HGA-end box ABDE10' 1. 0. 0. 3.62E+14 0.
(Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 'left-hand HGA-end box BCE10' 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) CylinderA CylinderA CylinderA CylinderA . 0 0 . PlateB PlateB PlateA

0

0

'left/right-hand HGA-end box ABFG10' 1 Number of different outgassing surfaces on object rate outgas 3.62E+14 100. PlateB 0

0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C)

'left/right-hand HGA-end box BCGH10' 1 Number of different outgassing surfaces on object PlateB 1 0

Number of different outgassing surfaces on object 'right-hand HGA-end box GHJK11' 1 Number of different outgassing surfaces on object 'right-hand HCA-end box CEF11' 1 'right-hand HGA-end box HIKL11' 1 Number of different outgaasing surfaces on object 'right-hand HCA-end box CIFL11' 0 'right-hand HGA-end box EFKL11' 1 HGA-end nose box CIMN11' I Number of different outgassing surfaces on object 'HGA-end nose box MNFL11' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object outgas rate outgas rate outgas rate rate outgas rate outgas rate rate outgas rate outgas outgas 100. 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 100. 3.62E+14 100. 100. 100. 3.62E+14 100. 3.62E+14 100. 3.62E+14 3.62E+14 3.62E+14 3.62E+14 'left/right-hand HGA-end box DEIJ10' 'left-hand HGA-end box CHEJ10' 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 1. PlateB PlateB 0 0. PlateA PlateB 0 PlateB **PlateB** PlateB

'solar panel support JK12'
1 Number of different outgassing surfaces on object 3.62E+14 3.62E+14 3.62E+14 3.62E+14 3.62E+14 3.62E+14 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C) 'solar panel mount EFGH12' 'solar panel mount ABCD12' 'solar panel mount AECG12' 'solar panel mount BFDH12' 'solar panel mount ABEF12' 'solar panel support J12' 0. 0. 1. CylinderA CylinderA .0 SphereE 0 PlateB PlateB PlateB **PlateB** PlateB 0

HGA-end nose box INL11' I Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'solar panel support IJ12' 1 Number of different outgassing surfaces on object rate rate rate rate rate outgas rate outgas rate outgas rate outgas outgas outgas outgas outgas 100. 100. 100. 100. 100. 100. 100. 100. PlateA

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outgas rate

100.

3.62E+14

0. 0. 0. 1. 0. 0. [(Number/m2/sec), ref temp(C)

.

'HGA-end nose box CMF11' 1 Number of different outgassing surfaces on object

3.62E+14 100. outgas rate

0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

PlateA

outgas rate

100.

3.62E+14

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

PlateB 0 'solar panel support J112' 1 Number of different outgassing surfaces on object

outgas rate

3.62E+14 100.

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

CylinderC

solar panel support JM12' t Number of different outgassing surfaces on object outgas rate outgas rate outgas rate 100. 1.10E+16 100. 1.62E+15 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 1 (Number/m2/sec), ref temp(C) 0. 0. 0. 0. 1. 1 (Number/m2/sec), ref temp(C) 'solar panel NOPQ12' 0. 0. 0. 1. cylinderC . 0 PlateB

PlateB

0

PlateB

PlateB

'solar panel support RS12' 1 Number of different outgassing surfaces on object CylinderA

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 1.

'solar panel support R12' 1 Number of different outgassing surfaces on object SphereE

outgas rate D. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 1.

Number of different outgassing surfaces on object 'solar panel support S12' SphereE 0

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'HRDI telescope mount AB13'

Number of different outgassing surfaces on object CylinderA

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C)

'HRDI telescope mount BC13' 1 Number of different outgassing surfaces on object 3.62E+14 100. 0. 0. 0. 1. 0 ConeD

outgas rate

'HRDI telescope mount FGJK13' 1 Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) PlateB

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

HRDI telescope mount HILM13' L outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) PlateB

Number of different outgassing surfaces on object 'HRDI telescope mount FGHI13' PlateB

Number of different outgassing surfaces on object 'HRDI telescope mount GIKM13' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'HRDI telescope mount IOSU13' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object outgas rate 100. 100. 100. 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 100. 3.62E+14 100. 3.62E+14 100. 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), ref temp(C) 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) 'HRDI telescope mount JKLM13' 'HRDI telescope mount FHJL13' 'HRDI telescope mount HIRS13' 'HRDI telescope mount NOTU13' 'HRDI telescope mount HNRT13' 'HRDI telescope mount RSTU13' 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. ³ (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. ² (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) . 0 0.0.

PlateB

PlateB

.

PlateB

PlateB

'HRDI telescope mount knob' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object o

cylinderA

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), reftemp(C)

'HRDI telescope mount knob'

Number of different outgassing surfaces on object Disk

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object outgas rate outgas rate 100. 3.62E+14 100. 3.62E+14 HRDI telescope mount PQVW13' 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) PlateB D1sk

'HRDI telescope mount LMXY13' 1 Number of different outgassing surfaces on object

0. 0. 0. 1. PlateB

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), reftemp(C)

'HRDI telescope mount QMW13' 1 PlateB

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HRDI telescope mount PLVX13' PlateB

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HRDI telescope mount VWXY13' 0

Number of different outgassing surfaces on object outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'HRDI telescope mount knob' 1. CylinderA

Number of different outgassing surfaces on object outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) HRDI telescope mount knob' Disk

'HRDI telescope mount knob' 1 Number of different outgassing surfaces on object 3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 0 0. 0. Disk

Number of different outgassing surfaces on object outgas rate 100. 4.17E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'HRDI telescope DE13' 1. cylinderA . 0

'HRDI telescope D13' 1 Number of different outgassing surfaces on object

Disk

Number of different outgassing surfaces on object

HRDI telescope mount knob'

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 0. 1. o. 0.

'HRDI telescope E13'

Number of different outgassing surfaces on object Disk

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), reftemp(C) . 0

'HRDI telescope box abcd13' 1 Number of different outgassing surfaces on object PlateB

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0

'HRDI telescope box efgh13'

Number of different outgassing surfaces on object outgas rate 4.17E+14 100. PlateB

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

'HRDI telescope box aceg13' 1 PlateB

outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 0

'HRDI telescope box bdfhl3' 1 Number of different outgassing surfaces on object PlateB

outgas rate 100. 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) .

'HRDI telescope box cdgh13' 1 Number of different outgassing surfaces on object **PlateB**

outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'SSPP box ABCD14' PlateB

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) . 0

'SSPP box EFGH14'

Number of different outgassing surfaces on object PlateB

outgas rate 100. 4.17E+14 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) .

Number of different outgassing surfaces on object 'SSPP box ABEF14' PlateB

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), reftemp(C) .0

'SSPP box CDGH14'

Number of different outgassing surfaces on object 'ISAMS box AKEMIS' 1 Number of different outgassing surfaces on object 1 0 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 4.17E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 4.17E+14 100. outgas rate 0. 0. 0. 1. 0. 0. **4.17E+14 100. outgas rate** (Number/m2/sec), ref temp(C) 1 0 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. ((Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 'ISAMS box BFDH15' 'ISAMS box ABCD15' 'ISAMS box EFGH15' SSPP box BFDH14' 'ISAMS box ABEF15' 'ISAMS box CDKL15' 'SSPP box AECG14' 'ISAMS box GHMN15' 1 PlateB 1 PlateB PlateB PlateB PlateB . o . o . PlateB PlateB PlateB . . . PlateB PlateB

Number of different outgassing surfaces on object outgas rate outgas rate outgas rate 3.62E+14 100. outgas rate outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 'ISAMS box KLMN15' 'ISAMS box LJPR15' Plate**B**

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 'ISAMS box DHIJ15' 'HGA antenna AB16' 'HGA antenna CD16' 'HGA antenna A16' 'HGA antenna B16' 'HGA antenna D16' 'HGA antenna C16' CylinderA CylinderA . 0 SphereE 0 0 PlateB PlateB Disk Disk

Number of different outgassing surfaces on object

3.62E+14 100. outgas rate

0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

SphereE

'HGA antenna DE16'

CylinderA

0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

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'CLAES lower mount, DEF17' 1 Number of different outgassing surfaces on object 'CLAES lower mount, ACDF17' 1 Number of different outgassing surfaces on object 'CLAES upper mount, GH117' 1 Number of different outgassing surfaces on object 'CLAES upper mount, JKL17' 1 'WINDII base, ABCD18' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'CLAES upper mount, HIKL17' 1 Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate outgas rate 3.62E+14 100. outgas rate 3.62E+14 100. outgas rate outgas rate outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 100. 100. 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 3.62E+14 100. 100. 3.62E+14 100. 0. 0. 0. 0. 0. 1. 1.62E+15 (Number/m2/sec), reftemp(C) 0. 0. 0. 0. 1. 1.62E+15 3.62E+14 0. 0. 0. 0. 0. 1. 1 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. [(Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'CLAES lower mount, BCEF17' 'CLAES upper mount, GIJL17' 'CLAES lower mount, ABC17' 'HGA antenna E16' SphereC 0 0 .0 PlateA 0 PlateA 0 0 c PlateB PlateB PlateA PlateA PlateB PlateB PlateB

'WINDII base, DBOP18' 1 'WINDII base, CEQ18' 1 Number of different outgassing surfaces on object outgas rate 100. 100. 100. 100. 100. 100. 100. 2.61E+13 100. 100. 0. 0. 0. 1. 0. 0. 2.61E+13 (Number/m2/sec), ref temp(C) 2.61E+13 2.61E+13 2.61E+13 0. 2.61E+13 2.61E+13 2.61E+13 2.61E+13 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 2. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 'WINDII base, OPQR18' 'WINDII base, ACRQ18' 'WINDII base, DF018' 'WINDII Dase, FN018' 'WINDII base, EMQ18' 'WINDII base, HFN18' , . . 0 . 0 . 0 0.0. PlateB PlateB PlateB PlateA PlateA PlateA PlateA PlateA 0 . .

Number of different outgassing surfaces on object

'WINDII base, GEM18'

PlateA 1 0 0. 0.

rate

outgas

100.

2.61E+13

0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 'WINDII base, CDEF18' ' ' Number of different outgassing surfaces on object

PlateB

'WINDII base, MNKL18'
1 Number of different outgassing surfaces on object 'WINDII base, HJNL18' 1 'WINDII base, IGKM18' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'WINDII base, GH1J18' 1 1 Number of different outgassing surfaces on object 'PEM-AXIS base, ABCD19' 1 outgas rate 0. 0. 0. 1. 0. 0. 2.61E+13 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate outgas rate 0. 0. 0. 1. 0. 0. 2.61E+13 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 100. 2.61E+13 100. 2.61E+13 100. 2.61E+13 100. 2.61E+13 100. 1 0 0. 0. 0. 1. 0. 0. 2.61E+13 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) WINDII base, MNQ018' 'WINDII base, IJKL18' PlateB **PlateB** 1 PlateB PlateB 0 PlateB PlateB Plate8

'PEM-AXIS base, EFGH19' 1 Number of different outgassing surfaces on object PlateB

4.17E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) **.**

Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 'PEM-AXIS base, AECG19' PlateB

'PEM-AXIS base, BFDH19'

Number of different outgassing surfaces on object 'PEM-AXIS base, CDGH19' 1 Number of different outgassing surfaces on object outgas rate 100. 100. 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 100. 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 4.17E+14 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 'PEM-AXIS base, AEBF19' 'PEM-AXIS base, OPQR19' 'PEM-AXIS base, KOMQ19' 'PEM-AXIS base, KLMN19' 'PEM-AXIS base, LPNR19' 'PEM-AXIS base, MNQR19' . 0 1 0. 0. ° С PlateB PlateB Pl at eB PlateB PlateB PlateB PlateB

0

Number of different outgassing surfaces on object PlateB

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. / (Number/m2/sec), reftemp(C) ' . 0

'PEM-AXIS antenna JI19'

Number of different outgassing surfaces on object outgas rate 100. . 0 0 0 0. 0. 0. 0. 1. 0 (Number/m2/sec). ref temp(C) ConeD

outgas rate 100. 1.62E+15 (Number/m2/sec), ref temp(C) 。 。

'PEM-AXIS antenna J19'

Number of different outgassing surfaces on object 0 Disk 1

(Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'PEM-AXIS base, ST19' CylinderA

outgas rate 100. 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), reftemp(C) 'PEM-ZEPS base, ABC20' 1

outgas rate 3.62E+14 100. PlateA

0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C)

'PEM-ZEPS base, ABD20'

Number of different outgassing surfaces on object PlateA

outgas rate 0. 0. 0. 1. 0. 0. 1.62E+15 100. (Number/m2/sec), reftemp(C)

'PEM-ZEPS base, BCE20'

Number of different outgassing surfaces on object PlateA

outgas rate 0. 0. 0. 1. 0. 0. 1.62E+15 100. (Number/m2/sec), reftemp(C)

'PEM-ZEPS base, BDE20' 1 PlateA

outgas rate 1.62E+15 100. 0. 0. 0. 1. 0. 0. 1 (Number/m2/sec), reftemp(C)

Number of different outgassing surfaces on object 'PEM-ZEPS base, FG20' CylinderA

outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 'PEM-ZEPS base, G20' 1 3.62E+14 100. RingÅ

outgas rate 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C)

'PEM-ZEPS box HIJK20' 1 outgas rate 3.09E+15 100. 1 0 0. 0. 0. 0. 1. 0. 3 (Number/m2/sec), reftemp(C) PlateB

PEM-ZEPS box LMN020

Number of different outgassing surfaces on object 'PEM-ZEPS box JKNO20' 0

Number of different outgassing surfaces on object

'PEM-ZEPS box HJLN20' 1 Number of different outgassing surfaces on object ۲ 0. 0. o PlateB

3.09E+15 100. outgas rate

。

1. .0 . 0

(Number/m2/sec), ref temp(C)

'PEM-ZEPS box HILM20' 0 Number of different outgassing surfaces on object 'PEM-ZEPS box IKMO20'

outgas rate 100. 0. 0. 0. 0. 1. 0. 3.09E+15 (Number/m2/sec), reftemp(C) . PlateB

'PEM-ZEPS shaft (approx.) PQ20' 0

Number of different outgassing surfaces on object 'MLS gizmo box ABCD21' PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0.

'MLS gizmo box EFGH21'

Number of different outgassing surfaces on object PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

'MLS gizmo box EFAB21'

Number of different outgassing surfaces on object PlateB

outgas rate 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) 0.0.

Number of different outgassing surfaces on object 'MLS gizmo box BFDH21'

outgas rate 100. 3.62E+14 . 0 PlateB

0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

'MLS gizmo box AECG21'

Number of different outgassing surfaces on object PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) .0

Number of different outgassing surfaces on object 'MLS gizmo box CDGH21' 0.0. PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 'MLS box behind antenna 1JKL21' 1 PlateB

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 7 (Number/m2/sec), ref temp(C)

'MLS box behind antenna JNLP21'

Number of different outgassing surfaces on object 0. 1. • • • • • 0 PlateB

outgas rate

3.62E+14 100.

.

.0

(Number/m2/sec), ref temp(C)

outgas rate

'MLS box behind antenna KOLP21' 1 outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) Plate**B**

'MLS box behind antenna 1JMN21' 1 Number of different outgassing surfaces on object PlateB

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

'MLS cylinder QR21'

Number of different outgassing surfaces on object CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate .(Number/m2/sec), ref temp(C)

'MLS cylinder end' 1 Number of different outgassing surfaces on object c

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C)

'MLS LHS box ABCD22' 1 PlateB

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object MLS LHS box ABEF22' ° . PlateB

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

MLS LHS box CDGH22'

Number of different outgassing surfaces on object PlateB

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 'MLS LHS box BFDH22' 1 1 PlateB

'MLS LHS box AECG22' 1 1 3.62E+14 100. outgas rate 100. outgas rate 3.62E+14 1 0 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) PlateB 1 0 0.0.1.0.3 (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object

MLS LHS box EFIJ22'

PlateB 1 0

Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'MLS LHS box QORP22' 1 Number of different outgassing surfaces on object 'MLS large antenna HIL24' 0 Number of different outgassing surfaces on object Number of different outgassing surfaces on object outgas rate 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 3.62E+14 100. 100. 1 0 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 1 0 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 'MLS large antenna BCDE24' 'MLS large antenna DEH124' 'MLS LHS box GHRL22' MLS LHS box IJQK22' MLS LHS box JKHL22' MLS LHS box QKOM22' MLS LHS box RLPN22' MLS LHS box IQGR22' , °. ' <mark>.</mark> PlateB PlateB PlateB PlateB PlateB PlateB PlateB 0

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'MLS large antenna JKM24'
0 Number of different outgassing surfaces on object

Number of different outgassing surfaces on object

Number of different outgassing surfaces on object

'MLS large antenna FGJK24'

'MLS large antenna BCFG24'

'MLS large antenna DEH124' 1 Number of different outgassing surfaces on object 'MLS large antenna FGJK24' 1 Number of different outgassing surfaces on object outgas rate 3.62E+14 100. outgas rate 3.62E+14 100. 100. 100. 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 100. 100. 100. 3.62E+14 3.62E+14 3.62E+14 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0.] (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) (Number/m2/sec), ref temp(C) . 'MLS large antenna CCEE24' 'MLS large antenna EEII24' 'MLS large antenna BBDD24' MLS large antenna BCDE24' 'MLS large antenna BCFG24' 'MLS large antenna DDHH24' MLS large antenna HIL24' 'MLS large antenna JKM24' .0 0. 1. . 0 。 ° . PlateB PlateB PlateB PlateB PlateB PlateB PlateB PlateA PlateB

'MLS large antenna CCGG24' 1 Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate outgas rate 100. 100. 100. 100. 100. 3.62E+14 3.62E+14 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0.] (Number/m2/sec), reftemp(C) 'MLS large antenna GGKK24' PlateB PlateB

(Number/m2/sec), ref temp(C)

'MLS large antenna IILL24' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object outgas rate outgas rate outgas rate 100. 3.62E+14 100. 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C) 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'MLS large antenna FFJJ24' 'MLS large antenna KKMM24' 'MLS large antenna BBFF24' 'MLS large antenna HHLL24' 'MLS small antenna OPQR24' 0. 0. 0. 1. .0 0 .0 PlateB 0 PlateB PlateB PlateB PlateB PlateB 0

on object

Number of different outgassing surfaces

75

Number of different outgassing surfaces on object

'MLS small antenna OPQR24'

'MLS small antenna QRU24'

3.62E+14 100. outgas rate

. 0 .0

÷ .0

0 0. 0.

PlateB

Number of different outgassing surfaces on object

3.62E+14 100. outgas rate

. 0

.0

. 1 .

0.0. PlateB

(Number/m2/sec), ref temp(C)

'MLS small antenna QRU24'

Number of different outgassing surfaces on object outgas rate 3.62E+14 100. PlateA

0. 0. 0. 1. 0. 0. (Number/m2/sec), reftemp(C)

'MLS small antenna OPST24' 0 Number of different outgassing surfaces on object

Number of different outgassing surfaces on object 'MLS small antenna STV24'

'MLS small antenna OPST24'

Number of different outgassing surfaces on object 0 PlateB

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0.

'MLS gmall antenna STV24'

Number of different outgassing surfaces on object PlateA

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

'MLS small antenna PPRR24' 1 PlateB

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3. (Number/m2/sec), ref temp(C) . .

'MLS small antenna PPTT24'

Number of different outgassing surfaces on object PlateB

outgas rate 100. 3.62E+14 0. . .

'MLS small antenna RRUU24'

Number of different outgassing surfaces on object PlateB

100. outgas rate 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 100. outgas rate 3.62E+14 'MLS small antenna TTVV24' PlateB . .

'MLS small antenna 000024' ' ' 'MLS small antenna OOSS24' 1 Number of different outgassing surfaces on object rate outgas 100. 3.62E+14 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) (Number/m2/sec), ref temp(C) 'MLS small antenna QQUU24' 0 PlateB

Number of different outgassing surfaces on object 'MLS small antenna SSVV24'

0. 0. 0. 1. PlateB

outgas rate 100. 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), reftemp(C)

'MLS antenna arm, RHS ABCD25'

Number of different outgassing surfaces on object outgas rate outgas rate 0 0 0.0.1.0.0.3.62E+14 100. (Number/m2/sec), ref temp(C) 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) PlateB

'MLS antenna arm, RHS EF25'

Number of different outgassing surfaces on object cylinderA

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C)

'MLS antenna arm, RHS E25'

Number of different outgassing surfaces on object 0 Disk

outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C)

'MLS antenna arm, RHS F25'

Number of different outgassing surfaces on object 0 Disk

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. ² (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'MLS antenna arm, back GH25' CylinderA

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 2 (Number/m2/sec), ref temp(C) 0. 0. 1.

'MLS antenna arm, back 1J25' l

CylinderA

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C)

'MLS antenna arm, back H25' 1 Number of different outgassing surfaces on object SphereE 0

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'MLS antenna arm, back J25'

outgas rate

3.62E+14 100.

. .

.

1 v 0. 0. 0. 1.

PlateB 1 0

SphereE

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

'MLS antenna arm, back G25' 1 SphereA o

outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'MLS antenna arm, back 125' SphereA

outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), ref temp(C) 'MLS antenna arm, between GK25' 1 CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

'MLS antenna arm, between IL25' 1 CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'MLS antenna arm, side K25' SphereA

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'MLS antenna arm, side L25' 1 SphereA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HGA-side bracework AB23' CylinderA

0

0

outgas rate 3.62E+14 100. 1 0 0. 0. 0. 1. 0. 0. [(Number/m2/sec), ref temp(C) 'HGA-side bracework CB23'

Number of different outgassing surfaces on object outgas rate 3.62E+14 100. 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) cylinderA

HGA-side bracework EB23′ L outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) CylinderA

'HGA-side bracework GB23'

Number of different outgassing surfaces on object 'HGA-side bracework IJ23' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'HGA-side bracework 0J23' 1 1 Number of different outgassing surfaces on object on object outgas rate Number of different outgassing surfaces 100. 3.62E+14 100. 100. 100. 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 3.62E+14 3.62E+14 0. 0. 0. 1. 0. 0. 3.62E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'HGA-side bracework QR23' 'HGA-side bracework KJ23' 'HGA-side bracework MJ23' 'HGA-side bracework SR23' 'Sphere junctn R23' 0 'Sphere junctn B23' 'Sphere junctn J23' 'Dish above CLAES' CylinderA cylinderA CylinderA cylinderA cylinderA CylinderA CylinderA

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Number of different outgassing surfaces on object

Thrusters, AC26'

outgas rate outgas rate

0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 3.09E+15 100. (Number/m2/sec), ref temp(C)

° ° ConeA

o. 0.

'Thrusters, BD26' ' Number of different outgassing surfaces on object Number of different outgassing surfaces on object 1 0 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) rate outgas rate outgas 100. 100.
 1
 Number of different outgass

 ConeA
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 0

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 1

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 0
 3
 09E+15
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 0
 1
 0
 1
 1
 'HALOE mount AB27' 'HALOE mount A27' 1 Dísk

Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) CylinderA

'HALOE mount B27'

Number of different outgassing surfaces on object 0 RingA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

'HALOE mount BC27' 1 1 CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HALOE mount C27' RingA

3. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HALOE mount CD27' ConeD

3.62E+14 100. outgas rate 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C)

Number of different outgassing surfaces on object 1 0 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 'HALOE mount D27' RingA

Number of different outgassing surfaces on object 1 0 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), reftemp(C) 'HALOE mount DE27' CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 1 0 0.0.0.1.0.0.3.62E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 1 0 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 'HALOE mount FNJR27' 'HALOE mount FGJK27' 'HALOE mount HILM27' 'HALOE mount HLQU27' 'HALOE mount RJTU27' 'HALOE mount NRPT27' PlateB , . PlateB PlateB PlateB PlateB PlateB PlateB

Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate outgas rate outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 'HALOE mount FGHI27' 'HALOE mount JKLM27' ۰. 0. PlateB PlateB

'HALOE mount NFPQ27' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object outgas rate outgas rate

'HALOE mount VW27'

Number of different outgassing surfaces on object CylinderA

0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), ref temp(C)

'HALOE mount E27' 1 Number of different outgassing surfaces on object 1 Dísk 1 0

Number of different outgassing surfaces on object Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'HALOE box GHIJ28' 1 Number of different outgassing surfaces on object 'HALOE box CDEF28' 1 Number of different outgassing surfaces on object outgas rate 0. 0. 0. 1. 0. 0. 3.62E+14 100. outgas rate (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 4.17E+14 100. outgas rate 1 U 0.0.1.0.1.0.3.62E+14 100. (Number/m2/sec).reftemp(C) 3.62E+14 100. 3.62E+14 100. 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 1 0 0.0.1.0.3 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 'HALOE box ABCD28' 'HALOE box CEIK28' 'HALOE mount VX27' 'HALOE box BDHJ28' 'HALOE box IJKL28' 'HALOE mount X27' 'HALOE mount V27' CylinderA 1 PlateB 0 0 PlateB 0.0. PlateB 0 PlateB 0 PlateB 0 PlateB RingA 1 Disk -- 0

Number of different outgassing surfaces on object outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 100. 0. 0. 1. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 100. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 4.17E+14 100. 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), reftemp(C) 'HALOE box MNOP28' 'HALOE box QRST28' 'HALOE box ABEF29' 'HALOE box QRUV28' 'HALOE box STWX28' 'HALOE box RVTX28' 'HALOE box QUSW28' 'HALOE box ABCD29' 'HALOE box EFGH29' 'HALOE box BDFH29' 'HALOE box DHLM29' 0. . . 0. 0. 0. . 0 0. 0.0 . 0 PlateB PlateB PlateB PlateB PlateB PlateB 0 0 0 0

'HALOE box DFJL28'

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Number of different outgassing surfaces on object

outgas rate

0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C)

PlateB

'HALOE cover IJ29'

'HALOE box EFKL28' 0 Number of different outgassing surfaces on object

Number of different outgassing surfaces on object 'HALOE aperture K29' 1 outgas rate outgas rate 100. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 (Number/m2/sec), ref temp(C) 'HALOE COVER JK29' CylinderA ConeA Disk

PlateB

¢

0

outgas rate 3.09E+15 100. 0. 0. 0. 0. 1. 0. 3 (Number/m2/sec), reftemp(C) . 0

PlateB

'HALOE sun-sensor NOPQ29'

Number of different outgassing surfaces on object

PlateB ¢

。

Number of different outgassing surfaces on object 'HALOE sun-sensor NORS29' PlateB

0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C)

'HALOE sun-sensor PQTU29'

Number of different outgassing surfaces on object **PlateB**

PlateB

outgas rate 4.17E+14 100. 0. 0. 0. 1. 0. 0. 0. (Number/m2/sec), ref temp(C)

'HAL/OE sun-sensor NRPT29' 1 Number of different outgassing surfaces on object PlateB

PlateB

outgas rate 4.17E+14 100. 0. 0. 1.

'HALOE sun-sensor OSQU29'

Number of different outgassing surfaces on object **PlateB**

PlateA

0. 0. 0. 1. 0. 0. 4.175+14 100. outgas rate (Number/m2/sec), ref temp(C)

Number of different outgassing surfaces on object 'HALOE aperture cover L29' ¢

Number of different outgassing surfaces on object outgas rate 100. 3.62E+14 0. 0. 0. 1. 0. 0. 3 (Number/m2/sec), reftemp(C) 'SSPP support' CylinderA 0. 0.

Number of different outgassing surfaces on object 0. 0. 0. 1. 0. 0. 4.17E+14 100. outgas rate (Number/m2/sec), ref temp(C) 'ISAMS box DIOP15' . ° °. PlateB

Number of different outgassing surfaces on object 'ISAMS box HJQR15' 1

Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'ISAMS box STWX15' 1 Number of different outgassing surfaces on object outgas rate 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C)
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 0.
 100.

 (Number/m2/sec), ref temp(C)
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 1.
 0.
 100.

 0.
 0.
 1.
 0.
 0.
 4.17E+14
 100.

 0.
 0.
 1.
 0.
 1.
 0.
 4.17E+14
 100.

 0.
 0.
 1.
 0.
 0.
 4.17E+14
 100.

 (Number/m2/sec), ref temp(C)
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 1.
 10.
 100.
 0. 0. 1. 0. 0. 4.17E+14 100. Number/m2/sec), ref temp(C) 100. 4.17E+14 100. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) v. v. u. 1. 0. 0. 4.17E+14
(Number/m2/sec), ref temp(C) 0. 0. 0. 1. 0. 0. 4 (Number/m2/sec), ref temp(C) 'ISAMS box OPST15' 'ISAMS box QRUV15' 'ISAMS box PRTV15' 'ISAMS box UVYZ15' 'ISAMS box SUTVIS' 'ISAMS box OLSI5' 'ISAMS box QNU15' 0. . 0

outgas rate 0. 0. 0. 1. 0. 0. 4.17E+14 100. (Number/m2/sec), ref temp(C) NEPS DCIJ15' PlateA 0

Number of different outgassing surfaces on object outgas rate 3.09E+15 100. 0. 0. 0. 0. 1. 0. 3 (Number/m2/sec), reftemp(C) 0. 0. PlateB 0

Number of different outgassing surfaces on object 'NEPS HGKL15'

outgas rate 100. 3.09E+15 . 1. . 0 . . . PlateB 0

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(Number/m2/sec), ref temp(C)

'IM vent ACE31'

Number of different outgassing surfaces on object 'PEM-AXIS antenna J19' 1 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'HRDI telescope box abef13' 0 'HALOE mount PQTU27' 0 Number of different outgassing surfaces on object CLAES Neon vent B30' 0 Number of different outgassing surfaces on object Number of different outgassing surfaces on object 'CLAES CO2 vent D30' 0 'IM vent ABEF31' 1 1 Number of different outgassing surfaces on object 0. 0. 0. 0. 1. 0. 3.09E+15 100. outgas rate (Number/m2/sec), ref temp(C) outgas rate outgas rate rate 1.62E+15 100. outgas rate 9.64E+18 100. outgas 0. 0. 0. 0. 1. 0. 3.09E+15 100. (Number/m2/sec), ref temp(C) 100. 0. 0. 0. 0. 0. 1. 1.62E+15 (Number/m2/sec), reftemp(C) 0. 0. 0. 0. 0. 1. 1 (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. (Number/m2/sec), ref temp(C) 'PEM-AXIS antenna ??19' 'CLAES Neon vent AB30' 'CLAES CO2 vent CD30' 0 Number (CLAES Neon vent A30' 'HALOE mount GIKM27' 'Dish above CLAES' 'Dish above CLAES' 'NEPS DHIK15' NEPS CGJL15' CylinderA PlateB 0 PlateB 0 °. PlateB 1 Disk 0 0 0 0 0

HALOE blanket vent HALOE blanket vent Number of different outgassing surfaces on object outgas rate outgas rate outgas rate outgas rate outgas rate outgas rate LateB 0 0 0.0.1.0.0.3.62E+14 100. (Number/m2/sec), r f temp(C) 16.100. pointA pointB pointC pointD pointA pointB pointC pointD 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), ref temp(C) 7.35E+17 100. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 0. 0. 0. 1. 0. 0. 3.62E+14 100. (Number/m2/sec), reftemp(C) 7.35E+17 100. 1 4 0. 0. 0. 1. 0. 0. 7. (Number/m2/sec), reftemp(C) 140.36 -17.31 -63.83 140.36 -17.31 -63.58 137.82 -21.24 -65.59 137.82 -21.24 -65.34 0. 0. 7 reftemp(C) 0. 0. 1. 0. 0. (Number/m2/sec), ref tem 132.24 -17.31 -63.83 132.24 -17.31 -63.83 134.78 -21.24 -65.59 134.78 -21.24 -65.34 'HALOE mount CDGH4' 'HALOE mount ACFG4' 'IM vent BDF31' 0. 0. 0 . 0 0 o. 0. PlateB PlateB PlateB c ¢

Number of different outgassing surfaces on object

'IM vent CDEF31' 0 Nur

 Main block top plate ABDC0 Main block side Zmax DCHG0 Main block side Zmin ABEF0 Main block Xmin ADEH0 Main block Xmax BCFG0 Front small plate Xmin ABDC1 Front small plate Xmin DHC1 Front small plate Ymin DHC1 Front small plate Zmin ABEF1 	<pre>4 'CLAES big cap' 0 'CLAES fat cylindrical part' 1 'CLAES small cylindrical part' 1 'CLAES small cap' 2 'CLAES sheld plate' 4 'CLAES sheld plate' 1 'Battery package ABCD3' 1 'Battery package EFGH3' 2 'Battery package MNO3' 2 'Battery package OPOR3' 2 'Battery package OPOR3' 3 'Battery package OPOR3' 4 'Battery Package OPOR3'</pre>	<pre>'Battery package side AGCE3 lower X' Battery package side GIMK3 lower X' Battery package side MJNL3 lower X' Battery package side MJNL3 higher X' Battery package side MJNL3 higher X' Battery package side NDR3 higher X' Battery package side AGN lower X' Battery Package side AGN lower X' Battery Package side AGN lower X' Battery MS plane bottom' HALOE mount AEC4' HALOE mount AEC4' HALOE mount BEC4' HALOE mount BC64' NEPS BFDH5' NEPS BFDH5' NEPS FEH5' NEPS FEH5' NEPS FEH5' NEPS JLK5' NEPS JLK5'</pre>	Thin box under main block ABCD6' Thin box under main block CDGH6' Thin box under main block CDGH6' Thin box under main block EAGC6' Box under main block EAGC7' Box under main block EAGT7' Box under main block LTCD7' Box under main block LTCD7' Box under main block CDH7' HRD1 interferometer ABCD8' HRD1 interferometer ABCD8' CRD1 interferometer ABCD8' HRD1 interferometer ABCD8' HRD1 interferometer ABCD8' HRD1 interferometer ABCD8' CP11ndrical truss #3 at X = 0.' CP11ndrical
LUNALOLOALUN		00 \$\$0000\$\$\$000 \$\$000	

'left-hand HGA-end box AFDI10' 'left-hand HGA-end box ABDE10' 'left-hand HGA-end box BCE10'	<pre>'left/right-hand HGA-end box ABFG10' 'left/right-hand HGA-end box BCGH10' 'left-hand HCA-end box currin'</pre>	'left/right-hand HGA-end box DEIJ10'	right-hand HGA-end box GHJK11' 'right-hand HGA-end box CEF11'	'right-hand HGA-end box HIKL11'	right-hand HGA-end box CIFLII' 'right-hand HGA-end box EFKL11'	'HGA-end nose box CIMN11'	'HGA-end nose box MNFL11'	'HGA-end nose box CMF11' 'HGA-end nose box INL11'	'solar panel mount ABCD12'	'solar panel mount EFGH12'	'solar panel mount AECG12'	Solar panel mount BEF12'	'solar panel support 1112'	'solar panel support J12'	sular panel support JK12' 'solar panel support J112'	'solar panel support JM12'	'solar panel NOPQ12'	'solar panel support RS12'	solar panel support KL2' 'solar panel support S12'	'HRDI telescope mount AB13'	'HRDI telescope mount BCI3'	'HRDI telescope mount FGJK13'	'HRDI telescope mount HILM13' 'HRDI telescope mount FGHT13'	'HRDI telescope mount JKLM13'	'HRDI telescope mount GIKM13'	'HRDI telescope mount FHJL13'	'HKUI telescope mount HIRSI3' 'HRDI telescope mount Normula'	'HRDI telescope mount IOSU13'	'HRDI telescope mount HNRT13'	'HRDI telescope mount RSTU13'	HRUI telescope mount knob' 'HRDI telescope mount knob'	'HRDI telescope mount knob'	'HRDI telescope mount PQVW13'	'HKUI telescope mount LMXY13' 'HRDI telescope mount AMWV13'	'HRDI telescope mount PLVX13'	'HRDI telescope mount VWXY13'	'HRDI telescope mount knob'	'HRDI telescope mount knob' 'HRDI telescope mount knob'	'HRDI telescope DE13'	'HRDI telescope D13'	'HRDI telescope E13'	'HRDI telescope box abcdl3' 'HRDI telescope box afabl3'	'HRDI telescope box aced13'	'HRDI telescope box bdfh13'	'HRDI telescope box cdgh13'	'SSPP box ABCD14' 'SSPP box FECHIA'	SSPP box ABEF14'	'SSPP box CDGH14'	SSPP box AECG14'	'ISAMS box ABCD15'
-22 -22 -22	<u> </u>	4	- 22	- 25	• •	о і	on o	חה	- 25	- 22	יו רפ		9	σσ	n 01	6	ñ,	on o	n o n	4	4		* *	-	4	••	* 4	4	4	4.	15	-15	- 1 -	* 4	4	4	-12 -12	19	- 35	-34	7	, <u>,</u>	- 35	- 35	- 35	2 1	88-	-12	ς Ξ	-127

Table 7: Input Data Listing—Surface Temperatures (3 pgs.)

'ISAMS box EFGH15' 'ISAMS box BFDH15' 'ISAMS box ABEF15' 'ISAMS box ABEF15' 'ISAMS box CDKL15' 'ISAMS box CDKL15' 'ISAMS box CDKL15' 'ISAMS box CDH1115' 'ISAMS box LJPR15' 'ISAMS box LJPR15' 'ISAMS box DH1115' 'HGA antenna A16' 'HGA antenna A16' 'HGA antenna D16' 'HGA antenna D16' 'HGA antenna D16'	<pre>rest atterna atterna rest atterna atterna CLAES lower mount, DEF17 CLAES lower mount, DEF17 CLAES lower mount, BCE177 CLAES upper mount, GH117 CLAES upper mount, JKL17 CLAES upper mount, JKL17 CLAES upper mount, JKL17 CLAES upper mount, JKL17 CLAES upper mount, HIKL17 WINDII base, ABCD18 WINDII base, DEO18 WINDII base, DEO18 WINDII base, DEO18 WINDII base, DEO18 WINDII base, DEO18 WINDII base, ENO18 WINDII base, FNO18 WINDII base, ENO18 WINDII base, FNO18 WINDII base, GEM18 WINDII base, GEM18 WINDII base, GEM18 WINDII base, GEM18 WINDII base, ANQO18 WINDII base, ANU018 WINDII base, ANU018 WINDII base, GEM18 WINDII base, IJKL18 WINDII base, IJKL18 WINDI base, I</pre>	<pre>'PEN-AXIS base, ABCD19' 'PEN-AXIS base, EFGH19' 'PEN-AXIS base, AECG19' 'PEM-AXIS base, AECG19' 'PEM-AXIS base, CDGH19' 'PEM-AXIS base, CDGH19' 'PEM-AXIS base, CDGH19' 'PEM-AXIS base, NDQR19' 'PEM-AXIS base, NDQR19' 'PEM-AXIS base, NDQR19' 'PEM-AXIS base, NDQR19' 'PEM-AXIS base, NDQR19' 'PEM-AXIS base, ABC20' 'PEM-AXIS base, ABC20' 'PEM-ZEPS base, ABC20''</pre>

- 85	'MLS gizmo box A 'MLS gizmo box E	BCD21 ' FGH21 '
- 32	'MLS gizmo box E	FAB21'
-46	MLS gizmo box B	FDH21 '
-66	O XON DUT IS DOX O	DGH21
-37	'MLS box behind	antenna IJKL2
- 37	'MLS box behind	antenna JNLP2
76-	MLS box behind	antenna KoLP2 antenna Ilwun
-37	'MLS cylinder QR	21, 21,
-37	'MLS cylinder en	ب ا
- 17	MLS LHS box ABC	D22'
19-	MLS LHS DOX ABE	422'
-40	WLS LHS box BFD	122'
-42	MLS LHS box AEC	522'
	WLS LHS BOX EFL.	. 271
- 60	WLS LHS box GHR	122 *
-40	HXL XOA SHI SHY	.22 '
- 21	NLS LHS box okol	422 ·
- 60	WLS LHS box RLPI	422 '
- 42	MLS LHS box OOR	22' - Banna''
- 28	MLS large anten	la BCDE24
-28	'MLS large anten	A HIL24'
- 28	'MLS large anten	a BCFG24'
- 28	'MLS large anten	Da FGJK24'
-37	MLS large anten	IG UNM24
-37	'MLS large anten	a DEHI24'
- 37	'MLS large anten	Na HIL24'
-37	'MLS large anten	a BCFG24'
-37	'MLS large anten	a FGJK24'
 	'MLS large anten: 'MLS large anten:	la JKM24'
- 32	'MLS large anten	la EEII24'
-32	'MLS large anten	a BBDD24'
-32	'MLS large anten	a DDHH24'
25-	MLS large anten	a cccc24'
- 32	MLS large anten	DA BBFF24'
- 32	'MLS large antenr	a FFJJ24'
-32	'MLS large anten	a IILL24'
א ה י	MLS large antenr	La KKMM24'
-32	'MLS large anten	a JJMM24'
-37	'MLS small antenr	a OPQR24'
- 37	'MLS small antenr	Ia QRU24'
87-	MLS small antenr	a OPOR24'
- 37	'MLS Small antenr	A OPST24'
-37	'MLS small antenr	a STV24
- 28	'MLS small antenr	a OPST24'
87- 87	'MLS Small antenr 'MLS small antenr	a STV24'
- 32	'MLS small antenn	a PPTT24'
-32	'MLS small antenn	a RRUU24
- 32	'MLS small antenn	a TTW24'
- 32	'MLS small antenn	a 000024'
7 F	'MLS Small antenn 'MLS small antenn	a 00SS24'
-32	'MLS small antenn	a SSVV24
- 28	'MLS antenna arm,	RHS ABCD25'
- 28	'MLS antenna arm,	RHS EF25'
-28	'MLS antenna arm,	RHS F25'

MLS antenna arm, back H25 MLS antenna arm, between GX25 MLS antenna arm, between GX25 MLS antenna arm, eide K25 MLS antenna arm, eide K25 MLS antenna arm, eide K25 MLS antenna arm, eide L25 HKA-side bracework RD3 HALOE mount RD7 HALOE mount VZ7 HALOE GH25 ' 1,725' back back antenna arm, MLS antenna arm, EFGH29 box ABEF29 box BDFH29 box DHLM29 cover IJ29 JK29 cover ğ HALOE HALOE HALOE 1 HALOE 1 HALOE 0 MLS HALOE

'HALOE aperture K29'
'HALOE sun-sensor NOPQ29'
'HALOE sun-sensor NOR29'
'HALOE sun-sensor NRP29'
'ISAMS box HJOFI5'
'ISAMS box HJOFI5'
'ISAMS box NUTI5'
'ISAMS box NUT15'
<

Data	Description
0.0254	scale
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	jet direction cosine, <i>Ne</i> vent jet center jet radius jet density [molecules/m ³] jet velocity [m/sec] jet exit temperature [K] species fraction in jet
-0.4924 0.6428 0.5868 65.1 36.6 26.2 0.5 4.04E+20 244. 207. 0. 0. 1. 0. 0. 0.	jet direction cosine, CO_2 vent jet center jet radius jet density [molecules/ m^3] jet velocity [m/sec] jet exit temperature [K] species fraction in jet

Table 8: Typical Elemental Sonic Orifice Data

SP(2, index0) * (SP(1, n) / SP(1, index0)) **. 3333 SP(1,n) = (150.0 * 1.e-3) / avogadro
SP(2,n) = SP(2,index0)*(SP(1,n)/SP(1,index0))**.3333 SP(1,n) = (200.0 * 1.e-3) / avogadro
SP(2,n) = SP(2,index0) *(SP(1,n)/SP(1,index0))**.3333 tables for rot. & vib. relaxation (SPRR) MOSS ********************* Ŀ. diam.: from 44.01 * 1.e-3) / avogadro * 1.e-3) / avogadro molecular MRCFF= max(itable,1) Carbon Dioxide CO_2 5.41e-10 ~ gas 🛊 1 ~ ₩ 3 • gas gas Data for Tref, SP(1,n) = (4)SP(2,n) = 5.4= --= indexco2 0 0 0 <u>.</u> ÷. ò n = indexo2 0 00 0 <u>.</u> 000 no. of n = indexo3 Outgassing Outgassing Outgassing H нни Ð H H n n 81 н н n н SP (5, n) SP (6, n) SP (7, n) SP (8, n) SP (9, n) SP (2, n) SP (3, n) SP (4, n) SP (5, n) SP (6, n) SP (7, n) SP (8, n) SP (9, n) SP (2, n) SP (3, n) SP (4, n) SP (5, n) SP (5, n) SP (6, n) SP (8, n) SP (9, n) SP (2, n) SP (3, n) SP (4, n) SP (5, n) SP (6, n) SP (8, n) SP (9, n) Tref=300W = 0.75cont inue -max. c **** . 1 110 į ٠ ÷. . . • . * . ч Ч MNVT = maximum # of vibrational degrees of freedom in any species MNVT = 0 T = TREF (meter) rel. of j energy energy rel. SP(3,L) = \emptyset of rotational deg. of freedom for species L SP(4,L) = index K pointing to the table of SPRR for rot. IRROT(1) = switch for the \emptyset of collisions to relax rot. e SPRR(K,1) = \emptyset of collisions to relax rotational energy SPRR(K,3) = polynomial coefficient: first order of temp SPRR(K,3) = polynomial coefficient: second order of temp SPRR(K,4) = polynomial coefficient: third order of temp SPRR(K,4) = polynomial coefficient: third order of temp SP(5,1) = index M pointing to the table of SPRR for vib. IRVIB(1) = switch for the * of collisions to relax vib. (SPRR(M,1) = * of collisions to relax vibrational energy SPRR(M,2) = polynomial coefficient: first order of temp SPRR(M,3) = polynomial coefficient: second order of temp SPRR(M,3) = polynomial coefficient: third order of temp SPRR(M,4) = polynomial coefficient: third order of temp SPR(M,4) = vibrational temperature for vib. = 100 = 150 = 200 at of a molecule of species L (Kg) ster of a molecule of species L mass Mass Mass n = index0 SP(1,n) = (16.0 * 1.e-3) / avogadro SP(3,n) = 3.0e-10 SP(3,n) = 0. SP(5,n) = 0. SP(5,n) = 0. SP(5,n) = 0. SP(6,n) = 0. SP(9,n) = 0. SP(9,n) = 0. n = indexNe SP(1.n) = (20.179 * 1.e-3) / avogadro SP(3.n) = 2.72e-10 SP(3.n) = 0. SP(4.n) = 0. molecular n molecular n molecular table SP(1,L) = mass of a molecule of s SP(2,L) = diameter of a molecule ---No Internal energy, no chemistry 5 gas around UARS counter for internal energy = 1 means chemistry is = 0 4: outgas 5: outgas 6: outgas avogadro = 6.02252e+23
boltzmann = 1.38054e-23 0 C0_2 Monatomic Oxygen 0 -GAS species # *----data to model -GAS species (-GAS species (species species species CONVENTION a ни ł. itable = 0indexco2 IndexNe indexo1 indexo3 Indexo2 Neon Ne Index0 --IRA -GAS -GAS IRA -----÷ . į * . *

Table 9: Input Data Listing-General Preprocessor Input

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Species	GMW	d [Å]	Mass Flux Rates at 100°C [gm/cm ² /sec]
ficticious organic volatile species representing products from MLI	100	5.33	4.33×10^{-13} to 6.01×10^{-12}
ficticious organic volatile species representing products from solar array adhesives	100	5.33	1.83×10^{-10}
ficticious organic volatile species representing products from IM and MLI vents	100	5.33	1.60×10^{-7} (IM) 1.22×10^{-8} (MLI)
ficticious organic volatile species representing products from MMS vents	100	5.33	3.67×10^{-11} to 1.22×10^{-10}
ficticious organic volatile species representing products from Chemglaze Z306	150	6.33	7.70×10^{-11}
ficticious organic volatile species representing products from S/13G/LO-V10	200	6.96	4.30×10^{-11} to 5.39×10^{-11}
neon vented from CLAES experiment	20.18	2.72	4.14×10 ^{-4*}
carbon dioxide vented from CLAES experiment	44.01	5.41	7.20×10 ^{-4*}

Table 10: Outgassing Species Information

* rate at operating temperature $T_{\text{exit}} = 207K$

Table 11: Gas Species Data

0 spatial resolution switch: body-0, gas-1 7. max no. of Megabytes for body defn. 30000 ratio to compute mean no. of subcells/cell 0.5 ratio of cells near body 0 initially uniform freestream or vacuum 6 total no. of molecular species 2 no. of jet species (subset of total no. of species) 132 GAS?.FOR file (species-dependent gas info.) 7500. free stream velocity Ο. angle of incidence alpha (deg) 0. roll angle phi (deg) 6.e+12 1000. freestream density, temp. 1. 0. 0. 0. 0. 0. fraction of each species in freestream 300. surface temp. 300. mean expected temp. in flow 2 2 2 0 2 2 boundary conds. at -X, -Y, -Z, +X, +Y, +Z1. 1. 1000. safety factors for max no. of molecules, timestep, FNUM 20. 10. 10. 10. 10. 10. clearances for -X, +X, -Y, +Y, -Z, +Z edges 350000 no. of subcells within computational domain 2 scale ratio between inner & outer domains 3. 0.28 anticipated density enhancements: peak, mean (used to estimate cell and subcell sizes) 1. fraction of total volume to be used 2 50 no. of timesteps between sampling, no. of samples between saved states 2 parameter used to size pixel element arrays

Species	Mass	Flux Rates [gm/cm ²	2/sec]
	Case #1	Case #2	Case #3
monatomic oxygen from freestream distribution	1.2×10 ⁻¹⁰	1.0×10 ⁻¹⁰	$< 4.2 \times 10^{-14*}$
monatomic oxygen from surface-accommodated distribution	9.3×10 ⁻¹²	7.5×10^{-12}	5.4×10^{-12}
neon vented from CLAES experiment (return flux)	1.9×10 ⁻¹¹	5.9×10 ⁻¹²	$< 2.1 \times 10^{-12*}$
neon vented from CLAES experiment (direct flux)	1.3×10 ⁻¹¹	5.9×10 ⁻¹²	$< 2.1 \times 10^{-12*}$
carbon dioxide vented from CLAES experiment	$< 5.8 \times 10^{-12*}$	$< 6.5 \times 10^{-12*}$	$< 4.6 \times 10^{-12*}$
ficticious organic volatile species representing all $GMW = 100$ materials	9.2×10 ⁻¹⁴	1.8×10 ⁻¹³	8.4×10 ⁻¹⁴
ficticious organic volatile species representing $GMW = 150$ material	3.9×10^{-15}	1.1×10 ⁻¹⁴	1.4×10 ⁻¹⁴
ficticious organic volatile species representing $GMW = 200$ material	4.3×10^{-13}	1.8×10 ⁻¹⁴	2.7×10^{-13}

Table 12: Mass Flux Rates Intercepted at HALOE Aperture

* no samples collected

Table 13a: Subassembly Contributions toCumulative Contaminant Deposition (Case #1)

Subassembly	Percent Con	Percent Contribution to Contaminant Flux								
	GMW = 100	GMW = 150	GMW = 200							
Solar Panel ($\Omega = 0.527$ steradians)	56	_	81							
Instrument Module $(\Omega = 0.719 \text{ steradians})$	13	—	19							
HALOE	25	73	_							
NEPS	3	27								
ISAMS	3	—								

Subassembly	Percent Con	tribution to Conta	minant Flux
	GMW = 100	CMW = 150	CMW - 900
	01111 = 100	GMW = 150	GWW = 200
Solar Panel	92		—
$(\Omega = 0 \text{ steradians})$			
Instrument Module			100
$(\Omega = 0.292 \text{ steradians})$			100
HALOE	8	80	
NEPS		20	

Table 13b: Subassembly Contributions toCumulative Contaminant Deposition (Case #2)

Table 13c: Subassembly Contributions to Cumulative Contaminant Deposition (Case #3)

Subassembly	Percent Contribution to Contaminant Flux								
	GMW = 100	GMW = 150	GMW = 200						
Solar Panel ($\Omega = 0.412$ steradians)	75	_	94						
Instrument Module ($\Omega = 0.0354$ steradians)	13		6						
HALOE	12	100							

Table 14: Cumulative Volatile Organic Contaminant Deposition at HALOE Aperture(values based on d_0 in parentheses)

Species	Cumulative Depth Over 35 Months [Å]									
	Case #1	Case #2	Case #3							
ficticious organic volatile species representing all $GMW = 100$ materials	9496	9787	4663							
	(1602)	(1652)	(787)							
ficticious organic volatile species representing $GMW = 150$ material	683	408	524							
	(173)	(103)	(133)							
ficticious organic volatile species representing $GMW = 200$ material	13355	489	7460							
	(4507)	(165)	(2518)							
total extrapolated	23534	10684	12647							
accumulation per run	(6282)	(1920)	(3438)							

Item	Amount Based On $l = 10\text{\AA}$ [Å]	Amount Based On $d_O = 3.0$ Å [Å]
Average for runs #1 & #2	17109	(4101)
Avg. \times (1 - τ_{stow}/τ_{orbit})	2673	(641)
Average for run #3	12647	(3438)
Avg. $\times \tau_{\rm stow}/\tau_{\rm orbit}$	10671	(2901)
Case-averaged Total Deposition	13344	(3542)

Table 15: Cumulative Volatile Organic Contaminant Depositionat HALOE Aperture—Arrival at Case-Averaged Total Deposition(values based on d_O in parentheses)

 Table 16: Simulation Set-Up and Performance

Item	Inner Domain	Outer Domain
$\Delta t \ [sec]$	1.35×10^{-5}	2.69×10^{-5}
FNUM	2.08×10^{13}	4.17×10 ¹³
Volume $[m^3]$	11.21×6.97×15.75	21.20×21.20×21.20
CCM Resolution	74×46×104	70×70×70
FCM Resolution w/in CCM	3×3×3	1×1×1
No. of cells	34,900	7,530
No. of simulated molecules	329,000	404,000
Total CPU time [hrs]	191	150
Memory required [Mbytes]	60	40
Performance $[\mu sec/particle/\Delta t]$	44	29



Figure 1. UARS model used in DSMC simulation: (a) +Z side, Case 1; (b) -Z side, Case 1; (c) -Z side, Case 2; (d) -Z side, Case 3. Key: 1-Cryogenic Limb Array Etalon Spectrometer (CLAES), 2-Solar panel (SP), 3-Multi-mission Modular Spacecraft (MMS), 4-Nadir Energetic Particle Spectrometer (NEPS), 5-Zenith Energetic Particle Spectrometer (ZEPS), 6-High Gain Antenna (HGA), 7-Solar/Stellar Positioning Platform (SSPP), and 8-Instrument Module (IM).



Figure 2. Schematic representation of computational flowfield volume used with parallelization routines.



Figure 3. Representative cross-sections of computational grid for DSMC simulation; (a) inner domain at Z = 0, (b) inner domain at Y = 0.



Figure 4. Representative cross-section of UARS geometric model discretized for incorporation into DSMC code. Outward-pointed normals included with surface pixel locations.



Figure 5. Typical behavior for number of particles per timestep versus simulated elapsed time as steady state is approached.



Figure 6. Typical distribution of particles per inner-domain cell before and after grid adaption.



Figure 7. Case 1 number density contours of freestream species O, logarithmic scale nondimensionalized by freestream number density $[O]_{\infty}$: (a) +Z side, (b) -Z side.



Figure 8. Case 1 number density contours of neon, logarithmic scale nondimensionalized by $[O]_{\infty}$: (a) +Z side, (b) -Z side.



Figure 9. Case 1 number density contours of carbon dioxide, logarithmic scale nondimensionalized by $[O]_{\infty}$: (a) +Z side, (b) -Z side.



Figure 10. Case 1 number density contours of GMW = 100 outgassing species, logarithmic scale nondimensionalized by $[O]_{\infty}$: (a) +Z side, (b) -Z side.



Figure 11. Case 1 number density contours of GMW = 150 outgassing species, logarithmic scale nondimensionalized by $[O]_{\infty}$: (a) +Z side, (b) -Z side.



Figure 12. Case 1 number density contours of GMW = 200 outgassing species, logarithmic scale nondimensionalized by $[O]_{\infty}$: (a) +Z side, (b) -Z side.


1.25 0.75

0.75 0.5 0.25 3.725E-8 -0.25 -0.5 -0.75

(a)



(b)







Figure 13. Case 1 species number density contour maps emphasizing the HALOE aperture environment. Logarithmic scale nondimensionalized by freestream number density $[O]_{\infty}$: (a) monatomic oxygen, (b) neon, (c) carbon dioxide, (d) GMW = 100 species, (e) GMW = 150 species, and (f) GMW = 200 species.



(a)



(b)



(c)

(d)



Figure 14. Case 2 species number density contour maps emphasizing the HALOE aperture environment. Logarithmic scale nondimensionalized by freestream number density $[O]_{\infty}$: (a) monatomic oxygen, (b) neon, (c) carbon dioxide, (d) GMW = 100 species, (e) GMW = 150 species, and (f) GMW = 200 species.



(a)





(b)



(c)

(d)



Figure 15. Case 3 species number density contour maps emphasizing the HALOE aperture environment. Logarithmic scale nondimensionalized by freestream number density $[O]_{\infty}$: (a) monatomic oxygen, (b) neon, (c) carbon dioxide, (d) GMW = 100 species, (e) GMW = 150 species, and (f) GMW = 200 species.



Figure 16. Number of surface collisions encountered by particles prior to striking the HALOE aperture: (a) Case 1, (b) Case 2, and (c) Case 3.



Figure 17. Case 1 histograms representing velocity distribution functions for particles striking the HALOE aperture: (a) X direction, (b) Y direction, (c) Z direction.



Figure 18. Case 2 histograms representing velocity distribution functions for particles striking the HALOE aperture: (a) X direction, (b) Y direction, (c) Z direction.



Figure 19. Case 3 histograms representing velocity distribution functions for particles striking the HALOE aperture: (a) X direction, (b) Y direction, (c) Z direction.



Figure 20. Actual HALOE signal attenuation measurements between October 11, 1991 and October 20, 1992 for (a) *HF* and (b) *HCl* species.

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A three-dimensional version of the direct simulation Monte Carlo method is adapted to assess the contamination environment surrounding a highly detailed model of the Upper Atmosphere Research Satellite. Emphasis is placed on simulating a realistic, worst-case set of flow field and surface conditions and geometric orientations for the satellite in order to estimate an upper limit for the cumulative level of volatile organic molecular deposits at the aperture of the Halogen Occultation Experiment. A detailed description of the adaptation of this solution method to the study the satellite's environment is also presented. Results pertaining to the satellite's environment are presented regarding contaminant cloud structure, cloud composition, and statistics of simulated molecules impinging on the target surface, along with data related to code performance. Using procedures developed in standard contamination analyses, along with many worst-case assumptions, the cumulative upper-limit level of volatile organic deposits on HALOE's aperture over the instrument's 35-month nominal data collection period is estimated at about 13,350 A.							
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