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MOLECULAR BEAM MASS SPECTROMETER DEVELOPMENT

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By

Frank J. Brock, Principal Investigator

Final Report

Prepared for the
National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia

Under
Grant NGR 47-003-043
October 1, 1970-February 28, 1976
Ronald A. Outlaw, Technical Monitor
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Theoretical Analysis of the Density Within an Orbiting Molecular Shield*

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ABSTRACT

An analytical model, based on the kinetic theory of a drifting Maxwellian gas is used to determine the non-equilibrium molecular density distribution within a hemispherical shell open aft with its axis parallel to its velocity. Separate numerical results are presented for the primary and secondary density distribution components due to the drifting Maxwellian gas, for speed ratios between 2.5 and 10. An analysis is also made of the density component due to gas desorbed from the wall of the hemisphere and numerical results are presented for the density distribution. It is shown that the adsorption process may be completely ignored. The results are applicable to orbital trajectories in any planet-atmosphere system and interplanetary transfer trajectories. Application to the earth's atmosphere is mentioned briefly.

INTRODUCTION

Experiments are planned for the Space Shuttle Orbiter which require very low gas density. For the applicable orbit height range, the orbit velocity is very much larger than the molecular mean thermal speed in the atmosphere. Therefore, from the kinetic theory of a drifting Maxwellian gas, it is plausible to expect a very low density within a properly oriented and deployed molecular shield, although the atmospheric density in orbit may be unacceptably high. The purpose of this paper is to analyze the molecular density distribution within a hemispherical molecular shield oriented such that it opens aft with its axis parallel to the orbit velocity vector. The results developed here are applicable to orbiting in any planet-atmosphere system and to high velocity transfer trajectories between planets. In a separate paper,[1] the results have been applied to the Shuttle Orbiter in the earth's atmosphere.

It is convenient to replace the system consisting of a moving orbiter and a stationary atmosphere with the equivalent system consisting of a stationary orbiter and a drifting atmosphere. Since the atmosphere is in local equilibrium it is then a drifting Maxwellian gas. In orbit the local mean free path λ, is large compared to the radius R, of the hemisphere $(\lambda/R > 100)$; thus the disturbance produced by the hemisphere is completely negligible. The problem may then be analyzed in terms of an undisturbed drifting Maxwellian gas.

For each molecular species k, the molecular number density within the hemisphere has three components:

1. The primary density n_k^p, is associated with the primary flux entering the hemisphere, directly from the atmosphere.

2. The secondary density n_k^s, is associated with the secondary flux scattered randomly about the hemisphere (after having made an initial surface collision).

3. The desorption density n_k^d, is associated with the molecular flux desorbed from the inner surface of the hemisphere (for example, outgassing). The density of species k within the hemisphere is then

$$n_k = n_k^p + n_k^s + n_k^d \tag{1}$$

and the total density for all species is given by the sum over k. In the analysis that follows, data are presented for each of the density components in Eq. (1). These data are presented in normalized form such that they are applicable to any molecular species. The species subscript is therefore dropped in the following analysis. Computational methods were developed for the numerical calculations which returned numerical results valid to at least six significant digits.

DRIFTING MAXWELLIAN GAS

The distribution function of a drifting Maxwellian gas may be obtained from the distribution function of a stationary equilibrium gas,

$$f(V) = \frac{n}{\pi^{3/2}\, V_m^3} \exp\left[-\left(V_x^2 + V_y^2 + V_z^2\right)/V_m^2\right] \quad , \tag{2}$$

by the velocity transformation[2]

$$\vec{W} = \vec{V} - \vec{U} \ , \tag{3}$$

where $\vec{V}$ is the molecular thermal velocity in the stationary equilibrium gas, $\vec{U}$ is the orbiter velocity ($-\vec{U}$ is the gas drift velocity relative to the orbiter), and $\vec{W}$ is the molecular velocity in the reference system fixed in the orbiter. Since the gas is in equilibrium, the initial choice of the orientation of the velocity space coordinate system relative to the geometrical coordinate system is arbitrary. In this paper, the following orientations are used uniformly: +z is chosen to coincide with the orbit velocity $\vec{U}$ (the atmospheric drift velocity coincides with -z) and $+w_z$ is chosen parallel to +z. For notational convenience, the velocity components are written in dimensionless form by normalizing with respect to the most probable thermal speed

$$v_m = (2kT/m)^{1/2} \quad . \tag{4}$$

The velocity components are then written

$$w_i = W_i/v_m, \qquad i = x, y, z \tag{5}$$

and the speed ratio is

$$S = U/v_m \quad . \tag{6}$$

From Eqs. (2) through (5), for the orientation convention described above, the distribution function for a drifting Maxwellian gas becomes

$$f(S,w) = \frac{n}{\pi^{3/2}} \exp\left\{- \left[w_x^2 + w_y^2 + (w_z + S)^2\right]\right\}, \tag{7}$$

where n is the atmospheric molecular number density for the k-th species.

DRIFTING MAXWELLIAN GAS FLUX DENSITY

The molecular flux density ν, incident on a surface element (molecular collision frequency per unit area) in a drifting Maxwellian gas may be obtained from the distribution function and the geometry of Fig. 1[(2)]. The number of molecules in the cylinder which have velocities within $d\vec{w}$ of $\vec{w}$ is given by

$$d^3\nu dsdt = f(S,w)\, dw_x dw_y dw_z dV \quad , \tag{8}$$

where the cylindrical volume element is

$$dV = |\vec{\eta} \cdot \vec{w}|\, v_m dsdt \quad , \tag{9}$$

and the surface normal $\vec{\eta}$, lies in the (x,z)-plane. In Eq. (9), the absolute value of the dot product is taken to yield a positive value for the flux density incident on the positive side of the surface element (side from which $\vec{\eta}$ is drawn). From Fig. 1, it may be seen that

$$|\vec{\eta} \cdot \vec{w}| = w \cos\gamma \quad , \tag{10}$$

and

$$\cos\gamma = \sin\beta \sin\theta \cos\phi - \cos\beta \cos\theta \quad . \tag{11}$$

Eq. (8) may then be written

$$d^3\nu = v_m f(S,w)\, w \cos\gamma\, dw_x dw_y dw_z \quad , \tag{12}$$

where γ ranges over all values for which molecules from the volume element can reach the surface.

For a flat or convex surface, $\gamma_{max} = \pi/2$. Thus, integration extends over a complete half-space in the w coordinate system. In this case, the integrations may be facilitated by rotating the w-coordinate system such that w_z is parallel to $\vec{\eta}$. All integrations may then be completed[3] and the incident flux density from the drifting Maxwellian gas may be expressed in closed form

$$\nu(S,\beta) = \frac{nv_m}{2\sqrt{\pi}} \left\{ \exp\left[-(S \cos\beta)^2\right] + \sqrt{\pi}\, S \cos\beta \left[1 + \mathrm{erf}(S \cos\beta)\right] \right\} , \quad 0 \le \beta \le \pi, \tag{13}$$

where the error function is given by

$$\mathrm{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x \exp(-\xi^2)\, d\xi \quad . \tag{14}$$

Eq. (13) is needed later in the calculation of the density distribution within the molecular shield.

HEMISPHERE PRIMARY FLUX DENSITY

The flux density incident on the concave surface of a hemisphere, oriented with its axis parallel with the velocity vector and open aft, originates in that part of the 6-dimensional space (the combined velocity space and geometrical space) from which molecules can reach the surface. Thus the w-space integration range is constrained by the hemisphere to something less than a complete half-space as shown in Fig. 2. In this case, the incremental primary flux density $d\nu_i^p$, incident on a surface element ds_i, is given by Eq. (12) applied to the geometry shown in Fig. 2. Transforming Eq. (12) to spherical coordinates in w-space, the primary flux density incident on the inner surface of the hemisphere may be written

$$\nu^p(S,\zeta) = v_m \int_0^{2\pi} \int_0^{\theta} \int_0^{\infty} f(S,w)\, w^3 dw \cos\gamma \sin\theta \, d\theta d\phi \, +$$

$$+ \, 2v_m \int_0^{\pi} \int_{\theta}^{\theta(\phi)} \int_0^{\infty} f(S,w)\, w^3 dw \cos\gamma \sin\theta \, d\theta d\phi \quad , \tag{15}$$

and from Fig. 2 it follows that

$$\cos\gamma = \sin\zeta \sin\theta \cos\phi + \cos\zeta \cos\theta \quad , \tag{16}$$

$$\theta = \text{atan} \left[(1 - \sin\zeta)/\cos\zeta \right] \quad , \tag{17}$$

and

$$\theta(\phi) = \text{atan} \left[(1 + \tan^2\zeta \cos^2\phi)^{1/2} + \tan\zeta \cos\phi \right] \quad . \tag{18}$$

After performing the w and θ integrations[3], Eq. (15) simplifies to

$$\nu^p(S,\zeta) = \frac{n v_m}{2\sqrt{\pi}} \left\{ \exp(-S^2) - \sqrt{\pi}\, S \,\text{erfc}(S) \cos\zeta + \frac{S \cos\zeta}{2\sqrt{\pi}} g(S,\zeta) \right\} \quad , \tag{19}$$

where

$$g(S,\zeta) = \int_0^{\pi} \cos\theta(\phi) \,\text{erfc} \left[S \cos\theta(\phi) \right] \exp \left[-S^2 \sin^2\theta(\phi) \right] f_1(\zeta,\phi) d\phi \quad , \tag{20}$$

$$\cos\theta(\phi) = \left[\frac{1}{2} - \frac{\cos\phi}{2(\cot^2\zeta + \cos^2\phi)^{1/2}} \right]^{1/2} , \tag{21}$$

$$\sin^2\theta(\phi) = 1 - \cos^2\theta(\phi) , \tag{22}$$

$$f_1(\zeta,\phi) = 1 - \frac{\sin^2\phi}{\cot^2\zeta + \cos^2\phi} , \tag{23}$$

and

$$\mathrm{erfc}(x) = 1 - \mathrm{erf}(x) . \tag{24}$$

Eq. (19) is needed later in the calculation of the density distribution within the molecular shield.

The primary flux density incident on the inner surface of the hemisphere was machine evaluated using Eq. (19) for $0 \leq \zeta \leq \pi/2$ and for[4] $S = 2.5(2.5)10$. The numerical results are presented (normalized) in Fig. 3. The normalization relation applied to the numerical data is

$$\tilde{\nu}^P(S,\zeta) = \nu^P(S,\zeta) \left(\frac{nv_m}{2\sqrt{\pi}}\right)^{-1} . \tag{25}$$

The data for each value of the speed ratio are subsequently renormalized with respect to the value at $\zeta = \pi/2$ before plotting in Fig. 3.

HEMISPHERE SECONDARY DENSITY

The atmospheric flux which enters the hemisphere is scattered about randomly and eventually passes out of the hemisphere; after the first surface collision for some molecules but after several collisions for others. (The process of adsorption is discussed later.) On any surface element ds_i (see Fig. 4), there is an incident primary (direct from the atmosphere) flux density ν_i^p, and an incident secondary flux density ν_i^s, consisting of molecules scattered off all other surface elements of the hemisphere in a direction such that they can reach ds_i. Particle conservation at ds_i requires that the sum of these two incident flux densities be equal to the molecular emission flux density ν_e, thus

$$\nu_i^p + \nu_i^s = \nu_e \quad . \tag{26}$$

Making the usual assumptions that the emission flux density is thermally accommodated[5] and has an angular distribution given by a cosine function with respect to the surface normal, the emission flux density must satisfy

$$\nu_e = \int_{\Omega_{1/2}} I_e \cos\gamma_e \, d\omega_e \quad , \tag{27}$$

where $I_e \cos\gamma_e$ is the emission flux density per unit solid angle, γ_e is the angle between the surface normal and the direction of emission, and $\Omega_{1/2}$ is the half-space solid angle into which all molecules from ds_i are emitted. From the above assumptions, I_e is independent of ω_e and therefore, may be factored out of the integral with the result that

$$\nu_e = \pi I_e \quad . \tag{28}$$

From Fig. 4 and particle conservation, the secondary flux incident on ds_i emitted from ds_e is given by

$$d\nu_i^s ds_i = I_e \cos\gamma_e \, d\omega_e \, ds_e \quad . \tag{29}$$

Also from Fig. 4, the differential solid angle may be written

$$d\omega_e = \cos\gamma_i \, ds_i/\rho^2 \quad , \tag{30}$$

where ρ is the distance between ds_e and ds_i. Since both ds_e and ds_i lie on the surface, it follows that

$$\rho^{-2} \cos\gamma_e \cos\gamma_i = (4R^2)^{-1} \quad . \tag{31}$$

Substituting Eqs. (30) and (31) into (29) gives the secondary flux density incident on any surface element ds_i,

$$\nu_i^s = \frac{1}{4R^2} \int_{\Sigma_h} I_e \, ds_e \quad , \tag{32}$$

where Σ_h indicates that the integration extends over the inner surface of the hemisphere.

Substituting Eqs. (19), (27), and (32) into Eq. (26) yields the following integral equation for I_e (where the subscripts have been dropped since they are no longer needed for clarity)

$$\pi I = \nu^P(S,\zeta) + (2R)^{-2} \int_{\Sigma_h} I ds \quad . \tag{33}$$

The solution to this equation is

$$I(S,\zeta) = \nu^P(S,\zeta)/\pi + (2\pi^2 R^2)^{-1} \int_{\Sigma_h} \nu^P(S,\zeta) ds \quad , \tag{34}$$

as may be verified by substitution. The integral in Eq. (34) is the integral of the primary flux density over the entire inner surface of the hemisphere. Particle conservation requires that this integral be equal to the total primary flux incident on the plane $z = 0$. The primary flux density incident on the plane $z = 0$ is given by Eq. (13), after substituting $\beta = \pi$, and this flux density is uniform over the hemisphere entrance plane. Therefore, the integral in Eq. (34) may be evaluated as follows

$$\int_{\Sigma_h} \nu^P \; (S,\zeta)ds = \int_{\Sigma_o} \nu^P(S,\beta=\pi)ds = \pi R^2 \nu_o^P(S) \quad , \tag{35}$$

where Σ_o indicates integration over the hemisphere entrance plane $(z = 0)$, and $\nu_o^P(S) \equiv \nu^P(S,\beta=\pi)$. Thus from Eq. (13) for $\beta = \pi$, it follows that

$$\nu_o^P(S) = \frac{nv_m}{2\sqrt{\pi}} \left[\exp(-S^2) - \sqrt{\pi}\; S\; \mathrm{erfc}(S)\right] \quad . \tag{36}$$

Finally, the integral equation solution may be written[6]

$$I(S,\zeta) = \nu_o^P(S)\;(2\pi)^{-1} + \nu^P(S,\zeta)\pi^{-1} \quad , \tag{37}$$

where $\nu_o^P(S)$ i. given by Eq. (36) and $\nu^P(S,\zeta)$ is given by Eq. (19). Th. val .ty of Eq. (37) is discussed in Appendix A.

The function $I(S,\zeta)$ may now be used to determine the density of secondary molecules at any point within the hemisphere volume. Assuming that the molecular emission is in equilibrium with the surface, the incremental molecular density at a point ρ from a surface increment (see Fig. 5) is given by

$$d\nu(\rho) = \frac{2v_m'}{\sqrt{\pi}}\,dn(\rho) \quad , \tag{38}$$

where

$$v_m' = (2kT'/m)^{1/2} \quad , \tag{39}$$

and T' is the surface temperature. For the collisionless, expanding flux leaving ds_e, continuity of flux requires that the flux density at a distance ρ from the surface satisfy the relation

$$d\nu(\rho)ds = d\nu_e ds_e \quad , \tag{40}$$

where

$$ds = \rho^2 d\omega_e \quad , \tag{41}$$

and $d\nu_e$ may be obtained from Eq. (27) by differentiation.

Substituting the derivative of Eq. (27) and Eqs. (40) and (41) into Eq. (38) yields

$$dn(\rho) = \frac{\sqrt{\pi}}{2v_m'} \, I_e \cos\gamma_e \, ds_e/\rho^2 \quad . \tag{42}$$

Applying Eq. (42) to the hemisphere shown in Fig. 6, it follows that the density of secondary molecules at any point (λ,μ) within the hemisphere is given by

$$n^s(S,\lambda,\mu) = \frac{\sqrt{\pi}}{2v_m'} \int_{\Sigma_h} I(S,\zeta) \cos\gamma \, ds/\rho^2 \quad , \tag{43}$$

where the function $I(S,\zeta)$ is given by Eq. (37), Σ_h indicates integration over the inner surface of the hemisphere, and from the geometry of Fig. 6 it follows that

$$\cos\gamma \, ds/\rho^2 = \frac{[1 - \lambda(\cos\mu \cos\zeta + \sin\mu \sin\zeta \cos\xi)] \sin\zeta \, d\xi d\zeta}{[1 - 2\lambda(\cos\mu \cos\zeta + \sin\mu \sin\zeta \cos\xi) + \lambda^2]^{3/2}} \quad . \tag{44}$$

The ξ integration may be executed in terms of complete elliptic integrals[3], which simplifies Eq. (43) to

$$n^s(S,\lambda,\mu) = \frac{nv_m}{2v_m'} \int_0^{\pi/2} I(S,\zeta) \, h(\lambda,\mu,\zeta) d\zeta \quad , \tag{45}$$

where

$$h(\lambda,\mu,\zeta) = \left\{ \frac{(1 - \lambda^2) \, E(k)}{[1 - 2\lambda \cos(\zeta - \mu) + \lambda^2]} + K(k) \right\} \frac{\sin\zeta}{[1 - 2\lambda \cos(\zeta + \mu) + \lambda^2]^{1/2}} \, , \tag{46}$$

the complete elliptic integral of the 1st kind is

$$K(k) = \int_0^{\pi/2} (1 - k^2 \sin^2 x)^{-1/2}\, dx \quad , \tag{47}$$

the complete elliptic integral of the 2nd kind is

$$E(k) = \int_0^{\pi/2} (1 - k^2 \sin^2 x)^{1/2}\, dx \quad , \tag{48}$$

and the modulus k, is given by

$$k^2 = \frac{4\lambda \sin\mu \sin\zeta}{1 - 2\lambda \cos(\zeta + \mu) + \lambda^2} \quad . \tag{49}$$

The secondary density distribution within the hemisphere was calculated numerically from Eq. (45) for $S = 2.5(2.5)10$, $\lambda = 0(0.1)1$, $\mu = 0°(10°)90°$, and for a number of irregular values of these parameters. The numerical results are presented (normalized) in Fig. 7. The normalized secondary density distribution is given by

$$\tilde{n}^S(S,\lambda,\mu) = n^S(S,\lambda,\mu)\ (nv_m/v_m')^{-1} \quad . \tag{50}$$

The data for each value of the speed ratio are subsequently renormalized with respect to the value at the hemisphere origin ($\lambda = 0$) before plotting in Fig. 7.

HEMISPHERE PRIMARY DENSITY

The density distribution of primary molecules n^p, within the hemisphere may be calculated directly from the distribution function of the drifting Maxwellian gas, since the hemisphere produces a negligible disturbance in the gas. The molecular density at any point in the drifting Maxwellian gas is given by the integral of the distribution function, Eq. (7), over the appropriate limits. Thus, at any point (r,μ) within the hemisphere (see Fig. 8), the density of primary molecules is given by (after transforming to spherical coordinates in w-space)

$$n^P(S,r,\mu) = \int_0^{2\pi}\int_0^{\Theta}\int_0^{\infty} f(S,w)\, w^2\, dw\, \sin\theta\, d\theta d\phi \; +$$

$$+\; 2\int_0^{\pi}\int_{\Theta}^{\theta(\phi)}\int_0^{\infty} f(S,w)\, w^2\, dw\, \sin\theta\, d\theta d\phi \quad . \tag{51}$$

For the aft opening hemisphere with its axis parallel to $\vec{U}$, the integration limits in Eq. (51) may be obtained from Fig. 8 and are given by

$$\Theta = \text{atan}\left[(1 - r\,\sin\mu)/r\,\cos\mu\right] \quad , \tag{52}$$

and

$$\theta(\phi) = \text{atan}\left[\frac{r\,\sin\mu\,\cos\phi + (1 - r^2\,\sin^2\mu\,\sin^2\phi)^{1/2}}{r\,\cos\mu}\right] \quad . \tag{53}$$

After completing the w and θ integrations[3], Eq. (51) simplifies to

$$n^P(S,r,\mu) = \frac{n}{2}\,\text{erfc}(S) - \frac{n}{2\pi}\int_0^{\pi} \cos\theta(\phi)\,\text{erfc}\left[S\,\cos\theta(\phi)\right]\,\exp\left[-S^2\,\sin^2\theta(\phi)\right] d\phi \quad , \tag{54}$$

where

$$\cos\theta(\phi) = \frac{r\,\cos\mu}{\left\{r^2\,\cos^2\mu + \left[r\,\sin\mu\,\cos\phi + (1 - r^2\,\sin^2\mu\,\sin^2\phi)^{1/2}\right]^2\right\}^{1/2}} \tag{55}$$

and

$$\sin\theta(\phi) = \frac{r\,\sin\mu\,\cos\phi + (1 - r^2\,\sin^2\mu\,\sin^2\phi)^{1/2}}{\left\{r^2\,\cos^2\mu + \left[r\,\sin\mu\,\cos\phi + (1 - r^2\,\sin^2\mu\,\sin^2\phi)^{1/2}\right]^2\right\}^{1/2}} \quad . \tag{56}$$

The primary density distribution within the hemisphere was evaluated numerically using Eq. (54) for $S = 2.5(2.5)10$, $\hbar = 0(0.1)1$, $\mu = 0°(10°)90°$, and for a number of irregular values of these parameters. The numerical results are presented (normalized) in Fig. 9. In this figure, the normalized primary density distribution is given by

$$\tilde{n}^p(S,\hbar,\mu) = n^p(S,\hbar,\mu)/n \quad . \tag{57}$$

The data for each value of speed ratio are subsequently renormalized with respect to the value at the hemisphere origin before plotting in Fig. 9.

HEMISPHERE DESORPTION DENSITY

A molecular desorption flux (outgassing) from metal surfaces is commonly observed, even for very clean surfaces. Associated with the desorption flux density ν^d, from the inner surface of the hemisphere, there is a molecular density n^d, within the volume of the hemisphere. It is reasonable to assume that ν^d is uniform over the surface. In this case, particle conservat n at ds_i (see Fig. 4) requires that

$$\nu^d + \nu_i^s = \nu_e \tag{58}$$

where ν_i^s and ν_e have the same meaning as in Eq. (26) except that they refer to the desorption gas source rather than the atmospheric source. From an argument similar to that leading to Eqs. (28) and (32), it follows that

$$\nu_e = \pi I^d \tag{59}$$

and

$$\nu_i^s = \frac{1}{4R^2} \int_{\Sigma_h} I^d \, ds \quad . \tag{60}$$

Substituting Eqs. (59) and (60) into Eq. (58) gives the integral equation

$$\pi I^d = \nu^d + \frac{1}{4R^2} \int_{\Sigma_h} I^d \, ds \quad . \tag{61}$$

Since ν^d is constant, the solution to Eq. (61) is

$$I^d = 2\nu^d/\pi \quad . \tag{62}$$

Using this result in Eq. (42) and again applying that equation to the hemisphere, it follows that the molecular density distribution within the hemisphere due to desorption from the surface is

$$n^d(\lambda,\mu) = \frac{2\nu^d}{\sqrt{\pi}\, v'_m} \int_0^{\pi/2} h(\lambda,\mu,\zeta) d\zeta \quad , \tag{63}$$

where $h(\lambda,\mu,\zeta)$ is given by Eq. (46).

The molecular density distribution within the hemisphere due to surface desorption was machine evaluated using Eq. (63) for $\lambda = 0(0.1)1$, and $\mu = 0°(10°)90°$. The results are presented (normalized) in Fig. 10. The normalized desorption density distribution is given by

$$\tilde{n}^d(\lambda,\mu) = n^d(\lambda,\mu) \sqrt{\pi}\, v'_m (2\nu^d)^{-1} \quad . \tag{64}$$

DISCUSSION

For the oriented hemisphere-drifting Maxwellian gas system analyzed here, it is shown below that the adsorption-desorption process has a vanishingly small effect on the density within the hemisphere, provided the speed ratio is not small. The primary (atmospheric) flux density incident on the inner surface of the hemisphere, given by Eq. (19), is maximum for $\zeta = \pi/2$ as shown in Fig. 3. For this value of ζ, Eq. (19) can be integrated, yielding

$$\nu^p(S,\pi/2) = nv_m(4\sqrt{\pi})^{-1} \quad \mathrm{erfc}(S) \quad . \qquad (65)$$

Thus, ν^p is a maximum for the smallest applicable value of S. The atmospheric species which has the smallest S is atomic hydrogen. For a mean model atmosphere[7], the maximum atomic hydrogen density is $n_H \approx 2.74 \cdot 10^4 \ cm^{-3}$ and the local temperature is $T = 10^3$ K. At this height, the orbit velocity is $U = 7.64$ km sec^{-1} (for a circular orbit) and, thus $S = 1.87$. It therefore follows from Eq. (65) that the atomic hydrogen flux density incident on the inner surface of the hemisphere from the atmosphere is $\nu^p(1.87, \pi/2) = 1.31 \cdot 10^7 \ cm^{-2}sec^{-1}$. If the surface capture probability (sticking coefficient) for atomic hydrogen were 1.0, the adsorption of a monolayer would require approximately 10^8 sec. For all other adsorbable atmospheric species, although the density may be much higher, the speed ratio is much larger and the monolayer adsorption time is much larger, as may be verified by inspecting the form of Eq. (65).

The total molecular number density distribution within the hemisphere is given by Eq. (1) summed over k, where (for each species) n^p is taken from Eq. (54), n^s is obtained from Eq. (45), and n^d is given by Eq. (63). It is obvious that the gas resulting from the double summation is not an equilibrium gas. In a rigorous sense, the molecular species of n^p and n^s should be the same species as the drifting Maxwellian gas. However, in a practical sense, within the volume of the hemisphere, the density of the atmospheric species with high molecular mass (large speed ratio) are completely negligible in comparison with the low mass (small S) species.

Since n^d is generated by an internal gas source, it is a function of ν^d only. Thus, n^d consists of molecular species not related to the atmosphere. The desorption flux density is in general a function of the surface temperature T', the history of the surface, and also the history of the bulk since diffusion from the bulk to the surface is frequently the principal gas source. Eq. (63), which gives the density due to desorption, remains valid if the surface temperature is a slowly varying function of time but uniform over the surface. If the desorption flux density is not uniform, ν^d must remain under the integral in Eq. (63), and if the surface temperature is not uniform, v'_m must remain under the integral. A typical value of ν^d, for a thoroughly degassed metal surface, is $\nu^d \approx 3 \cdot 10^7$ $cm^{-2}sec^{-1}$ (molecular hydrogen). From Fig. 10 and Eq. (64), for a surface temperature $T' = 300K$, it follows that $n^d(0,0) \approx 675\ cm^{-3}$.

The atmospheric component of the density distribution within the hemisphere n^a, is the sum of the primary density given by Eq. (54) and the secondary density given by Eq. (45)

$$n^a(S,\lambda,\mu) = n^p(S,\lambda,\mu) + n^s(S,\lambda,\mu) \quad , \tag{66}$$

for each molecular species in the drifting Maxwellian gas. Since the geometry is prescribed, n^p depends only on the atmospheric density n, and the speed ratio S, but n^s depends on these parameters as well as the surface temperature T' (assuming complete accommodation). Since only n can be factored out of the right side of Eq. (66), both S and (T/T') must be prescribed to obtain n^a. (8) If the surface temperature is uniform but varies slowly with time, Eq. (45) remains valid. However, if the surface temperature is not uniform, v'_m must remain under the integral in Eq. (45).

The atmospheric component of the density distribution within the hemisphere is presented in Fig. 11 for $(T/T') = 3.333$ (a typical value) and for $S = 2.5(2.5)10$. The normalization relation applied to these data is given by

$$\tilde{n}^a(S,\lambda,\mu) = n^a(S,\lambda,\mu)/n \quad . \tag{67}$$

The data for each value of speed ratio are subsequently renormalized with respect to the value at the hemisphere origin before plotting in Fig. 11.

Eq. (66) may be applied to a hemisphere in any planetary atmosphere provided the structure of the atmosphere is known. In a separate paper[1], the structure of the earth's atmosphere and Eq. (66) were used to calculate the density of each molecular species within a hemispherical molecular shield deployed from the Shuttle Orbiter, for a range of orbits within the operating envelope of the Shuttle. However, it may be seen from Fig. 11(c) and Eq. (67) that the atomic oxygen density within the hemisphere is less than $2.5 \cdot 10^{-16}$ cm^{-3}, since the density of atomic oxygen in the atmosphere at the minimum orbit height is about 10^{10} cm^{-3} and the speed ratio is slightly greater than 7.5 (for a mean atmosphere). Atmospheric atomic hydrogen, on the other hand, has the smallest speed ratio. For a mean atmosphere, its speed ratio is $S \approx 1.87$ where its density is maximum $n_H \approx 3 \cdot 10^4$ cm^{-3}. Thus the hydrogen density in the molecular shield is of the order of 300 cm^{-3}. Therefore, even though atomic oxygen is the most abundant species, it makes a completely negligible contribution to the density compared to atomic hydrogen, a minor constituent of the atmosphere.

ACKNOWLEDGMENTS

The authors are grateful to the personnel of the Langley Research Center's Analysis and Computation Division for their support in the execution of this work. A special thanks go to Steven K. Park and Athena Markos for their imagination and creativity in the difficult task of producing these precision numerical results.

APPENDIX A

The validity of the function $I(S,\zeta)$ may be tested by using $I(S,\zeta)$ to calculate the secondary molecular flux density $\nu^s(S,r)$, passing through the plane $z = 0$ in the negative direction for an arbitrary point in the plane. Particle conservation (in the absence of adsorption) requires that the integral of this secondary flux density over the plane $z = 0$ be equal to the incident primary flux. The secondary flux density incident on the plane $z = 0$ (see Fig. A1) is

$$\nu^s(S,r) = \int_{\Sigma_h} I(S,\zeta)\ \cos\gamma_i\ \cos\gamma_e\ ds_e/\rho^2$$

$$= 2\int_0^{\pi/2}\int_0^{\pi} I(S,\zeta)\ \frac{(1 - r\cos\zeta\ \cos\xi)d\xi\ \sin\zeta\ d\zeta}{\left[1 - 2r\ \sin\zeta\ \cos\xi + r^2\right]^2}$$

$$= \pi\int_0^{\pi/2} I(S,\zeta)\ \frac{(1 + r^2\ \cos 2\zeta)\ \sin 2\zeta\ d\zeta}{\left[1 + 2r^2\ \cos 2\zeta + r^4\right]^{3/2}} \tag{A1}$$

Particle conservation at $z = 0$ requires

$$\int_0^1\int_0^{2\pi} \nu_o^p(S)d\xi r dr = \int_0^1\int_0^{2\pi} \nu^s(S,r)d\xi r dr \quad , \tag{A2}$$

from which it follows that

$$\nu_o^p(S) = 2\int_0^1 \nu^s(S,r) r dr \quad . \tag{A3}$$

Substituting from Eq. (A1) for $\nu^s(S,r)$, Eq. (A3) may be written

$$\nu_o^p(S) = 2\pi\int_0^1\int_0^{\pi/2} I(S,\zeta)\ \frac{(1 + r^2\ \cos 2\zeta)\ \sin 2\zeta\ d\zeta r dr}{\left[1 + 2r^2\ \cos 2\zeta + r^4\right]^{3/2}} \quad . \tag{A4}$$

Interchanging the order of integration and performing the λ integration[3], this equation becomes

$$\nu_o^P(S) = \pi \int_0^{\pi/2} I(S,\zeta)\ \sin\zeta d\zeta \qquad . \tag{A5}$$

Substituting for $I(S,\zeta)$ from Eq. (37) and performing the integration over the constant part of $I(S,\zeta)$ gives the result

$$\nu_o^P(S) = 2 \int_0^{\pi/2} \nu^P(S,\zeta)\ \sin\zeta d\zeta \qquad . \tag{A6}$$

This equation is identical with the boundary condition given in Eq. (35), after completing the azimuthal integration in that equation, thus demonstrating the validity of the function $I(S,\zeta)$. The precision of the numerical methods used in the calculations may be estimated by using them to evaluate the integral in Eq. (A6) with $\nu^P(S,\zeta)$ taken from Eq. (19). The machine results differed from an exact equality by no more than a few parts in 10^7 for all values of S.

REFERENCES AND FOOTNOTES

- Work supported by NASA Grants NGR 47-003-043 and NGR 47-003-082.

1. L.T. Melfi, et al. "Molecular Shield: An Orbiting Low Density Materials Laboratory," J. Vac. Sci. Technol. .

2. S. Chapman and T.G. Cowling, *The Mathematical Theory of Non-Uniform Gases*, (Cambridge University Press, London, 1961).

3. I.S. Gradshteyn and I.M. Ryzhik, *Tables of Integrals Series and Products*, (Academic Press, New York, NY, 1965).

4. The notation indicates that S takes values from 2.5 in increments of 2.5 up to 10.

5. In the reference system fixed with respect to the molecular shield, the mean value of the z-component of the molecular velocity for molecules which enter the hemisphere is

$$\left\langle v_{+z} \right\rangle = \frac{v_m}{\sqrt{\pi}} \left\{ e^{-S^2} - \sqrt{\pi} S \operatorname{erfc}(S) \right\} / \operatorname{erfc}(S) \quad .$$

For $S >> 1$, it follows that

$$\left\langle v_{+z} \right\rangle / v_m \approx (2S)^{-1}$$

Thus, the molecular velocity of approach is small and accommodation to the surface temperature requires a relatively small change in molecular kinetic energy.

6. If adsorption on the surface of the hemisphere is not negligible, Eq. (37) must be modified. If a is the adsorption probability in each molecular collision with the surface, the right side of Eq. (26) must be multiplied by (1 - a) and the solution to the resulting integral equation is

$$I(S,\zeta) = \frac{(1-a)}{\pi} \left\{ \frac{1}{2} \left(\frac{1-a}{1+a} \right) \nu_o^p(S) + \nu^p(S,\zeta) \right\} \quad ,$$

where $\nu_o^p(S)$ and $\nu^p(S,\zeta)$ are given by Eq. (36) and (19), respectively.

7. COSPAR International Reference Atmosphere 1972, Akademie-Verlag, Berlin, 1972.

8. One test of the validity of the analytical expression for n^a is to examine its behavior as S approaches zero. For this limit, n^a should approach n. Under this condition, the drifting Maxwellian gas becomes stationary and the density in the hemisphere should be the same as the atmospheric density. A machine experiment was conducted on Eq. (66) to determine the limit of n^a as S approaches zero. For $T' = T$, it was found that $\lim\limits_{S\to 0} n^a(S,\lambda,\mu) = n$. The validity of n^a may also be tested by examining its behavior as S approaches infinity. From the analytical form of Eqs. (19), (36), and (54), which are the equations that determine the behavior of n^a in the limit, it is clear that $\lim\limits_{S\to\infty} n^a(S,\lambda,\mu) = 0$.

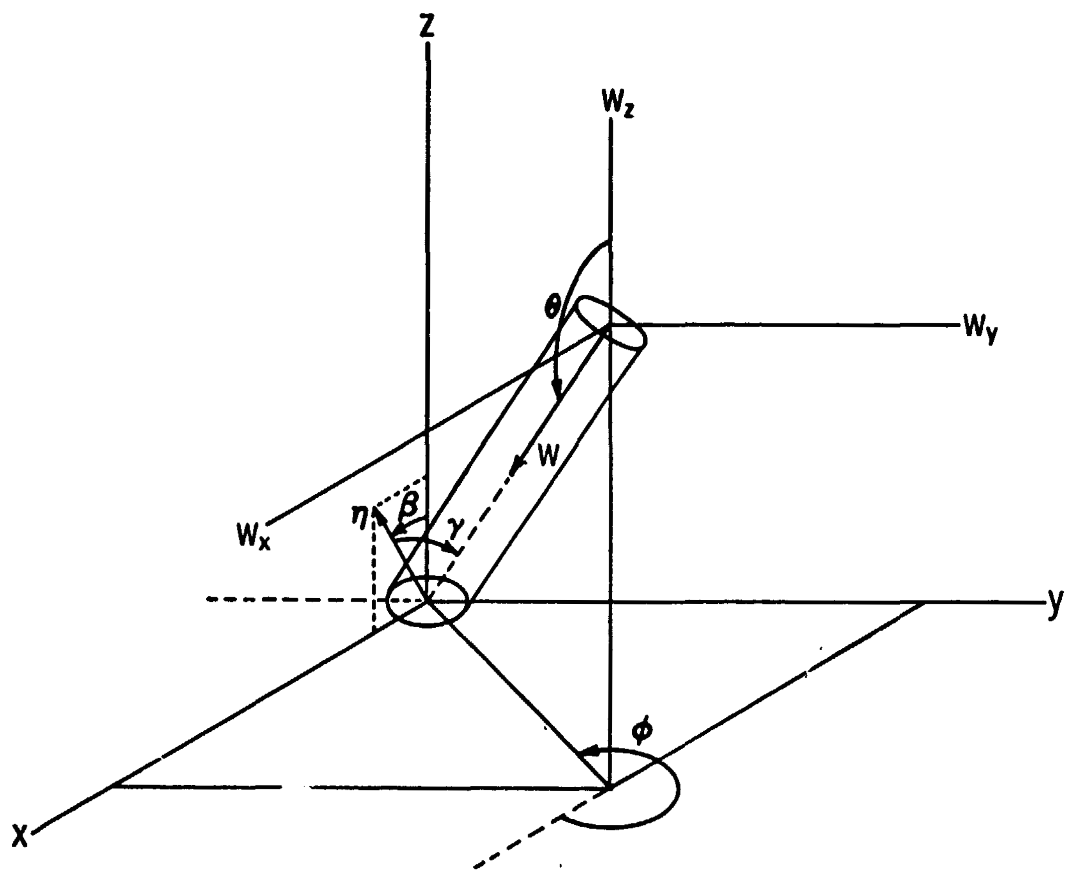

Fig. 1. Drifting Maxwellian gas incident flux density coo[illegible]nate system.

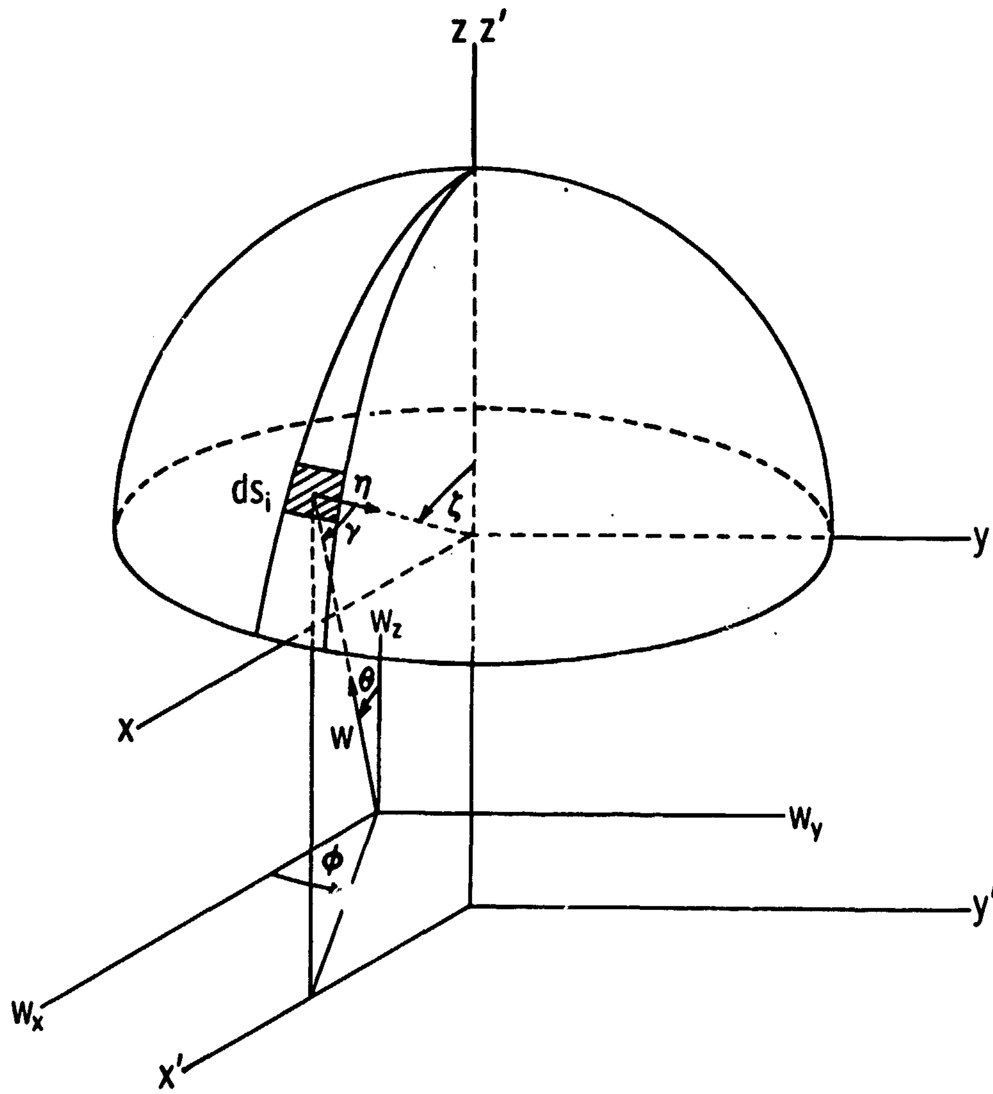

Fig. 2. Coordinate system for the calculation of the incident flux density on a hemisphere in a drift'ng Maxwellian gas.

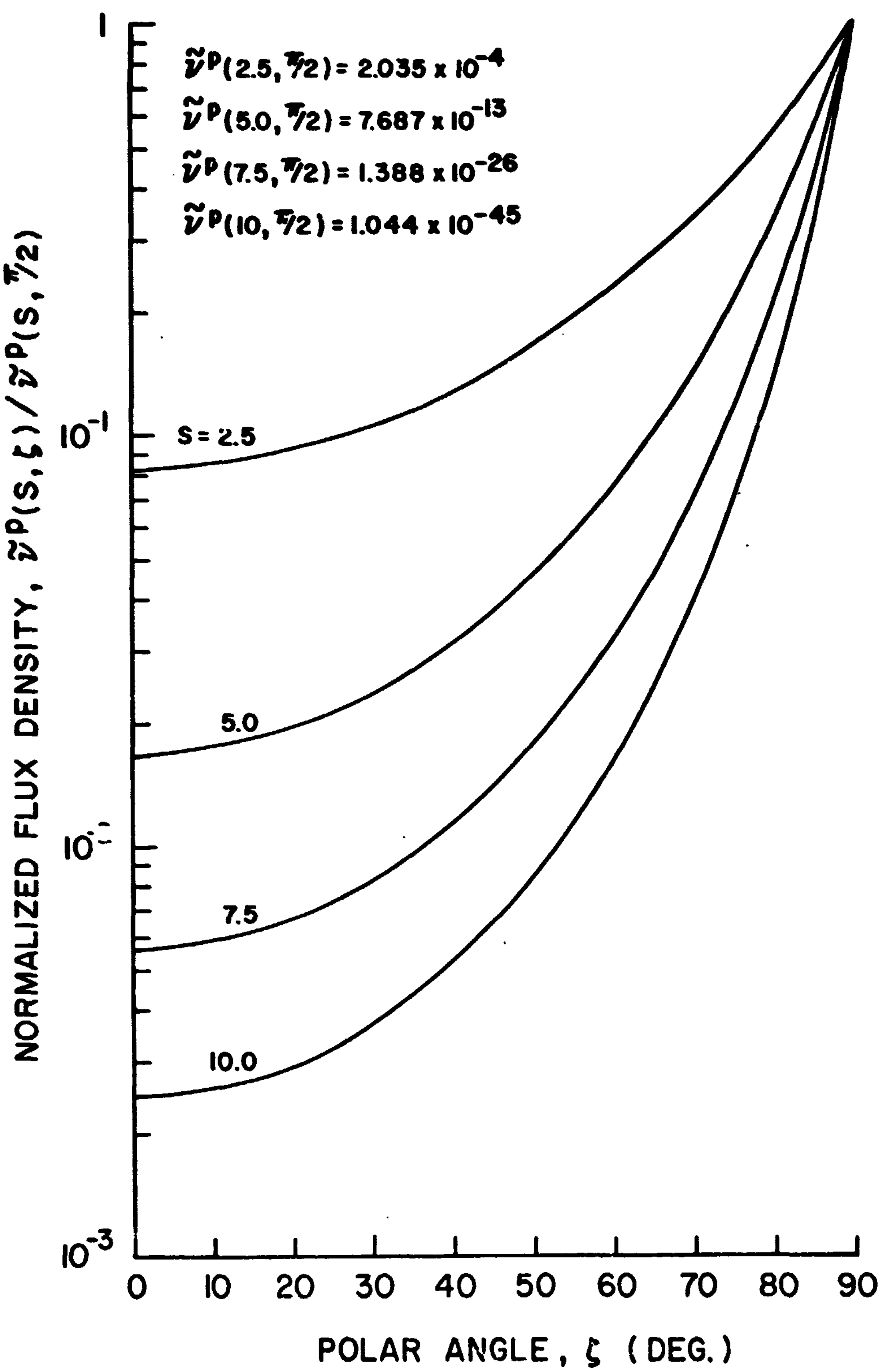

Fig. 3. Primary flux density distribution with[illegible] [illegible]here in a drifting Maxwellian gas, $\nu^P(S,\zeta) = \tilde{\nu}^P(S,\zeta$[illegible]

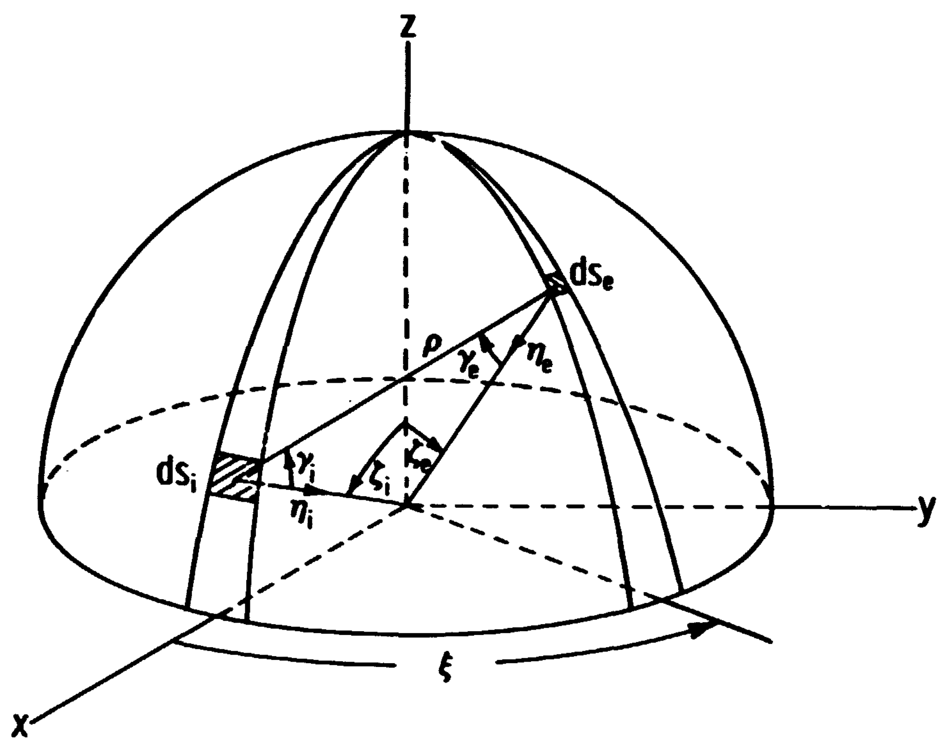

Fig. 4. Geometry of internal scattering in a hemisphere; hemisphere radius = R.

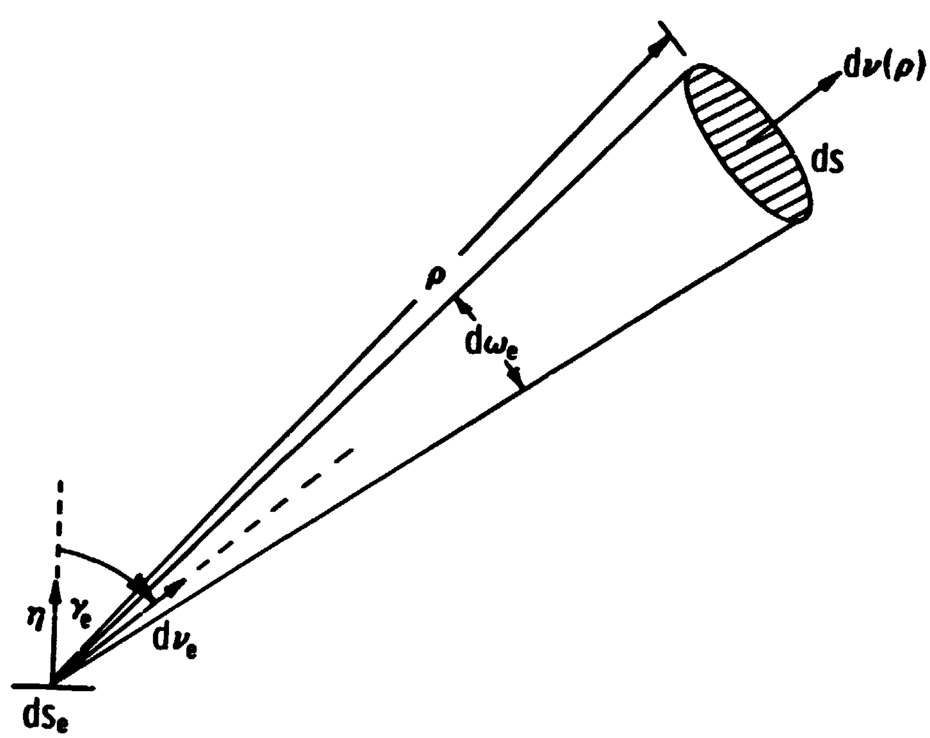

Fig. 5. Emission flux geometry.

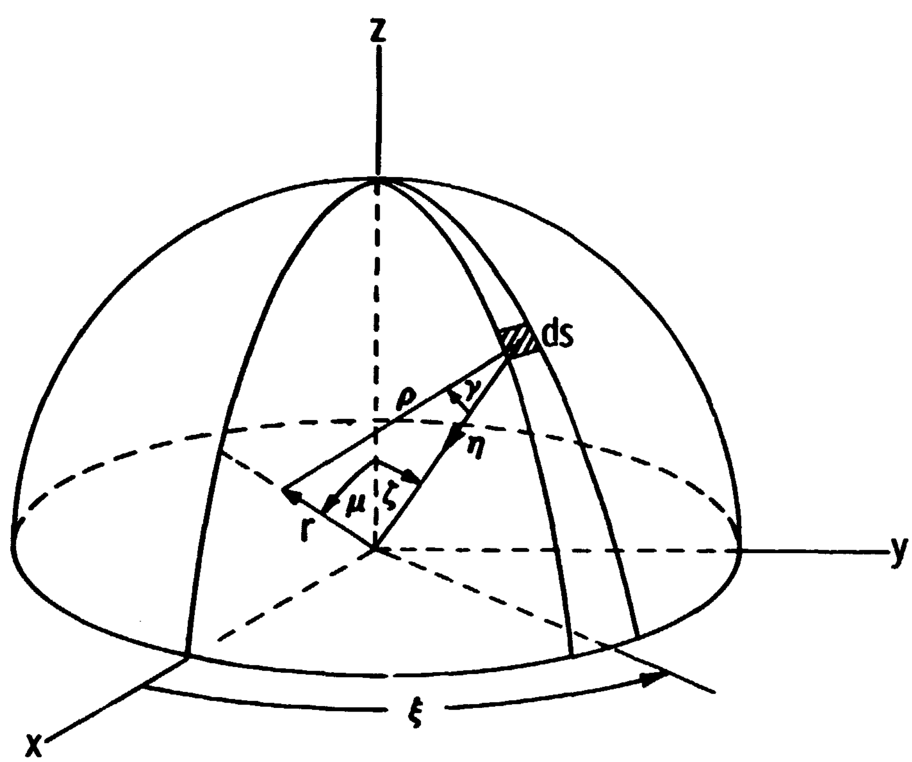

Fig. 6.. Geometry for the calculation of the secondary density in a hemisphere; hemisphere radius = R, normalized radius = λ = r/R.

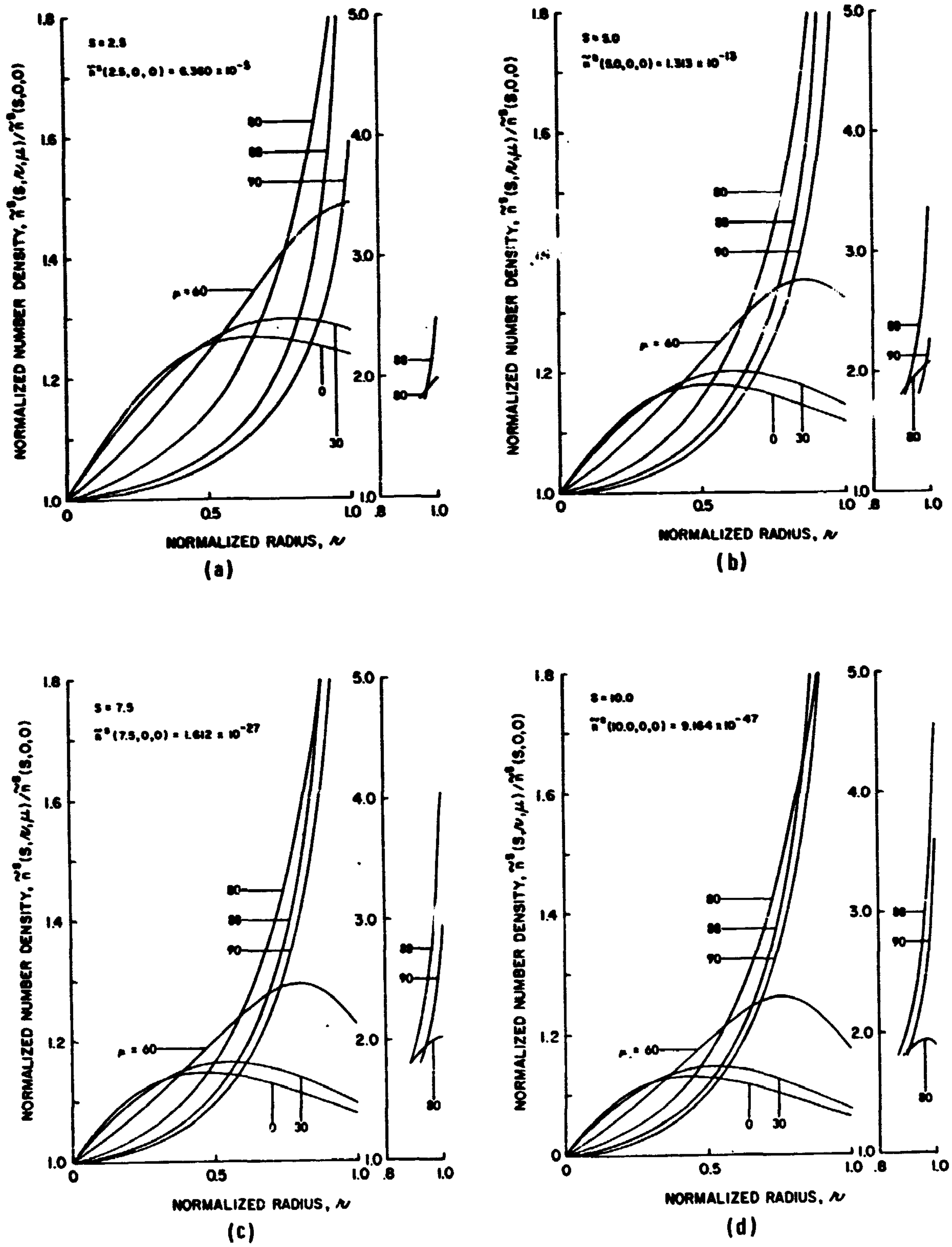

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Fig. 7. Secondary density distribution within a hemisphere in a drifting Maxwellian gas: (a) S = 2.5, (b) S = 5.0, (c) S = 7.5, (d) S = 10.0; $n^S(S,r,\mu) = \tilde{n}^S(S,r,\mu)\, n\, v_{\infty}/v'$.

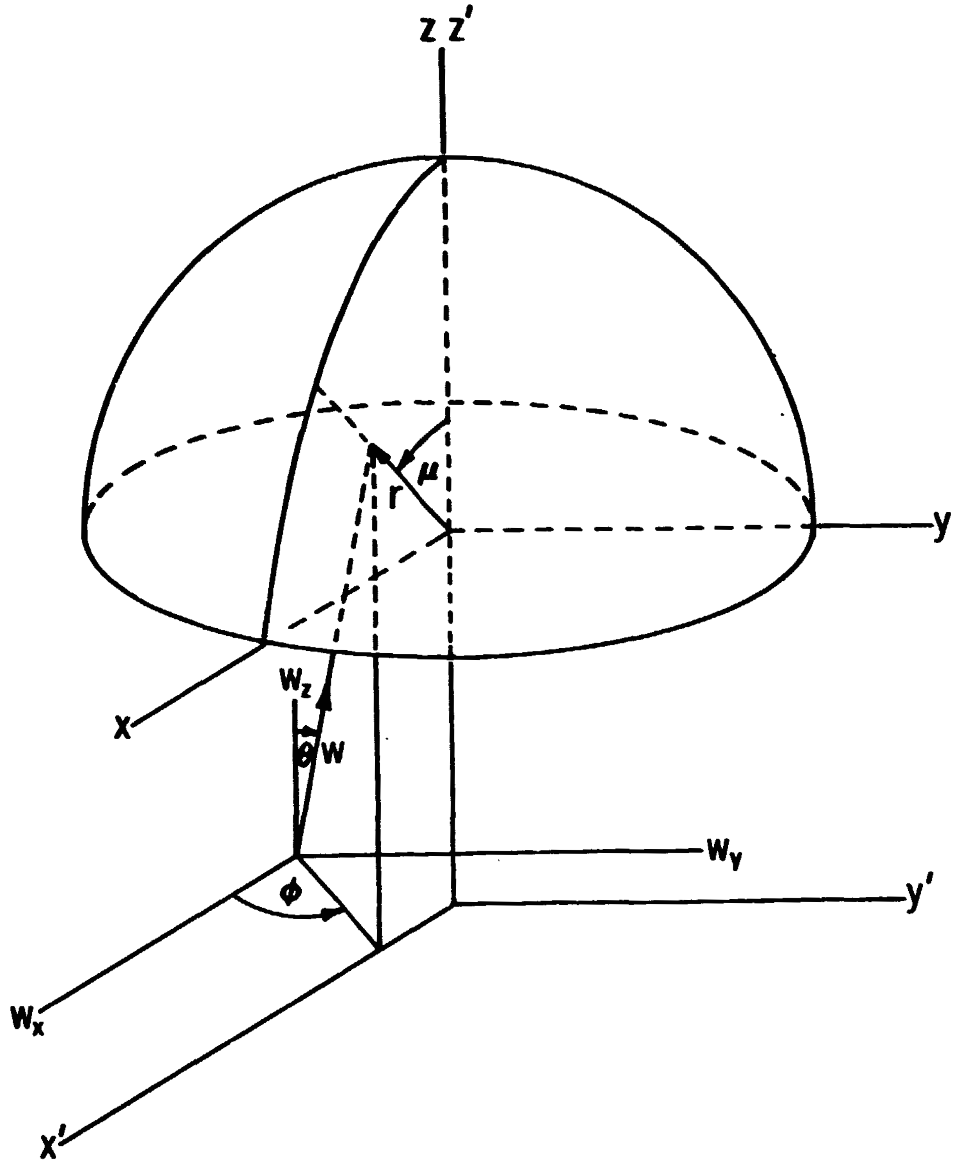

Fig. 8. Coordinate system for the calculation of the primary density distribution within a hemisphere in a drifting Maxwellian gas; hemisphere radius = R, normalized radius = λ = r/R.

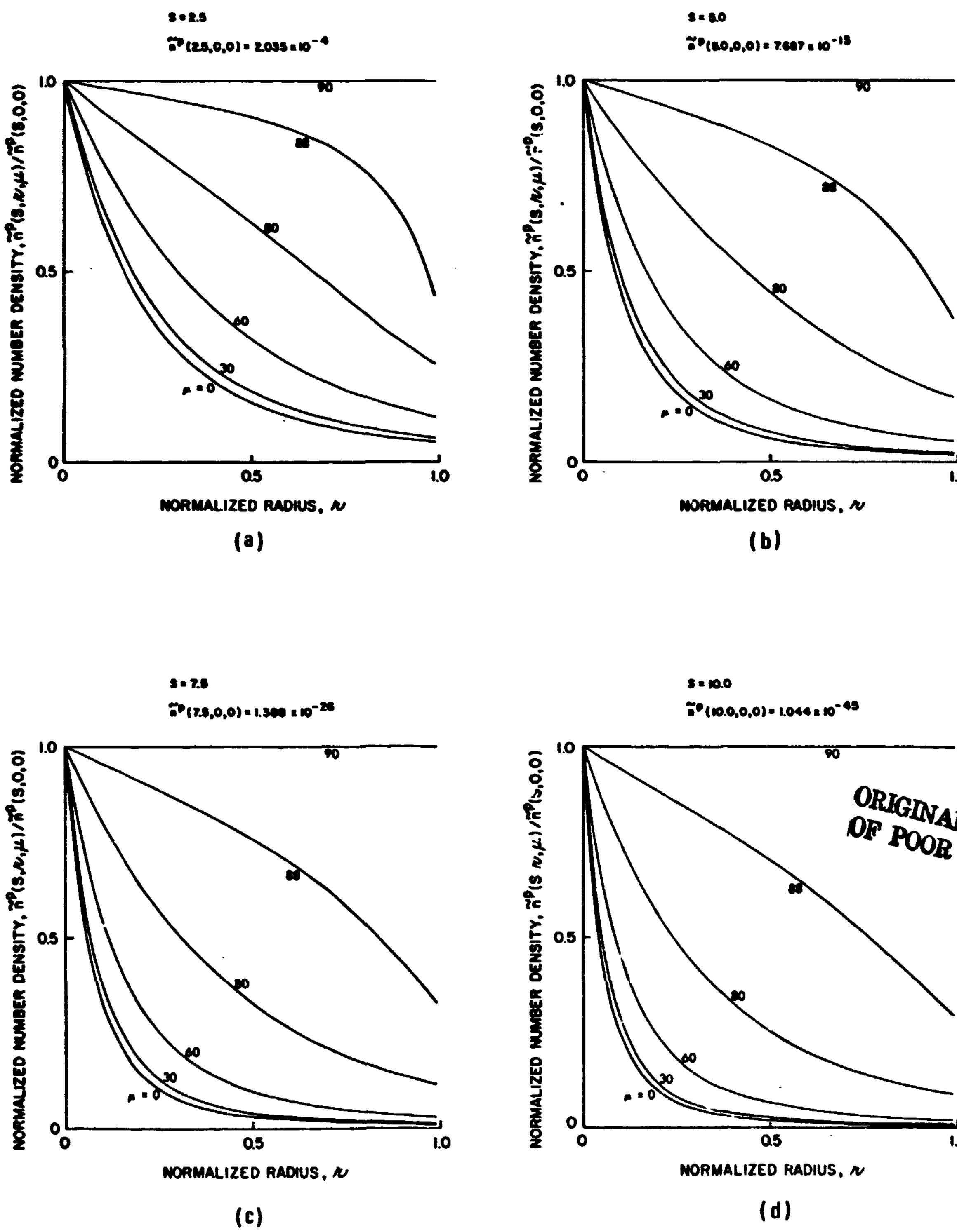

Fig. 9. Primary density distribution within a hemisphere in a drifting Maxwellian gas: (a) S = 2.5, (b) S = 5.0, (c) S = 7.5, (d) S = 10.0; $n^p(S,r,\mu) = \tilde{n}^p(S,r,\mu)n$.

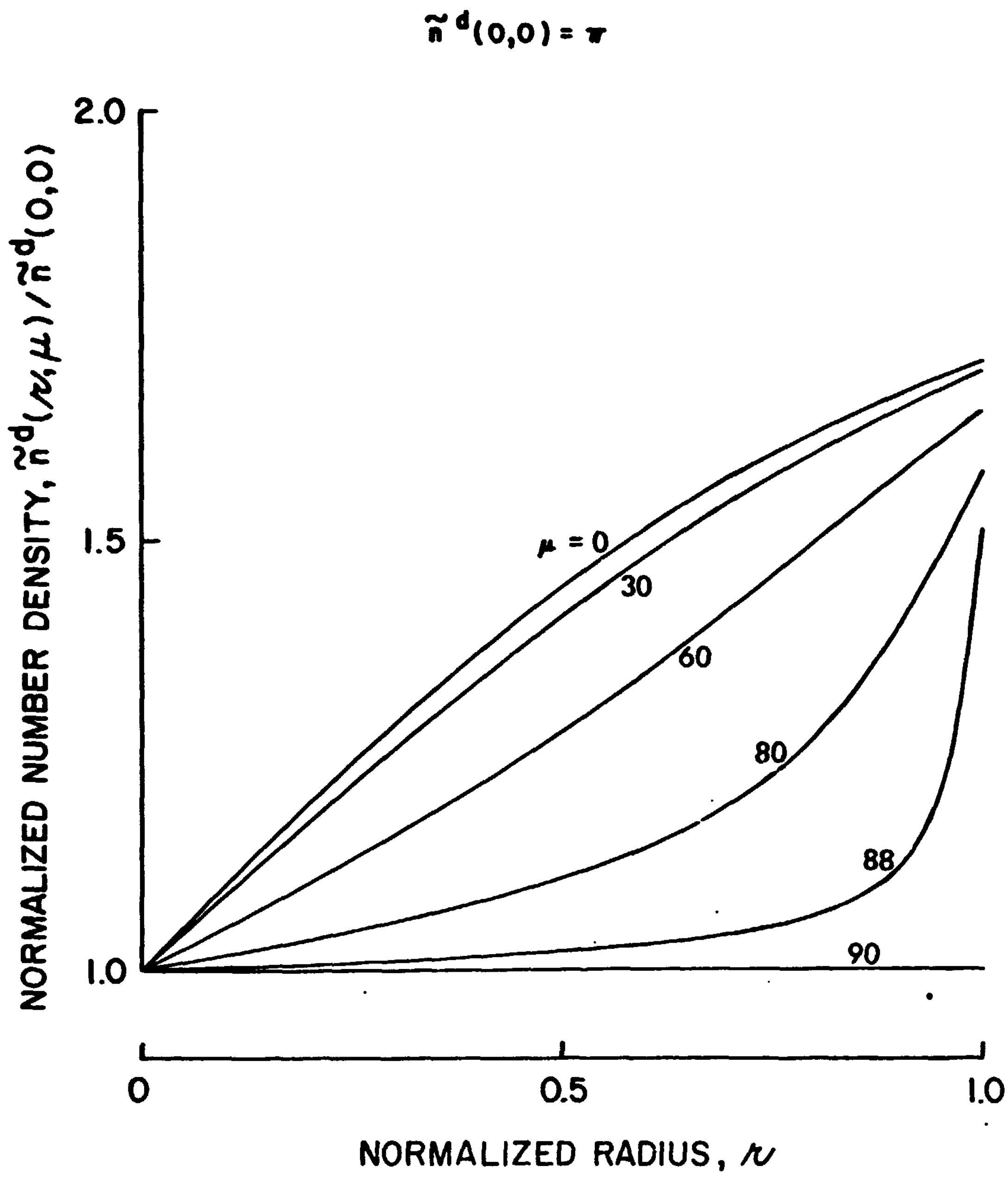

Fig. 10. Density distribution within a hemisphere due to desorption;

$$n^d(\kappa,\mu) = \tilde{n}^d(\kappa,\mu)\, 2\nu^d(\sqrt{\pi}v_m)^{-1}.$$

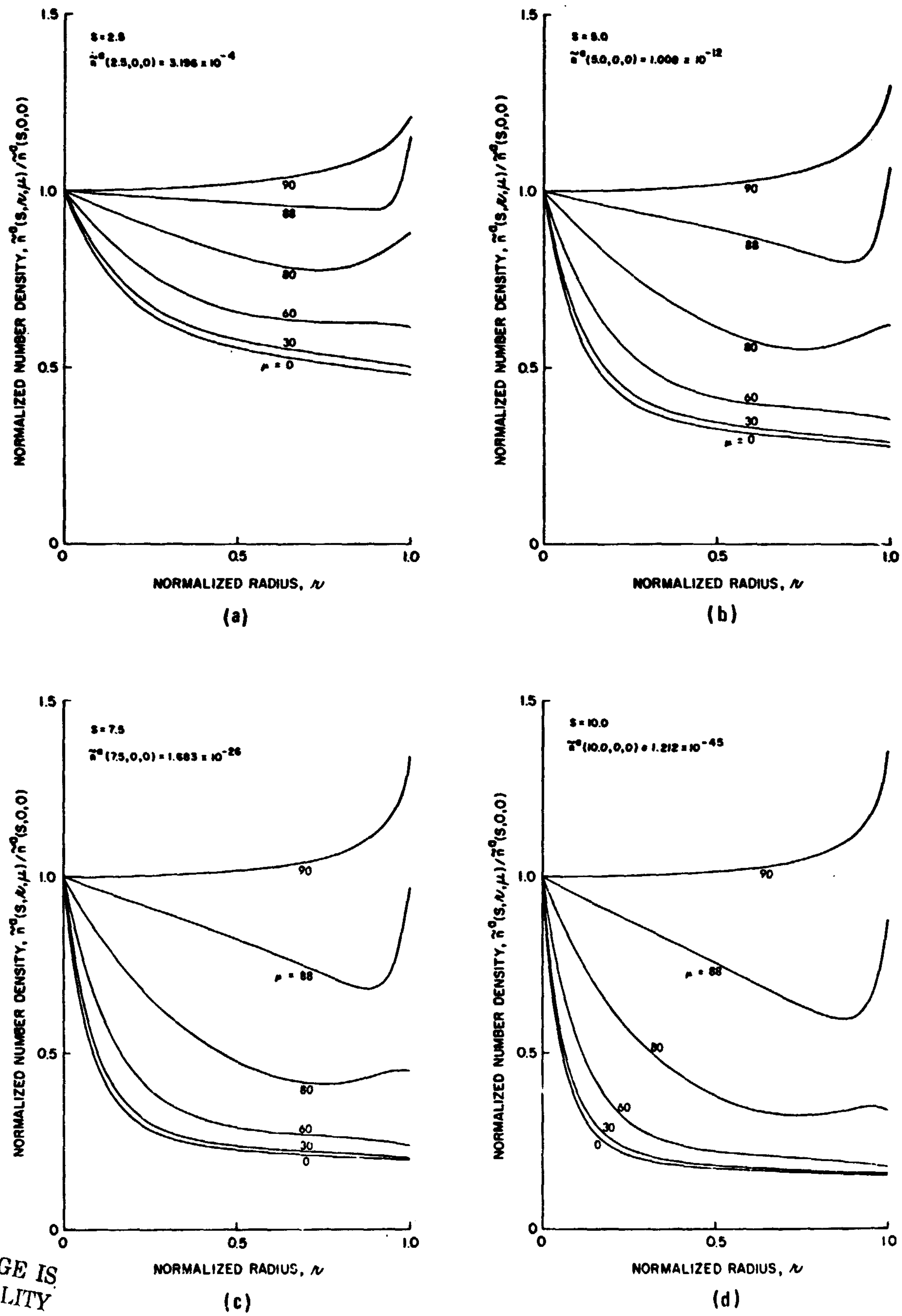

Fig. 11. Density distribution within a hemisphere due to the drifting Maxwellian gas for $T/T' = 3.333$: (a) $S = 2.5$, (b) $S = 5.0$, (c) $S = 7.5$, (d) $S = 10.0$; $n^a(S,\mathcal{r},\mu) = \tilde{n}^a(S,\mathcal{r},\mu)n$.

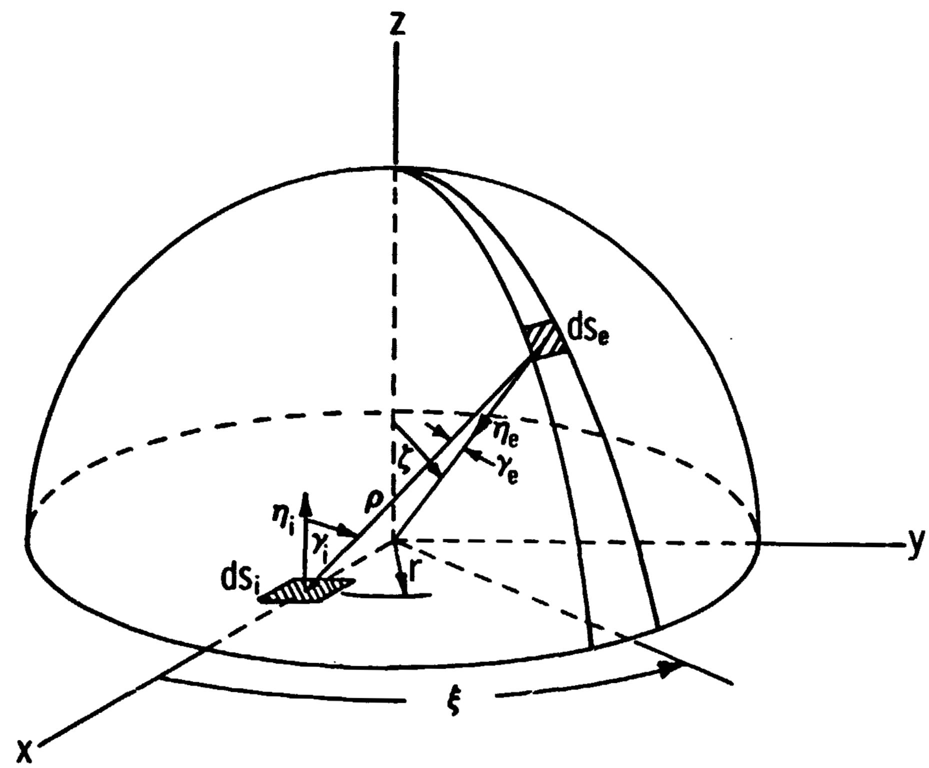

Fig. A1. Geometry for the calculation of the secondary flux density incident on the exit plane; hemisphere radius = R, normalized radius = $\hbar$ = r/R.

Molecular Shield: An Orbiting Low Density Materials Laboratory

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ABSTRACT

The concept of a molecular shield in terrestrial orbit above 200 km is analyzed using the kinetic theory of a drifting Maxwellian gas. Data are presented for the components of the gas density within the shield due to the free stream atmosphere, outgassing from the shield and enclosed experiments, and atmospheric gas scattered off a shield-orbiter system. The disturbance caused by the orbiter for a 100 m boom separation produces a negligible effect on the density within the shield. The application of the system concept to the Space Shuttle Orbiter is conceptually outlined. From the analysis presented, the atmospheric component of the gas density within the shield is less than 10^3 cm^{-3} (principally atomic hydrogen) and the density from all gas sources considered is expected to be less than 10^4 cm^{-3}, corresponding to a pressure of approximately 3×10^{-13} Torr for an equilibrium gas at 300 K.

INTRODUCTION

There are experiments in the fields of materials research and process development which require the simultaneous conditions of near zero gravity and very low gas density. The first of these conditions occurs naturally in orbit since there is an approximate balance between inertial forces and gravitational forces for circular orbits. The very low gas density condition may be realized in orbit by conducting the experiments in a molecular shield. In this paper, kinetic theory is applied to a hemispherical shell geometry containing internal gas sources and imbedded in a drifting Maxwellian gas (terrestrial atmosphere). The analysis demonstrates that the gas density within a molecular shield is less than 10^4 cm^{-3} at orbit heights greater than 200 km, although the atmospheric density[1] may be orders of magnitude higher as shown in Fig. 1. The hemispherical shell geometry is the optimum configuration for the molecular shield since it minimizes the internal surface-to-volume ratio. It also provides structural stability and is analytically amenable.

First, the molecular shield concept is discussed and the gas sources which contribute to the density within the molecular shield are identified. Then, the effects of each gas source are discussed separately. Next, atmospheric scattering and interaction effects associated with the shield-orbiter system are investigated. Finally, the concept is applied to the Space Shuttle Orbiter.

MOLECULAR SHIELD CONCEPT

The molecular shield is shown schematically in Fig. 2. In a low density gas such that the mean free path is large compared to the apparatus dimensions, substantially all the molecules incident on the apparatus experienced their last molecular encounter in a region of space well removed from the apparatus. Further, the reflected molecules have their next molecular encounter at a substantial distance from the apparatus (on the average). In the low density atmosphere encountered in orbit, where the mean free path is of the order of 0.4 km or greater, the local disturbance produced by the orbiter and molecular shield is small. Therefore the atmosphere remains in near equilibrium and may be considered a Maxwellian gas. Numerical data will be presented later which demonstrate that the disturbance is small.

In a drifting Maxwellian gas, only a small fraction of the molecules have the proper combination of spatial location, kinetic energy, and momentum components such that they can reach (overtake) a surface element with its normal parallel to the atmosphere drift velocity $(-u)$, provided that $S \gg 1$, where $S \equiv u/v_m$ is the speed ratio and $v_m = (2kT/m)^{1/2}$ is the molecular mean thermal speed. Thus, only a very small fraction of the drifting Maxwellian gas from the aft half-space can enter the hemispherical molecular shield, implying that the atmospheric gas density in the hemisphere is necessarily very low.

To facilitate theoretical analysis, the total density within the molecular shield may be decomposed into components, each of which is related to a specific gas source. There are five principal gas sources which may contribute to the density within the shield in the deployed configuration: (1) the free stream atmosphere, (2) outgassing from the inner surface of the shield, (3) gas released by the experiments, (4) atmospheric gas scattered off the orbiter, and (5) gas released by the orbiter (outgassing, leaks, dumps, etc.). Since the orbiter gas sources are not yet adequately defined, they will not be discussed here (potentially they could be the principal gas sources). The first four sources are illustrated by molecular trajectories in Fig. 2.

EFFECTS OF GAS SOURCES

Density Due to Atmosphere

The component of the density distribution within the hemisphere associated with the free stream atmosphere was calculated[2] using the kinetic theory of a drifting Maxwellian gas for nonequilibrium, steady state, free molecular flow. It was assumed that molecules incident on the inner surface of the hemisphere were thermally accommodated in their first collision with the surface, the reemitted flux density was Maxwellian, no molecules were adsorbed, and the reflected flux density angular dependence was given by a cosine function. Fig. 3 shows the results of calculations for the density at the origin of the hemisphere as a function of orbit height (for circular orbits) based on a model atmosphere[1] having an exospheric temperature T_e = 1000 K. The atmospheric component of the density at any point within the hemisphere is a function of the coordinates of that point. However, this dependence is relatively weak; the density is not more than 1.5 times greater than that shown in Fig. 3 throughout the hemisphere. Only the low mass molecular species of the atmosphere appear since the contribution by all higher mass species combined are negligible by comparison. Thus, although atomic oxygen is the principal atmospheric species over a wide range of orbit heights, its speed ratio is sufficiently large ($S \approx 8$ typically) that it is undetectable within the hemisphere.

The atmospheric component of the density within the hemisphere is a strong function of speed ratio. The orbit velocity is a weak function of orbit height, but the molecular mean thermal speed is a strong function of orbit height and exospheric temperature, which varies substantially with sun angle and solar activity. The atmospheric component of the density at the origin of the hemisphere is given in Fig. 4 as a function of exospheric temperature for the maximum temperature excursion expected during a solar cycle.

Density Due to Shield Outgassing

A nonequilibrium, steady state, free molecular flow analysis was made of the emission flux density from the shield surface generated by outgassing. It was assumed that the emission flux density had a Maxwellian distribution, that it was uniformly distributed over the surface, and that its angular distribution was given by a cosine function. From this analysis, the density distribution throughout the hemisphere associated with outgassing was calculated[2]. The density at the origin of the hemisphere is given in Fig. 5 as a function of the outgassing emission flux density. Outgassing emission flux densities of the order of $3 \times 10^7 cm^{-2} sec^{-1}$ are commonly achieved in high performance laboratory systems. Taking this value as typical, the density at the origin of the shield due to outgassing is expected to be approximately 700 cm^{-3}, for a shield temperature of 300 K. The density at any point within the hemisphere is a function of the coordinates of that point; however, nowhere inside the hemisphere is the density due to outgassing greater than 2 times that shown in Fig. 5. Figs. 3, 4, and 5 apply to any size hemisphere since these density components are not a function of the hemisphere radius.

Density Due to Experiment Outgassing

A similar density analysis which considered the effect of installed experiments was made[3] by introducing (in addition to normal outgassing) a prescribed gas source and a prescribed reduction in escape probability, both associated with the installed experiments. In this configuration, the density distribution within the hemisphere, in addition to being a function of the coordinates, is a function of the radius of the hemisphere, the size and location of the installed experiment, and the magnitude of the experiment gas source. However, for experiments having a moderate gas load, a hemisphere radius may be chosen (large compared to the experiment size) such that the density within the hemisphere is not substantially larger than that shown in Fig. 5.

DENSITY DUE TO INTERACTION WITH ORBITER

Up to this point, an isolated molecular shield has been considered; however, the shield will normally be deployed in a prescribed configuration from an orbiter. Since the atmospheric mean free path may be as small as 10 orbiter lengths, it is necessary to estimate the magnitude of possible orbiter-molecular shield interaction effects. For this purpose, the orbiter was replaced by an analytically amenable model consisting of a cone-cylinder combination having the approximate dimensions of the orbiter with its axis parallel to the orbit velocity vector (cylindrical symmetry). See Fig. 6.

There is a substantial molecular flux density incident on the surface of the orbiter from the atmosphere, especially at the lower orbit heights. This incident flux density is reflected back into the atmosphere and may be considered a gas source distributed over the surface of the orbiter such that, for any surface element, the local emission flux density is equal to the local incident flux density. The molecular density distribution in the neighborhood of the orbiter, associated with the reflected gas only, was calculated[4] from a steady state, collisionless flow analysis by representing the atmosphere as a drifting Maxwellian gas. It was assumed that incident molecules were accommodated to the orbiter surface temperature, the emission flux density was Maxwellian, and the local angular distribution was given by a cosine function. The reflected gas density distribution in the neighborhood of the orbiter model is given by the set of curves in Fig. 7 for an orbit height of 200 km (corresponding to a high atmospheric density). The maximum density in the reflected gas occurs in the immediate vicinity of the surface, and is given by the solid curve in Fig. 7.

The magnitude of the local disturbance produced in the atmospheric gas by interaction with the reflected gas may be estimated by a first collision analysis in v the atmospheric molec. . enter the reflected gas from all direction: .. a probability given by the distribution function of the drifting Max ellian gas. Instead of calculating the collision probability distribution, it is sufficient for present purposes to calculate the total collision probability along a specified trajectory. The upper limit of the total collision probability for an atmospheric molecule passing through the reflected gas occurs along a molecular trajectory which passes by the orbiter model immediately outside the surface and parallel to the symmetry axis. (This is the longest trajectory in the highest density region of the reflected gas.) For all other trajectories, the molecules either collide with the surface (which have already been counted in generating the reflected gas) or pass through the reflected gas in a region of lower density with a shorter trajectory. The total collision probability for the above trajectory is given by curve 1 in Fig. 8 as a function of orbit height, based on $T_e = 1000$ K and a hard sphere elastic collision cross section for atomic oxygen[5] of 22 $\mathring{A}^2$. Similarly, the total collision probability for a reflected molecule emitted parallel to the surface normal, and passing to infinity through the maximum density region of the reflected gas only is given by curve 2 of Fig. 8. Finally, the total collision probability of a reflected molecule leaving along the surface normal and passing through the atmospheric gas out to a distance of 100 m (large compared to the orbiter dimensions) is given by curve 3 of Fig. 8. From these data, it is obvious that scattering off the orbiter surface and subsequent gas-gas interactions produce only a weak disturbance in the atmosphere for orbit heights above 200 km. The assertion that the atmosphere may then be locally represented by an undisturbed, drifting Maxwellian gas is valid. It may also be concluded that the component of the density at the shield origin due to all atmospheric effects is just that given by Fig. 3. The total density at the origin is then the sum of the densities in Fig. 3 for a given orbit height and in Fig. 5 for a given emission flux density.

APPLICATION TO SPACE SHUTTLE

Based on the preceding results, it is concluded that application of the molecular shield technique to the Space Shuttle for conducting experiments in orbit is practicable. The Space Shuttle Orbiter has substantial capabilities with respect to experiment weight, size, and power requirements; onboard data processing; manual monitoring of the experiments; and experiment return for further study in terrestrial laboratories. Shown conceptually in Fig. 9 are the four major components of the orbiter-shield system; an attitude-controlled orbiter, a protective ultra high vacuum (UHV) enclosure within which the shield and experiments are stowed from launch through orbit trim, an extendable/retractable boom (shown deployed) which supports the shield and is attached to the orbiter structure by gimbals, and the molecular shield which contains the experiments.

In orbit, the vacuum enclosure is opened, the boom is attached to the shield, and the shield is deployed several orbiter lengths away from and aft of the orbiter under servo control. This configuration minimizes the probability of atmospheric gas scattering off the orbiter directly into the shield and also minimizes the risk of experiment contamination from sources aboard the orbiter. For this class of experiments, the orbiter attitude is controlled by a cold gas jet-gyro system to maintain the orbiter axis parallel to the orbit velocity vector.

The orbiter payload bay has the capacity to accommodate a 3 m diameter shield (stowed). The shield material may be selected from several low outgassing materials, compatible with degassing at high temperature prior to installation of the experiments. Final degassing of the shield and experiments is executed in the vacuum enclosure where they are stowed under ultrahigh vacuum until deployment. In orbit, deployment is delayed until the initial transients of the high flux contamination sources aboard the orbiter have dissipated. To minimize the risk of experiment contamination during deployment, the shield is provided with a closure plate which seals the hemisphere through a low conductance seal, and which is jettisoned after deployment.

For Shuttle applications, the density within the molecular shield due to outgassing of the shield material and the experiments will probably exceed the component of the density due to the atmosphere, including atmosphere-orbiter scattering. From the previous analyses, it is expected that the atmospheric component will be less than 10^3 cm^{-3} (principally atomic hydrogen). The outgassing component can actually be made smaller than this value by a severe degassing pretreatment, selection of a shield size which is compatible with the experiment, selection of an appropriate shield material, and proper location of the experiment within the shield. In practice, the severe pretreatment may be impractical, at least for some experiments. Under practical conditions, it is expected that the density components due to outgassing from the shield and experiments can be maintained less than 10^4 cm^{-3} without substantial difficulty.

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2. Theoretical Analysis of the Density Within an Orbiting Molecular Shield. J. E. Hueser and F. J. Brock, J. Vac. Sci. Technol.
3. The analysis was made for a model consisting of a hemisphere having a gas source distributed over the inner surface and a disc, located in the entrance-exit plane of the hemisphere, having an independent gas gas source distributed over its inner surface. In the model, the two independent gas sources may be adjusted to approximate the anticipated outgassing associated with a particular experiment installed in the molecular shield. The disc radius is also an independent parameter such that the mean escape probability in the model may be adjusted to approximate the escape probability for molecules given off by a particular shield-experiment system. This analysis is the subject of a paper in preparation.
4. To be published.
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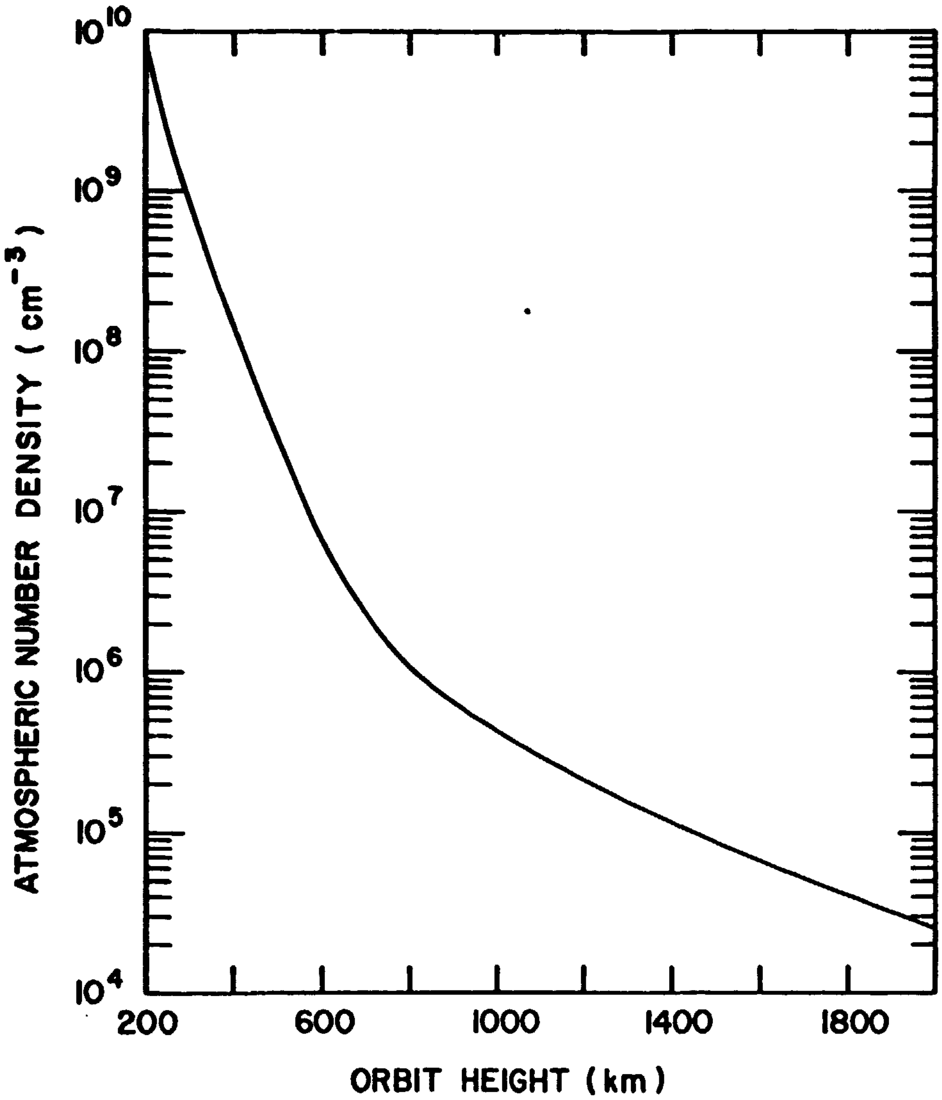

Fig. 1. Total number density as a function of orbit height for a terrestrial atmosphere model with an exospheric temperature, T_e = 1000 K (ref. 1).

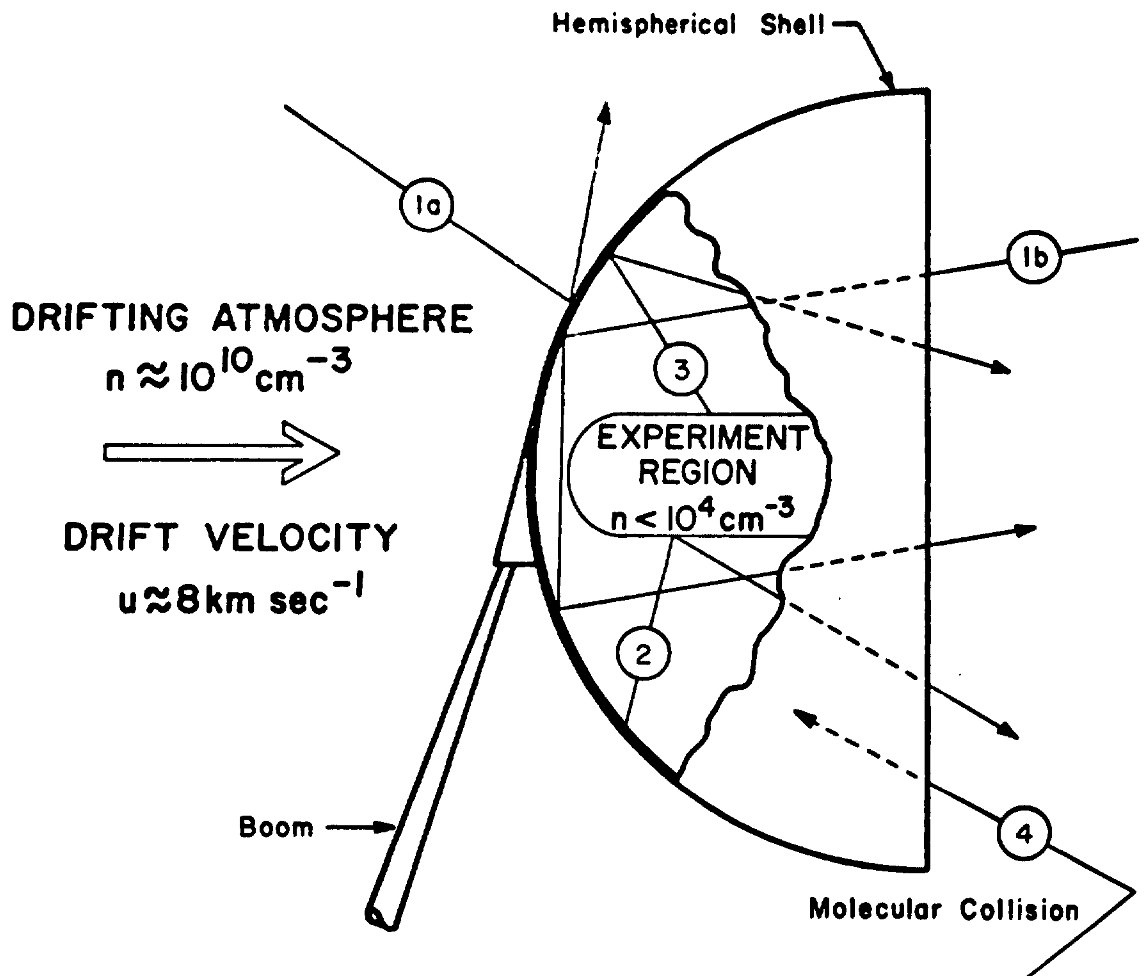

Fig. 2. Schematic representation of the molecular shield geometry in the drifting gas, illustrating typical molecular trajectories: (1a and 1b) free stream molecules, flux of 1a type molecules in much greater than flux of 1b type molecules; (2) desorbed molecules from the shield; (3) desorbed molecules from the experiment; and (4) molecules scattered from the Orbiter.

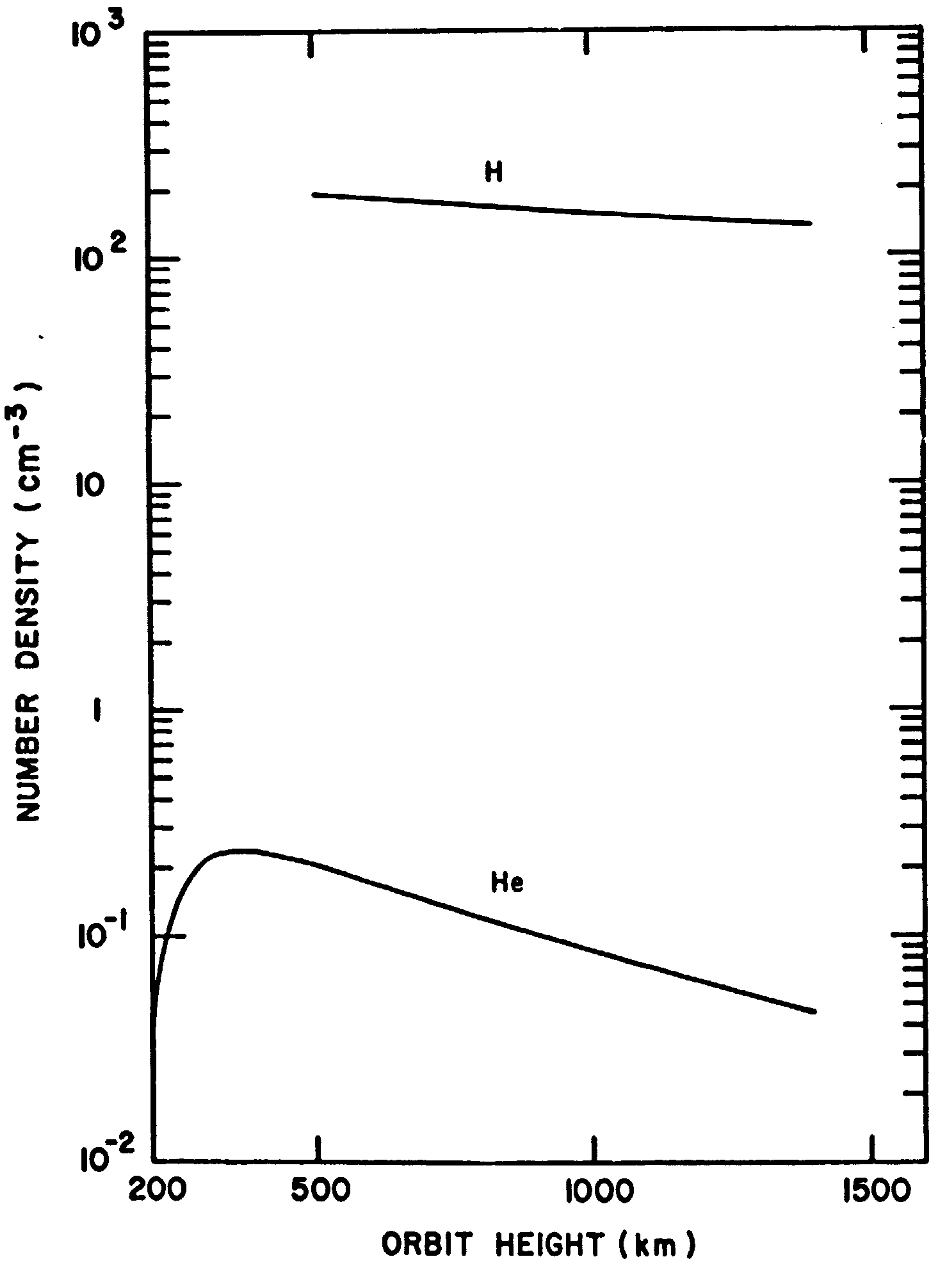

Fig. 3. Number density at the origin of the hemisphere due to the free stream atmosphere as a function or orbit height for T_e = 1000 K.

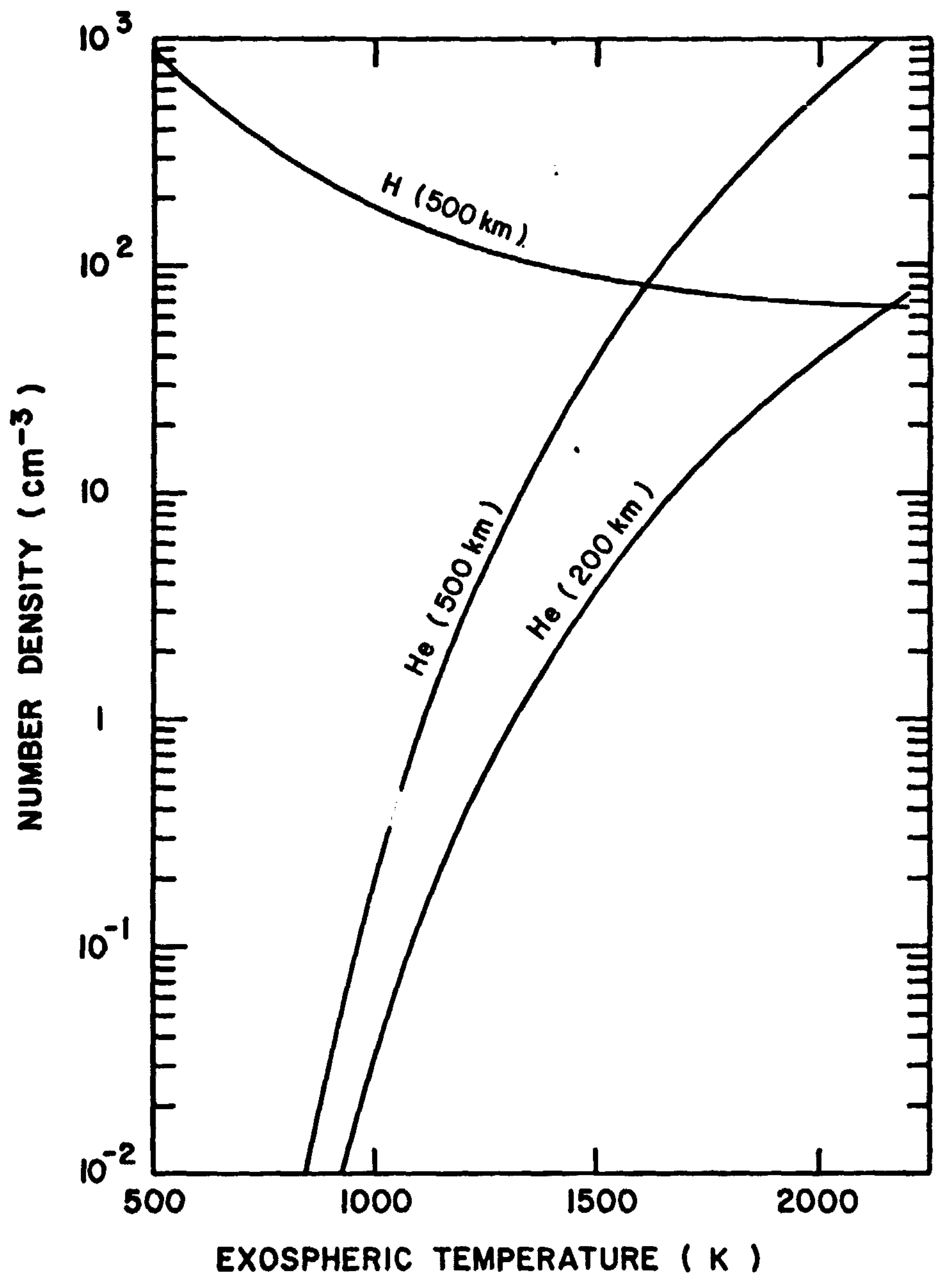

Fig. 4. Number density at the origin of the hemisphere due to the free stream atmosphere as a function of exospheric temperature for orbit heights of 200 and 500 km.

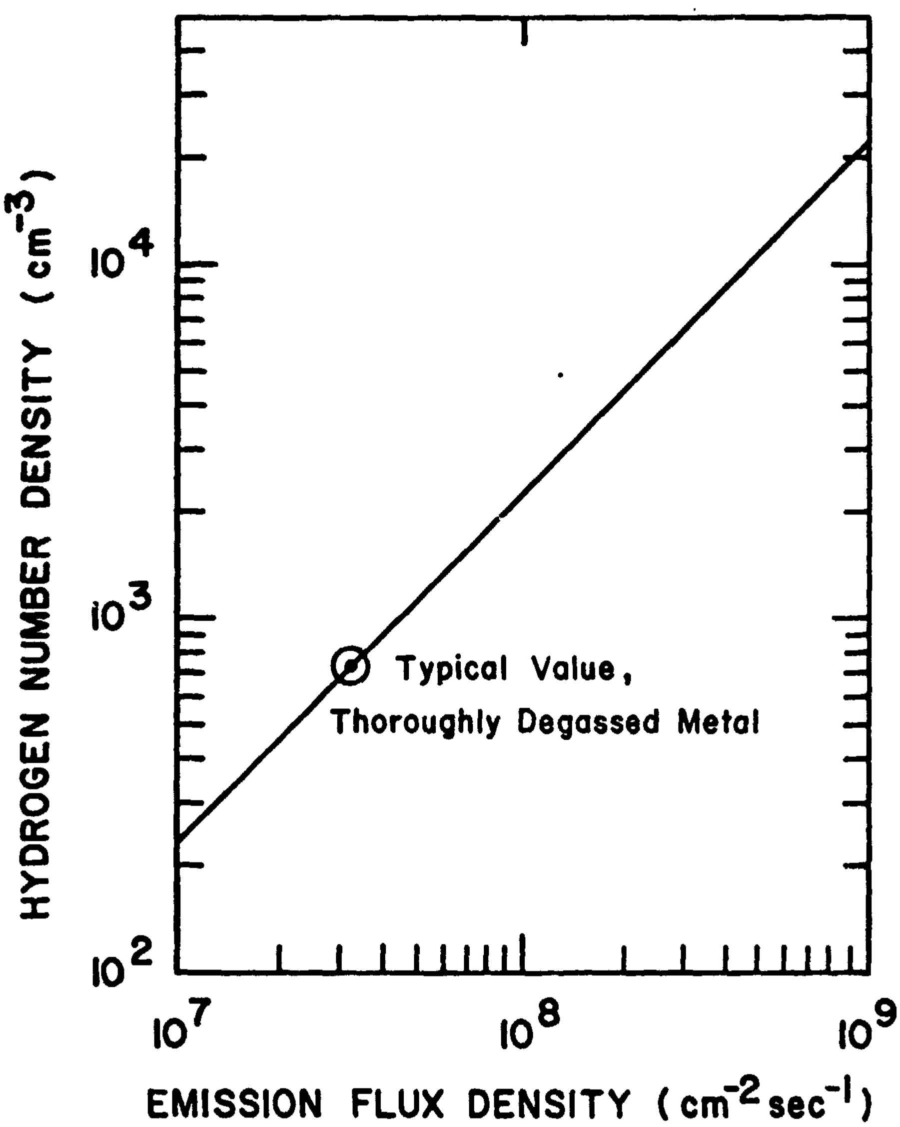

Fig. 5. Number density at the origin of the hemisphere due to outgassing of the shield as a function of emission flux density. The emission flux is assumed to be H_2 and the surface temperature equals 300 K. (1 cm^{-2} sec^{-1} = 3.11 x 10^{-20} Torr liters cm^{-2} sec^{-1}.)

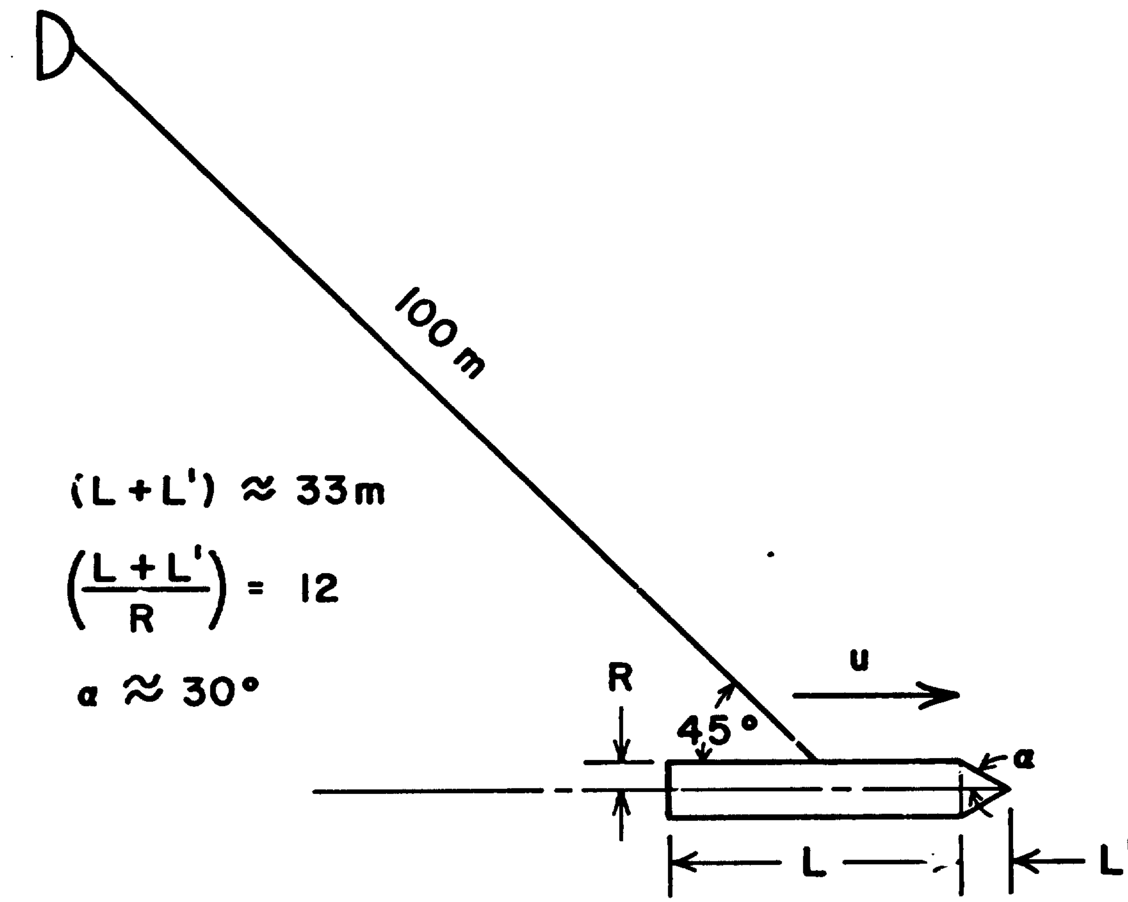

Fig. 6. Schematic of the shield-orbiter model.

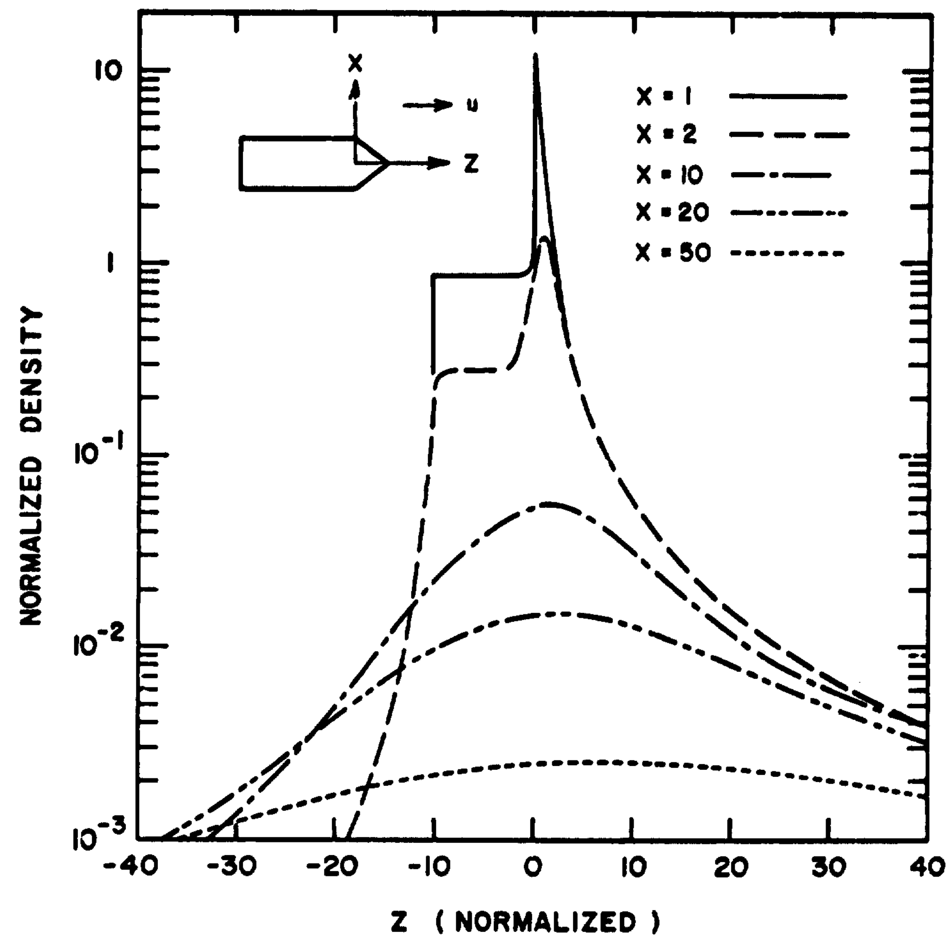

Fig. 7. Density distribution in the reflected gas for a cone-cylinder model at an orbit height of 200 km with T_e = 1000 K. Number density is normalized to the free stream value of 8.3×10^9 cm^{-3}. Axial and radial dimensions are normalized with respect to the cylinder radius. Model surface temperature is 300 K.

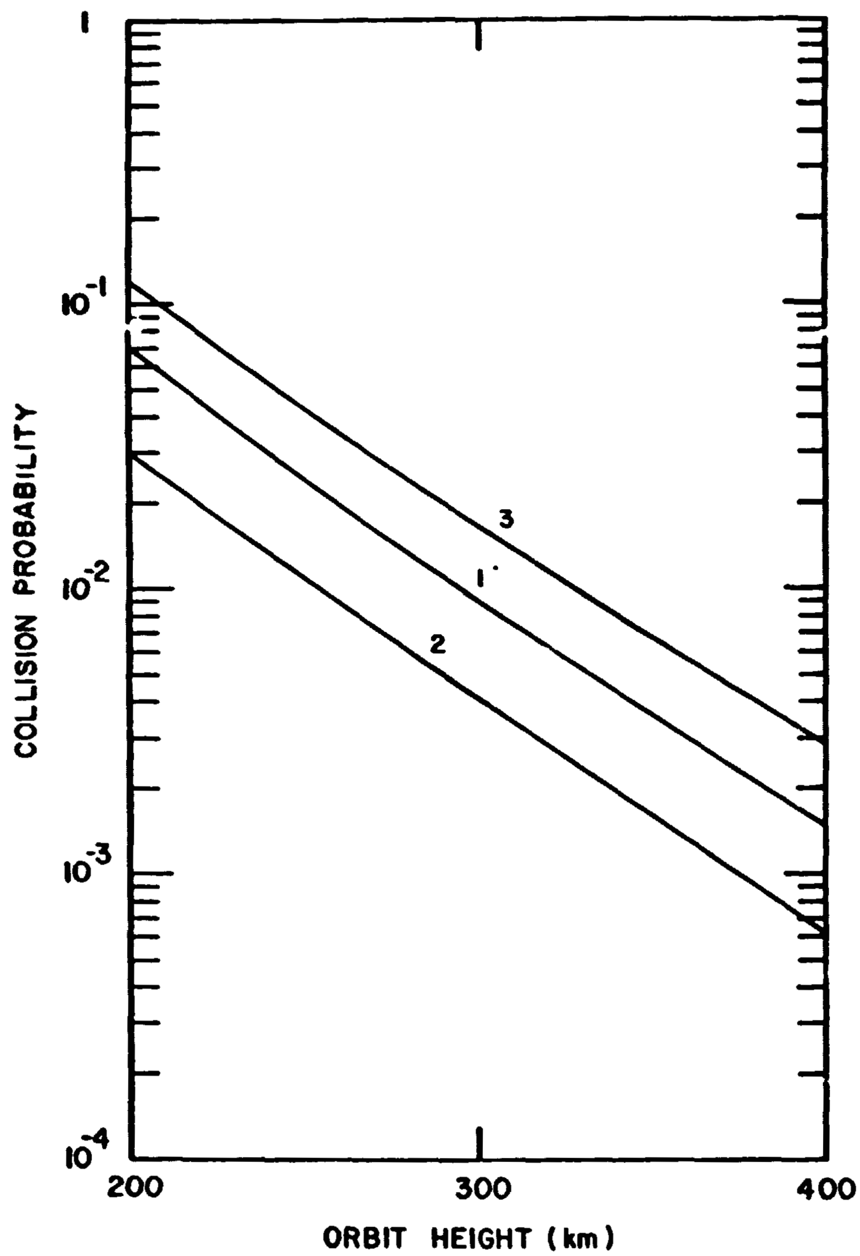

Fig. 8. Total collision probability as a function of orbit height: (1) an atmospheric molecule passing through the reflected gas along an axial trajectory just outside the cylindrical surface; (2) a reflected molecule leaving normal to the cylindrical surface and passing radially to infinity through the maximum density region of the reflected gas; and (3) a reflected molecule leaving the model and passing through the atmospheric gas to a distance of 100 m.

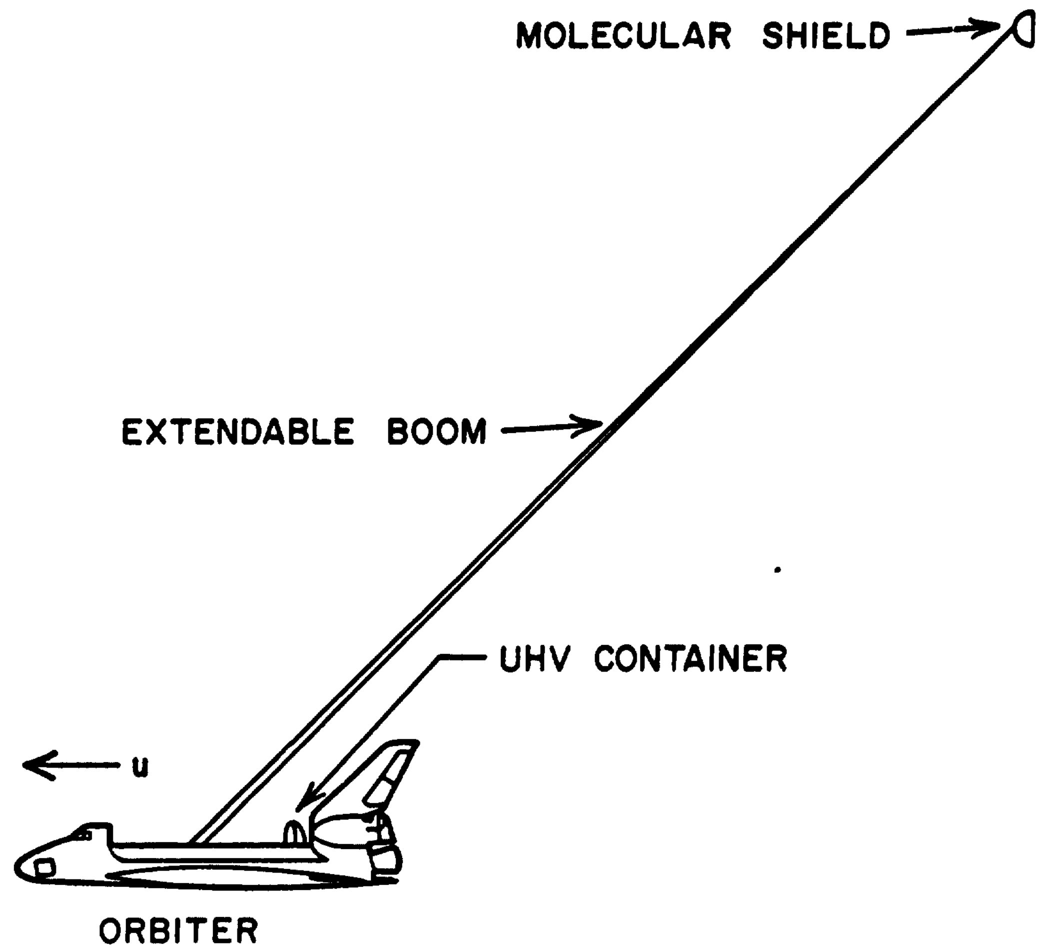

Fig. 9. Schematic of shield-Space Shuttle Orbiter system.

A MONTE CARLO DIRECT SIMULATION PROGRAM FOR THE SPACE SHUTTLE FLOWFIELD UNDER ORBITAL CONDITIONS

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SUMMARY

A description of a FORTRAN program for the computation of the three-dimensional transition regime flow past the Space Shuttle Orbital Vehicle. This employs the direct simulation Monte Carlo method which models the real flow by some thousands of simulated molecules. These are followed through representative collisions and boundary interactions in simulated physical space. The geometry of the Orbital Vehicle has been approximated by a number of quadric surface elements. The flowfield density and the molecular flux to the surface constitute the primary output quantities. Control jet efflux and surface outgassing effects are included in the model and the results distinguish between the various classes of molecules.

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INTRODUCTION

Typical number densities in the undisturbed ambient atmosphere at typical orbital altitudes of the Space Shuttle range from 2×10^{14} to $4 \times 10^{16} m^{-3}$. If the atmosphere is assumed to consist of atomic oxygen with an effective collision cross-section of $2.2 \times 10^{-19} m^2$, the equilibrium mean free path ranges from 16,000 m to 80 m. The lower value is of the same order as the overall dimensions of the vehicle. This means that the free-molecule theory which ignores intermolecular collisions cannot be relied upon to provide an adequate description of the rarefied flowfield of the Orbital Vehicle. A flowfield that involves intermolecular collisions is qualitatively as well as quantitatively different from a free molecule or collisionless flowfield. The major points of difference are that molecules do not have to strike the surface of the vehicle in order to be affected by its presence, and the molecules that are reflected or emitted from the surface of the vehicle may be deflected back to it by the intermolecular collisions.

The Knudsen number K_n of the overall flowfield may be defined as the ratio of the undisturbed atmospheric mean free path to the length of the vehicle. The above values of the effective mean free path lead to a Knudsen number range of 440 down to 2.2. Free molecule or collisionless theory requires the Knudsen number to be very large compared with unity and the continuum approach, through the Navier-Stokes equations, requires that it should be very small compared with unity. The problem under consideration therefore extends from the collisionless regime into the transition regime between the collisionless and continuum regimes. Furthermore, it is a three-dimensional problem involving large disturbances. The direct simulation Monte Carlo method (ref. 1) has been extensively applied to large disturbance transition regime flows with one or two spatial dimensions. This method is essentially a technique for the computer modelling of a real gas flow by some thousands of simulated molecules. The velocity components and position coordinates of the simulated molecules are stored in the computer and are progressively modified as collisions and boundary interactions are calculated among the molecules. The time parameter in the simulation may be related directly to real time and the flow follows a physically valid time-dependent process. However, the boundary conditions may be such that a steady flow is obtained as the large-time state of the unsteady process. In the present case, the initial state is a vacuum and the ambient gas starts crossing the boundaries of the simulated region at zero time. This simulated region of physical space is divided into a network of cells with dimensions such that the change in flow properties across each cell is small.

The major difficulty in the application of the method to three-dimensional problems is associated with the required number of cells. This number is inversely proportional to the cube of the cell size so that an overall halving of the linear dimensions of the cells leads to an eightfold increase in their number. In the present case, the costing formula employed by the LRC Computer Center made the extensive use of disc storage prohibitively expensive. This meant that the program had to run within 111K words of core storage and it was this constraint that dictated the approach through which the vehicle geometry is defined. Bird (ref. 1) has described a scheme for a universal three-dimensional program in which the vehicle and cell system is defined by a network of points. However, for a body shape as complex as the Space Shuttle Orbital Vehicle, this leads to an excessive number of cells. The alternative is to have a set of regular cells unrelated to the vehicle geometry which must then be defined analytically. This approach was adopted with the vehicle being defined as a set of thirteen quadric surfaces. These include elements of ellipsoids, elliptic cones, elliptic cylinders and planes. This number is increased if the payload bay doors are chosen in the open, rather than the closed, position. For Knudsen numbers in the required range, sufficient resolution is obtained if the region of interest in the flowfield is divided into approximately 700 cells. Some 8000 simulated molecules may then be employed in a run fitting within the 111K words.

A further difficulty with this particular application is that the region of interest extends to approximately 100 metres from the vehicle. At this distance, the molecules that have been affected by or emitted from the vehicle form a very small percentage of the total. This means that, in a straightforward application of the method, an excessively long run would be required to build up the necessary sample size. This problem has been overcome by the application of weighting factors to the undisturbed freestream molecules. Each simulated freestream molecule in the outer region of the flow represents more real molecules than does an affected molecule. The net effect is that the sample of affected molecules typically corresponds to that which would be obtained from a straightforward simulation involving 40000, rather than 8000 molecules.

GENERAL FORMULATION

The analytical represenation of the Space Shuttle Orbital Vehicle is illustrated in fig. 1. The nose and windshield consist of elements of three ellipsoids. The fuselage is formed by halves of two elliptic cylinders and the OMS pods by additional ellipsoidal elements. The glove fairings and the leading edges of the wings are elements of elliptic cones. The upper and lower rear surfaces of the wings are planes that are tangential to the elliptic cones. The wingtips, base and fin are plane surfaces. The geometry is variable to the extent that the payload bay doors may be selected in the closed or open position. In the latter case the open door is approximated by a plane which also forms the floor of the payload bay. The front and rear bulkheads of the payload bay are also plane. The origin has been chosen at the apex of the nose with the x axis along the fuselage. The y and z axes are normal to and parallel to the plane of the wings, respectively. All the surfaces conform to the general equation of a quadric surface

$$F(x,y,z) = 0 , \qquad \text{where} \qquad (1)$$

$$F(x,y,z) = a_{11}x^2 + a_{22}y^2 + a_{33}z^2 + 2a_{23}yz + 2a_{31}zx + 2a_{12}xy + 2a_{14}x + 2a_{24}y + 2a_{34}z + a_{44}.$$

The detailed definition of the surface elements is given in Appendix A and their geometrical configuration is shown in fig. 2.

The flowfield is divided into seven blocks, as shown in fig. 3. The central block 1 must be sufficiently large to completely enclose the vehicle. It is rectangular and extends from x = X1 to X2, y = Y1 to Y2, and z = 0 to Z2. The other blocks are also rectangular and the remainder of the geometry is defined by the minimum x plane x = XF, the maximum x plane x = XR, the maximum z plane z = ZM, the minimum y plane y = YB, the intermediate y plane between blocks 6 and 7 y = YM, and the maximum y plane y = YT. Each block is divided into cells of equal size, the number of divisions in the x,y and z directions being set in the data. The block sizes and divisions will generally be such that the smallest cells are in block 1, with the cell size increasing with distance from the vehicle.

The plane z = 0 is assumed to be a plane of symmetry so that the program is restricted to zero yaw cases. The free stream velocity may be specified in any direction in the x - y plane. Other major items in the specification of the flow conditions are the magnitude of the freestream velocity, the most probable molecular speed in the freestream; and the mean free path in this gas. The surface temperature of the vehicle is assumed to be uniform and is specified by its ratio to the freestream temperature. A uniform flux of outgassed molecules may be specified and provision is also made for the inclusion of an arbitrary number of jets.

The primary output quantities are the flowfield density and the molecular flux to the surface. This information is provided separately for undisturbed freestream molecules, molecules that have struck the surface, molecules that have been indirectly affected by the presence of the vehicle, outgassed molecules and jet molecules. In order to provide the density information in a readily appreciated manner, the densities at a number of points in four planes of constant z are printed out to the correct scale relative to a pictorial representation of the vehicle. A further quantity of interest is the density of the molecules that have a velocity component directed upstream. This, together with the mean value of this velocity component, is also printed out in a graphical fashion. Finally, the densities, velocity components and temperatures are listed for all the cells into which the seven blocks are divided. The output from a typical application is reproduced in Appendix D.

The molecular weight of the gas is chosen to correspond with that of atomic oxygen and the gas is, therefore, monatomic. The program offers a choice between the hard sphere and the inverse ninth power law of repulsion molecular models. The choice of the latter involves some difficulty in interpreting the balance between the unaffected and indirectly affected molecular types in the output. This is because the inverse power law model does not have a fixed cross-section and an arbitrary cut-off must be used. This affects the number of simulated collisions, but not the overall flow since the collisions that are omitted are grazing collisions which hardly affect the velocities and which are, in any case, ill-defined in a quantum mechanical sense. The comparison between corresponding flows for the two models should be based primarily on quantities such as the flowfield density and the return flux of reflected molecules, the density of upstream moving molecules, and the macroscopic flow properties.

DESCRIPTION OF PROGRAM

The program is listed as Appendix B. While it is impractical to produce a completely detailed flow chart, the major steps are shown in fig. 4 which is similar to the flow chart that appears in the general description of the method in ref. 1 (p. 119). The start of each item on this flow chart is indicated in the program by comment cards. The block geometry, the data cards and the meanings of the subscripted variables are explained in a series of the comment cards at the beginning of the program. Note that the undisturbed freestream molecules, freestream molecules that have struck the surface of the vehicle, freestream molecules that have been indirectly affected by the presence of the vehicle, outgassed molecules and jet molecules are referred to as molecules of type 1 to 5 respectively.

The first item on the flowchart is the reading of the data cards. These have already been described in the comment cards and further information on the normalisation of the variables is given when the data is printed out at the start of the output. The densities and temperatures are normalised to the values in the undisturbed freestream gas. Distances, including the mean free path in the undisturbed stream, are quoted in metres and velocities are input in metres per second. However, in the output, the flowfield velocities are normalised to the most probable molecular speed in the undisturbed freestream gas. The outgassing rate is normalised to the effusion rate in a stationary gas at the freestream density and temperature.

The most important time parameter in the simulation is the time interval over which the molecular motion and collision processes are uncoupled. This is denoted by DTM and is in seconds. This time should be small compared with the mean collision time, and this consideration will generally decide its value in a low Knudsen number flow. However, DTM could be indefinitely large in a free-molecule flow and, at high Knudsen numbers, DTM is effectively set by the fact that it can be no larger than the interval at which the flow is sampled. The magnitude of DTM has a major influence on the computing time and, if the unsteady phase of the flow is of no interest, computing time can be saved by setting a large value of DTM during the unsteady phase and a small value for time averaging after the establishment of a steady flow. The steady flow value is denoted in the program by DTMS. The sampling interval is set as a multiple of DTM and should be sufficiently large for the successive samples to be independent. The time interval for the printing of results is set as a convenient interval of the sampling times. The time at which steady flow is assumed and the time at which the calculation stops are, in turn, set as convenient multiples of the printing time interval.

The cell sizes will normally be set such that the cell size increases with distance from the vehicle. As noted in the Introduction, weighting factors are used to reduce the sample of undisturbed freestream molecules in the regions further from the vehicle. These weighting factors are such that there would be an equal number of molecules in each cell in an undisturbed flow. This number is set in the data as NMC. The maximum total number of molecules is set as MNM and this number should correspond to the dimension of the second subscript of the P and IP arrays.

The number of jets is set by NCJ and the 12th data card is followed by one additional card for each jet. This sets the coordinates of the jet, the direction cosines of the centreline of the jet efflux, the jet speed and the flux normalised to the freestream flux across one square metre normal to the stream direction if the thermal velocities were neglected. The individual jet molecules are generated with the fixed speed, but their direction is at an angle θ to the jet centreline such that the probability of a particular value of θ is proportional to $\exp(-10\theta/\pi)$. This distribution has been chosen arbitrarily, but is intended to simulate the angular distribution in a jet plume after it has expanded to a collisionless state. The jet coordinates should correspond to the effective center of the jet plume rather than to the actual position of the jet nozzle.

The next item is to set the constants and, while the basis of most statements is obvious, some require further explanation. The description of the subscripted variables that appears in the comment cards makes the setting of the block boundaries, cell sizes and cell numbers quite straightforward. It is assumed that there will be no cells smaller than those in block 1, so that the molecules in this block may be assumed to have unit weighting factor, and the freestream number density FDN based on the weighted number of molecules is given by the quotient of NMC and the volume of a cell in block 1. The mean free path λ in an equilibrium gas is given by

$$\lambda = (2^{\frac{1}{2}}\pi d^2 n)^{-1} \tag{2}$$

where n is the number density and πd^2 is the total collision cross-section for hard sphere molecules. The statement that sets CXS for hard sphere molecules follows directly from the application of eq(2) to the undisturbed freestream gas. The collision cross-section is used only in the statement that calculates the cell time interval Δt_c appropriate to an individual collision. This is (ref. 1, p. 121, eq(7.4)),

$$\Delta t_c = (2/N_m)(\pi d^2 n\, c_r)^{-1}, \tag{3}$$

where N_m is the number of molecules in the cell and c_r is the relative speed in the collision. The corresponding equation for the more general inverse power law molecule is (ref. 1, p. 121, eq(7.2)),

$$\Delta t_c = (2/N_m)\left\{\pi W_{0,m}^{\ 2}(\kappa/m_r)^{2/(\eta-1)}\, n\, c_r^{\ (\eta-\zeta)/(\eta-1)}\right\}^{-1}, \tag{4}$$

where $W_{0,m}$ is the cut-off value of the dimensionless impact parameter, m_r is the reduced mass, and κ and η are, respectively, the constant of proportionality and the exponent of the model. For the optional inverse ninth power law model, the FORTRAN variable CXS is most conveniently applied to the product $\pi W_{0,m}^{\ 2}(\kappa/m_r)^{2/(\eta-1)}$ through the relationship (ref. 1, p. 140, eq (8.17))

$$\pi W_{0,m}^{\ 2}(\kappa/m_r)^{2/(\eta-1)} = 3.06(RT_1)^{\frac{1}{4}}/(n_1\lambda_1), \tag{5}$$

where the subscript 1 denotes the reference state. This assumes a value of 1.5 for $W_{0,m}$.

The number of molecules crossing a surface per unit area per unit time is (ref. 1, p 62, eq(4.18))

$$N = \{n/(2\pi^{\frac{1}{2}}\beta)\} \left[\exp(-s_n{}^2) + \pi^{\frac{1}{2}} s_n\{1 + \mathrm{erf}\ (s_n)\}\right] \tag{6}$$

where s_n is the speed ratio based on the component of velocity normal to the surface and β is the inverse of the most probable molecular speed (equal to unity in the freestream for the normalisation that has been adopted here). The expression in square brackets on the right hand side of eq(6) is evaluated in subroutine SENT and the actual number of molecules entering across the various boundaries per DTM is stored in the subscripted variable ENT. Note that the subroutine SENT evaluates the error function by a rational approximation. The selection of a typical normal velocity component for the entry gas requires the evaluation of the expression (ref. 1, p 158, eq(9.2))

$$\frac{2(\beta u_n + s_n)}{s_n + (s_n{}^2 + 2)^{\frac{1}{2}}} \exp\left[\frac{1}{2} + \frac{s_n}{2}\{s_n - (s_n{}^2 + 2)^{\frac{1}{2}}\} - \beta^2 u_n{}^2\right] . \tag{7}$$

Since this will be evaluated many thousands of times during a typical run, it is desirable to store the constant functions of s_n. The subscripted variable FS1 stores $s_n + (s_n^2 + 2)^{\frac{1}{2}}$ which is evaluated through the function subroutine FSNA, while FS2 stores $\frac{1}{2} + \frac{s_n}{2}\{s_n - (s_n{}^2 + 2)^{\frac{1}{2}}\}$ which is evaluated through FSNB.

Since the weighting factors are applied to the undisturbed freestream molecules only, the collisions are calculated through the procedures for a binary gas mixture with the undisturbed and disturbed molecules being regarded as the two species 1 and 2, respectively. The maximum magnitude of the relative velocity is required for the 1-1, 1-2, 2-1, and 2-2 collisions, respectively. Conservative values are set initially in the two dimensional array VMP. Should higher values occur during the running of the program, the values in this array are reset accordingly.

The flowfield is initially a vacuum, so that the number of molecules NM and the factored number of molecules are initially set to zero. In addition to the weighting factors applied to undisturbed molecules on the basis of the cell volume, there is an overall weighting factor OWF which comes into operation only if NMC is set too large and the number of molecules tends to build up with time to a value above MNM. In that case, molecules are removed at random from the calculation and the overall weighting factor increases accordingly. The cell volumes CVL(N), cell coordinates, and weighting factors WF(N) are set with the loop over label 24. The exact meaning of the weighting WF(N) of cell N is that an undisturbed (type 1) molecule in cell N represents WF(N) times as many real molecules as does a similar molecule in a cell in block 1 (for which WF(N) would be 1).

The cell volumes in block 1 must be corrected for the volume occupied by the vehicle. This is most conveniently done by an application of the subroutine that is primarily used to determine whether a particular molecular trajectory collides with the vehicle surface. This subroutine has 22 arguments and some of these are variously known, unknown or dummy quantities in different applications of the subroutine. Referring to the argument notation in the listing of VIM; XI, YI, and ZI are the coordinates of the initial point on the trajectory; DX, DY and DZ are the projections on the X, Y, and Z axes of the trajectory element; XC, YC, and ZC are the coordinates of the intersection of the trajectory with the body (if any); U, V, and W are the velocity components of a typical reflected molecule from the collision point; AL, AM, and AN are the direction cosines of the normal to the surface at the collision point; VMR is the most probable molecular speed of the reflected molecules; Q is the normalised distance to the collision point on one of the surface elements; M is the code number of the surface element (see comment cards on Q) or -1 if there is no collision; X, Y and Z are the coordinates of the end point of the trajectory element, and DIN indicates whether the payload bay doors are open or shut.

Within the subroutine VIM, the possible collision with each of the surface elements is examined in turn. This is done through subroutine QUADD which is based on the theorem that the points of intersection of the line

$$x = x_i + \ell_s$$

$$y = y_i + m_s$$

$$z = z_i + n_s$$

with the quadric surface $F(x,y,z) = 0$ of eqn(1) are given by the roots of

$$A_1 s^2 + 2A_2 s + A_3 = 0, \qquad (8)$$

where

$$A_1 = a_{11}\ell^2 + a_{22}m^2 + a_{33}n^2 + 2a_{23}mn + 2a_{31}n\ell + 2a_{12}\ell m ,$$

$$A_2 = \ell(a_{11}x_i + a_{12}y_i + a_{13}z_i + a_{14}) + m(a_{21}x_i + a_{22}y_i + a_{23}z_i + a_{24}) + n(a_{31}x_i + a_{32}y_i + a_{33}z_i + a_{34})$$

and $A_3 = F(x_i, y_i, z_i)$. In the present case, the direction cosines ℓ, m, and n are replaced by DX, DY, and DZ, respectively, and the solution is then for the distance to the intersection point divided by the distance moved during the time step. This solution is returned as the parameter S1. A collision with the surface element during the time step requires a value of S1 between 0 and 1. If there are two valued solutions the lesser is chosen. Alternatively, if there are no real solutions or the real solutions lie outside the range 0 to 1, S1 is returned as 1.1. The subroutine QUADD is called only when the initial and final locations of the trajectory are such that a solution cannot be ruled out by elementary geometrical reasoning. When all elements have been investigated with the various values of S1 being set in the array Q, the smallest value of Q is chosen. If this value is less than one and less than Q(3) (which in some calls of VIM is set as the distance to the nearest intersection with a block boundary), the coordinates (XC, YC, ZC) of the collision point are calculated. The assigned GO TO statement then transfers to the appropriate element where the subroutine SRM is used to calculate the code number M (note that the meaning of M changes here) of the subdivided surface element (for the printout of the molecular flux to the surface), the velocity components of the reflected molecule, and the direction cosines of the normal to the intersection point. Should no collision occur with the surface, the variable M is returned as -1.

The calculation, in the subroutine SRM, of the direction cosines (ℓ,m,n) of the surface normals to the collision point (x_c,y_c,z_c) is based on the standard quadric surface theorem,

$$\ell = L/A, \quad m = M/A, \quad n = N/A$$

where
$$L = a_{11}x_c + a_{12}y_c + a_{13}z_c + a_{14}$$
$$M = a_{21}x_c + a_{22}y_c + a_{23}z_c + a_{24}$$
$$N = a_{31}x_c + a_{32}y_c + a_{33}z_c + a_{34}$$
and
$$A = \pm (L^2 + M^2 + N^2)^{\frac{1}{2}}$$

The sign of A must be chosen such that the surface normal is directed outward from the surface. It is readily seen that the negative sign applies only to the glove fairing, the flat portion of the lower surface of the wing, the outside of the payload bay doors and to the rear bulkhead of the payload bay. The sign parameter appears as SP in the argument list of SRM.

The function subroutine SALR(A) calculates the function $A(-\ln(r_f))^{\frac{1}{2}}$ where r_f is a uniformly distributed random fraction between 0 and 1. This appears in the equations for the selection of a pair of velocity components in a stationary equilibrium gas (ref. 1, p. 210, eq(D11)) and for the normal velocity components of a diffusely reflected molecule (ref. 1, p. 130, eq(7.9)). In the subroutine SRM it is used in both contexts, first for the normal velocity component u_n of the reflected molecule and then for the pair of parallel velocity components u_p and u_q. The distribution of the parallel components is identical with that for the components in a stationary equilibrium gas. These velocities must then be transformed to the (u,v,w) components parallel to (x,y,z) directions. The required transformation is

$$u = u_n\ell - u_q(n^2 + m^2)^{\frac{1}{2}}$$
$$v = u_n m + u_p n/(n^2 + m^2)^{\frac{1}{2}} + u_q \ell m/(n^2 + m^2)^{\frac{1}{2}}$$
and
$$w = u_n n - u_p m/(n^2 + m^2)^{\frac{1}{2}} + u_q \ell n/(n^2 + m^2)^{\frac{1}{2}},$$

and forms the basis of the final steps in subroutine SRM.

Returning now to the main program, the call of VIM during the adjustment of the cell volumes is for trajectories in the positive and negative y directions over a network of values of x and z. The y coordinate of the intersection point is the only output quantity required here. The volume of each element between the upper intersection and the lower boundary of block 1 is subtracted from the cell volumes and that between the lower intersection and the boundary is added.

The areas of the surface elements appear directly in the program as numerical constants. This is done in order to save computation time, since the calculation of these quantities in an optional subroutine SETA requires significant computing effort. This subroutine also employs the subroutine VIM and its subsidiary subroutines. The general principle is that a rectangular block surrounding the vehicle is divided into a grid with each element having the area dA. Trajectories normal to the grid elements (that is in the positive and negative x and y directions and the negative z direction) are then generated and the points of intersection with the vehicle are calculated. Then, if the direction cosine b with the trajectory direction is larger than the other two direction cosines, the area dA/b is added to the appropriate surface element. The fraction of the total surface area contributed by the trajectories "looking" in the various directions is also recorded and is used in the generation of the uniform outgassed flux. The total number of outgassed molecules per DTM is calculated as DENT.

The main loop of the program starts at label 103 and this is indicated in fig. 4. The outer loop is over the printing interval and, if the number of printing intervals have not reached that at which steady flow is assumed, the flow sampling variables are reset to zero. At the steady flow time, the time step is reset from the unsteady to the steady flow value. The loop over the sampling intervals in one printing interval and over the DTM's in one sampling interval commence just after label 104 and extend to labels 111 and 112, respectively. The first step in the inner loop is to advance the overall time parameter TIME by DTM. This is followed by the routines for the movement of the molecules (including boundary interactions and the entry of new molecules) and for the calculation of collisions. These are the key routines in the program and will be discussed in detail.

The total number NM of molecules changes during the molecular movement routine, so the loop variable N is initially set to zero, it is advanced by one at the statement labelled 116 and an exit from the loop to label 117 occurs when N is greater than NM. The procedure is similar to that described in Appendix H of ref. 1, but is more complex in the present case because there is a second return to label 116 to deal with the entering, outgassed and jet molecules. Up to the first exit to label 117, the loop deals with molecules that are already in the flow and this is flagged by a negative value of the variable IFT. The initial position of the molecule is indicated by (XI, YI, ZI) and the time interval over which the molecules move by AT. The variable AT is equal to DTM when IFT is negative but, for the entering molecules with IFT positive, AT is set equal to a random fraction of DTM. The variable AT is also set equal to a random fraction of DTM for undisturbed molecules that are generated at a block boundary due to the operation of the weighting factors. These molecules are flagged by a negative value of IP(1,N). This usage of IP(1,N) is independent of its main function which is not required in the molecular move routine and which is reset in the molecular indexing routine which immediately follows the movement routine. The subroutine QIN is called to set all values of the array Q to the default value of 1.1 and the values of Q(1), Q(2), Q(3) corresponding to the distance ratios to the X,Y,Z block boundaries are calculated. The smallest of these is set as Q(KC). The trajectory calculation is recommenced from a point just within the block boundary when a molecule crosses to a new block so that collisions with the vehicle need only be considered if the number of the initial block IB is equal to 1. The subroutine VIM is then called if the initial and final points of the trajectory are such that a collision with the surface is possible. If the subroutine returns with M = -1, no collision occurs and transfer is again made to label 703.

When a collision with the surface occurs, the event is recorded in the array W, AT is set to the time interval remaining and a transfer is made to label 90 for the calculation of the remainder of the trajectory. This could involve further interactions with the vehicle or interactions with the block boundaries. In order to avoid problems with round-off errors, the initial points of the remaining trajectory elements are set just outside the vehicle surface or just inside the new block, as the case may be. In the case of the surface interactions, a further safeguard against infinite loops is provided by discarding any molecule that suffers more than twenty surface interactions within a single time step. A diagnostic message is printed when the number of interactions exceeds twelve. The subroutine VIM and its subsidiary subroutines QUADD and SPM have already been discussed in general terms. Note that, in this case, the value of Q(3) for the fractional distance to the block boundary normal to the z axis is carried into the subroutine and an intersection with the plane of symmetry z = 0 before the surface interaction causes an exit with M = -1.

In the absence of collisions with the surface, a transfer is made to label 703 and, if Q(KC) is less than one, the molecule interacts with a block boundary. For the outer boundaries, the molecule is specularly reflected if it crosses the plane Z = 0 and is discarded if it crosses the planes z = ZM, y = YB, y = YT, x = XF or x = XR. A molecule is discarded through being replaced by the final molecule in the array N = NM. This process commences at label 120. The factored number FNM and the number NM of molecules is reduced by the weighting factor of the discarded molecule and one, respectively. The molecule counter N is also reduced by one so that, on return to label 116 the molecule that has been moved down the list is the next one to be dealt with. The crossing of an inter-block boundary has no effect on disturbed molecules, but action must be taken on the basis of the change in weighting factors for the undisturbed molecules. The ratio of the initial to the new weighting factor is calculated as A. If A is less than one there is the probability 1 - A that the molecule will be discarded while, if A is greater than unity, INT(A - 1) new molecules will be generated at the boundary with the probability FRAC(A - 1) of a further one being generated. These probabilities are handled by the routine employing the integer LL. This is based directly on the routine presented in Appendix H of ref. 1. The new molecules must be chosen from the distribution of molecules flowing across a surface and this varies with the orientation of the surface. This is handled by the set of computed GO TO statements. The parallel and normal velocity components of the new molecule are generated in the subroutines SETVC and EVC, respectively. The position coordinates are duplicated from those of the original molecule. The initial position of the original molecule is then set just within the new block (statement labelled 704 and following statements) the time remaining is set as AT and a transfer made back to label 90 for the computation of the remainder of the trajectory.

Should the molecule remain in the same block and not collide with the vehicle surface, the new cell number is calculated (statements around label 76) and is set in IP(2,N). This and the previous setting of the new position coordinates in P(1,N) to P(3,N) are the only changes and the program transfers back to label 116 to deal with the new molecule.

After the first exit to label 117, IFT is set equal to one and new molecules enter across the five outer bounding planes. Should this process cause the number of molecules NM to rise above the limit MNM set by the dimensions of P and IP, the subroutine CTNML is called to discard one of the molecules at random and to adjust the overall weighting factor OWF accordingly. While this is preferable to having to stop the calculation, it is desirable to set data that avoids the calling of this subroutine as far as possible. Three of the bounding planes consist of the faces of a number of individual blocks and, since these generally have different weighting factors, not all locations on the boundary plane are equally likely for the point of entry of the new molecules. The points of entry are, therefore, generated by a simple acceptance-rejection procedure employing the minimum weighting factors on the various bases (WFM1 etc.) which had been calculated earlier. The initial point on the trajectories are set just within the boundary and the velocity components are again generated by the subroutines EVC and SETVC. The variable IP(1,NM) is not required at this stage and is set equal to the dummy value NM; while IP(2,NM) need not indicate the actual cell at this stage but must indicate the correct block. IP(2,NM) is therefore put equal to the number of the first cell in the block, while IP(3,NM) is set to 1 to indicate an undisturbed molecule.

The generation of the initial position of the uniformly outgassed molecules poses a non-trivial problem. A solution is again provided by the subroutine VIM. The fraction of the surface area obtained from the trajectories "looking" in each direction was recorded when the subroutine SETA was included and this is used in an acceptance-rejection routine to determine the direction of the "look" that will produce the next initial position. A location on the plane normal to this direction is then selected at random and the relative magnitude of the contribution to the area that the trajectory through this location would make is calculated. This is zero if the trajectory does not intersect with the surface or if the direction cosine A with this direction of the normal to the surface at the point of intersection is not the largest of the three direction cosines. Otherwise the relative contribution (normalised to a maximum of unity) is $(\sqrt{3}\Lambda)^{-1}$ and this is used in another acceptance rejection routine to select the point. As in the calculation of the surface areas, the case with open payload bay doors is treated separately with an analytical treatment being possible for the additional elements because of their simple geometry.

The generation of the jet molecules from the jet does not pose any difficulties. The polar angle from the jet direction is selected from the distribution $\exp(-10\theta/\pi)$ with θ between 0 and π by an acceptance - rejection routine and the azimuth angle is uniformly distributed between 0 and 2π. This enables a velocity component UN in the jet direction and two mutually perpendicular components, UP and UQ, in the plane normal to it to be generated. These components are then transformed to the (x,y,z) directions by a further application of eq(10).

The program then transfers back to label 116 for all the entering molecules to move through the appropriate distances and, in some cases, boundary interactions. The next transfer to label 117 (with IFT = 1) results in a transfer to label 132 for the molecular indexing to be reset.

The idea of the indexing is to enable the molecules in a given cell to be chosen readily from the P and IP arrays in which they are stored at random. For this application, it is necessary to be able to choose the type 1 and the other than type 1 molecules separately and the array IP(1,N) contains the molecule numbers arranged in order of the cells and with the other than type one molecules first. The molecule number is the value of N in P(M,N) and in IP(M,N) for $M \neq 1$. Note that the second subscript has a completely different meaning in IP(1,N) than in the P array and in the remainder of the IP array. The other arrays involved in the indexing are IC(1,L) and IC(2,L) which contain the starting address -1 (address here refers to the index N in IP(1,N)) of the other than type 1 and type 1 molecules, respectively, in cell L. The number IC(3,L) of other than type 1 and the number IC(4,L) of type 1 molecules in cell L are also set during the indexing process. These numbers are first set to zero (loop over cells to label 151) then, in a loop over the molecules to label 152, the existence of the cell number in IP(2,N) enables them to be set to their correct values. The loop over the cells to label 153 then sets IC(1,L) and IC(2,L) to their final values, but sets the IC(3,L) and IC(4,L) back to zero. The final loop is over the molecules to label 154 and, for each molecule, either IC(3,L) or IC(4,L) are advanced by unity and, since IC(1,L) and IC(2,L) are now known, the cross reference array IP(1,N) can be set. At the end of this loop, IC(3,L) and IC(4,L) have returned to their correct values.

The collisions are then calculated for each cell in turn (outer loop to label 155) and, since the type 1 and other than type 1 molecules are treated separately, the procedures resemble those for a gas mixture (ref. 1, ch. 10). There is a double inner loop over the two sets of molecules to label 155. In each case the index 1 corresponds to other than type 1 and 2 to type 1. The three-dimensional array CTIM(2,2,N) is a time parameter for each type of collision in each cell, and collisions are computed until this parameter reaches the overall time parameter TIME. The details of the collision computation follow the theory and examples in ref. 1 (p 130 for hard sphere collisions, p 139 for inverse ninth power law molecules, and p 170 for the collision of molecules with different weighting factors). The major complication here is that the class of molecule may change during a collision since a type 1 molecule becomes type 3 on collision with any molecule of type other than one. This must happen irrespective of the weighting factor of the type 1 molecule because the type 3 has a unit weighting factor. There are two options, depending on whether the acceptance-rejection procedure applied to the inverse of the weighting factor (just before label 243) decides that the velocity components of the type 1 molecule are, or are not, to be changed by the collision. If they are changed, the type of the molecule is simply changed from 1 to 3. However, if the velocity components were not changed during the loop to label 159 (i.e. the collision was not "counted" for the type 1 molecule), it is duplicated as an additional type 1 molecule and the modified velocity components (which had been stored in VRC(3) are substituted at this stage and its type is changed from 1 to 3. This generation of additional molecules during the collision process introduces some of the procedures that are required for the simulation of chemical reactions.

Label 112 appears immediately after the termination of the collision routine at label 155. At time intervals of NIS * DTM, this inner loop is completed and the flow properties are sampled. First there is a loop over the cells to label 164 in which the cross-reference variable IP(1,N) is again used to choose the relevant molecules. At alternative system would have looped over the molecules and used the cell number IP(2,N) to place the information in the correct location. There is then a loop over these molecules to label 451 for the sampling of the flow density and the upstream moving molecules within the set of large cubic cells that are used just for this purpose. In this case, the cell number is worked out for each molecule in turn.

The final step, following the exit from the loop terminating at label 111 at intervals of NIS * NSP * DTM prints out the results. The semi-pictorial results for the densities will be one of the most frequently studied quantities and, in order to give some indication of the statistical scatter that should be associated with these, the "minimum density resolution" has been printed. This is the density value that would be printed if just one molecule had appeared at one of the sampling intervals. A value is also given for the value that would appear if one molecule is sampled at each sampling interval. Note that these quantities assume unit weighting factor and the resolution would be much worse for the type 1 molecules. For the quantities in the molecular flux to the surface and in the overall flow table the expected scatter may be deduced from the size of the sample.

Reference

1. Bird, G.A.; Molecular Gas Dynamics. Oxford University Press (London), 1976.

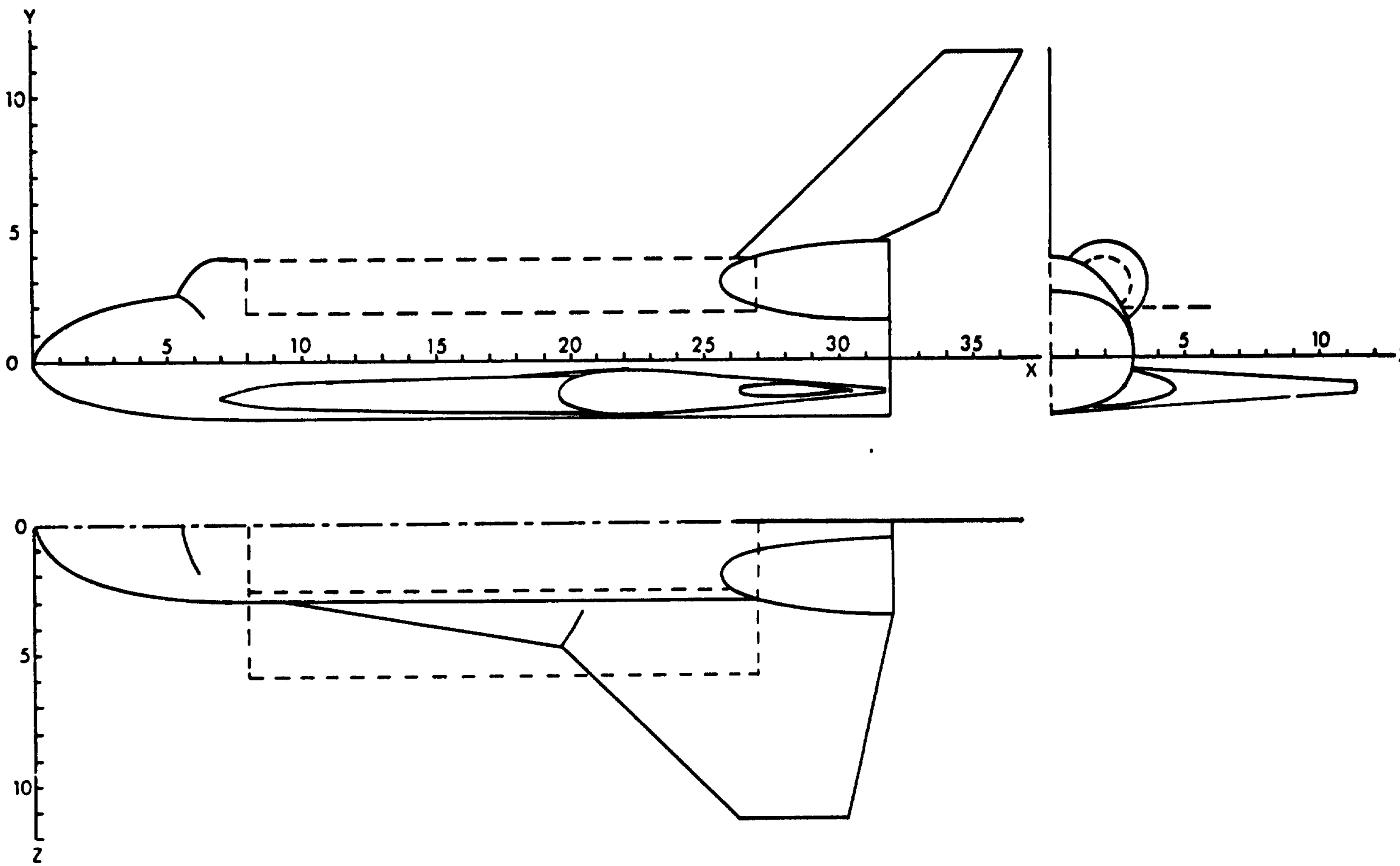

Fig. 1. The Shuttle geometrical representation.

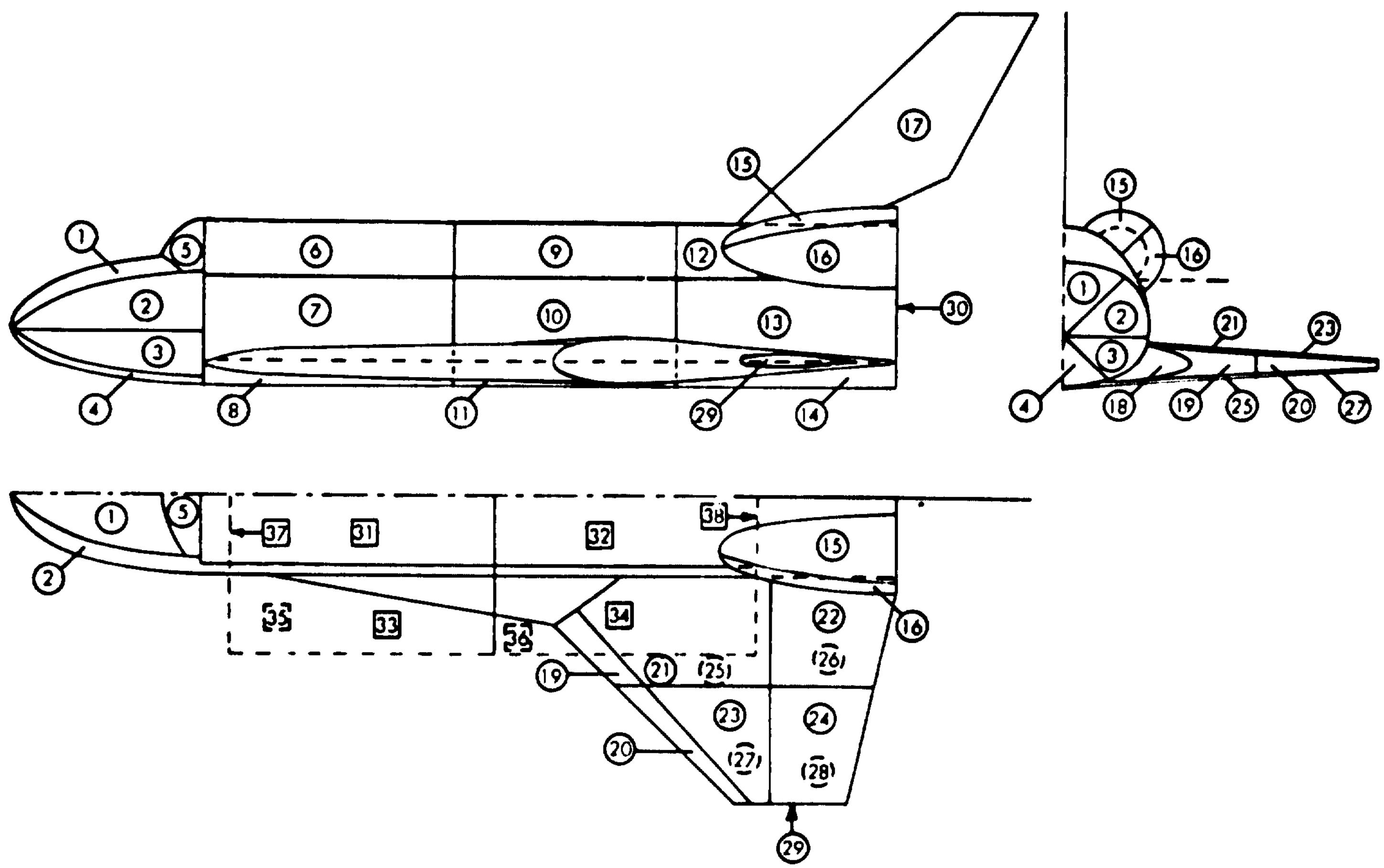

Fig. 2. The geometrical configuration of the surface elements. Numbers in solid symbols refer to surface elements in direct view, numbers in dashed symbols refer to elements on the opposite side of the surface. The square symbol refers to the doors open configuration only.

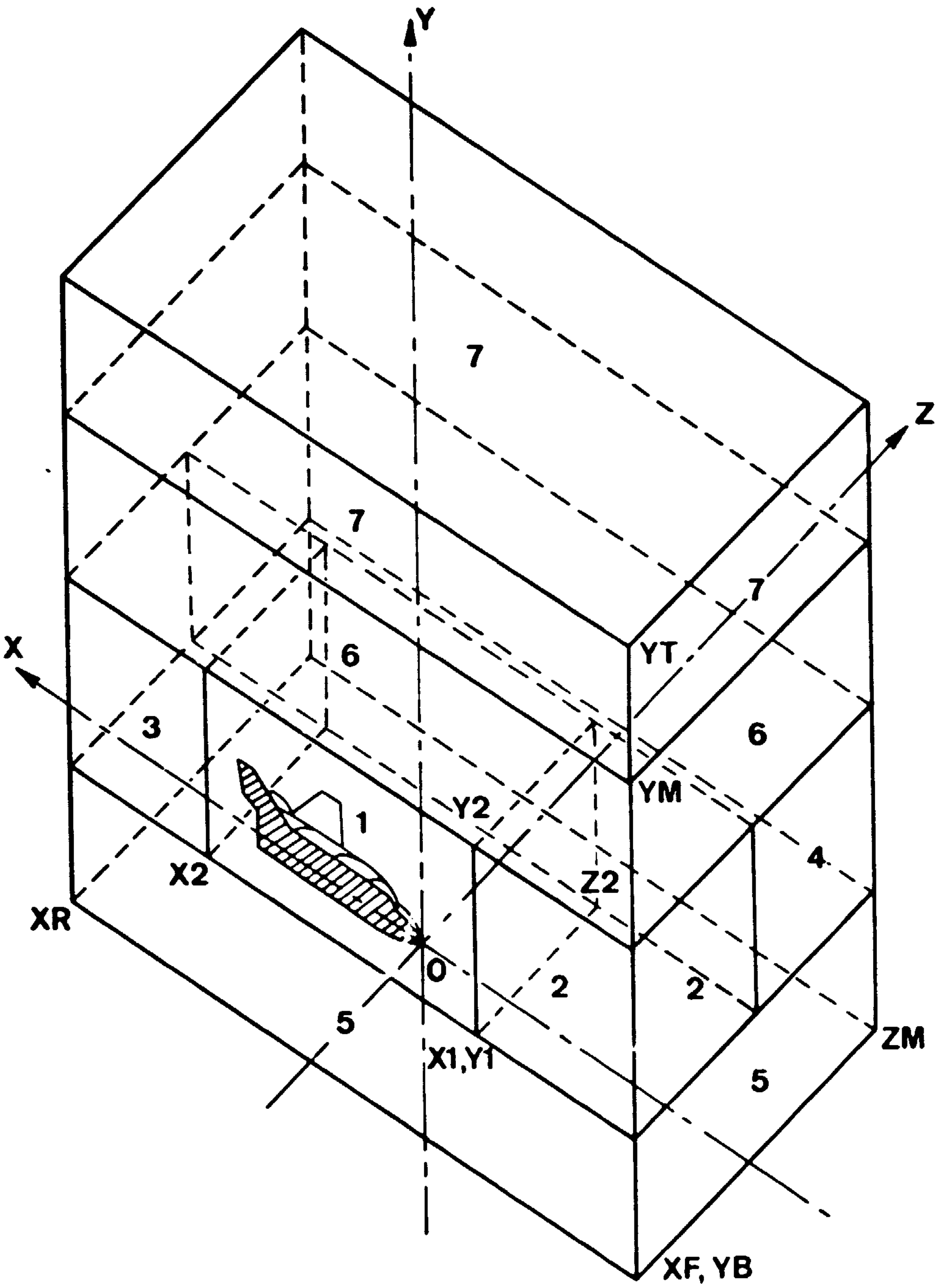

Fig. 3. The block structures in the simulated flowfield.

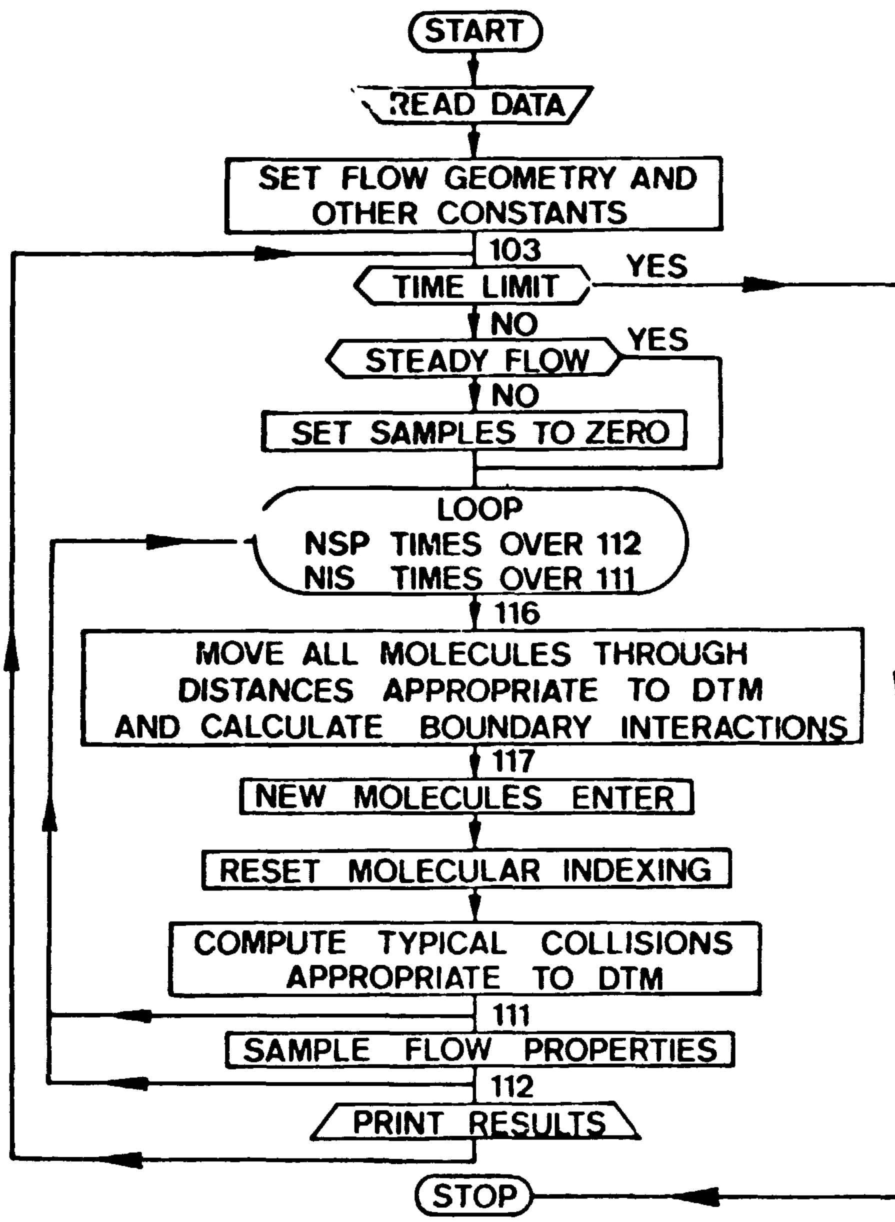

Fig. 4. Schematic flow chart.

Appendix A

Definition of Surface Elements

1. Upper Nose

Non-zero quadric coefficients (ellipsoid)

$a_{11} = 60.84$

$a_{22} = 441$

$a_{33} = 331.24$

$a_{14} = 1425.88$

Region of validity

$x < 7,$

$y > 0,$

and outside surface 3.

2. Lower Nose

Non-zero quadric coefficients (ellipsoid)

$a_{11} = 36$

$a_{22} = 441$

$a_{33} = 196$

$a_{14} = -252$

Region of validity

$x < 7,$

$y < 0.$

3. Windshield

Non-zero quadric coefficients (ellipsoid)

$a_{11} = 36$

$a_{22} = 9$

$a_{33} = 16$

$a_{14} = -252$

$a_{44} = 1620$

Region of validity

$x < 7,$

$y > 0,$

and outside surface 1.

4. Upper Fuselage

Non-zero quadric coefficients (elliptic cylinder)

$a_{22} = 9$

$a_{33} = 16$

$a_{44} = -144$

Region of validity

$7 < x < 32,$

$y < 0,$

and outside surface 6.

Also, if payload bay doors are open, $y < 2$ for $8 < x < 27$.

5. Lower Fuselage

Non-zero quadric coefficients (elliptic cylinder)

$a_{22} = 9$

$a_{33} = 4$

$a_{44} = -36$

Region of validity

$7 < x < 32,$

and $y < 0.$

6. OMS Pod

Non-zero quadric coefficients (ellipsoid)

$a_{11} = 1$

$a_{22} = 16$

$a_{33} = 16$

$a_{14} = -32$

$a_{24} = -48$

$a_{34} = -32$

$a_{44} = 1191.04$

Region of validity

$x < 32,$

and outside surface 4.

Also, if payload bay doors are open, $x < 32$.

7. Fin

Non-zero quadric coefficient (plane)

$a_{34} = 0.5$

Region of validity

$4 < y < 11.8,$

$y < x - 22.2,$

$y > 2x - 61.8,$

and $y > 0.4286x - 8.857.$

8. Base

Non-zero quadric coefficients (plane)

$a_{14} = 0.5$

$a_{44} = -32$

Region of validity:

$(y > 0$ and $(y - 3)^2 + (z - 2)^2 < 2.56$ or $y < (144 - 16z^2)^{\frac{1}{2}}/3)$ or

$(y < 0$ and $y > -(36 - 4z^2)/3)$.

9. Glove Fairing

Non-zero quadric coefficients (portion of elliptic cone)

$a_{11} = 1$

$a_{22} = -1296$

$a_{33} = -36$

$a_{14} = 9$

$a_{24} = -1296$

$a_{44} = -1215$

Region of validity

$6 < x < 22,$

and outside other surfaces.

10. Wing Leading Edge

Non-zero quadric coefficients (portion of elliptic cone)

$a_{11} = 195.4999006$

$a_{22} = 6400$

$a_{33} = 35.50009932$

$a_{31} = -115.5000687$

$a_{14} = -4112.49603$

$a_{24} = 6400$

a_{34} = 2912.500578

a_{44} = 85787.37332

Region of validity

$11.3 > z > 2.67165829x - 64.73123913$,

and outside other surfaces.

11. Wing Upper Rear

Non-zero quadric coefficients (portion of plane)

a_{14} = 5.384525625

a_{24} = 50.19715575

a_{34} = 1.031079375

a_{44} = -250.4018047

Region of validity

$z_c < 2.67165829x - 64.73123913$,

$z_c < 170.1111111 - 5.222222x$,

$z_c < 11.3$

and outside ot' ᐧ ꞇ surfaces.

12. Wing Lower Rear

Non-zero quadric coefficients (plane)

a_{14} = -5.38452625

a_{24} = 50.1971Ꞔ 75

a_{34} = -1.031079375

a_{44} = 451.1904277

Region of validity

As for surface 11.

13. Wingtip

Non-zero quadric coefficients (plane)

a_{34} = 0.5

a_{44} = -11.3

Region of validity

$30.4106 > x > 26.29999703$

and $|y + 1| < (-195.4999006x^2 + 10832.29361x - 149742.894)^{\frac{1}{2}}/80$

if $x < 28.458448$, otherwise

$|y + 1| < 3.262074498 - 0.107267544x$.

Surfaces 14 to 17 apply when payload bay doors are open.

14. Payload Bay Base and Inside of Doors

Non-zero quadric coefficients (plane)

$a_{24} = 0.5$

$a_{44} = -2$

Region of validity

$8. < x < 27.$ and

$z < 5.9.$

15. Outside of Payload Bay Doors

Non-zero quadric coefficients

As for surface 14

Region of validity

$8 < x < 27$

$z < 5.9$

and outside other surfaces.

16. Forward Bulkhead of Payload Bay

Non-zero quadric coefficients (plane)

$a_{14} = 0.5$

$a_{44} = -8$

Region of validity:

$9y^2 + 16z^2 - 144 < 0$

and outside other surfaces.

17. Rear Bulkhead of Payload Bay

Non-zero quadric coefficients (plane)

$a_{14} = 0.5$

$a_{44} = -27$

Region of validity

$(y - 3)^2 + (z - 2)^2 < 0.9975$ or $y < (144 - 16z^2)^{\frac{1}{2}}/3$

Appendix B

The main program and all required subroutines are listed on pages B1 thru B43. A typical set of input data is listed at the end of the program on page B43.

```
      PROGRAM SSFF(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT)
      DIMENSION P(6,7800),IP(3,7800),C(16,661),IC(5,661),H(2,3,7),FCOL(2
     1,2),ND(3,7),NC(7),CW(3,7),CTIM(2,2,661),VMP(2,2),ENT(5),REM(5),
     2WF(7),CVL(7),MMC(3),FS1(5),FS2(5),VRC(3),SA(12),W(6,38),DN(5,480),
     3UN(5,84),UJ(5,83),Q(20),PJ(10,4)
C  DIMENSIONS OF ARRAYS
C
C P(6,MNM),IP(6,MNM) WHERE MNM IS THE MAXIMUM NUMBER OF MOLECULES (AS SET IN
C      THE DATA)
C C(16,NCT),IC(5,NCT),CTIM(2,2,NCT) WHERE NCT IS THE TOTAL NUMBER OF CELLS
C PJ(10,MNCJ) WHERE MNCJ IS THE MAXIMUM NUMBER OF CONTROL JETS
C
C  ALL OTHER DIMENSIONS ARE FIXED
C
C DESCRIPTION OF DATA CARDS
C
C
C CARD 1  THE LOCATIONS OF THE BOUNDING PLANES (METRES RELATIVE TO APEX OF NOSE)
C        X=XF IS THE MINIMUM X PLANE (BOUNDS BLOCKS 2,4,5,6,7)
C        X=XR IS THE MAXIMUM X PLANE (BOUNDS BLOCKS 3,4,5,6,7)
C        Z=ZM IS THE MAXIMUM Z PLANE (BOUNDS BLOCKS 4,5,6,7)
C        Y=YB IS THE MINIMUM Y PLANE (BOUNDS BLOCK 5)
C        Y=YM IS THE INTERMEDIATE PLANE BETWEEN BLOCKS 6 AND 7
C        Y=YT IS THE MAXIMUM Y PLANE (BOUNDS BLOCK 7)
C
C CARD 2 THE LOCATIONS OF THE BOUNDING PLANES OF BLOCK 1 (ENCLOSING THE VEHICLE)
C        X=X1 IS THE MINIMUM X PLANE
C        X=X2 IS THE MAXIMUM X PLANE
C        Y=Y1 IS THE MINIMUM Y PLANE
C        Y=Y2 IS THE MAXIMUM Y PLANE
C        Z=Z2 IS THE MAXIMUM Z PLANE
C
C CARDS 3 TO 9  (FOR BLOCKS 1 TO 7, RESPECTIVELY)
C   THE NUMBER OF CELL DIVISIONS IN THE X,Y,Z DIRECTIONS RESPECTIVELY
C
C CARD 10 THE FREESTREAM VELOCITY (METRES/SEC), THE DIRECTION COSINE OF THIS
C  WITH THE X AXIS, THE DIRECTION COSINE WITH THE Y AXIS, THE MOST PROBABLE
C  MOLECULAR SPEED IN THE FREESTREAM (METRES/SEC), THE FREESTREAM MEAN FREE PATH
C  (METRES), THE RATIO OF THE SURFACE TEMPERATURE TO THE FREESTREAM GAS
C  TEMPERATURE, THE RATIO OF THE OUTGASSING NUMBER FLUX TO THE NUMBER FLUX IN A
C  STATIONARY GAS AT THE UNDISTURBED FREESTREAM DENSITY
C
C CARD 11  THE TIME INTERVAL DTM UP TO THE STEADY FLOW TIME (SECONDS), THE TIME
C  INTERVAL DTM AFTER THE STEADY FLOW TIME , -1, IF THE PAYLOAD DOORS ARE SHUT
```

```
C  OR 1. IF THEY ARE OPEN
C
C CARD 12  THE NUMBER OF INITIAL (UNSTEADY FLOW) DTM.S IN ONE SAMPLING INTERVAL.
C  THE NUMBER OF SAMPLING INTERVALS IN ONE PRINTING INTERVAL. THE NUMBER OF
C  PRINTING INTERVALS TO THESTEADY FLOW TIME. THE TOTAL NUMBER OF PRINTING
C  INTERVALS TO THE END OF THE CALCULATION. THE NUMBER OF SIMULATED MOLECULES
C  PER CELL IN THE UNDISTURBED FREESTREAM. THE MAXIMUM NUMBER OF MOLECULES. 0
C  FOR HARD SPHERE MOLECULES OR 1 FOR INVERSE NINTH POWER LAW MOLECULES. THE
C  NUMBER OF CONTROL JETS
C
C CARD 13 IS REPEATED FOR EACH CONTROL JET (OMITTED IF THERE ARE NONE)
C  THE X.Y.Z COORDINATES OF THE EFFECTIVE JET LOCATION (METRES)
C  THE L.M.N DIRECTION COSINES OF THE JET DIRECTION
C  THE JET VELOCITY (METRES/SEC)
C  THE RATIO OF THE JET NUMBER FLUX TO THE FLUX OF THE (MOVING) FREESTREAM
C   ACROSS ONE SQUARE METRE NORMAL TO THE STREAM DIRECTION
C
C P(N.M) INFORMATION ON UP TO M MOLECULES
C  N=1.2.3    X.Y.Z  POSITION COORDINATES
C  N=4.5.6    U.V.W  VELOCITY COMPONENTS
C IP(N.M) INTEGER INFORMATION
C  N=1 CROSS REFERENCE ARRAY (M MOLECULES IN ORDER OF CELLS)
C  N=2 CELL NUMBER
C  N=3 TYPE OF MOLECULE
C         TYPE 1   UNDISTURBED FREESTREAM
C         TYPE 2   FREESTREAM THAT HAS STRUCK SURFACE
C         TYPE 3   FREESTREAM THAT HAS BEEN INDIRECTLY AFFECTED
C         TYPE 4   OUTGASSED FROM VEHICLE SURFACE
C         TYPE 5   CONTROL JET EFFLUX
C
C C(N.M) INFORMATION ON UP TO M CELLS
C  N=1.2.3    X.Y.Z  POSITION COORDINATES
C  N=4   CELL VOLUME
C  N=5.6.7 SUM OF U.V.W VELOCITY COMPONENTS (WEIGHTED)
C  N=8.9.10SUM OF U*U.V*V.W*W  (WEIGHTED)
C  N=11.12.13.14.15 SUM OF TYPE 1.2.3.4.5 MOLECULES   (WEIGHTED)
C  N=16 UNWEIGHTED SAMPLE
C
C IC(N.M) INTEGER INFORMATION
C  N=1 (STARTING ADDRESS-1) OF MOLECULES IN CROSS REFERENCE ARRAY (NE.1 MOLS.)
C  N=2 (STARTING ADDRESS-1) OF EQ.1 MOLECULES
C  N=3 NUMBER OF MOLECULES IN CELL  (TYPE NE.1 MOLECULES)
C  N=4 NUMBER OF TYPE EQ.1 MOLECULES IN CELL
C  N=5 BLOCK IN WHICH THE CELL LIES
```

```
C
C  CTIM(2,2,N) TIME IN CELL N FOR THE FOUR TYPES OF COLLISIONS WHEN
C              TYPE 1 AND OTHER THAN TYPE 1 MOLECULES ARE REGARDED SEPARATELY
C           (SUBSCRIPT 1 FOR NE.1 , SUBSCRIPT 2 FOR EQ.1)
C
C  H(L,M,N) CONTAINS THE MAXIMUM (L=2) AND MINIMUM (L=1) COORDINATES IN THE
C           X (M=1), Y (M=2), AND Z (M=3) DIRECTIONS OF BLOCK N
C
C  ND(M,N)            THE NUMBER OF CELL DIVISIONS IN THE X,Y,Z DIRNS., BLOCK N
C
C  NC(N) THE NUMBER OF CELLS UP TO THOSE IN BLOCK N
C
C  CW(M,N) CELL DIMENSION IN THE X(M=1), Y(M=2) AND Z (M=3) DIRECTIONS, BLOCK N
C
C  VMP(2,2) THE MAXIMUM LIKELY REATIVE SPEED IN THE COLLISIONS
C
C  ENT(N) THE FACTORED NUMBER OF MOLECULES ENTERING ACROSS THE FRONT (N=1),
C         REAR  (N=2), SIDE (N=3) ,TOP (N=4), AND BOTTOM (N=5) FACES
C
C  REM(N) THE REMAINDER
C
C  FS1(N),FS2(N) ARE CONSTANTS IN THE ENTERING DISTRIBUTION FUNCTION
C
C  FCOL(2,2) THE FACTORED NUMBER OF COLLISIONS
C
C  CVL(N)  IS THE CELL VOLUME IN BLOCK N
C
C  WF(N) IS THE WEIGHTING FACTOR OF TYPE 1 MOLECULES IN BLOCK N
C
C  W(N,M) NUMBER OF TYPE N MOLECULES STRIKING SURFACE ELEMENT M  (N=1 TO 5)
C  W(6,M) AREA OF ELEMENT M
C
C DN(N,M) NUMBER OF TYPE N MOLECULES IN OVERALL DENSITY SAMPLING CELL M
C IF XF.GT.-40, YT.LT.80, YB.GT.-20 OR XR.LT.80  THEY SHOULD BE MULTIPLES OF TEN
C   IN ORDER NOT TO UPSET THE OVERALL DENSITY SAMPLING
C
C UN(N,M) NUMBER OF TYPE N UPSTREAM MOVING MOLECULES IN SAMPLING CELL M
C
C UU(N,M) SUM OF THE UPSTREAM VELOCITY COMPONENTS OF THESE MOLECULES
C
C
C Q(K) DISTANCE TO A POSSIBLE COLLISION POINT DIVIDED BY DISTANCE MOVED
C   K=1,2,3 FOR COLLISION WITH X,Y,Z  BLOCK BOUNDARIES
C  K=4 TO 16 FOR COLLISIONS WITH THE THIRTEEN QUADRIC ELEMENTS
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C  K=17 TO 20 FOR COLLISIONS WITH PAYLOAD BAY AND DOORS (WHEN OPEN)
C PJ(N,M) INFORMATION ON UP TO M JETS
C  N=1,2,3 X,Y,Z OF EFFECTIVE POINT SOURCE CORRESPONDING TO JET
C  N=4,5,6 L,M,N DIRECTION COSINES OF JET DIRECTION
C  N=7 JET VELOCITY
C  N=8 JET FLUX (NORMALISED FROM DATA, CONVERTED TO NUMBER PER DTM)
C  N=9 REMAINDER WHEN AN INTEGER NUMBER OF MOLECULES ARE ADDED EACH TIME STEP
C  N=10 SQRT(M*M+N*N)
C
C
C
      WRITE (6,1)
1     FORMAT (25H1 SPACE SHUTTLE FLOWFIELD///)
C
C  THE FLOWFIELD IS DIVIDED INTO SEVEN BLOCKS
C  BLOCK 1 ENCLOSES THE VEHICLE WHICH HAS ITS APEX AT THE ORIGIN
C      AND  EXTENDS FROM X=X1 TO X=X2, Y=Y1 TO Y2 , Z=0 TO Z2 (METRES)
C  BLOCK 2 IS AHEAD (IN -VE X-DIRECTION) OF BLOCK 1
C      AND  EXTENDS FROM X=XF  TO X=X1
C  BLOCK 3 IS BEHIND (IN +VE X-DIRECTION) OF BLOCK 1
C      AND  EXTENDS FROM X=X2 TO X=XR
C  BLOCK 4 IS OUTSIDE (IN +VE Z-DIRECTION) BLOCKS 1,2, AND 3
C      AND  EXTENDS FROM Z=Z2 TO ZM
C  BLOCK 5 IS BELOW (IN -VE Y-DIRECTION) BLOCKS 1,2,3, AND 4
C      AND  EXTENDS FROM Y=Y1 TO Y=YB
C  BLOCK 6 IS ABOVE (IN +VE Y-DIRECTION) BLOCKS 1,2,3, AND 4
C      AND  EXTENDS FROM Y=Y2 TO Y-YM
C  BLOCK 7 IS ABOVE BLOCK 6
C      AND  EXTENDS FROM Y=YM TO Y=YT
C
C  READ DATA
C
      READ(5,2) XF,XR,ZM,YB,YM,YT
2     FORMAT (8F10.5)
      WRITE (6,18) XF,XR,ZM,YB,YM,YT
18    FORMAT (5H XF =,F9.5,5H XR =,F9.5,5H ZM =,F9.5,5H YB =,F9.5,5H YM
     1=,F9.5,5H YT =,F9.5)
      READ (5,2) X1,X2,Y1,Y2,Z2
      WRITE (6,17) X1,X2,Y1,Y2,Z2
17    FORMAT (5H X1 =,F9.5,5H X2 =,F9.5,5H Y1 =,F9.5,5H Y2 =,F9.5,5H Z2
     1=,F9.5)
      DO 3 N=1,7
      READ (5,4) (ND(M,N),M=1,3)
3     WRITE (6,19) N,(ND(M,N),M=1,3)
```

```
19    FORMAT (6H BLOCK,I5,13H DIVIDED INTO,3I5,16H X Y Z INTERVALS)
4     FORMAT (8I10)
      READ (5,2) VF,DCX,DCY,VMF,FMP,SFT,OFD
      WRITE (6,5) VF,DCX,DCY
5     FORMAT (24H THE STREAM VELOCITY IS ,F10.5,30H AND HAS DIRECTION CO
     1SINES OF ,F10.5,5H AND ,F10.5,23H WITH THE X AND Y AXES )
      WRITE (6,6) VMF,FMP
6     FORMAT (95H THE UNDISTURBED FREESTREAM VALUES OF THE MOST PROBABLE
     1THERMAL VELOCITY AND MEAN FREE PATH ARE ,F10.5,5H AND ,F10.5)
      WRITE (6,26) OFD
26    FORMAT  (43H THE SURFACE OUTGASSES AT A RATE EQUAL TO  ,F10.5,64H
     1TIMES THE NUMBER FLUX (1/4NV) IN THE UNDISTURBED FREESTREAM GAS)
      WRITE (6,7)       SFT
7     FORMAT (28H THE SURFACE TEMPERATURE IS ,F10.5,37H TIMES THE FREEST
     1REAM GAS TEMPERATURE)
      READ (5,2) DTM,DTMS,DIN
      WRITE (6,27) DTM,DTMS
27    FORMAT (36H THE TIME INTERVAL DTM IS INITIALLY ,F10.5,16H AND CHAN
     1GES TO ,F10.5,39H AFTER THE ESTABLISHMENT OF STEADY FLOW)
      IF (DIN.LT.0.) WRITE (6,200)
      IF (DIN.GT.0.) WRITE (6,201)
200   FORMAT (27H PAYLOAD BAY DOORS ARE SHUT)
201   FORMAT (27H PAYLOAD BAY DOORS ARE OPEN)
      READ (5,4) NIS,NSP,NPS,NPT,NMC,MNM,KTM,NCJ
      WRITE (6,8) NIS,NSP
8     FORMAT (10H THERE ARE,I4,31H DTM TO A SAMPLING INTERVAL AND,I5,41H
     1SAMPLING INTERVALS TO A PRINTING INTERVAL)
      WRITE (6,9)NPS,NPT
9     FORMAT (29H STEADY FLOW IS ASSUMED AFTER,I5,51H PRINTING INTERVALS
     1 AND THE CALCULATION STOPS AFTER,I5,19H PRINTING INTERVALS)
      WRITE (6,10)NMC,MNM
10    FORMAT (44H THE INITIAL NUMBER OF MOLECULES PER CELL IS,I6,26H AND
     1 THE MAXIMUM TOTAL IS ,I7)
      IF (KTM.EQ.0) WRITE (6,30)
30    FORMAT (22H HARD SPHERE MOLECULES)
      IF (KTM.EQ.1) WRITE (6,31)
31    FORMAT (30H INVERSE NINTH POWER MOLECULES)
      IF (NCJ.EQ.0) GO TO 32
      WRITE (6,41)
41    FORMAT (1H ,4H JET,3X,3H X ,8X,3H Y ,8X,3H Z ,8X,3H L ,8X,3H M ,8X
     1,3H N ,9H VELOCITY,6H  FLUX)
C THE JET FLUX IS THE RATIO TO THE STREAM FLUX (AT T=0) ACROSS ONE SQUARE METRE
      DO 39 N=1,NCJ
      READ (5,2) (PJ(M,N),M=1,8)
```

```
      40) N,(PJ(M,N),M=1,8)
      6,8F10.5)

      NTS
      PI 159265
      PT(P )
      =1.7320508
      =V /VMF
      F X=VF*DCX
      VFY=VF*DCY
      NSB=0
      L=0
      DO 11 N=1,7
      NC(N)=L
   11 L=L+ND(1,N)*ND(2,N)*ND( ,N)
      NCT=L
C NCT IS THE TOTAL NUMBER OF CELLS
      H(1,1,1)=H(2,1,2)=X1
      H(2,1,1)=H(1,1,3)=X2
      H(1,1,2)=H(1,1,4)=H(1,1,5)=H(1,1,6)=H(1,1,7)=XF
      H(2,1,3)=H(2,1,4)=H(2,1,5)=H(2,1,6)=H(2,1,7)=XR
      H(1,2,1)=H(1,2,2)=H(1,2,3)=H(1,2,4)=H(2,2,5)=Y1
      H(2,2,1)=H(2,2,2)=H(2,2,3)=H(2,2,4)=H(1,2,6)=Y2
      H(1,2,5)=YB
      H(2,2,6)=H(1,2,7)=YM
      H(2,2,7)=YT
      H(1,3,1)=H(1,3,2)=H(1,3,3)=H(1,3,5)=H(1,3,6)=H(1,3,7)=0.
      H(1,3,4)=H(2,3,1)=H(2,3,2)=H(2,3,3)=Z2
      H(2,3,4)=H(2,3,5)=H(2,3,6)=H(2,3,7)=ZM
      DO 12 N=1,7
      DO 12 M=1,3
   12 CW(M,N)=(H(2,M,N)-H(1,M,N))/ND(M,N)
      NPRNT=-1
      PR=0.
      FDN=NMC/(CW(1,1)*CW(2,1)*CW(3,1))
C FDN IS THE UNDISTURBED FREESTREAM NUMBER DENSITY (BASED ON FACTORED NUMBERS)
      CXS=1./(SQRT(2.)*FMP*FDN)
C CXS IS THE COLLISION CROSS SECTION (HARD SPHERE ONLY)
C SEE EQ.(8.17),BIRD FOR PARAMETER CXS FOR INVERSE POWER LAW MOLECULES
      IF (KTM.EQ.1) CXS=2.57*SQRT(VMF)/(FMP*FDN)
      SN=S*DCX
      A=FDN*ZM*(YT-YB)*DTM*VMF/(2.*SPI)
      ENT(1)=A*SENT(SN)
```

```
      ENT(2)=A*SENT(-SN)
      FS1(1)=FSNA(SN)
      FS2(1)=FSNB(SN)
      FS1(2)=FSNA(-SN)
      FS2(2)=FSNB(-SN)
      SN=S*DCY
      A=FDN*ZM*(XR-XF)*DTM*VMF/(2.*SPI)
      ENT(5)=A*SENT(SN)
      ENT(4)=A*SENT(-SN)
      FS1(5)=FSNA(SN)
      FS2(5)=FSNB(SN)
      FS1(4)=FSNA(-SN)
      FS2(4)=FSNB(-SN)
      ENT(3)=FDN*(XR-XF)*(YT-YB)*DTM*VMF/(2.*SPI)
      REM(1)=REM(2)=REM(3)=REM(4)=REM(5)=0
C PARAMETERS FOR ENTERING MOLECULES HAVE NOW BEEN SET
      TIME=0.
      DO 13 N=1,2
      DO 13 M=1,2
      FCOL(N,M)=0.
      DO 13L=1,NCT
13    CTIM(N,M,L)=-100000.
C THE INITIAL CELL TIME WILL BE RESET TO A RANDOM FRACTION OF THE TIME
C            INCREMENT FOR THE INITIAL COLLISION
      VMR=VMF*SQRT(SFT)
      VMP(1,2)=VMP(2,1)=VF+VMF+VMR
      VMP(2,2)=3.*VMF
      VMP(1,1)=VF+2.*VMR
C THE MOST LIKELY COLLISION RELATIVE VELOCITIES WILL BE INCREASED AS NECESSARY
C
C
      OWF=1.
C OWF IS THE OVERALL WEIGHTING FACTOR AND IS INCREASED ONLY WHEN A MOLECULE IS
C     DISCARDED TO KEEP THE TOTAL NUMBER OF MOLECULES WITHIN MNM  (TYPE NE.1)
      FNM=0.
      NM=0
C AT ZERO TIME THE FLOW IS A VACUUM
      DO 24 I=1,7
      A=CW(1,I)*CW(2,I)*CW(3,I)
      WF(I)=A/(CW(1,1)*CW(2,1)*CW(3,1))
      CVL(I)=A
      NCX=ND(1,I)
      NCY=ND(2,I)
      NCZ=ND(3,I)
```

```
      DO 24 N=1,NCX
      DO 24 M=1,NCY
      DO 24 L=1,NCZ
      J=(L-1)*(NCX*NCY)+(M-1)*NCX+N+NC(I)
      C(1,J)=H(1,1,I)+(N-0.5)*CW(1,I)
      C(2,J)=H(1,2,I)+(M-0.5)*CW(2,I)
      C(3,J)=H(1,3,I)+(L-0.5)*CW(3,I)
      C(4,J)=CVL(I)
      IC(3,J)=IC(4,J)=0
24    IC(5,J)=I
      WFM1=AMIN1(WF(2),WF(4),WF(5),WF(6),WF(7))
      WFM2=AMIN1(WF(3),WF(4),WF(5),WF(6),WF(7))
      WFM3=AMIN1(WF(4),WF(5),WF(6),WF(7))
C NOW SUBTRACT VEHICLE VOLUME FROM APPROPRIATE CELL VOLUMES
      DO 34 N=1,160
      X=(N-0.5)*0.2
      MMC(1)=(X-H(1,1,1))/CW(1,1)+0.99999
      IF (MMC(1).EQ.0) MMC(1)=1
      DO 34 L=1,2
      FML=1.
      IF (L.EQ.2) FML=-1.
      DO 34 M=1,32
      Z=(M-0.5)*0.2
      IF (M.GT.15) Z=Z+(M-15.5)*0.3
      IF ((M.GT.15).AND.(Z.GT.14.75*(X-16.75))) GO TO 34
      DZ=0.2
      IF (M.GT.15) DZ=0.5
      MMC(3)=(Z-H(1,3,1))/ CW(3,1)+0.99999
      IF (MMC(3).EQ.0) MMC(3)=1
C THE Y COORDINATES OF THE UPPER (L=1) AND LOWER (L=2) SURFACES ARE CALCULATED
C  BY SUCCESSIVE APPLICATIONS OF THE SUBROUTINE VIM LOOKING IN THE NEGATIVE AND
C  POSITIVE DIRECTIONS RESPECTIVELY
      CALL QIN(Q)
      IF (L.EQ.1) CALL VIM(X,7.,Z,0.,-10.,0.,XC,Y,ZC,U,V,E,AL,AM,AN,1.,Q
     1,K,X,-3.,Z,-1.)
      IF (L.EQ.2) CALL VIM(X,-3.,Z,0.,10.,0.,XC,Y,ZC,U,V,E,AL,AM,AN,1.,Q
     1,K,X,7.,Z,-1.)
      IF (L.EQ.2) GO TO 202
      IF (QIN.LT.0.) GO TO 202
      IF (X.GT.8..AND.X.LT.27..AND.Z.LT.2.598) Y=2.
C VIM IS CALLED WITH DOORS SHUT AND PRECEDING STATEMENT ADJUSRS VOLUMES
202   IF (K.LT.0) GO TO 34
33    MMC(2)=0
35    MMC(2)=MMC(2)+1
```

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      J=(MMC(3)-1)*ND(1,1)*ND(2,1)+(MMC(2)-1)*ND(1,1)+MMC(1)
      IF (Y.LT.(CW(2,1)*FLOAT(MMC(2))+YT)) GOTO 36
      C(4,J)=C(4,J)-0.2*DZ*CW(2,1)*FML
      GO TO 35
36    C(4,J)=C(4,J)-0.2*DZ*(Y-YT-(FLOAT(MMC(2))-1.)*CW(2,1))*FML
34    CONTINUE
      DO 28 N=1,NCT
      IF (C(4,N).LT.0.00001) C(4,N)=0.00001
28    WRITE (6,29) N,IC(5,N),(C(M,N),M=1,4)
29    FORMAT(5H CELL,I5,6H BLOCK,I5,3H X=,F10.5,3H Y=,F10.5,3H Z=,F10.5,
     19H VOLUME =,F10.5)
C NOW SET AREAS OF SURFACE ELEMENTS
      W(6,1)=9.19
      W(6,2)=11.71
      W(6,3)=13.32
      W(6,4)=9.73
      W(6,5)=7.27
      W(6,6)=31.29
      W(6,7)=24.49
      W(6,8)=19.4
      W(6,9)=27.9
      W(6,10)=18.63
      W(6,11)=7.97
      W(6,12)=13.88
      W(6,13)=19.16
      W(6,14)=16.79
      W(6,15)=13.33
      W(6,16)=12.99
      W(6,17)=34.74
      W(6,18)=35.2
      W(6,19)=7.41
      W(6,20)=6.96
      W(6,21)=25.6
      W(6,22)=14.68
      W(6,23)=11.29
      W(6,24)=14.47
      W(6,25)=42.76
      W(6,26)=19.82
      W(6,27)=11.29
      W(6,28)=14.47
      W(6,29)=.96
      W(6,30)=18.41
      ATT=516.65
C ATT IS THE TOTAL SURFACE AREA
```

```
      IF (DIN.GT.0.) W(6,6)=3.48
      IF (DIN.GT.0.) W(6,9)=0.000001
      IF (DIN.GT.0.) W(6,12)=4.45
      IF (DIN.GT.0.) W(6,15)=11.63
      IF (DIN.GT.0.) W(6,16)=11.29
      IF (DIN.GT.0.) ATT=631.9
      W(6,31)=24.68
      W(6,32)=24.68
      W(6,33)=31.37
      W(6,34)=31.37
      W(6,35)=31.37
      W(6,36)=31.37
      W(6,37)=3.69
      W(6,38)=5.26
      IF (NCJ.EQ.0) GO TO 45
      DO 46 N=1,NCJ
      PJ(8,N)=PJ(8,N)*VF*FDN*DTM
      PJ(10,N)=SQRT(PJ(5,N)**2+PJ(6,N)**2)
46    PJ(9,N)=0.
45    OENT=ATT*OFD*DTM*FDN*VMF/(2.*SPI)
      OREM=0.
C OENT IS THE NUMBER OF OUTGASSED MOLECULES ENTERING THE FLOW IN TIME DTM
103   NPRNT=NPRNT+1
      IF (NPRNT.GT.NPS) GO TO 104
      PR=0.
C NOT YET STEADY FLOW TIME. SET SAMPLES TO ZERO
      DO 14 M=1,38
      DO 14 I=1,5
14    W(I,M)=0.
      DO 450 M=1,5
      DO 550 I=1,84
      UN(M,I)=0.
550   UU(M,I)=0.
      DO 450 L=1,480
450   DN(M,L)=0.
      DO 108  M=1,NCT
      DO 108  I=5,16
108   C(I,M)=0.
      IF (NPRNT.LT.NPS) GO TO 104
C THE TIME STEP IS ALTERED WHEN NPRNT CORRESPONDS TO THE STEADY FLOW TIME
      A=DTMS/DTM
      NIS=NIS*IFIX ((DTM*1.0001)/DTMS)
      DTM=DTMS
      DO 42  =1,5
```

```
42     ENT(M)=ENT(M)*A
       IF (NCJ.EQ.0) GO TO 43
       DO 44 M=1,NCJ
44     PJ(8,M)=PJ(8,M)*A
43     CONTINUE
       OENT=OENT*A
104    PR=PR+1.
C LOOPS OVER SAMPLING AND PRINTING INTERVALS
       DO 111 JJJ=1,NSP
       DO 112 III=1,NIS
       TIME=TIME+DTM
C
C MOLECULES MOVE
C
       IFT=-1
C A NEGATIVE IFT INDICATES THAT MOLECULES WERE ALREADY IN THE FLOW
C
       N=0
116    N=N+1
       IF (N.GT.NM) GO TO 117
       XI=P(1,N)
       YI=P(2,N)
       ZI=P(3,N)
       IF (IFT.LT.0) AT=DTM
C IFT IS POSITIVE FOR ENTERING MOLECULES
       IF (IFT.GT.0.OR.IP(1,N).LT.0) AT=DTM*RANF(0)
       IK=IP(2,N)
       IB=IC(5,IK)
C IB IS THE BLOCK IN WHICH THE MOLECULE INITIALLY LIES
       NSN=0
C NSN COUNTS THE NUMBER OF SURFACE INTERACTIONS FOR THIS MOVE OF MOLECULE N
90     DX=P(4,N)*AT
       DY=P(5,N)*AT
       DZ=P(6,N)*AT
       P(1,N)=XI+DX
       P(2,N)=YI+DY
       P(3,N)=ZI+DZ
       X=P(1,N)
       Y=P(2,N)
       Z=P(3,N)
       MT=IP(3,N)
       CALL QIN(Q)
       IF (DX.GT.0.) Q(1)=(H(2,1,IB)-XI)/DX
       IF (DX.LT.0.) Q(1)=(H(1,1,IB)-XI)/DX
```

```
      IF (DY.GT.0.) Q(2)=(H(2,2,IB)-YI)/DY
      IF (DY.LT.0.) Q(2)=(H(1,2,IB)-YI)/DY
      IF (DZ.GT.0.) Q(3)=(H(2,3,IB)-ZI)/DZ
      IF (DZ.LT.0.) Q(3)=(H(1,3,IB)-ZI)/DZ
      KC=1
      IF (Q(2).LT.Q(1)) KC=2
      IF (Q(3).LT.Q(1).AND.Q(3).LT.Q(2)) KC=3
      IF (IB.NE.1) GO TO 703
      IF (XI.LT.0..AND.X.LT.0.) GO TO 703
      IF (YI.LT.-2..AND.Y.LT.-2.) GO TO 703
C 703-NO POSSIBLE COLLISIONS
      CALL VIM(XI,YI,ZI,DX,DY,DZ,XC,YC,ZC,P(4,N),P(5,N),P(6,N),AL,AM,AN
     1,VMR,Q,M,X,Y,Z,DIN)
      IF (M.LT.0) GO TO 703
      S1=(XC-XI)/DX
      XI=XC-.0001*DX
      YI=YC-.0001*DY
      ZI=ZC-.0001*DZ
      W(MT,M)=W(MT,M)+1.
      NSB=NSB+1
      NSN=NSN+1
      IF (NSN.GT.12) WRITE (6,600) NSN,N,XC,YC,ZC,P(4,N),P(5,N),P(6,N),M
600   FORMAT (20H SURFACE INTERACTION,I4,9H MOLECULE,I6,9H POSITION,3F10
     1.5,9H VELOCITY,3F10.2,5H CODE,I5)
      IF (NSN.GT.20) W(MT,M)=W(MT,M)-20.
      IF (NSN.GT.20) NSB=NSB-20
      IF (NSN.GT.20) GO TO 120
C MOLECULE IS REMOVED AFTER DIAGNOSTIC OUTPUT IF EXCESSIVE SURFACE INTERACTIONS
C    OCCUR
      AT=(1.-S1)*AT
      IF (AT.LT..0000001) AT=.0000001
C AT IS THE TIME INTERVAL REMAINING
      IF (IP(3,N).EQ.1.OR.IP(3,N).EQ.3) IP(3,N)=2
      GO TO 90
703   IF (Q(KC).LT.1.) GO TO 705
C MOLECULE STAYS IN THE SAME BLOCK
      NBL=IB
      DO 76 M=1,3
      MMC(M)=(P(M,N)-H(1,M,NBL))/CW(M,NBL)+0.99999
      IF (MMC(M).LE.0) MMC(M)=1
      IF (MMC(M).GT.ND(M,NBL)) MMC(M)=ND(M,NBL)
76    CONTINUE
C CALCULATION OF NEW CELL NUMBER
      IP(2,N)=(MMC(3)-1)*ND(1,NBL)*ND(2,NBL)+(MMC(2)-1)*ND(1,NBL)+MMC(1)
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     1+NC(NBL)
      GO TO 116
705   S1=Q(KC)*1.00001
C THERE IS A COLLISION WITH THE BLOCK BOUNDARY
      X=XI+DX*S1
      Y=YI+DY*S1
      Z=ZI+DZ*S1
C THIS POINT IS JUST WITHIN THE NEW BLOCK
50    IF (Z.GT.ZM) GO TO 120
      IF (Y.LT.YB.OR.Y.GT.YT) GO TO 120
      IF (X.LT.XF.OR.X.GT.XR) GO TO 120
      IF (Z.LT.0.) P(6.N)=-P(6.N)
      IF (Z.LT.0.) Z=-Z
      P(1.N)=X
      P(2.N)=Y
      P(3.N)=Z
      NBL=1
      IF (Y.GT.YM) NBL=7
      IF (Y.LT.YM.AND.Y.GT.Y2 ) NBL=6
      IF (Y.LT.Y1  ) NBL=5
      IF (Y.GT.Y2 .OR.Y.LT.Y1) GO TO 75
      IF (Z.GT.Z2  ) NBL=4
      IF (Z.GT.Z2  ) GO TO 75
      IF (X.GT.X2  ) NBL=3
      IF (X.LT.X1  ) NBL=2
      IF (NBL.EQ.IB) GO TO 704
C ADJUSTMENT WILL NOW BE MADE FOR WEIGHTING FACTOR CHANGES
75    IF (IP(3.N).NE.1) GO TO 704
      FNM=FNM-WF(IB)+WF(NBL)
      A=WF(IB)/WF(NBL)
      LL=0
60    IF (A.LT.1.) GO TO 61
      LL=LL+1
      A=A-1.
      GO TO 60
61    B=RANF(0)
      IF (B.LT.A) LL=LL+1
      IF (LL.EQ.0) GO TO 63
      LL=LL-1
      IF (LL.EQ.0) GO TO 704
      DO 64 M=1.LL
      IF (NM.EQ.MNM) GO TO 64
C MOLECULE OVERFLOW SHOULD OCCUR ONLY DURING THE ENTRY OF NEW MOLECULES
      NM=NM+1
```

C.2

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      FNM=FNM+WF(NBL)
C A NEW TYPE 1 MOLECULE  IS NOW GENERATED AT THE SAME LOCATION
      DO 65 J=1,3
      IP(J,NM)=IP(J,N)
65    P(J,NM)=P(J,N)
      IP(2,NM)=NC(NBL)+1
C IP(2,NM) NEED ONLY INDICATE THE BLOCK
      GO TO (301,302,303,304,305,306,307),NBL
301   GO TO ( 64,311,312,316,313,314, 64),IB
302   GO TO (312, 64, 64,316,313,314, 64),IB
303   GO TO (311, 64, 64,316,313,314, 64),IB
304   GO TO (315,315,315, 64,313,314, 64),IB
305   GO TO (314,314,314,314, 64, 64, 64),IB
306   GO TO (313,313,313,313, 64, 64,314),IB
307   GO TO ( 64, 64, 64, 64, 64,313, 64),IB
311   SN=S*DCX
      CALL EVC(V,SN,FS1(1),FS2(1))
      P(4,NM)=V*VMF
317   CALL SETVC(P(5,NM),VFY,P(6,NM),0.,VMF)
      GO TO 640
312   SN=-S*DCX
      CALL EVC(V,SN,FS1(2),FS2(2))
      P(4,NM)=-V*VMF
      GO TO 317
313   SN=S*DCY
      CALL EVC(V,SN,FS1(5),FS2(5))
      P(5,NM)=V*VMF
318   CALL SETVC(P(4,NM),VFX,P(6,NM),0.,VMF)
      GO TO 640
314   SN=-S*DCY
      CALL EVC(V,SN,FS1(4),FS2(4))
      P(5,NM)=-V*VMF
      GO TO 318
315   P(6,NM)=SALR(VMF)
      CALL SETVC(P(4,NM),VFX,P(5,NM),VFY,VMF)
      GO TO 640
316   P(6,NM)=-SALR(VMF)
      CALL SETVC(P(4,NM),VFX,P(5,NM),VFY,VMF)
640   IP(1,NM)=-1
64    CONTINUE
C  NEGATIVE IP(1,N) INDICATES A DUPLICATED MOLECULE
704   XI=X
      YI=Y
      ZI=Z
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
      AT=AT*(1.-S1)
      IF (AT.LT..0000001) AT=.0000001
      IB=NBL
      GO TO 90
 63   FNM=FNM-WF(NBL)+WF(IB)
 120   IF (IP(3,N).EQ.1) FNM=FNM-WF(IB)
      IF (IP(3,N).NE.1) FNM=FNM-OWF
C REMOVAL OF MOLECULE N THROUGH ITS REPLACEMENT BY MOLECULE NM
      DO 67 J=1,6
 67   P(J,N)=P(J,NM)
      DO 68 J=1,3
 68   IP(J,N)=IP(J,NM)
      NM=NM-1
      N=N-1
      GO TO 116
 117  IF (IFT.GT.0) GO TO 132
C NEW MOLECULES ENTER (FRONT,REAR,SIDE,TOP AND BOTTOM FACES IN TURN)
      IFT=1
C MOLECULES ENTER X=XF BOUNDARY
      FEN=0.
 130  IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      P(1,NM)=XF+0.0000001
 190  P(2,NM)=RANF(0)*(YT-YB)+YB
      P(3,NM)=RANF(0)*ZM
      NBL=2
      IF (P(2,NM).GT.YM) NBL=7
      IF (P(2,NM).LT.YM.AND.P(2,NM).GT.Y2 ) NBL=6
      IF (P(2,NM).LT.Y1 ) NBL=5
      IF (P(2,NM).GT.Y2 .OR.P(2,NM).LT.Y1 ) GO TO 220
      IF (P(3,NM).GT.Z2 ) NBL=4
 220  A=WFM1/WF(NBL)
      B=RANF(0)
      IF (A.LT.B) GO TO 190
      FEN=FEN+WF(NBL)*OWF
      IF (FEN.LT.ENT(1)+REM(1)) GO TO 221
      FEN=FEN-WF(NBL)*OWF
      REM(1)=ENT(1)+REM(1)-FEN
      NM=NM-1
      GO TO 222
 221  FNM=FNM+WF(NBL)
      SN=S*DCX
      CALL EVC(V,SN,FS1(1),FS2(1))
      P(4,NM)=V*VMF
```

ORIGINAL PAGE IS OF POOR QUALITY

```
      CALL SETVC(P(5,NM),VFY,P(6,NM),0.,VMF)
      IP(1,NM)=NM
      IP(2,NM)=NC(NBL)+1
C IP(2,N) MUST INDICATE THE BLOCK ,ACTUAL CELL SET DURING SUBSEQUENT MOVE
      IP(3,NM)=1
      GO TO 130
222   FEN=0.
C  MOLECULES ENTER X=XR BOUNDARY
224   IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      P(1,NM)=XR-0.0000001
191   P(2,NM)=RANF(0)*(YT-YB)+YB
      P(3,NM)=RANF(0)*ZM
      NBL=3
      IF (P(2,NM).GT.YM) NBL=7
      IF (P(2,NM).LT.YM.AND.P(2,NM).GT.Y2 ) NBL=6
      IF (P(2,NM).LT.Y1  ) NBL=5
      IF (P(2,NM).GT.Y2 .OR.P(2,NM).LT.Y1  ) GO TO 225
      IF (P(3,NM).GT.Z2  ) NBL=4
225   A=WFM2/WF(NBL)
      B=RANF(0)
      IF (A.LT.B) GO TO 191
      FEN=FEN+WF(NBL)*OWF
      IF (FEN.LT.ENT(2)+REM(2)) GO TO 226
      FEN=FEN-WF(NBL)*OWF
      REM(2)=ENT(2)+REM(2)-FEN
      NM=NM-1
      GO TO 227
226   FNM=FNM+WF(NBL)
      SN=-S*DCX
      CALL EVC(V,SN,FS1(2),FS2(2))
      P(4,NM)=-V*VMF
      CALL SETVC(P(5,NM),VFY,P(6,NM),0.,VMF)
      IP(1,NM)=NM
      IP(2,NM)=NC(NBL)+1
      IP(3,NM)=1
      GO TO 224
227   FEN=0
C MOLECULES ENTER Y=YT BOUNDARY
229   IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      P(1,NM)=RANF(0)*(XR-XF)+XF
      P(2,NM)=YT-0.0000001
      P(3,NM)=RANF(0)*ZM
```

```
      FEN=FEN+WF(7)*OWF
      IF (FEN.LT.ENT(4)+REM(4)) GO TO 230
      FEN=FEN-WF(7)*OWF
      REM(4)=ENT(4)+REM(4)-FEN
      NM=NM-1
      GO TO 231
230   FNM=FNM+WF(7)
      SN=-S*DCY
      CALL EVC(V,SN,FS1(4),FS2(4))
      P(5,NM)=-V*VMF
      CALL SETVC(P(4,NM),VFX,P(6,NM),0.,VMF)
      IP(1,NM)=NM
      IP(2,NM)=NC(7)+1
      IP(3,NM)=1
      GO TO 229
231   FEN=0.
C MOLECULES ENTER THE Y=YB BOUNDARY
233   IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      P(1,NM)=RANF(0)*(XR-XF)+XF
      P(2,NM)=YB+0.0000001
      P(3,NM)=RANF(0)*ZM
      FEN=FEN+WF(5)*OWF
      IF (FEN.LT.ENT(5)+REM(5)) GO TO 234
      FEN=FEN-WF(5)*OWF
      REM(5)=ENT(5)+REM(5)-FEN
      NM=NM-1
      GO TO 235
234   FNM=FNM+WF(5)
      SN=S*DCY
      CALL EVC(V,SN,FS1(5),FS2(5))
      P(5,NM)=V*VMF
      CALL SETVC(P(4,NM),VFX,P(6,NM),0.,VMF)
      IP(1,NM)=NM
      IP(2,NM)=NC(5)+1
      IP(3,NM)=1
      GO TO 233
235   FEN=0.
C MOLECULES ENTER ACROSS Z=ZM BOUNDARY
237   IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      P(3,NM)=ZM-0.0000001
192   P(1,NM)=RANF(0)*(XR-XF)+XF
      P(2,NM)=RANF(0)*(YT-YB)+YB
```

```
      NBL=4
      IF (P(2,NM).GT.YM) NBL=7
      IF (P(2,NM).LT.YM .AND.P(2,NM).GT.Y2 ) NBL=6
      IF (P(2,NM).LT.Y1 ) NBL=5
      A=WFM3/WF(NBL)
      B=RANF(0)
      IF (A.LT.B) GO TO 192
      FEN=FEN+WF(NBL)*OWF
      IF (FEN.LT.ENT(3)+REM(3)) GO TO 238
      FEN=FEN-WF(NBL)*OWF
      REM(3)=ENT(3)+REM(3)-FEN
      NM=NM-1
      GO TO 272
238   FNM=FNM+WF(NBL)
      P(5,NM)=-SALR(VMF)
      CALL SETVC(P(4,NM),VFX,P(5,NM),VFY,VMF)
      IP(1,NM)=NM
      IP(2,NM)=NC(NBL)+1
      IP(3,NM)=1
      GO TO 237
C OUTGASSED MOLECULES ENTER
272   A=OWF*OENT+OREM
      K=A
      OREM=A-K
      IF (K.EQ.0) GO TO 286
      VO=VMR
      DO 273 L=1,K
      IF (NM.EQ.MNM) CALL CTNML (P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      B=RANF(0)
      IF (DIN.GT.0.) GO TO 330
      IF (B.LT..00965)   GO TO 275
      IF (B.LT..04539)   GO TO 276
      IF (B.LT..2422)    GO TO 279
      IF (B.LT..4869)    GO TO 280
      IF (B.LT..5843)    GO TO 281
      IF (B.LT..6818)    GO TO 282
      IF (B.LT..9319)    GO TO 283
      GO TO 284
C ABOVE NUMBERS ARE BASED ON THE SURFACE FRACTIONS IN THE VARIOUS CLASSES
330   IF (B.LT..00788) GO TO 275
      IF (B.LT..03705) GO TO 276
      IF (B.LT..1368)  GO TO 279
      IF (B.LT..3365)  GO TO 280
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      IF (B.LT..4161)  GO TO 281
      IF (B.LT..4956)  GO TO 282
      IF (B.LT..6532)  GO TO 283
      IF (B.LT..7088)  GO TO 284
      IF (B.LT..8864)  GO TO 331
      IF (B.LT..9858)  GO TO 332
      IF (B.LT..9917)  GO TO 333
      GO TO 334
C THE ABOVE NUMBERS REPRESENT THE FRACTION OF THE SURFACE AREA OBTAINED FROM
284   X=RANF(0)*11.+26.
C LOOKING IN THE NEGATIVE Z DIRECTION FOR X FROM 26 TO 37 AND Y FROM 4 TO 12
      Y=RANF(0)*8.+4.
      CALL QIN(Q)
      CALL VIM(X,Y,1.,0.,0.,-2.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,Y,-1.,-
     11.)
      IF (M.LT.0) GO TO 284
      IF (ABS(AN).LT.ABS(AL).OR.ABS(AN).LT.ABS(AM)) GO TO 284
      A=1./(ABS(AN)*SQ3)
      B=RANF(0)
      IF (A.LT.B) GO TO 284
      GO TO 285
283   X=RANF(0)*32.
C LOOKING IN THE NEGATIVE Z DIRECTION FOR X FROM 0 TO 32 AND Y FROM -2 TO 5
      Y=RANF(0)*7.-2.
      IF (DIN.GT.0..AND.Y.GT.2..AND.X.GT.8..AND.X.LT.27.) GO TO 283
      CALL QIN(Q)
      CALL VIM(X,Y,12.,0.,0.,-12.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,Y,0.,
     1-1.)
      IF (M.LT.0) GO TO 283
      IF (ABS(AN).LT.ABS(AL).OR.ABS(AN).LT.ABS(AM)) GO TO 283
      A=1./(ABS(AN)*SQ3)
      B=RANF(0)
      IF (A.LT.B) GO TO 283
      GO TO 285
282   X=13.*RANF(0)+19.
C LOOKING IN THE POSITIVE Y DIRECTION FOR X FROM 19 TO 32 AND Z FROM 5 TO 12
      Z=7.*RANF(0)+5.
      CALL QIN(Q)
      CALL VIM(X,-2.,Z,0.,2.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,0.,Z,-1
     1.)
      IF (M.LT.0) GO TO 282
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 282
      A=1./(ABS(AM)*SQ3)
      B=RANF(0)
```

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      IF (A.LT.B) GO TO 282
      GO TO 285
  281 X=13.*RANF(0)+19.
C LOOKING IN THE NEGATIVE Y DIRECTION FOR X FROM 19 TO 32 AND Z FROM 5 TO 12
      Z=7.*RANF(0)+5.
      CALL QIN(Q)
      CALL VIM(X,0.,Z,0.,-2.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,-2.,Z,-
     11.)
      IF (M.LT.0) GO TO 281
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 281
      A=1./(ABS(AM)*SQ3)
      B=RANF(0)
      IF (A.LT.B) GO TO 281
      GO TO 285
  280 X=32.*RANF(0)
C LOOKING IN THE POSITIVE Y DIRECTION FOR X FROM 0 TO 32 AND Z FROM 0 TO 5
      Z=5.*RANF(0)
      CALL QIN(Q)
      CALL VIM(X,-2.,Z,0.,9.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,7.,Z,-1
     1.)
      IF (M.LT.0) GO TO 280
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 280
      A=1./(ABS(AM)*SQ3)
      B=RANF(0)
      IF (A.LT.B) GO TO 280
      GO TO 285
  279 X=32.*RANF(0)
C LOOKING IN THE NEGATIVE Y DIRECTION FOR X FROM 0 TO 32 AND Z FROM 0 TO 5
      Z=5.*RANF(0)
      IF (DIN.GT.0..AND.Y.GT.2..AND.X.GT.8..AND.X.LT.27.) GO TO 280
      CALL QIN(Q)
      CALL VIM(X,8.,Z,0.,-10.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,X,-2.,Z,
     1-1.)
      IF (M.LT.0) GO TO 279
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 279
      A=1./(ABS(AM)*SQ3)
      B=RANF(0)
      IF (A.LT.B) GO TO 279
      GO TO 285
  276 Y=7.*RANF(0)-2.
C LOOKING IN THE NEGATIVE X DIRECTION FOR Y FROM -2 TO 5 AND Z FROM 0 TO 4
      Z=4.*RANF(0)
      CALL QIN(Q)
      CALL VIM(35.,Y,Z,-35.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,0.,Y,Z,
```

```
     1-1.)
      IF (M.LT.0) GO TO 276
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 276
      A=1./(ABS(AL)*SO3)
      B=RANF(0)
      IF (A.LT.B) GO TO 276
      GO TO 285
275   Y=7.*RANF(0)-2.
C LOOKING IN THE POSITIVE X DIRECTION FOR Y FROM -2 TO 5 AND Z FROM 0 TO 4
      Z=4.*RANF(0)
      CALL QIN(Q)
      CALL VIM(0.,Y,Z,32.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,VO,Q,M,32.,Y,Z,-
     11.)
      IF (M.LT.0) GO TO 275
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 275
      A=1./(ABS(AL)*SO3)
      B=RANF(0)
      IF (A.LT.B) GO TO 275
      GO TO 285
331   YC=2.
C OUTGASSING FROM BASE AND INSIDE OF DOORS OF PAYLOAD BAY
      XC=8.+19.*RANF(0)
      ZC=5.9*RANF(0)
      V=SALR(VMR)
      A=2.*PI*RANF(0)
      B=SALR(VMR)
      U=B*SIN(A)
      E=B*COS(A)
      GO TO 285
332   YC=2.
C OUTGASSING FROM OUTSIDE OF PAYLOAD BAY DOORS
      XC=8.+19.*RANF(0)
      ZC=2.598+3.302*RANF(0)
      V=-SALR(VMR)
      A=2.*PI*RANF(0)
      B=SALR(VMR)
      U=B*SIN(A)
      E=B*COS(A)
      GO TO 285
333   YC=2.+2.*RANF(0)
      ZC=RANF(0)*2.598
      A=9.*YC*YC+16.*ZC*ZC-144.
      IF (A.GT.0.) GO TO 333
      XC=8.
```

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82

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      U=SALR(VMR)
      A=2.*PI*RANF(0)
      B=SALR(VMR)
      V=B*SIN(A)
      E=B*COS(A)
      GO TO 285
334   YC=2.+2.*RANF(0)
C OUTGASSING FROM REAR BULKHEAD OF PAYLOAD BAY
      ZC=RANF(0)*2.598
      A=SQRT(144.-16.*ZC*ZC)/3.
      B=(YC-3.)**2+(ZC-2.)**2
      IF (YC.GT.A.AND.B.GT.0.9975) GO TO 334
      XC=27.
      U=-SALR(VMR)
      A=2.*PI*RANF(0)
      B=SALR(VMR)
      V=B*SIN(A)
      E=B*COS(A)
285   P(1,NM)=XC+0.0000001*U
      P(2,NM)=YC+0.0000001*V
      P(3,NM)=ZC+0.0000001*E
      P(4,NM)=U
      P(5,NM)=V
      P(6,NM)=E
      IP(1,NM)=NM
      IP(2,NM)=1
      IP(3,NM)=4
273   FNM=FNM+OWF
C THE JET EFFLUX MOLECULES NOW ENTER
286   IF (NCJ.EQ.0) GO TO 185
      DO 287 J=1,NCJ
      A=PJ(8,J)+PJ(9,J)
      L=A
      PJ(9,J)=A-L
      IF (L.EQ.0) GO TO 287
      DO 288 K=1,L
      IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      DO 289 I=1,3
289   P(I,NM)=PJ(I,J)
290   D=PI*RANF(0)
      A=EXP(-10.*D/PI)
      B=RANF(0)
      IF (B.GT.A) GO TO 290
```

```
C THE ANGLE D BETWEEN THE MOLECULAR VELOCITY AND THE JET DIRECTION HAS BEEN
C  SELECTED FROM AN ARBITRARILY ASSUMED DISTRIBUTION
      VN=PJ(7,J)*COS(D)
      A=2.*PI*RANF(0)
      UP=PJ(7,J)*SIN(D)*COS(A)
      UQ=PJ(7,J)*SIN(D)*SIN(A)
      P(4,NM)=VN*PJ(4,J)-UQ*PJ(10,J)
      P(5,NM)=VN*PJ(5,J)+(UP*PJ(6,J)+UQ*PJ(4,J)*PJ(5,J))/PJ(10,J)
      P(6,NM)=VN*PJ(6,J)-(UP*PJ(5,J)-UQ*PJ(4,J)*PJ(6,J))/PJ(10,J)
      IP(1,NM)=NM
      IP(2,NM)=1
C THE JET IS ASSUMED TO BE IN BLOCK 1
      IP(3,NM)=5
  288 FNM=FNM+OWF
  287 CONTINUE
  185 N=N-1
      GO TO 116
  132 DO 151 N=1,NCT
C RESET INDEXING WITH NE.1 MOLECULES AHEAD OF EQ.1 MOLECULES IN EACH CELL
      IC(3,N)=0
  151 IC(4,N)=0
      DO 152 N=1,NM
      M=IP(2,N)
      IF (IP(3,N).NE.1) IC(3,M)=IC(3,M)+1
      IF (IP(3,N).EQ.1) IC(4,M)=IC(4,M)+1
  152 CONTINUE
      M=0
      DO 153 N=1,NCT
      IC(1,N)=M
      M=M+IC(3,N)
      IC(2,N)=M
      M=M+IC(4,N)
      IC(3,N)=0
  153 IC(4,N)=0
      DO 154 N=1,NM
      M=IP(2,N)
      IF (IP(3,N).NE.1) IC(3,M)=IC(3,M)+1
      IF (IP(3,N).EQ.1) IC(4,M)=IC(4,M)+1
      IF (IP(3,N).NE.1) K=IC(1,M)+IC(3,M)
      IF (IP(3,N).EQ.1) K=IC(2,M)+IC(4,M)
  154 IP(1,K)=N
C  CALCULATE COLLISIONS
      DO 155 N=1,NCT
      DO 155 LL=1,2
```

```
      DO 155 NN=1,2
C LL,NN=1 CORRESPONDS WITH TYPE NE.1
C LL,NN=2 CORRESPONDS WITH TYPE EQ.1
271   IF (CTIM(LL,NN,N).GT.TIME) GO TO 155
      NC3=6*(IC(LL+2,N)+IC(NN+2,N))
      IF (LL.EQ.NN.AND.IC(LL+2,N).GE.2) GO TO 156
      IF (IC(LL+2,N).GE.1.AND.IC(NN+2,N).GE.1.AND.LL.NE.NN) GO TO 156
24.   CTIM(LL,NN,N)=CTIM(LL,NN,N)+DTM
      GO TO 155
156   NCC=0
241   NCC=NCC+1
      IF (NCC.GT.NC3) GO TO 240
      K=RANF(0)*IC(LL+2,N)+IC(LL,N)+0.999999
      IF (K.EQ.IC(LL,N)) K=K+1
      L=IP(1,K)
      IF (LL.EQ.2.AND.IP(3,L).NE.1) GO TO 241
157   K=RANF(0)*IC(NN+2,N)+IC(NN,N)+0.999999
      IF (K.EQ.IC(NN,N)) K=K+1
      M=IP(1,K)
      IF (NN.EQ.2.AND.IP(3,M).NE.1) GO TO 241
C  L IS TYPE LL
C  M IS TYPE NN
      IF (M.EQ.L) GO TO 157
      DO 158 K=1,3
158   VRC(K)=P(K+3,L)-P(K+3,M)
      VR=SQRT(VRC(1)*VRC(1)+VRC(2)*VRC(2)+VRC(3)*VRC(3))
      IF(KTM.EQ.0) VE=VR
      IF (KTM.EQ.1) VE=SQRT(VR)
      IF (VE.GT.VMP(LL,NN)) VMP(LL,NN)=VE
      A=VE/VMP(LL,NN)
      B=RANF(0)
      IF (A.LT.B) GO TO 241
      LLP=NNP=1
C LLP AND NNP ARE THE PROBABILITIES OF COLLISION BEING COUNTED
      NBL=IC(5,N)
      IF (LL.EQ.NN) GO TO 243
      B=RANF(0)
      A=1. /WF(NBL)
      IF (A.GT.B) GO TO 243
      IF (LL.EQ.2) LLP=0
      IF (NN.EQ.2) NNP=0
243   WFL=WFN=OWF
      IF (LL.EQ.2) WFL=WF(NBL)*OWF
      IF (NN.EQ.2) WFN=WF(NBL)*OWF
```

```
      DTC=(C(4,N)/(CXS*VE     ))*(FLOAT(LLP)/(FLOAT(IC(LL+2,N)*IC(NN+2,N)
     1)*WFN)+FLOAT(NNP)/(FLOAT(IC(NN+2,N)*IC(LL+2,N))*WFL))
      IF (CTIM(LL,NN,N).GT.0.) GO TO 270
      CTIM(LL,NN,N)=RANF(0)*DTC
      GO TO 271
270   CTIM(LL,NN,N)=CTIM(LL,NN,N)+DTC
      FCOL(LL,NN)=FCOL(LL,NN)+0.5*(LLP*WFL+NNP*WFN)
      IF (KTM.EQ.0) GO TO 291
      WA=SQRT(RANF(0))*1.5
      EPS=2.*PI*RANF(0)
      A=WA*(1.26233+WA*(1.84145+WA*(-8.87881+WA*(20.3313+WA*(-23.81[illegible]+WA
     1*(14.5046+WA*(-4.42027+WA*0.535193)))))))
      CHI=PI-2.*A
      CC=COS(CHI)
      SC=SIN(CHI)
      CE=COS(EPS)
      SE=SIN(EPS)
      DU=VRC(1)
      DV=VRC(2)
      DW=VRC(3)
      A=SQRT(DV*DV+DW*DW)
      VRC(1)=DU*CC+SC*SE*A
      VRC(2)=DV*CC+SC*(VR*DW*CE-DU*DV*SE)/A
      VRC(3)=DW*CC-SC*(VR*DV*CE+DU*DW*SE)/A
      GO TO 292
291   B=1.-2.*RANF(0)
      A=SQRT(1.-B*B)
      VRC(1)=B*VR
      B=2.*PI*RANF(0)
      VRC(2)=A*COS(B)*VR
      VRC(3)=A*SIN(B)*VR
292   DO 159 K=4,6
      VCCM=0.5*(P(K,L)+P(K,M))
      IF (LLP.EQ.1) P(K,L)=VCCM+VRC(K-3)*0.5
      IF (NNP.EQ.1) P(K,M)=VCCM-VRC(K-3)*0.5
      IF (LLP.EQ.0) VRC(K-3)=VCCM+VRC(K-3)*0.5
      IF (NNP.EQ.0) VRC(K-3)=VCCM-VRC(K-3)*0.5
C ONLY ONE OF LLP AND NNP CAN BE 0.VRC NOW CONTAINS THE MODIFIED VELOCITY [illegible]
159   CONTINUE
C THE FOLLOWING ROUTINE CHANGES A TYPE 1 MOECULE TO TYPE 3, ON COLLISION WITH
C OTER THAN TYPE 1. FURTHERMORE,IT IS DUPLICATED AS TYPE 0 IF THE RELATIVE
C WEIGHTING FACTORS ARE SUCH THAT ITS VELOCITY COMPONENTS ARE NOT MO[illegible]IED
      IF (LL.EQ.NN) GO TO 244
      IF (LL.NE.2.OR.NN.NE.1) GO TO 244
```

```
      IF (LL.EQ.1) GO TO 245
      IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      FNM=FNM+WF(NBL)
      DO 246 K=1,6
246   P(K,NM)=P(K,L)
      DO 247 K=1,3
247   IP(K,NM)=IP(K,L)
      DO 248 K=4,6
248   P(K,L)=VRC(K-3)
245   IP(3,L)=3
      FNM=FNM-WF(NBL)+OWF
244   IF (NN.NE.2.OR.LL.NE.1) GO TO 249
      IF (NNP.EQ.1) GO TO 250
      IF (NM.EQ.MNM) CALL CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
      NM=NM+1
      FNM=FNM+WF(NBL)
      DO 251 K=1,6
251   P(K,NM)=P(K,M)
      DO 252 K=1,3
252   IP(K,NM)=IP(K,M)
      DO 253 K=4,6
253   P(K,M)=VRC(K-3)
250   IP(3,M)=3
      FNM=FNM-WF(NBL)+OWF
249   IF (TIM(LL,NN,N).LT.TIME) GO TO 156
155   CONTINUE
112   CONTINUE
C NOW SAMPLE FLOW FIELD
      DO 164 N=1,NCT
      L=IC(3,N)+IC(4,N)
      IF (L.EQ.0) GO TO 164
      DO 165 J=1,L
      C(16,N)=C(16,N)+1.
      K=IC(1,N)+J
      M=IP(1,K)
      I=IC(5,N)
      WFM=WF(I)*OWF
      IF (IP(3,M).NE.1) WFM=OWF
      I=IP(3,M)+10
      C(I,N)=C(I,N)+WFM
      DO 165 I=1,3
      C(I+4,N)=C(I+4,N)+P(I+3,M)*WFM
165   C(I+7,N)=C(I+7,N)+P(I+3,M)*P(I+3,M)*WFM
```

```
  164   CONTINUE
        DO 451 N=1,NM
        M=(P(1,N)+40.)/10.+0.99999
        IF (M.LE.0 .OR.M.GT.12 ) GO TO 451
        L=(P(2,N)+20.)/10.+0.99999
        IF (L.LE.0 .OR.L.GT.10) GO TO 451
        K=P(3,N)/10.+0.99999
        IF (K.EQ.0) K=1
        J=120*(K-1)+12*(L-1)+M
        JU=120*(K-1)+12*(10-L)+M
C J AND JU ARE THE OVERALL DENSITY AND THE UPSTREAM FLUX SAMPLING CELLS, RESP.
        M=IP(3,N)
        L=IP(2,N)
        K=IC(5,L)
        WFM=OWF
        IF (M.EQ.1) WFM=WF(K)*OWF
        DN(M,J)=DN(M,J)+WFM
        IF (JU.GT.84) GO TO 451
        V=P(4,N)*DCX+P(5,N)*DCY
        IF (V.GE.0.) GO TO 451
        UN(M,JU)=UN(M,JU)+WFM
        UU(M,JU)=UU(M,JU)-WFM*V
  451   CONTINUE
  111   CONTINUE
C NOW PRINT RESULTS
        WRITE (6,452)
  452   FORMAT (37H1 FLOWFIELD OF ORBITING SPACE SHUTTLE//)
        G=ATAN2(DCY,DCX)*180./PI
        WRITE (6,453) VF,G
  453   FORMAT (21H ATOMIC OXYGEN STREAM,F12.5,6H M/SEC,13H AT INCIDENCE,F
       19.5,8H DEGREES)
        WRITE (6,454) FMP,S
  454   FORMAT (28H FREESTREAM MEAN FREE PATH =,F7.1,20H METRES AND SPEED
       1RATIO=,F9.4)
        WRITE (6,26) OFD
        WRITE (6,465) NCJ
  465   FORMAT (1H ,I5,26H CONTROL JETS IN OPERATION)
        IF (DIN.LT.0.) WRITE (6,200)
        IF (DIN.GT.0.) WRITE (6,201)
        WRITE (6,455) SFT
  455   FORMAT (50H THE SURFACE TEMPERATURE IS ASSUMED TO BE EQUAL TO,F9.5
       1,34H TIMES THE ATMOSPHERIC TEMPERATURE//)
        WRITE (6,456)
  456   FORMAT (88H THE FIVE NUMBERS AT EACH POINT REPRESENT DENSITIES NOR
```

```
     1MALIZED TO THE FREESTREAM DENSITY/)
      WRITE (6,458)
458   FORMAT (1H ,30X,44H DENSITY OF UNDISTURBED FREESTREAM MOLECULES)
      WRITE (6,459)
459   FORMAT (1H ,30X,46H DENSITY OF MOLECULES THAT HAVE STRUCK SURFACE)
      WRITE (6,460)
460   FORMAT (1H ,30X,41H DENSITY OF INDIRECTLW AFFECTED MOLECULES)
      WRITE (6,461)
461   FORMAT (1H ,30X,31H DENSITY OF OUTGASSED MOLECULES)
      WRITE (6,485)
485   FORMAT (1H ,30X,25H DENSITY OF JET MOLECULES///)
      B=PR*FLOAT(NSP)*1000.*FDN
      DRA=1./B
      DRB=1./(1000.*FDN)
      WRITE (6,558) DRA,DRB
558   FORMAT (29H MINIMUM DENSITY RESOLUTION =,F10.7,25H BASED ON ONE MO
     1LECULE OR,F10.7,44H BASED ON ONE MOLECULE PER SAMPLING INTERVAL)
      WRITE (6,559)
559   FORMAT (53H NOTE THAT ABOVE FIGURES ASSUME UNIT WEIGHTING FACTOR/)
      DO 468 M=1,480
      DO 468 L=1,5
468   DN(L,M)=DN(L,M)/B
      DO 462 N=1,4
      A=(FLOAT(N)-0.5)*10.
      WRITE (6,463) A
463   FORMAT (12H IN PLANE Z=,F7.1,43H METRES FROM THE VERTICAL PLANE OF
     1 SYMMETRY//)
      WRITE (6,464)
464   FORMAT (1H ,7X,115H X=-35      X=-25      X=-15      X=-5       X=5
     1     X=15       X=25       X=35       X=45       X=55       X=65       X=
     275)
      DO 469 M=1,7
      K=90.1-10.*FLOAT(M)
      WRITE (6,467) K,K
467   FORMAT (3H Y=,I3,118X,3H Y=,I3)
      DO 469 L=1,5
      I=120*N-12*M+1
      J=I+11
469   WRITE (6,470) (DN(L,K),K=I,J)
470   FORMAT (4H     ,12F10.6)
      K=10
      WRITE (6,471) K,K
471   FORMAT (3H Y=,I3,72X,3H --,43X,3H Y=,I3)
      I=120*N-95
```

```
      J=I+3
      II=J+5
      JJ=II+3
      WRITE (6,472) (DN(1,K),K=I,J),(DN(1,K),K=II,JJ)
472   FORMAT (4H     ,4F10.6,32X,5H /   /,3X,4F 10.6)
      WRITE (6,473) (DN(2,K),K=I,J),(DN(2,K),K=II,JJ)
473   FORMAT(4H     ,4F10.6,30X,6H /    /,4X,4F10.6)
      WRITE (6,474) (DN(3,K),K=I,J),(DN(3,K),K=II,JJ)
474   FORMAT(4H     ,4F10.6,28X,7H /     /,5X,4F10.6)
      WRITE (6,475) (DN(4,K),K=I,J),(DN(4,K),K=II,JJ)
475   FORMAT(4H     ,4F10.6,26X,8H / USA /,6X,4F10.6)
      WRITE (6,476) (DN(5,K),K=I,J),(DN(5,K),K=II,JJ)
476   FORMAT(4H     ,4F10.6,6X,28H --------------------        I,6X,4F10.6)
      K=0
      WRITE (6,477) K,K
.77   FORMAT (3H Y=,I3,41X,4H    /,25X,2H I,46X,3H Y=,I3)
      I=120*N-107
      J=I+3
      II=J+5
      JJ=II+3
      WRITE (6,478) (DN(1,K),K=I,J),(DN(1,K),K=II,JJ)
478   FORMAT (4H     ,4F10.6,6H   --**,25X,2H I,7X,4F10.6)
      WRITE (6,479) (DN(2,K),K=I,J),(DN(2,K),K=II,JJ)
479   FORMAT (4H     ,4F10.6,8H (   NASA,23X,2H I,7X,4F10.6)
      WRITE (6,480) (DN(3,K),K=I,J),(DN(3,K),K=II,JJ)
480   FORMAT (4H     ,4F10.6,35H  ---------------------------------,5X,4F
     110.6)
      WRITE (6,481) (DN(4,K),K=I,J),(DN(4,K),K=II,JJ)
481   FORMAT (4H     ,4F10.6,40X,4F10.6)
      WRITE (6,481) (DN(5,K),K=I,J),(DN(5,K),K=II,JJ)
      K=-10
      WRITE (6,467)K,K
      I=120*N-119
      J=I+11
      DO 482 L=1,5
482   WRITE (6,470) (DN(L,K),K=I,J)
      K=-20
      WRITE (6,467) K,K
462   WRITE (6,483)
483   FORMAT (1H ///)
      DO 484 M=1,480
      DO 484 L=1,5
484   DN(L,M)=DN(L,M)*B
      WRITE (6,551)
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
551   FORMAT  (82H DENSITY OF UPSTREAM MOVING MOLECULES, NORMALIZED TO T
     1HE TOTAL UNDISTURBED DENSITY/)
      WRITE (6,552)
552   FORMAT  (81H VALUES ARE AGAIN GIVEN FOR THE FIVE CLASSES OF MOLECU
     1LE IN TURN AT EACH LOCATION//)
      B=PR*FLOAT(NSP)*1000.*FDN
      DRA=1./B
      DRB=1./(1000.*FDN)
      WRITE (6,558) DRA,DRB
      WRITE (6,559)
      DO 553 M=1,84
      DO 553 L=1,5
      IF (UN(L,M).LT..5) GO TO 553
      UU(L,M)=UU(L,M)     /(UN(L,M)*VMF)
553   UN(L,M)=UN(L,M)/B
      A=5.
      WRITE(6,463) A
      WRITE(6,464)
      DO 554 M=1,7
      K=90.1-10.*FLOAT(M)
      WRITE (6,467)K,K
      DO 554 L=1,5
      I=12*(M-1)+1
      J=I+11
554   WRITE (6,470) (UN(L,K),K=I,J)
      K=10
      WRITE (6,467)K,K
      WRITE (6,483)
      WRITE (6,555)
555   FORMAT(110H MEAN UPSTREAM VELOCITY COMPONENT OF UPSTREAM MOVING MO
     1LECULES, NORMALIZED TO THE UNDISTURBED MOST PROB. SPEED/)
      WRITE (6,552)
      WRITE(6,463) A
      WRITE(6,464)
      DO 556 M=1,7
      K=90.1-10.*FLOAT(M)
      WRITE (6,467)K,K
      DO 556 L=1,5
      I=12*(M-1)+1
      J=I+11
556   WRITE (6,470) (UU(L,K),K=I,J)
      K=10
      WRITE (6,467)K,K
      WRITE (6,483)
```

```
      DO 557 M=1,84
      DO 557 L=1,5
      UN(L,M)=UN(L,M)*B
557   UU(L,M)=UU(L,M)*(UN(L,M)*VMF)
      WRITE (6,483)
      WRITE (6,350)
350   FORMAT (26H MOLECULAR FLUX TO SURFACE/)
      WRITE (6,457)
457   FORMAT (1H+,30X,41H NORMALISED BY STATIONARY FREESTREAM FLUX)
C FLUX NORMALISED BY FLUX IN STATIONARY FREESTREAM GAS
      WRITE (6,351)
351   FORMAT (17H LOCATION ON BODY,31X,67H SAMPLE TOTAL FLUX    TYPE 1
     1 TYPE 2     TYPE 3     TYPE 4     TYPE 5/)
      A=PR*DTM*NIS*NSP*FDN*VMF/(2.*SPI)
      DO 352 N=1,38
      IF (DIN.LT.0..AND.N.GT.30.) GO TO 352
      IF (N.EQ.1 ) WRITE (6,361)
      IF (N.EQ.2 ) WRITE (6,362)
      IF (N.EQ.3 ) WRITE (6,363)
      IF (N.EQ.4 ) WRITE (6,364)
      IF (N.EQ.5 ) WRITE (6,365)
      IF (N.EQ.6 ) WRITE (6,366)
      IF (N.EQ.7 ) WRITE (6,367)
      IF (N.EQ.8 ) WRITE (6,368)
      IF (N.EQ.9 ) WRITE (6,369)
      IF (N.EQ.10) WRITE (6,370)
      IF (N.EQ.11) WRITE (6,371)
      IF (N.EQ.12) WRITE (6,372)
      IF (N.EQ.13) WRITE (6,373)
      IF (N.EQ.14) WRITE (6,374)
      IF (N.EQ.15) WRITE (6,375)
      IF (N.EQ.16) WRITE (6,376)
      IF (N.EQ.17) WRITE (6,377)
      IF (N.EQ.18) WRITE (6,378)
      IF (N.EQ.19) WRITE (6,379)
      IF (N.EQ.20) WRITE (6,380)
      IF (N.EQ.21) WRITE (6,381)
      IF (N.EQ.22) WRITE (6,382)
      IF (N.EQ.23) WRITE (6,383)
      IF (N.EQ.24) WRITE (6,384)
      IF (N.EQ.25) WRITE (6,385)
      IF (N.EQ.26) WRITE (6,386)
      IF (N.EQ.27) WRITE (6,387)
      IF (N.EQ.28) WRITE (6,388)
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      IF (N.EQ.29) WRITE (6,389)
      IF (N.EQ.30) WRITE (6,390)
      IF (N.EQ.31) WRITE (6,391)
      IF (N.EQ.32) WRITE (6,392)
      IF (N.EQ.33) WRITE (6,393)
      IF (N.EQ.34) WRITE (6,394)
      IF (N.EQ.35) WRITE (6,395)
      IF (N.EQ.36) WRITE (6,396)
      IF (N.EQ.37) WRITE (6,397)
      IF (N.EQ.38) WRITE (6,398)
      SA(1)=0
      L=0
      DO 353 M=1,5
      L=L+W(M,N)
      SA(M+1)=W(M,N)/(W(6,N)*A)
353   SA(1)=SA(1)+SA(M+1)
      WRITE (6,354) L,(SA(M),M=1,6)
352   CONTINUE
354   FORMAT (1H+,45X,I6,2F10.5,4F11.7)
361   FORMAT(45H NOSE (X=0 TO 7) TOP                          )
362   FORMAT(45H NOSE UPPER SIDE                              )
363   FORMAT(45H NOSE LOWER SIDE                              )
364   FORMAT(45H NOSE BOTTOM                                  )
365   FORMAT(45H WINDSHIELD                                   )
366   FORMAT(45H FUSELAGE FORWARD (X=7 TO 16) UPPER (Y GT 2) )
367   FORMAT(45H FUSELAGE FORWARD SIDE                        )
368   FORMAT(45H FUSELAGE FORWARD LOWER (Y LT -1)             )
369   FORMAT(45H FUSELAGE CENTER  (X=16 TO 24) UPPER          )
370   FORMAT(45H FUSELAGE CENTER  SIDE                        )
371   FORMAT(45H FUSELAGE CENTER  LOWER                       )
372   FORMAT(45H FUSELAGE REAR    (X=24 TO 32) UPPER          )
373   FORMAT(45H FUSELAGE REAR    SIDE                        )
374   FORMAT(45H FUSELAGE REAR    LOWER                       )
375   FORMAT(45H OMS POD UPPER                                )
376   FORMAT(45H OMS POD LOWER                                )
377   FORMAT(45H VERTICAL TAIL                                )
378   FORMAT(45H GLOVE FAIRING                                )
379   FORMAT(45H WING INNER (Z LT 7) LEADING EDGE (.10 CHORD))
380   FORMAT(45H WING OUTER LEADING EDGE                      )
381   FORMAT(45H WING UPPER INNER FORWARD (X LT 27.5)         )
382   FORMAT(45H WING UPPER INNER REAR                        )
383   FORMAT(45H WING UPPER OUTER FORWARD                     )
384   FORMAT(45H WING UPPER OUTER REAR                        )
385   FORMAT(45H WING LOWER INNER FORWARD                     )
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386    FORMAT(45H WING LOWER INNER REAR                         )
387    FORMAT(45H WING LOWER OUTER FORWARD                      )
388    FORMAT(45H WING LOWER OUTER REAR                         )
389    FORMAT(45H WINGTIP                                       )
390    FORMAT(45H BASE                                          )
391    FORMAT(45H PAYLOAD BAY BASE FORWARD                      )
392    FORMAT(45H PAYLOAD BAY BASE REAR                         )
393    FORMAT(45H PAYLOAD BAY DOORS INSIDE FORWARD              )
394    FORMAT(45H PAYLOAD BAY DOORS INSIDE REAR                 )
395    FORMAT(45H PAYLOAD BAY DOORS OUTSIDE FORWARD             )
396    FORMAT(45H PAYLOAD BAY DOORS OUTSIDE REAR                )
397    FORMAT(45H PAYLOAD BAY FORWARD BULKHEAD                  )
398    FORMAT(45H PAYLOAD BAY REAR BULKHEAD                     )
       WRITE (6,254) TIME
254    FORMAT (14H1FLOW TO TIME ,F10.5///)
       WRITE (6,255) NM,FNM
255    FORMAT (22H NUMBER OF MOLECULES =,I9,18H FACTORED NUMBER =,F9.2)
       WRITE (6,256) FCOL
256    FORMAT (21H FACTORED COLLISIONS ,4F10.2)
       WRITE (6,260) NSB
260    FORMAT (29H TOTAL SURFACE INTERACTIONS =,I9)
       WRITE (6,257)
257    FORMAT (126H CELL    X        Y        Z   SAMPLE DENSITY  TYPE 1  TY
      1PE 2   TYPE 3   TYPE 4   TYPE 5    U       V       W      TX      TY
      2   TZ /)
C DISTANCES IN METRES
C VELOCITIES NORMALISED TO FREESTREAM MOST PROBABLE MOLECULAR VELOCITY
C DENSITIES AND TEMPERATURES NORMALISED TO UNDISTURBED FREESTREAM VALUES
       DO 179 N=1,NCT
       IF (C(4,N).LT.0.000001) GO TO  179
       I=C(16,N)+0.5
       A=C(11,N)+C(12,N)+C(13,N)+C(14,N)+C(15,N)
       IF (A.LT.0.00001) GO TO 179
       B=PR*FLOAT(NSP)*C(4,N)*FDN
       SA(1)=A/B
       DO 258 M=1,5
258    SA(M+1)=C(M+10,N)/B
       DO 261 M=1,3
       SA(M+6)=C(M+4,N)/(A*VMF)
261    SA(M+9)=2.*(C(M+7,N)/A-(SA(M+6)*VMF)**2)/(VMF*VMF)
       WRITE (6,259) N,C(1,N),C(2,N),C(3,N),I,(SA(M),M=1,12)
259    FORMAT (1H ,I4,3F8.3,I6,2F8.4,4F9.6,6F7.3)
179    CONTINUE
       IF (NPRNT.LT.NPT) GO TO 103
```

```
      STOP
      END
      FUNCTION SENT(A)
      B=ABS(A)
      IF (B.LT.4.) GO TO 1
      D=1.
      GO TO 2
    1 C=EXP(-B*B)
      T=1./(1.+0.3275911*B)
      D=1.-(0.254829592*T-0.284496736*T*T+1.421413741*T*T*T-1.453152027*
     1T*T*T*T+1.061405429*T*T*T*T*T)*C
    2 IF (A.LT.0.) D=-D
      SENT=EXP(-A*A)+1.77245385*A*(1.+D)
      RETURN
      END
      FUNCTION FSNA(A)
      FSNA=A+SQRT(A*A+2.)
      RETURN
      END
      FUNCTION FSNB(A)
      FSNB=0.5*(1.+A*(A-SQRT(A*A+2.)))
      RETURN
      END
      SUBROUTINE SETVC(VCA,SVA,VCB,SVB,VMP)
C GENERATES EQUILIBRIUM VELOCITY COMPONENTS VCA,VCB IN GAS WITH MOST PROBABLE
C  MOLECULAR SPEED VMP AND STREAM COMPONENTS SVA,SVB IN VCA,VCB DIRECTIONS
      A=6.2831853*RANF(0)
      B=SALR(VMP)
      VCA=B*SIN(A)+SVA
      VCB=B*COS(A)+SVB
      RETURN
      END
      FUNCTION SALR(A)
      SALR=A*SQRT(-ALOG(RANF(0)))
      RETURN
      END
      SUBROUTINE EVC(V,SN,FSA,FSB)
C GENERATES A NORMAL ENTERING VELOCITY COMPONENT
1     V=-3.+6.*RANF(0)+SN
      IF (SN.LT.-2.) V=2.*RANF(0)
      IF (V.LT.0.) GO TO 1
      A=(2.*V/FSA)*EXP(FSB-(V-SN)*(V-SN))
      B=RANF(0)
      IF (A.LT.B) GO TO 1
```

```
      RETURN
      END
      SUBROUTINE VIM(XI,YI,ZI,DX,DY,DZ,XC,YC,ZC,U,V,W,AL,AM,AN,VMR,Q,M,
     1X,Y,Z,DIN)
C  CHECKS FOR COLLISIONS OF TRAJECTORY WITH VEHICLE, RETURNS REFL. VELS, ETC.
      DIMENSION Q(20)
      QC1=195.4999006
      QC2=35.50009932
      QC3=-115.5000687
      QC4=-4112.49603
      QC5=2912.500578
      QC6=85787.37332
      QC7=5.384525625
      QC8=50.19715575
      QC9=1.031079375
      QC10=-250.4018047
      QC11=451.1904277
      QC12=2.67165829
      QC13=64.73123913
      QC14=170.1111111
      QC15=5.222222222
      IF (ZI.GT.3..AND.Z.GT.3.) GO TO 802
C 802- NO COLLISION WITH NOSE OR FUSELAGE
      IF (YI.GT.4..AND.Y.GT.4.) GO TO 807
C 807 - COLLISION CAN ONLY BE WITH FIN , POD OR BASE
      IF (XI.GT.7..AND.X.GT.7.) GO TO 803
C 803 NO COLLISION WITH NOSE
      IF (YI.LT.0..AND.Y.LT.0.) GO TO 804
C POSSIBLE COLLISION WITH UPPER NOSE
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,60.84,441.,331.24,0.,0.,0.,-425.88,0,
     1,0.,0.,Q(4))
      IF (XI.LT.5..AND.X.LT.5.) GO TO 804
C POSSIBLE COLLISION WITH WINDSCREEN
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,36.,9.,16.,0.,0.,0.,-252.,0.,0.,1620.,
     1,Q(6))
      IF (YI.GT.0..AND.Y.GT.0.) GO TO 803
C POSSIBLE COLLISION WITH LOWER NOSE
804   CALL QUADD(XI,YI,ZI,DX,DY,DZ,36.,441.,196.,0.,0.,0.,-252.,0.,0.,0.,
     1,Q(5))
803   IF (XI.GT.32..AND.X.GT.32.) GO TO 805
C 805- COULD ONLY COLLIDE WITH FIN
      IF (YI.LT.0..AND.Y.LT.0.) GO TO 806
C POSSIBLE COLLISION WITH UPPER FUSELAGE
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,9.,16.,0.,0.,0.,0.,0.,0.,-144.,Q(7
```

```
      1))
       IF (YI.GT.0..AND.Y.GT.0.) GO TO 807
C POSSIBLE COLLISION WITH LOWER FUSELAGE
806    CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,9.,4.,0.,0.,0.,0.,0.,0.,-36.,Q(8))
802    IF (ZI.GT.11.3.AND.Z.GT.11.3) GO TO 807
C 807- NO COLLISION WITH WING ETC.
       IF (XI.LT.6..AND.X.LT.6.) GO TO 807
       IF (XI.GT.22..AND.X.GT.22.) GO TO 808
       IF (ZI.GT.(XI+9.)/6..AND.Z.GT.(X+9.)/6.) GO TO 808
C POSSIBLE COLLISION WITH WING STRAKE
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,1.,-1296.,-36.,0.,0.,0.,9.,-1296.,0.,
      1-1215.,Q(12))
808    IF (ZI.GT.XI-14.99.AND.Z.GT.X-14.99) GO TO 807
       IF (ZI.LT.QC12*XI-QC13.AND.Z.LT.QC12*X-QC13) GO TO 809
C POSSIBLE COLLISION WITH ELLIPTIC CONE PORTION OF WING
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,QC1,6400.,QC2,0.,QC3,0.,QC4,6400.,QC5
      1,QC6,Q(13))
809    IF (ZI.GT.QC14-QC15*XI.AND.Z.GT.QC14-QC15*X) GO TO 810
C POSSIBLE COLLISION WITH FLAT PORTION OF UPPER WING
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,QC7,QC8,QC9,QC10,Q(
      114))
C POSSIBLE COLLISION WITH FLAT PORTION OF LOWER WING
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,-QC7,QC8,-QC9,QC11,
      1Q(15))
810    IF (ZI.LT.11.3.OR.Z.GT.11.3) GO TO 807
       IF (XI.LT.26.29.AND.X.LT.26.29) GO TO 807
C POSSIBLE COLLISION WITH WINGTIP
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.,0.,5,-11.3,Q(16
      1))
807    IF (ZI.GT.3.6.AND.Z.GT.3.6) GO TO 805
       IF (YI.GT.4.6.AND.Y.GT.4.6) GO TO 805
C 805 NO COLLISION WITH BASE OR ROCKET FAIRING
       IF (XI.LT.32..OR.X.GT.32.) GO TO 812
C POSSIBLE COLLISION WITH BASE
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,5,0.,0.,-32.,Q(11)
      1)
812    IF (XI.LT.25.6.AND.X.LT.25.6) GO TO 805
       IF (YI.LT.1.4.AND.Y.LT.1.4) GO TO 805
C POSSIBLE COLLISION WITH ROCKET FAIRING
       CALL QUADD(XI,YI,ZI,DX,DY,DZ,1.,16.,16.,0.,0.,0.,-32.,-48.,-32.,11
      191.04,Q(9))
805    IF (Z.GT.0.) GO TO 87
       IF (XI.LT.26..AND.X.LT.26.) GO TO 87
C POSSIBLE COLLISION WITH FIN
```

```
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.,0.,.5,0.,Q(10))
87    IF (DIN.LT.0.) GO TO 2
      IF (YI.LT.2..AND.Y.LT.2.) GO TO 2
      IF (XI.LT.8..AND.X.LT.8.) GO TO 2
      IF (XI.GT.27..AND.X.GT.27.) GO TO 2
      IF (ZI.GT.5.9.AND.Z.GT.5.9) GO TO 2
      IF (YI.LT.2..OR.Y.GT.2.) GO TO 3
C POSSIBLE COLLISION WITH PAYLOAD BAY BASE OR INSIDE OF PAYLOAD DOORS
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.,0.5,0.,-2.,Q(17)
     1)
3     IF (YI.GT.2..OR.Y.LT.2.) GO TO 4
C POSSIBLE COLLISION WITH OUTSIDE OF PAYLOAD BAY DOORS
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.,0.5,0.,-2.,Q(18)
     1)
4     IF (XI.LT.8..OR.X.GT.8.) GO TO 5
C POSSIBLE COLLISION WITH PAYLOAD BAY FORWARD BULKHEAD
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.5,0.,0.,-8.,Q(19)
     1)
5     IF (XI.GT.27..OR.X.LT.27.) GO TO 2
C POSSIBLE COLLISION WITH PAYLOAD BAY REAR BULKHEAD
      CALL QUADD(XI,YI,ZI,DX,DY,DZ,0.,0.,0.,0.,0.,0.,0.5,0.,0.,-27.,Q(20
     1))
2     KB=4
      DO 702 M=5,20
      IF (Q(M).LT.Q(KB)) KB=M
702   CONTINUE
      IF (Q(KB).GT.1..OR.Q(KB).GT.Q(3)) GO TO 1
C THERE IS A COLLISION WITH THE BODY ON SURFACE WITH Q(K) CODE K=KB
      S1=Q(KB)
      XC=XI+DX*S1
      YC=YI+DY*S1
      ZC=ZI+DZ*S1
      M=KB-3
      GO TO (711,712,713,714,715,716,717,718,719,720,721,721,722,723,724
     1,725,726),M
711   IF (XC.GT.7..OR.YC.LT.0.) GO TO 91
C COLLISION WITH UPPER NOSE
      CALL SRM(XC,YC,ZC,60.84,441.,331.24,0.,0.,0.,-425.88,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=1
      IF (ZC.GT.YC) M=2
      GO TO 94
91    Q(KB)=1.1
C COLLISION OUTSIDE LIMITS
```

```
      GO TO 2
712   IF (XC.GT.7.) GO TO 91
C COLLISION WITH LOWER NOSE
      CALL SRM(XC,YC,ZC,36.,441.,196.,0.,0.,0.,-252.,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=3
      IF(ZC.LT.-YC) M=4
      GO TO 94
713   IF (XC.GT.7..OR.YC.LT.0.) GO TO 91
C COLLISION WITH WINDSCREEN
      CALL SRM(XC,YC,ZC,36.,9.,16.,0.,0.,0.,-252.,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=5
      GO TO 94
714   IF (XC.LT.7..OR.XC.GT.32.) GO TO 91
      IF (YC.LT.0.) GO TO 91
      IF (DIN.LT.0.) GO TO 6
      IF (XC.GT.8..AND.XC.LT.27..AND.YC.GT.2.) GO TO 91
C COLLISION WITH UPPER FUSELAGE
6     CALL SRM(XC,YC,ZC,0.,9.,16.,0.,0.,0.,0.,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=6
      IF (YC.LT. .) M=M+1
      IF (XC.GT.16.) M=M+3
      IF (XC.GT.24.) M=M+3
      GO TO 94
715   IF (XC.LT.7..OR.XC.GT.32.) GO TO 91
C COLLISION WITH LOWER FUSELAGE
      CALL SRM(XC,YC,ZC,0.,9.,4.,0.,0.,0.,0.,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=8
      IF (XC.GT.16.) M=M+3
      IF (XC.GT.24.) M=M+3
      IF (YC.GT.-1.) M=M-1
      GO TO 94
716   IF (XC.GT.32.) GO TO 91
      IF (DIN.GT.0..AND.XC.LT.27.) GO TO 91
C COLLISION WITH ROCKET FAIRING
      CALL SRM(XC,YC,ZC,1.,16.,16.,0.,0.,0.,-32.,-48.,-32.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=15
      IF (YC-3..LT.ZC-2.) M=M+1
      GO TO 94
718   A=0.
```

```
      IF (ABS(ZC).LT.3.) A=SQRT(144.-16.*ZC*ZC)/3.
      B=(YC-3.)**2+(ZC-2.)**2
      IF (YC.GT.A.AND.B.GT.2.56) GO TO 91
      A=0.
      IF (ABS(ZC).LT.3.) A=-SQRT(36.-4.*ZC*ZC)/3.
C COLLISION WITH BASE
      IF (YC.LT.A) GO TO 91
      CALL SRM(XC,YC,ZC,0.,0.,0.,0.,0.,0.,0.5,0.,0.,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=30
      GO TO 94
717   IF (YC.GT.11.8) GO TO 91
      IF (YC.GT.XC-22.2) GO TO 91
      IF (YC.LT.2.*XC-61.8) GO TO 91
      IF (YC.LT.0.4286*XC-8.857) GO TO 91
C COLLISION WITH FIN
      CALL SRM(XC,YC,ZC,0.,0.,0.,0.,0.,0.,0.,0.,0.5,1.,VMR,
     1U,V,W,AL,AM,AN)
      M=17
      GO TO 94
719   IF (XC.LT.6..OR.XC.GT.22.) GO TO 91
      CALL SRM(XC,YC,ZC,1.,-1296.,-36.,0.,0.,0.,9.,-1296.,0.,-1.,VMR,
     1U,V,W,AL,AM,AN)
C COLLISION WITH WING STRAKE
      M=18
      GO TO 94
720   IF (ZC.GT.11.3) GO TO 91
C COLLISION WITH ELLIPTIC CONE PORTION OF WING
      CALL SRM(XC,YC,ZC,QC1,6400.,QC2,0.,QC3,0.,QC4,6400.,QC5,1.,VMR,
     1U,V,W,AL,AM,AN)
      A=1.13461538*(XC-16.75)
      IF (ZC.GT.A) GO TO 912
      M=21
      IF (XC.GT.27.5) M=M+1
      IF (ZC.GT.7.) M=M+2
      IF (YC.LT.-1) M=M+4
      GO TO 94
912   M=19
      IF (ZC.GT.7.) M=M+1
      GO TO 94
721   A=QC12*XC-QC13
      B=QC14-QC15*XC
      IF (ZC.GT.A.OR.ZC.GT.B.OR.ZC.GT.11.3) GO TO 91
C COLLISION WITH FLAT PORTION OF WING, KB=14,15  UPPER,LOWER
```

```
      IF (KB.EQ.15) GO TO 913
      CALL SRM(XC.YC.ZC.0..0..0..0..0..0..QC7.QC8.QC9.1..VMR.
     1U.V.W.AL.AM.AN)
      M=21
      IF (XC.GT.27.5) M=M+1
      IF (ZC.GT.7.) M=M+2
      GO TO 94
913   CALL SRM(XC.YC.ZC.0..0..0..0..0..0.. -QC7.QC8.-QC9.-1..VMR.
     1U.V.W.AL.AM.AN)
      M=25
      IF (XC.GT.27.5) M=M+1
      IF (ZC.GT.7.) M=M+2
      GO TO 94
722   IF (XC.LT.26.29999708) GO TO 91
      A=ABS(YC+1.)
      B=      -QC1*XC*XC+10835.29361*XC-1[illegible]9742.894
      IF (B.LT.0.) GO TO 92
      B=SQRT(B)/80.
93    IF (XC.GT.28.4584448) B=3.262074488-0.1072675442*XC
      IF (A.GT.B) GO TO 91
C COLLISION WITH WINGTIP
      CALL SRM(XC.YC.ZC.0..0..0..0..0..0..0..0..0.5.1..VMR.
     1U.V.W.AL.AM.AN)
      M=29
      GO TO 94
723   IF (XC.LT.8..OR.XC.GT.27..OR.ZC.GT.5.9) GO TO 91
C COLLISION WITH PAYLOAD BAY BASE OR INSIDE OF DOORS
      CALL SRM(XC.YC.ZC.0..0..0..0..0..0..0..0.5.0..1..VMR.U.V.W.AL.AM.A
     1N)
      M=31
      IF (XC.GT.17.5) M=M+1
      IF (ZC.GT.2.598) M=M+2
      GO TO 94
724   IF (XC.LT.8..OR.XC.GT.27..OR.ZC.GT.5.9) GO TO 91
C COLLISION WITH OUTSIDE OF PAYLOAD BAY DOORS
      CALL SRM(XC.YC.ZC.0..0..0..0..0..0..0..0.5.0..-1..VMR.U.V.W.AL.AM.
     1AN)
      M=35
      IF (XC.GT.17.5) M=M+1
      GO TO 94
725   IF (YC.LT.2.) GO TO 91
      A=9.*YC*YC+16.*ZC*ZC-144.
      IF (A.GT.0.) GO TO 91
C COLLISION WITH FORWARD BULKHEAD OF PAYLOAD BAY
```

```
      CALL SRM(XC,YC,ZC,0.,0.,0.,0.,0.,0.5,0.,0.,1.,VMR,U,V,W,AL,AM,A
     1N)
      M=37
      GO TO 94
726   IF (YC.LT.2.) GO TO 91
      A=0.
      IF (ABS(ZC).LT.3.) A=SQRT(144.-16.*ZC*ZC)/3.
      B=(YC-3.)**2+(ZC-2.)**2
      IF (YC.GT.A.AND.B.GT.0.9975) GO TO 91
C COLLISION WITH REAR BULKHEAD OF PAYLOAD BAY
      CALL SRM(XC,YC,ZC,0.,0.,0.,0.,0.,0.5,0.,0.,-1.,VMR,U,V,W,AL,AM,
     1AN)
      M=38
      GO TO 94
92    IF (XC.LE.28.4584448) GO TO 91
      GO TO 93
1     M=-1
94    RETURN
      END
      SUBROUTINE QUADD(XI,YI,ZI,DX,DY,DZ,A11,A22,A33,A23,A31,A12,A14,A2
     1,A34,A44,S1)
C RETURNS S1 AS THE FRACTION OF THE DISTANCE MOVED TO THE NEAREST INTERSECTION
C  WITH THE QU  RIC SURFACE. S1 IS SET TO 1.1 IF NO COLLISION CAN OCCUR
      A=A11*DX  X+A22*DY*DY+A33*DZ*DZ+2.*(A23*DY*DZ+A31*DZ*DX+A12*DX*D )
      B=2.*(DX*(A11*XI+A12*YI+A31*ZI+A14)+DY*(A12*XI+A22*YI+A23*ZI+A24)+
      1 Z*(A31*XI+A23*YI+A33*ZI+A34))
        11*XI*XI+A22*YI*YI+A33*ZI*ZI+2.*(A23*YI*ZI+A31*ZI*XI+A12*XI*YI+
          I+A24*YI+A34*ZI)+A44
          BS(A).GT.1.E-7) GO TO 3
          BS(B).LT.1.E-7) GO TO 1
          B
          4
3         4.*A*C
      IF (T.LT.0.) GO TO 1
      T=SQRT(T)
      S2=(-B-T)/(2.*A)
      S3=(T-B)/(2.*A)
      S4=1.1
      IF (S2.GT.0..AND.S2.LT.1.) S4=S2
      S5=1.2
      IF (S3.GT.0..AND.S3.LT.1.) S5=S3
      S1=S4
      IF (S5.LT.S4) S1=S5
      GO TO 2
```

```
C THE SMALLER ROOT IS CHOSEN IF VALID
4     IF (S1.GT.0..AND.S1.LT.1.) GO TO 2
1     S1=1.1
2     RETURN
      END
      SUBROUTINE SRM(X,Y,Z,A11,A22,A33,A23,A31,A12,A14,A24,A34,SP,VMR,U,
     1 V,W,AL,AM,AN)
C GIVEN THE COLLISION POINT (X,Y,Z), QUADRIC PARAMETERS,DIRECTION INDICATOR SP,
C  GENERATES DIFFUSELY REFLECTED VELOCITY COMPONENTS FOR MOST PROB. SPEED VMR
      AL=A11*X+A12*Y+A31*Z+A14
      AM=A12*X+A22*Y+A23*Z+A24
      AN=A31*X+A23*Y+A33*Z+A34
      A=SQRT(AL*AL+AM*AM+AN*AN)*SP
      AL=AL/A
      AM=AM/A
      AN=AN/A
      UN=SALR(VMR)
      A=6.28318531*RANF(0)
      B=SALR(VMR)
      UP=B*SIN(A)
      UQ=B*COS(A)
      A=SQRT(AN*AN+AM*AM)
      IF(A.LT.0.000001)AM=0.000002*RANF(0)
      IF(A.LT.0.000001)AN=0.000002*RANF(0)
      IF(A.LT.0.000001)A=SQRT(AM*AM+AN*AN)
      U=UN*AL-UQ*A
      V=UN*AM+(UP*AN+UQ*AL*AM)/A
      W=UN*AN-(UP*AM-UQ*AL*AN)/A
      RETURN
      END
      SUBROUTINE CTNML(P,IP,IC,WF,OWF,NM,MNM,FNM)
C REMOVES MOLECULE AT RANDOM AND INCREASES ALL WEIGHTING FACTORS
      DIMENSION  P(6,1),IP(3,1),IC(5,1),WF(7)
      WRITE (6,1)
1     FORMAT (24H EXCESS MOLECULE REMOVED)
      M=MNM*RANF(0)+0.99999
      IF (M.EQ.0) M=1
      J=IP(2,M)
      K=IC(5,J)
      WFM=WF(K)
      IF (IP(3,M).NE.1) WFM=OWF
      A=FNM/(FNM-WFM)
      FNM=FNM-WFM
      OWF=OWF*A
```

```
      DO 3 L=1,6
3     P(L,M)=P(L,MNM)
      DO 4 L=1,3
4     IP(L,M)=IP(L,MNM)
C THIS SUBROUTINE AVOIDS CATASTROPHIC FAILURE, BUT SLIGHTLY UPSETS THE AVERAGED
C     RESULTS AND, IF CALLED FROM THE COLLISION ROUTINE, UPSETS THE INDEXING
      NM=MNM-1
      RETURN
      END
      SUBROUTINE QIN(Q)
      DIMENSION Q(20)
      DO 1 N=1,20
1     Q(N)=1.1
      RETURN
      END
    -40.      80.      40.      -20.      32.      80.
     -7.      38.      -7.       14.      15.
          9        7        5
          5        3        2
          6        3        2
         10        2        2
         10        2        3
         10        2        3
         10        4        3
   7800.      1.       0.      850.      96.      .630      .124
      .003      .001      1.
          1        33       5       20       7       7800      0       0
```

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Appendix C

The optional program SETA, used for calculating the area of the surface elements of the Shuttle, is listed on pages C1 thru C4.

```
      CALL SETA (100,100W100,100,100,100,100,100,100,100,100,100)
      SUBROUTINE SETA (N1,N2,N3,N4,N5,N6,N7,N8,N9,N10,N11,N12)
C OPTIONAL SUBROUTINE FOR THE RECALCULATION OF SURFACE AREAS
      DIMENSION W(30),Q(16)
      AT=A1=A2=A3=A4=A5=A6=A7=A8=A9=A10=0.
      DO 2 N=1,30
2     W(N)=0.
C FIRST LOOK IN X DIRECTIONFROM Y=-2 TO 5 (N2 STEPS) AND Z=0 TO 4 (N1 STEPS)
      SY=7./N2
      SZ=4./N1
      DA=SY*SZ
      DO 1 N=1,N1
      ZI=(N-0.5)*SZ
      DO 1 L=1,N2
      YI=(L-0.5)*SY-2.
C FIRST LOOK IN POSITIVE X DIRECTION
      CALL QIN(Q)
      CALL VIM(0.,YI,ZI,32.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,32.,YI,
     1ZI,-1.)
      IF (M.LT.0) GO TO 12
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 12
      A=DA/ABS(AL)
      W(M)=W(M)+A
      A1=A1+A
C NOW LOOK IN THE NEGATIVE X DIRECTION
12    CALL QIN(Q)
      CALL VIM(35.,YI,ZI,-35.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,0.,YI
     1,ZI,-1.)
      IF (M.LT.0) GO TO 1
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 1
      A=DA/ABS(AL)
      W(M)=W(U)+A
      A2=A2+A
1     CONTINUE
C NOW LOOK IN THE X DIRECTION FROM Y=-2 TO 0 (N4 STEPS) AND Z=4 TO 12 (N3 STEPS)
      SY=2./N4
      SZ=8./N3
      DA=SY*SZ
      DO 3 N=1,N3
      ZI=4.+(N-0.5)*SZ
      DO 3 L=1,N4
      YI=-2.+(L-0.5)*SY
      CALL QIN(Q)
      CALL VIM(0.,YI,ZI,32.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,32.,YI,
```

```
     1ZI,-1.)
      IF (M.LT.0) GO TO 13
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 13
      A=DA/ABS(AL)
      W(M)=W(M)+A
      A3=A3+A
13    CALL QIN(Q)
      CALL VIM(32.,YI,ZI,-32.,0.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,0.,YI
     1,ZI,-1.)
      IF (M.LT.0) GO TO 3
      IF (ABS(AL).LT.ABS(AM).OR.ABS(AL).LT.ABS(AN)) GO TO 3
      A=DA/ABS(AL)
      W(M)=W(M)+A
      A4=A4+A
3     CONTINUE
C NEXT LOOK IN Y DIRECTION FROM X=0 TO 32 (N5 STEPS) Z=0 TO 5 (N6 STEPS)
      SX=32./N5
      SZ=5./N6
      DA=SX*SZ
      DO 4 N=1,N5
      XI=(N-0.5)*SX
      DO 4 L=1,N6
      ZI=(L-0.5)*SZ
      CALL QIN(Q)
      CALL VIM(XI,8.,ZI,0.,-10.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,-2.,
     1ZI,-1.)
      IF (M.LT.0) GO TO 14
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 14
      A=DA/ABS(AM)
      W(M)=W(M)+A
      A5=A5+A
14    CALL QIN(Q)
      CALL VIM(XI,-2.,ZI,0.,10.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,8.,
     1ZI,-1.)
      IF (M.LT.0) GO TO 4
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 4
      A=DA/ABS(AM)
      W(M)=W(M)+A
      A6=A6+A
4     CONTINUE
C NOW LOOK IN Y DIRECTION FROM X=19 TO 32 (N7 STEPS) AND Z=5 TO 12 (N8 STEPS)
      SX=13./N7
      SZ=7./N8
      DA=SX*SZ
```

```
      DO 5 N=1,N7
      XI=(N-0.5)*SX+19.
      DO 5 L=1,N8
      ZI=(L-0.5)*SZ+5.
      CALL OIN(O)
      CALL VIM(XI,0.,ZI,0.,-2.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,-2.,
     1ZI,-1.)
      IF (M.LT.0) GO TO 15
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 15
      A=DA/ABS(AM)
      W(M)=W(M)+A
      A7=A7+A
15    CALL OIN(O)
      CALL VIM(XI,-2.,ZI,0.,2.,0.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,0.,Z
     1I,-1.)
      IF (M.LT.0) GO TO 5
      IF (ABS(AM).LT.ABS(AL).OR.ABS(AM).LT.ABS(AN)) GO TO 5
      A=DA/ABS(AM)
      W(M)=W(M)+A
      A8=A8+A
5     CONTINUE
C LOOK IN NEGATIVE Z DIRECTION FROM X=0 TO 32 (N9 STEPS) Y=-2 TO 5 (N10 STEPS)
      SX=32./N9
      SY=7./N10
      DA=SX*SY
      DO 6 N=1,N9
      XI=(N-0.5)*SX
      DO 6 L=1,N10
      YI=(L-0.5)*SY-2.
      CALL OIN(O)
      CALL VIM(XI,YI,12.,0.,0.,-12.,XC,WC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,YI
     1,0.,-1.)
      IF (M.LT.0) GO TO 6
      IF (ABS(AN).LT.ABS(AL).OR.ABS(AN).LT.ABS(AM)) GO TO 6
      A=DA/ABS(AN)
      W(M)=W(M)+A
      A9=A9+A
6     CONTINUE
C FINALLY LOOK IN NEG. Z DIRN. FROM X=26 TO 37 (N11 STEPS) Y=4 TO 12 (N12 STEPS)
      SX=11./N11
      SY=8./N12
      DA=SX(SY
      DO 7 N=1,N11
      XI=(N-0.5)*SX+26.
```

```
      DO 7 L=1,N12
      YI=(L-0.5)*SY+4.
      CALL QIN(Q)
      CALL VIM(XI,YI,1.,0.,0.,-2.,XC,YC,ZC,U,V,E,AL,AM,AN,1.,Q,M,XI,YI,-
     11.,-1.)
      IF (M.LT.0) GO TO 7
      IF (ABS(AN).LT.ABS(AL).OR.ABS(AN).LT.ABS(AM)) GO TO 7
      A=DA/ABS(AN)
      W(M)=W(U)+A
      A10=A10+A
    7 CONTINUE
      DO 8 N=1,30
    8 WRITE (6,9) N,W(N)
    9 FORMAT (9H SURFACE ,I6,6H AREA ,F10.5)
      AT=A1+A2+A3+A4+A5+A6+A7+A8+A9+A10
      WRITE (6,10) A1,   AT
      WRITE (6,10) A2,   AT
      WRITE (6,10) A3,   AT
      WRITE (6,10) A4,   AT
      WRITE (6,10) A5,   AT
      WRITE (6,10) A6,   AT
      WRITE (6,10) A7,   AT
      WRITE (6,10) A8,   AT
      WRITE (6,10) A9,   AT
      WRITE (6,10) A10,  AT
   10 FORMAT (1H ,2F10.5)
      RETURN
      END
```

Appendix D

Two segments of a typical program output are listed on pages D1 thru D62. Pages D1 thru D38 list the 1st output (during the transient) and pages D39 thru D62 list the 8th output (during steady state). This output is produced by the input data listed on page B43.

```
SPACE SHUTTLE FLOWFIELD

XF =-40.00000 XR = 80.00000 ZP = 40.00000 YB =-20.00000 YM = 32.00000 YT = 80.00000
X1 = -7.00000 X2 = 38.00000 Y1 = -7.00000 Y2 = 14.00000 Z2 = 15.00000
BLOCK     1 DIVIDED INTO     9     7     5 X Y Z INTERVALS
BLOCK     2 DIVIDED INTO     5     3     2 X Y Z INTERVALS
BLOCK     3 DIVIDED INTO     6     3     2 X Y Z INTERVALS
BLOCK     4 DIVIDED INTO    10     2     2 X Y Z INTERVALS
BLOCK     5 DIVIDED INTO    10     2     3 X Y Z INTERVALS
BLOCK     6 DIVIDED INTO    10     2     3 X Y Z INTERVALS
BLOCK     7 DIVIDED INTO    10     4     3 X Y Z INTERVALS
THE STREAM VELOCITY IS 7820.00000 AND HAS DIRECTION COSINES OF     1.00000 AND     0.00000 WITH THE X AND Y AXES
THE UNDISTURBED FREESTREAM VALUES OF THE MOST PROBABLETHERMAL VELOCITY AND MEAN FREE PATH ARE  850.00000 AND   96.00000
THE SURFACE OUTGASSES AT A RATE EQUAL TO      .12400 TIMES THE NUMBER FLUX (1/4NV) IN THE UNDISTURBED FREESTREAM GAS
THE SURFACE TEMPERATURE IS      .43000 TIMES THE FREESTREAM GAS TEMPERATURE
THE TIME INTERVAL DTM IS INITIALLY      .00300 AND CHANGES TO      .00100 AFTER THE ESTABLISHMENT OF STEADY FLOW
PAYLOAD BAY DOORS ARE OPEN
THERE ARE    1 DTM TO A SAMPLING INTERVAL AND   33SAMPLING INTERVALS TO A PRINTING INTERVAL
STEADY FLOW IS ASSUMED AFTER    5 PRINTING INTERVALS AND THE CALCULATION STOPS AFTER   20 PRINTING INTERVALS
THE INITIAL NUMBER OF MOLECULES PER CELL IS      7 AND THE MAXIMUM TOTAL IS     7800
HARD SPHERE MOLECULES
CELL     1 BLOCK     1 X=   -4.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     2 BLOCK     1 X=     .50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     3 BLOCK     1 X=    5.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     4 BLOCK     1 X=   10.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     5 BLOCK     1 X=   15.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     6 BLOCK     1 X=   20.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     7 BLOCK     1 X=   25.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     8 BLOCK     1 X=   30.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL     9 BLOCK     1 X=   35.50000 Y=   -5.50000 Z=    1.50000 VOLUME =   45.00000
CELL    10 BLOCK     1 X=   -4.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    11 BLOCK     1 X=     .50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    12 BLOCK     1 X=    5.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    13 BLOCK     1 X=   10.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    14 BLOCK     1 X=   15.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    15 BLOCK     1 X=   20.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   44.45733
CELL    16 BLOCK     1 X=   25.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    17 BLOCK     1 X=   30.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    18 BLOCK     1 X=   35.50000 Y=   -2.50000 Z=    1.50000 VOLUME =   45.00000
CELL    19 BLOCK     1 X=   -4.50000 Y=     .50000 Z=    1.50000 VOLUME =   45.00000
CELL    20 BLOCK     1 X=     .50000 Y=     .50000 Z=    1.50000 VOLUME =   35.11761
CELL    21 BLOCK     1 X=    5.50000 Y=     .50000 Z=    1.50000 VOLUME =    9.39379
CELL    22 BLOCK     1 X=   10.50000 Y=     .50000 Z=    1.50000 VOLUME =    4.94918
CELL    23 BLOCK     1 X=   15.50000 Y=     .50000 Z=    1.50000 VOLUME =    3.86353
CELL    24 BLOCK     1 X=   20.50000 Y=     .50000 Z=    1.50000 VOLUME =    1.81149
CELL    25 BLOCK     1 X=   25.50000 Y=     .50000 Z=    1.50000 VOLUME =    2.75976
CELL    26 BLOCK     1 X=   30.50000 Y=     .50000 Z=    1.50000 VOLUME =   13.14456
```

ORIGINAL PAGE IS
OF POOR QUALITY

CELL	27	BLOCK	1	X=	35.50000	Y=	.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	28	BLOCK	1	X=	-4.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	29	BLOCK	1	X=	.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	42.94423
CELL	30	BLOCK	1	X=	5.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	24.70740
CELL	31	BLOCK	1	X=	10.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	31.23229
CELL	32	BLOCK	1	X=	15.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	31.23229
CELL	33	BLOCK	1	X=	20.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	31.23229
CELL	34	BLOCK	1	X=	25.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	24.86209
CELL	35	BLOCK	1	X=	30.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	9.19932
CELL	36	BLOCK	1	X=	35.50000	Y=	3.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	37	BLOCK	1	X=	-4.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	38	BLOCK	1	X=	.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	39	BLOCK	1	X=	5.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	40	BLOCK	1	X=	10.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	41	BLOCK	1	X=	15.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	42	BLOCK	1	X=	20.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	43	BLOCK	1	X=	25.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	44.89167
CELL	44	BLOCK	1	X=	30.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	41.98917
CELL	45	BLOCK	1	X=	35.50000	Y=	6.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	46	BLOCK	1	X=	-4.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	47	BLOCK	1	X=	.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	48	BLOCK	1	X=	5.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	49	BLOCK	1	X=	10.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	50	BLOCK	1	X=	15.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	51	BLOCK	1	X=	20.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	52	BLOCK	1	X=	25.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	53	BLOCK	1	X=	30.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	54	BLOCK	1	X=	35.50000	Y=	9.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	55	BLOCK	1	X=	-4.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	56	BLOCK	1	X=	.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	57	BLOCK	1	X=	5.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	58	BLOCK	1	X=	10.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	59	BLOCK	1	X=	15.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	60	BLOCK	1	X=	20.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	61	BLOCK	1	X=	25.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	62	BLOCK	1	X=	30.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	63	BLOCK	1	X=	35.50000	Y=	12.50000	Z=	1.50000	VOLUME	=	45.00000
CELL	64	BLOCK	1	X=	-4.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	65	BLOCK	1	X=	.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	66	BLOCK	1	X=	5.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	67	BLOCK	1	X=	10.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	68	BLOCK	1	X=	15.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	69	BLOCK	1	X=	20.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	70	BLOCK	1	X=	25.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	71	BLOCK	1	X=	30.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	72	BLOCK	1	X=	35.50000	Y=	-5.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	73	BLOCK	1	X=	-4.50000	Y=	-2.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	74	BLOCK	1	X=	.50000	Y=	-2.50000	Z=	4.50000	VOLUME	=	45.00000
CELL	75	BLOCK	1	X=	5.50000	Y=	-2.50000	Z=	4.50000	VOLUME	=	45.00000

CELL	76	BLOCK	1	X=	10.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	77	BLOCK	1	X=	15.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	78	BLOCK	1	X=	20.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	79	BLOCK	1	X=	25.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	80	BLOCK	1	X=	30.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	81	BLOCK	1	X=	35.50000	Y=	-2.50000	Z=	4.50000	VOLUME =	45.00000
CELL	82	BLOCK	1	X=	-4.50000	Y=	.50000	Z=	4.50000	VOLUME =	45.00000
CELL	83	BLOCK	1	X=	.50000	Y=	.50000	Z=	4.50000	VOLUME =	45.00000
CELL	84	BLOCK	1	X=	5.50000	Y=	.50000	Z=	4.50000	VOLUME =	45.00000
CELL	85	BLOCK	1	X=	10.50000	Y=	.50000	Z=	4.50000	VOLUME =	45.00000
CELL	86	BLOCK	1	X=	15.50000	Y=	.50000	Z=	4.50000	VOLUME =	43.91465
CELL	87	BLOCK	1	X=	20.50000	Y=	.50000	Z=	4.50000	VOLUME =	31.98690
CELL	88	BLOCK	1	X=	25.50000	Y=	.50000	Z=	4.50000	VOLUME =	26.36800
CELL	89	BLOCK	1	X=	30.50000	Y=	.50000	Z=	4.50000	VOLUME =	36.97521
CELL	90	BLOCK	1	X=	35.50000	Y=	.50000	Z=	4.50000	VOLUME =	45.00000
CELL	91	BLOCK	1	X=	-4.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	92	BLOCK	1	X=	.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	93	BLOCK	1	X=	5.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	94	BLOCK	1	X=	10.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	95	BLOCK	1	X=	15.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	96	BLOCK	1	X=	20.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	97	BLOCK	1	X=	25.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	98	BLOCK	1	X=	30.50000	Y=	3.50000	Z=	4.50000	VOLUME =	39.43098
CELL	99	BLOCK	1	X=	35.50000	Y=	3.50000	Z=	4.50000	VOLUME =	45.00000
CELL	100	BLOCK	1	X=	-4.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	101	BLOCK	1	X=	.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	102	BLOCK	1	X=	5.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	103	BLOCK	1	X=	10.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	104	BLOCK	1	X=	15.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	105	BLOCK	1	X=	20.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	106	BLOCK	1	X=	25.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	107	BLOCK	1	X=	30.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	108	BLOCK	1	X=	35.50000	Y=	6.50000	Z=	4.50000	VOLUME =	45.00000
CELL	109	BLOCK	1	X=	-4.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	110	BLOCK	1	X=	.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	111	BLOCK	1	X=	5.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	112	BLOCK	1	X=	10.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	113	BLOCK	1	X=	15.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	114	BLOCK	1	X=	20.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	115	BLOCK	1	X=	25.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	116	BLOCK	1	X=	30.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	117	BLOCK	1	X=	35.50000	Y=	9.50000	Z=	4.50000	VOLUME =	45.00000
CELL	118	BLOCK	1	X=	-4.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	119	BLOCK	1	X=	.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	120	BLOCK	1	X=	5.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	121	BLOCK	1	X=	10.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	122	BLOCK	1	X=	15.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	123	BLOCK	1	X=	20.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	124	BLOCK	1	X=	25.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000

CELL	125	BLOCK	1	X=	30.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	126	BLOCK	1	X=	35.50000	Y=	12.50000	Z=	4.50000	VOLUME =	45.00000
CELL	127	BLOCK	1	X=	-4.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	128	BLOCK	1	X=	.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	129	BLOCK	1	X=	5.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	130	BLOCK	1	X=	10.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	131	BLOCK	1	X=	15.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	132	BLOCK	1	X=	20.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	133	BLOCK	1	X=	25.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	134	BLOCK	1	X=	30.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	135	BLOCK	1	X=	35.50000	Y=	-5.50000	Z=	7.50000	VOLUME =	45.00000
CELL	136	BLOCK	1	X=	-4.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	137	BLOCK	1	X=	.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	138	BLOCK	1	X=	5.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	139	BLOCK	1	X=	10.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	140	BLOCK	1	X=	15.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	141	BLOCK	1	X=	20.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	142	BLOCK	1	X=	25.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	143	BLOCK	1	X=	30.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	144	BLOCK	1	X=	35.50000	Y=	-2.50000	Z=	7.50000	VOLUME =	45.00000
CELL	145	BLOCK	1	X=	-4.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	146	BLOCK	1	X=	.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	147	BLOCK	1	X=	5.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	148	BLOCK	1	X=	10.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	149	BLOCK	1	X=	15.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	150	BLOCK	1	X=	20.50000	Y=	.50000	Z=	7.50000	VOLUME =	43.73594
CELL	151	BLOCK	1	X=	25.50000	Y=	.50000	Z=	7.50000	VOLUME =	31.88717
CELL	152	BLOCK	1	X=	30.50000	Y=	.50000	Z=	7.50000	VOLUME =	41.82335
CELL	153	BLOCK	1	X=	35.50000	Y=	.50000	Z=	7.50000	VOLUME =	45.00000
CELL	154	BLOCK	1	X=	-4.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	155	BLOCK	1	X=	.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	156	BLOCK	1	X=	5.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	157	BLOCK	1	X=	10.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	158	BLOCK	1	X=	15.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	159	BLOCK	1	X=	20.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	160	BLOCK	1	X=	25.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	161	BLOCK	1	X=	30.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	162	BLOCK	1	X=	35.50000	Y=	3.50000	Z=	7.50000	VOLUME =	45.00000
CELL	163	BLOCK	1	X=	-4.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	164	BLOCK	1	X=	.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	165	BLOCK	1	X=	5.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	166	BLOCK	1	X=	10.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	167	BLOCK	1	X=	15.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	168	BLOCK	1	X=	20.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	169	BLOCK	1	X=	25.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	170	BLOCK	1	X=	30.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	171	BLOCK	1	X=	35.50000	Y=	6.50000	Z=	7.50000	VOLUME =	45.00000
CELL	172	BLOCK	1	X=	-4.50000	Y=	9.50000	Z=	7.50000	VOLUME =	45.00000
CELL	173	BLOCK	1	X=	.50000	Y=	9.50000	Z=	7.50000	VOLUME =	45.00000

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CELL  174 BLOCK   1 X=    5.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  175 BLOCK   1 X=   10.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  176 BLOCK   1 X=   15.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  177 BLOCK   1 X=   20.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  178 BLOCK   1 X=   25.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  179 BLOCK   1 X=   30.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  180 BLOCK   1 X=   35.50000 Y=    9.50000 Z=    7.50000 VOLUME =   45.00000
CELL  181 BLOCK   1 X=   -4.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  182 BLOCK   1 X=     .50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  183 BLOCK   1 X=    5.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  184 BLOCK   1 X=   10.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  185 BLOCK   1 X=   15.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  186 BLOCK   1 X=   20.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  187 BLOCK   1 X=   25.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  188 BLOCK   1 X=   30.50000 Y=   12.50000 Z=    [illegible].50000 VOLUME =   45.00000
CELL  189 BLOCK   1 X=   35.50000 Y=   12.50000 Z=    7.50000 VOLUME =   45.00000
CELL  190 BLOCK   1 X=   -4.50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  191 BLOCK   1 X=     .50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  192 BLOCK   1 X=    5.50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  193 BLOCK   1 X=   10.50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  194 BLOCK   1 X=   15.50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  195 BLOCK   1 X=   20.50000 Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  196 BLOCK   1 X=   [illegible] Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  197 BLOCK   1 X=   [illegible] Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  198 BLOCK   1 X=   [illegible] Y=   -5.50000 Z=   10.50000 VOLUME =   45.00000
CELL  199 BLOCK   1 X=   [illegible] Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  200 BLOCK   1 X=     .50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  201 BLOCK   1 X=    5.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  202 BLOCK   1 X=   10.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  203 BLOCK   1 X=   15.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  204 BLOCK   1 X=   20.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  205 BLOCK   1 X=   25.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  206 BLOCK   1 X=   30.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  207 BLOCK   1 X=   35.50000 Y=   -2.50000 Z=   10.50000 VOLUME =   45.00000
CELL  208 BLOCK   1 X=   -4.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  209 BLOCK   1 X=     .50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  210 BLOCK   1 X=    5.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  211 BLOCK   1 X=   10.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  212 BLOCK   1 X=   15.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  213 BLOCK   1 X=   20.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  214 BLOCK   1 X=   25.50000 Y=     .50000 Z=   10.50000 VOLUME =   41.13139
CELL  215 BLOCK   1 X=   30.50000 Y=     .50000 Z=   10.50000 VOLUME =   43.16932
CELL  216 BLOCK   1 X=   35.50000 Y=     .50000 Z=   10.50000 VOLUME =   45.00000
CELL  217 BLOCK   1 X=   -4.50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
CELL  218 BLOCK   1 X=     .50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
CELL  219 BLOCK   1 X=    5.50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
CELL  220 BLOCK   1 X=   10.50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
CELL  221 BLOCK   1 X=   15.50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
CELL  222 BLOCK   1 X=   20.50000 Y=    3.50000 Z=   10.50000 VOLUME =   45.00000
```

CELL	223	BLOCK	1	X=	25.50000	Y=	3.50000	Z=	10.50000	VOLUME =	45.00000
CELL	224	BLOCK	1	X=	30.50000	Y=	3.50000	Z=	10.50000	VOLUME =	45.00000
CELL	225	BLOCK	1	X=	35.50000	Y=	3.50000	Z=	10.50000	VOLUME =	45.00000
CELL	226	BLOCK	1	X=	-4.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	227	BLOCK	1	X=	.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	228	BLOCK	1	X=	5.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	229	BLOCK	1	X=	10.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	230	BLOCK	1	X=	15.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	231	BLOCK	1	X=	20.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	232	BLOCK	1	X=	25.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	233	BLOCK	1	X=	30.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	234	BLOCK	1	X=	35.50000	Y=	6.50000	Z=	10.50000	VOLUME =	45.00000
CELL	235	BLOCK	1	X=	-4.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	236	BLOCK	1	X=	.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	237	BLOCK	1	X=	5.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	238	BLOCK	1	X=	10.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	239	BLOCK	1	X=	15.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	240	BLOCK	1	X=	20.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	241	BLOCK	1	X=	25.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	242	BLOCK	1	X=	30.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	243	BLOCK	1	X=	35.50000	Y=	9.50000	Z=	10.50000	VOLUME =	45.00000
CELL	244	BLOCK	1	X=	-4.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	245	BLOCK	1	X=	.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	246	BLOCK	1	X=	5.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	247	BLOCK	1	X=	10.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	248	BLOCK	1	X=	15.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	249	BLOCK	1	X=	20.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	250	BLOCK	1	X=	25.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	251	BLOCK	1	X=	30.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	252	BLOCK	1	X=	35.50000	Y=	12.50000	Z=	10.50000	VOLUME =	45.00000
CELL	253	BLOCK	1	X=	-4.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	254	BLOCK	1	X=	.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	255	BLOCK	1	X=	5.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	256	BLOCK	1	X=	10.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	257	BLOCK	1	X=	15.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	258	BLOCK	1	X=	20.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	259	BLOCK	1	X=	25.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	260	BLOCK	1	X=	30.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	261	BLOCK	1	X=	35.50000	Y=	-5.50000	Z=	13.50000	VOLUME =	45.00000
CELL	262	BLOCK	1	X=	-4.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	263	BLOCK	1	X=	.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	264	BLOCK	1	X=	5.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	265	BLOCK	1	X=	10.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	266	BLOCK	1	X=	15.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	267	BLOCK	1	X=	20.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	268	BLOCK	1	X=	25.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	269	BLOCK	1	X=	30.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	270	BLOCK	1	X=	35.50000	Y=	-2.50000	Z=	13.50000	VOLUME =	45.00000
CELL	271	BLOCK	1	X=	-4.50000	Y=	.50000	Z=	13.50000	VOLUME =	45.00000

CELL	272	BLOCK	1	X=	.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	273	BLOCK	1	X=	5.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	274	BLOCK	1	X=	10.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	275	BLOCK	1	X=	15.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	276	BLOCK	1	X=	20.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	277	BLOCK	1	X=	25.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	278	BLOCK	1	X=	30.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	279	BLOCK	1	X=	35.50000	Y=	.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	280	BLOCK	1	X=	-4.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	281	BLOCK	1	X=	.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	282	BLOCK	1	X=	5.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	283	BLOCK	1	X=	10.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	284	BLOCK	1	X=	15.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	285	BLOCK	1	X=	20.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	286	BLOCK	1	X=	25.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	287	BLOCK	1	X=	30.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	288	BLOCK	1	X=	35.50000	Y=	3.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	289	BLOCK	1	X=	-4.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	290	BLOCK	1	X=	.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	291	BLOCK	1	X=	5.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	292	BLOCK	1	X=	10.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	293	BLOCK	1	X=	15.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	294	BLOCK	1	X=	20.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	295	BLOCK	1	X=	25.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	296	BLOCK	1	X=	30.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	297	BLOCK	1	X=	35.50000	Y=	6.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	298	BLOCK	1	X=	-4.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	299	BLOCK	1	X=	.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	300	BLOCK	1	X=	5.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	301	BLOCK	1	X=	10.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	302	BLOCK	1	X=	15.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	303	BLOCK	1	X=	20.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	304	BLOCK	1	X=	25.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	305	BLOCK	1	X=	30.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	306	BLOCK	1	X=	35.50000	Y=	9.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	307	BLOCK	1	X=	-4.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	308	BLOCK	1	X=	.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	309	BLOCK	1	X=	5.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	310	BLOCK	1	X=	10.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	311	BLOCK	1	X=	15.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	312	BLOCK	1	X=	20.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	313	BLOCK	1	X=	25.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	314	BLOCK	1	X=	30.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	315	BLOCK	1	X=	35.50000	Y=	12.50000	Z=	13.50000	VOLUME	=	45.00000
CELL	316	BLOCK	2	X=	-36.70000	Y=	-3.50000	Z=	3.75000	VOLUME	=	346.50000
CELL	317	BLOCK	2	X=	-30.10000	Y=	-3.50000	Z=	3.75000	VOLUME	=	346.50000
CELL	318	BLOCK	2	X=	-23.50000	Y=	-3.50000	Z=	3.75000	VOLUME	=	346.50000
CELL	319	BLOCK	2	X=	-16.90000	Y=	-3.50000	Z=	3.75000	VOLUME	=	346.50000
CELL	320	BLOCK	2	X=	-10.30000	Y=	-3.50000	Z=	3.75000	VOLUME	=	346.50000

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CELL	321	BLOCK	2	X=	-36.70000	Y=	3.50000	Z=	3.75000	VOLUME =	346.50000
CELL	322	BLOCK	2	X=	-30.10000	Y=	3.50000	Z=	3.75000	VOLUME =	346.50000
CELL	323	BLOCK	2	X=	-23.50000	Y=	3.50000	Z=	3.75000	VOLUME =	346.50000
CELL	324	BLOCK	2	X=	-16.90000	Y=	3.50000	Z=	3.75000	VOLUME =	346.50000
CELL	325	BLOCK	2	X=	-10.30000	Y=	3.50000	Z=	3.75000	VOLUME =	346.50000
CELL	326	BLOCK	2	X=	-36.70000	Y=	10.50000	Z=	3.75000	VOLUME =	346.50000
CELL	327	BLOCK	2	X=	-30.10000	Y=	10.50000	Z=	3.75000	VOLUME =	346.50000
CELL	328	BLOCK	2	X=	-23.50000	Y=	10.50000	Z=	3.75000	VOLUME =	346.50000
CELL	329	BLOCK	2	X=	-16.90000	Y=	10.50000	Z=	3.75000	VOLUME =	346.50000
CELL	330	BLOCK	2	X=	-10.30000	Y=	10.50000	Z=	3.75000	VOLUME =	346.50000
CELL	331	BLOCK	2	X=	-36.70000	Y=	-3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	332	BLOCK	2	X=	-30.10000	Y=	-3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	333	BLOCK	2	X=	-23.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	334	BLOCK	2	X=	-16.90000	Y=	-3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	335	BLOCK	2	X=	-10.30000	Y=	-3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	336	BLOCK	2	X=	-36.70000	Y=	3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	337	BLOCK	2	X=	-30.10000	Y=	3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	338	BLOCK	2	X=	-23.50000	Y=	3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	339	BLOCK	2	X=	-16.90000	Y=	3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	340	BLOCK	2	X=	-10.30000	Y=	3.50000	Z=	11.25000	VOLUME =	346.50000
CELL	341	BLOCK	2	X=	-36.70000	Y=	10.50000	Z=	11.25000	VOLUME =	346.50000
CELL	342	BLOCK	2	X=	-30.10000	Y=	10.50000	Z=	11.25000	VOLUME =	346.50000
CELL	343	BLOCK	2	X=	-23.50000	Y=	10.50000	Z=	11.25000	VOLUME =	346.50000
CELL	344	BLOCK	2	X=	-16.90000	Y=	10.50000	Z=	11.25000	VOLUME =	346.50000
CELL	345	BLOCK	2	X=	-10.30000	Y=	10.50000	Z=	11.25000	VOLUME =	346.50000
CELL	346	BLOCK	3	X=	41.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	347	BLOCK	3	X=	48.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	348	BLOCK	3	X=	55.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	349	BLOCK	3	X=	62.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	350	BLOCK	3	X=	69.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	351	BLOCK	3	X=	76.50000	Y=	-3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	352	BLOCK	3	X=	41.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	353	BLOCK	3	X=	48.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	354	BLOCK	3	X=	55.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	355	BLOCK	3	X=	62.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	356	BLOCK	3	X=	69.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	357	BLOCK	3	X=	76.50000	Y=	3.50000	Z=	3.75000	VOLUME =	367.50000
CELL	358	BLOCK	3	X=	41.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	359	BLOCK	3	X=	48.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	360	BLOCK	3	X=	55.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	361	BLOCK	3	X=	62.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	362	BLOCK	3	X=	69.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	363	BLOCK	3	X=	76.50000	Y=	10.50000	Z=	3.75000	VOLUME =	367.50000
CELL	364	BLOCK	3	X=	41.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	365	BLOCK	3	X=	48.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	366	BLOCK	3	X=	55.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	367	BLOCK	3	X=	62.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	368	BLOCK	3	X=	69.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	369	BLOCK	3	X=	76.50000	Y=	-3.50000	Z=	11.25000	VOLUME =	367.50000

CELL	370	BLOCK	3	X=	41.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	371	BLOCK	3	X=	48.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	372	BLOCK	3	X=	55.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	373	BLOCK	3	X=	62.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	374	BLOCK	3	X=	69.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	375	BLOCK	3	X=	76.50000	Y=	3.50000	Z=	11.25000	VOLUME =	367.50000
CELL	376	BLOCK	3	X=	41.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	377	BLOCK	3	X=	48.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	378	BLOCK	3	X=	55.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	379	BLOCK	3	X=	62.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	380	BLOCK	3	X=	69.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	381	BLOCK	3	X=	76.50000	Y=	10.50000	Z=	11.25000	VOLUME =	367.50000
CELL	382	BLOCK	4	X=	-34.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	383	BLOCK	4	X=	-22.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	[illegible]5.00000
CELL	384	BLOCK	4	X=	-10.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	[illegible]00000
CELL	385	BLOCK	4	X=	2.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	[illegible]00000
CELL	386	BLOCK	4	X=	14.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	[illegible]00000
CELL	387	BLOCK	4	X=	26.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	[illegible].00000
CELL	388	BLOCK	4	X=	38.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	389	BLOCK	4	X=	50.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	390	BLOCK	4	X=	62.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	391	BLOCK	4	X=	74.00000	Y=	-1.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	392	BLOCK	4	X=	-34.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	393	BLOCK	4	X=	-22.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	394	BLOCK	4	X=	-10.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	395	BLOCK	4	X=	2.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	396	BLOCK	4	X=	14.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	397	BLOCK	4	X=	26.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	398	BLOCK	4	X=	38.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	399	BLOCK	4	X=	50.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	400	BLOCK	4	X=	62.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	401	BLOCK	4	X=	74.00000	Y=	8.75000	Z=	21.25000	VOLUME =	1575.00000
CELL	402	BLOCK	4	X=	-34.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	403	BLOCK	4	X=	-22.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	404	BLOCK	4	X=	-10.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	405	BLOCK	4	X=	2.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	406	BLOCK	4	X=	14.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	407	BLOCK	4	X=	26.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	408	BLOCK	4	X=	38.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	409	BLOCK	4	X=	50.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	410	BLOCK	4	X=	62.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	411	BLOCK	4	X=	74.00000	Y=	-1.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	412	BLOCK	4	X=	-34.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	413	BLOCK	4	X=	-22.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	414	BLOCK	4	X=	-10.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	415	BLOCK	4	X=	2.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	416	BLOCK	4	X=	14.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	417	BLOCK	4	X=	26.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000
CELL	418	BLOCK	4	X=	38.00000	Y=	8.75000	Z=	33.75000	VOLUME =	1575.00000

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CELL  419 BLOCK    4 X=  50.00000 Y=   8.75000 Z=  33.75000 VOLUME =1575.00000
CELL  420 BLOCK    4 X=  62.00000 Y=   8.75000 Z=  33.75000 VOLUME =1575.00000
CELL  421 BLOCK    4 X=  74.00000 Y=   8.75000 Z=  33.75000 VOLUME =1575.00000
CELL  422 BLOCK    5 X= -34.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  423 BLOCK    5 X= -22.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  424 BLOCK    5 X= -10.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  425 BLOCK    5 X=   2.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  426 BLOCK    5 X=  14.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  427 BLOCK    5 X=  26.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  428 BLOCK    5 X=  38.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  429 BLOCK    5 X=  50.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  430 BLOCK    5 X=  62.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  431 BLOCK    5 X=  74.00000 Y= -16.75000 Z=   6.66667 VOLUME =1040.00000
CELL  432 BLOCK    5 X= -34.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  433 BLOCK    5 X= -22.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  434 BLOCK    5 X= -10.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  435 BLOCK    5 X=   2.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  436 BLOCK    5 X=  14.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  437 BLOCK    5 X=  26.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  438 BLOCK    5 X=  38.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  439 BLOCK    5 X=  50.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  440 BLOCK    5 X=  62.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  441 BLOCK    5 X=  74.00000 Y= -10.25000 Z=   6.66667 VOLUME =1040.00000
CELL  442 BLOCK    5 X= -34.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  443 BLOCK    5 X= -22.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  444 BLOCK    5 X= -10.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  445 BLOCK    5 X=   2.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  446 BLOCK    5 X=  14.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  447 BLOCK    5 X=  26.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  448 BLOCK    5 X=  38.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  449 BLOCK    5 X=  50.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  450 BLOCK    5 X=  62.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  451 BLOCK    5 X=  74.00000 Y= -16.75000 Z=  20.00000 VOLUME =1040.00000
CELL  452 BLOCK    5 X= -34.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  453 BLOCK    5 X= -22.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  454 BLOCK    5 X= -10.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  455 BLOCK    5 X=   2.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  456 BLOCK    5 X=  14.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  457 BLOCK    5 X=  26.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  458 BLOCK    5 X=  38.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  459 BLOCK    5 X=  50.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  460 BLOCK    5 X=  62.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  461 BLOCK    5 X=  74.00000 Y= -10.25000 Z=  20.00000 VOLUME =1040.00000
CELL  462 BLOCK    5 X= -34.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
CELL  463 BLOCK    5 X= -22.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
CELL  464 BLOCK    5 X= -10.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
CELL  465 BLOCK    5 X=   2.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
CELL  466 BLOCK    5 X=  14.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
CELL  467 BLOCK    5 X=  26.00000 Y= -16.75000 Z=  33.33333 VOLUME =1040.00000
```

CELL	468	BLOCK	5	X= 38.00000	Y= -16.75000	Z= 33.33333	VOLUME =1040.00000
CELL	469	BLOCK	5	X= 50.00000	Y= -16.75000	Z= 33.33333	VOLUME =1040.00000
CELL	470	BLOCK	5	X= 62.00000	Y= -16.75000	Z= 33.33333	VOLUME =1040.00000
CELL	471	BLOCK	5	X= 74.00000	Y= -16.75000	Z= 33.33333	VOLUME =1040.00000
CELL	472	BLOCK	5	X= -34.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	473	BLOCK	5	X= -22.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	474	BLOCK	5	X= -10.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	475	BLOCK	5	X= 2.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	476	BLOCK	5	X= 14.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	477	BLOCK	5	X= 26.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	478	BLOCK	5	X= 38.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	479	BLOCK	5	X= 50.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	480	BLOCK	5	X= 62.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	481	BLOCK	5	X= 74.00000	Y= -10.25000	Z= 33.33333	VOLUME =1040.00000
CELL	482	BLOCK	6	X= -34.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	483	BLOCK	6	X= -22.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	484	BLOCK	6	X= -10.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	485	BLOCK	6	X= 2.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	486	BLOCK	6	X= 14.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	487	BLOCK	6	X= 26.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	488	BLOCK	6	X= 38.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	489	BLOCK	6	X= 50.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	490	BLOCK	6	X= 62.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	491	BLOCK	6	X= 74.00000	Y= 18.50000	Z= 6.66667	VOLUME =1440.00000
CELL	492	BLOCK	6	X= -34.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	493	BLOCK	6	X= -22.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	494	BLOCK	6	X= -10.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	495	BLOCK	6	X= 2.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	496	BLOCK	6	X= 14.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	497	BLOCK	6	X= 26.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	498	BLOCK	6	X= 38.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	499	BLOCK	6	X= 50.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	500	BLOCK	6	X= 62.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	501	BLOCK	6	X= 74.00000	Y= 27.50000	Z= 6.66667	VOLUME =1440.00000
CELL	502	BLOCK	6	X= -34.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	503	BLOCK	6	X= -22.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	504	BLOCK	6	X= -10.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	505	BLOCK	6	X= 2.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	506	BLOCK	6	X= 14.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	507	BLOCK	6	X= 26.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	508	BLOCK	6	X= 38.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	509	BLOCK	6	X= 50.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	510	BLOCK	6	X= 62.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	511	BLOCK	6	X= 74.00000	Y= 18.50000	Z= 20.00000	VOLUME =1440.00000
CELL	512	BLOCK	6	X= -34.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	513	BLOCK	6	X= -22.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	514	BLOCK	6	X= -10.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	515	BLOCK	6	X= 2.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	516	BLOCK	6	X= 14.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000

CELL	517	BLOCK	6	X= 26.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	518	BLOCK	6	X= 38.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	519	BLOCK	6	X= 50.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	520	BLOCK	6	X= 62.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	521	BLOCK	6	X= 74.00000	Y= 27.50000	Z= 20.00000	VOLUME =1440.00000
CELL	522	BLOCK	6	X= -34.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	523	BLOCK	6	X= -22.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	524	BLOCK	6	X= -10.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	525	BLOCK	6	X= 2.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	526	BLOCK	6	X= 14.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	527	BLOCK	6	X= 26.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	528	BLOCK	6	X= 38.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	529	BLOCK	6	X= 50.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	530	BLOCK	6	X= 62.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	531	BLOCK	6	X= 74.00000	Y= 18.50000	Z= 33.33333	VOLUME =1440.00000
CELL	532	BLOCK	6	X= -34.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	533	BLOCK	6	X= -22.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	534	BLOCK	6	X= -10.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	535	BLOCK	6	X= 2.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	536	BLOCK	6	X= 14.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	537	BLOCK	6	X= 26.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	538	BLOCK	6	X= 38.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	539	BLOCK	6	X= 50.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	540	BLOCK	6	X= 62.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	541	BLOCK	6	X= 74.00000	Y= 27.50000	Z= 33.33333	VOLUME =1440.00000
CELL	542	BLOCK	7	X= -34.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	543	BLOCK	7	X= -22.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	544	BLOCK	7	X= -10.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	545	BLOCK	7	X= 2.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	546	BLOCK	7	X= 14.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	547	BLOCK	7	X= 26.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	548	BLOCK	7	X= 38.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	549	BLOCK	7	X= 50.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	550	BLOCK	7	X= 62.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	551	BLOCK	7	X= 74.00000	Y= 38.00000	Z= 6.66667	VOLUME =1920.00000
CELL	552	BLOCK	7	X= -34.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	553	BLOCK	7	X= -22.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	554	BLOCK	7	X= -10.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	555	BLOCK	7	X= 2.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	556	BLOCK	7	X= 14.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	557	BLOCK	7	X= 26.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	558	BLOCK	7	X= 38.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	559	BLOCK	7	X= 50.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	560	BLOCK	7	X= 62.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	561	BLOCK	7	X= 74.00000	Y= 50.00000	Z= 6.66667	VOLUME =1920.00000
CELL	562	BLOCK	7	X= -34.00000	Y= 62.00000	Z= 6.66667	VOLUME =1920.00000
CELL	563	BLOCK	7	X= -22.00000	Y= 62.00000	Z= 6.66667	VOLUME =1920.00000
CELL	564	BLOCK	7	X= -10.00000	Y= 62.00000	Z= 6.66667	VOLUME =1920.00000
CELL	565	BLOCK	7	X= 2.00000	Y= 62.00000	Z= 6.66667	VOLUME =1920.00000

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```
CELL  566 BLOCK   7 X=  14.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  567 BLOCK   7 X=  26.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  568 BLOCK   7 X=  38.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  569 BLOCK   7 X=  50.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  570 BLOCK   7 X=  62.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  571 BLOCK   7 X=  74.00000 Y=  62.00000 Z=   6.66667 VOLUME =1920.00000
CELL  572 BLOCK   7 X= -34.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  573 BLOCK   7 X= -22.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  574 BLOCK   7 X= -10.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  575 BLOCK   7 X=   2.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  576 BLOCK   7 X=  14.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  577 BLOCK   7 X=  26.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  578 BLOCK   7 X=  38.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  579 BLOCK   7 X=  50.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  580 BLOCK   7 X=  62.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  581 BLOCK   7 X=  74.00000 Y=  74.00000 Z=   6.66667 VOLUME =1920.00000
CELL  582 BLOCK   7 X= -34.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  583 BLOCK   7 X= -22.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  584 BLOCK   7 X= -10.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  585 BLOCK   7 X=   2.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  586 BLOCK   7 X=  14.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  587 BLOCK   7 X=  26.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  588 BLOCK   7 X=  38.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  589 BLOCK   7 X=  50.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  590 BLOCK   7 X=  62.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  591 BLOCK   7 X=  74.00000 Y=  38.00000 Z=  20.00000 VOLUME =1920.00000
CELL  592 BLOCK   7 X= -34.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  593 BLOCK   7 X= -22.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  594 BLOCK   7 X= -10.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  595 BLOCK   7 X=   2.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  596 BLOCK   7 X=  14.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  597 BLOCK   7 X=  26.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  598 BLOCK   7 X=  38.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  599 BLOCK   7 X=  50.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  600 BLOCK   7 X=  62.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  601 BLOCK   7 X=  74.00000 Y=  50.00000 Z=  20.00000 VOLUME =1920.00000
CELL  602 BLOCK   7 X= -34.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  603 BLOCK   7 X= -22.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  604 BLOCK   7 X= -10.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  605 BLOCK   7 X=   2.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  606 BLOCK   7 X=  14.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  607 BLOCK   7 X=  26.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  608 BLOCK   7 X=  38.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  609 BLOCK   7 X=  50.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  610 BLOCK   7 X=  62.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  611 BLOCK   7 X=  74.00000 Y=  62.00000 Z=  20.00000 VOLUME =1920.00000
CELL  612 BLOCK   7 X= -34.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  613 BLOCK   7 X= -22.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  614 BLOCK   7 X= -10.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
```

```
CELL  615 BLOCK    7 X=   2.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  616 BLOCK    7 X=  14.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  617 BLOCK    7 X=  26.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  618 BLOCK    7 X=  38.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  619 BLOCK    7 X=  50.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  620 BLOCK    7 X=  62.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  621 BLOCK    7 X=  74.00000 Y=  74.00000 Z=  20.00000 VOLUME =1920.00000
CELL  622 BLOCK    7 X= -34.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  623 BLOCK    7 X= -22.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  624 BLOCK    7 X= -10.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  625 BLOCK    7 X=   2.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  626 BLOCK    7 X=  14.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  627 BLOCK    7 X=  26.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  628 BLOCK    7 X=  38.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  629 BLOCK    7 X=  50.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  630 BLOCK    7 X=  62.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  631 BLOCK    7 X=  74.00000 Y=  38.00000 Z=  33.33333 VOLUME =1920.00000
CELL  632 BLOCK    7 X= -34.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  633 BLOCK    7 X= -22.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  634 BLOCK    7 X= -10.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  635 BLOCK    7 X=   2.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  636 BLOCK    7 X=  14.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  637 BLOCK    7 X=  26.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  638 BLOCK    7 X=  38.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  639 BLOCK    7 X=  50.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  640 BLOCK    7 X=  62.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  641 BLOCK    7 X=  74.00000 Y=  50.00000 Z=  33.33333 VOLUME =1920.00000
CELL  642 BLOCK    7 X= -34.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  643 BLOCK    7 X= -22.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  644 BLOCK    7 X= -10.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  645 BLOCK    7 X=   2.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  646 BLOCK    7 X=  14.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  647 BLOCK    7 X=  26.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  648 BLOCK    7 X=  38.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  649 BLOCK    7 X=  50.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  650 BLOCK    7 X=  62.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  651 BLOCK    7 X=  74.00000 Y=  62.00000 Z=  33.33333 VOLUME =1920.00000
CELL  652 BLOCK    7 X= -34.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  653 BLOCK    7 X= -22.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  654 BLOCK    7 X= -10.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  655 BLOCK    7 X=   2.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  656 BLOCK    7 X=  14.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  657 BLOCK    7 X=  26.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  658 BLOCK    7 X=  38.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  659 BLOCK    7 X=  50.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  660 BLOCK    7 X=  62.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
CELL  661 BLOCK    7 X=  74.00000 Y=  74.00000 Z=  33.33333 VOLUME =1920.00000
```

D14

FLOWFIELD OF ORBITING SPACE SHUTTLE

ATOMIC OXYGEN STREAM 7820.00000 M/SEC AT INCIDENCE 0.00000 DEGREES
FREESTREAM MEAN FREE PATH = 96.0 METRES AND SPEED RATIO= 9.2000
THE SURFACE OUTGASSES AT A RATE EQUAL TO .12400 TIMES THE NUMBER FLUX (1/4NV) IN THE UNDISTURBED FREESTREAM GAS
0 CONTROL JETS IN OPERATION
PAYLOAD BAY DOORS ARE OPEN
THE SURFACE TEMPERATURE IS ASSUMED TO BE EQUAL TO .43000 TIMES THE ATMOSPHERIC TEMPERATURE

THE FIVE NUMBERS AT EACH POINT REPRESENT DENSITIES NORMALIZED TO THE FREESTREAM DENSITY

DENSITY OF UNDISTURBED FREESTREAM MOLECULES
DENSITY OF MOLECULES THAT HAVE STRUCK SURFACE
DENSITY OF INDIRECTLY AFFECTED MOLECULES
DENSITY OF OUTGASSED MOLECULES
DENSITY OF JET MOLECULES

MINIMUM DENSITY RESOLUTION = .0001948 BASED ON ONE MOLECULE OR .0064286 BASED ON ONE MOLECULE PER SAMPLING INTERVAL
NOTE THAT ABOVE FIGURES ASSUME UNIT WEIGHTING FACTOR

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	.989091	1.280000	1.005714	1.138701	1.014026	1.005714	1.055584	.989091	.947532	1.047273	.889351	.955844	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000974	.000390	.000584	.000390	.000974	.001364	
	0.000000	0.000000	0.000000	.000390	.000779	.001753	.002338	.004286	.004091	.004481	.002922	.004870	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	.947532	.889351	.897662	.980779	.814545	.922597	.980779	.839481	.964156	1.113766	.847792	.964156	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	.001364	.000779	.001364	.001948	.001558	.000390	
	0.000000	0.000000	0.000000	.000779	.001169	.001558	.004091	.002922	.005260	.005065	.005844	.005260	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	.955844	.980779	.972468	.872727	1.005714	.839481	.947532	.889351	.831169	.772987	.930909	.731429	
	0.000000	0.000000	0.000000	0.000000	0.000000	.001364	.002727	.001364	.003896	.001558	.000974	.001948	
	0.000000	0.000000	.000195	.000390	.001753	.003312	.004286	.005844	.005844	.005844	.006429	.007597	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	1.063896	1.038961	1.122078	.955844	.980779	.980779	1.047273	.897662	1.030649	.922597	.939221	.881039	
	0.000000	0.000000	0.000000	0.000000	.000974	.002922	.003312	.004091	.003312	.002727	.004091	.002338	

D15

```
 0.000000  .000390  .001753  .001948  .003701  .003312  .007403  .008571  .009351  .007792  .010130  .007792
 0.000000 0.000000 0.000000 0.000000 0.000000  .000779 0.000000 0.000000 0.000000  .000584 0.000000  .000195
 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
Y= 40                                                                                                          Y= 40
  .966234  .953766 1.022338  .972468  .829091 1.005714  .097662  .845714  .806234  .918442  .858182  .941299
 0.000000  .000195  .001364  .001556  .003117  .007403  .011683  .008182  .003701  .005065  .003117  .002143
 0.000000  .000584  .001948  .004091  .003312  .008377  .010714  .012078  .014610  .012078  .010909  .011299
 0.000000 0.000000 0.000000 0.000000 0.000000  .000584  .000974  .000195  .000195 0.000000 0.000000 0.000000
 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
Y= 30                                                                                                          Y= 30
  .766753  .953766  .835325  .822857  .928831  .878961  .922597  .847792  .797922  .928831  .797922  .804156
 0.000000  .001753  .005844  .012662  .018312  .023766  .036234  .028831  .011104  .010325  .005065  .003896
 0.000000  .001364  .003701  .004286  .010519  .018117  .019091  .022013  .016558  .016948  .015000  .012857
 0.000000 0.000000 0.000000  .001364  .001364  .000974  .001753 0.000000  .000974  .000390  .000195  .000195
 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
Y= 20                                                                                                          Y= 20
 1.052747  .984039 1.015110  .859032  .989805  .770260  .889675  .765877  .832273  .790097  .758669  .766364
 0.000000  .002532  .016753  .056494  .090390  .082597  .116688  .077143  .023961  .008766  .005260  .006039
  .000195  .001558  .007792  .019091  .029221  .038377  .037013  .039740  .025714  .021818  .017143  .013442
 0.000000 0.000000  .000779  .001948  .004675  .005455  .004870  .007987  .005455  .001948  .000779  .000390
 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
Y= 10                                                         --                                               Y= 10
 1.042500  .918000  .945000  .881532                         / /       .602955  .610909 ..591818  .622045
 0.000000  .007597  .036818  .241753                       /   /       .035844  .015779  .010130  .007403
  .000974  .005260  .010325  .046506                     /   /         .027273  .017143  .014610  .013442
 0.000000 0.000000  .000195  .005455                   / USA /         .006429  .003506  .001558  .001169
 0.000000 0.000000 0.000000 0.000000    -------------------     I      0.000000 0.000000 0.000000 0.000000
Y=  0                                  /                        I                                              Y=  0
  .990145 1.083156 1.023162  .949946 --**                      I        .671546  .671342  .725368  .668431
 0.000000  .001948  .019481  .178442 (  NASA                   I        .018117  .010714  .007013  .004870
  .000195  .001753  .006818  .038571 --------------------------------   .024156  .019286  .013442  .011688
 0.000000 0.000000  .000584  .004481                                    .004286  .001169  .000584  .000974
 0.000000 0.000000 0.000000 0.000000                                   0.000000 0.000000 0.000000 0.000000
Y=-10                                                                                                          Y=-10
 1.040000  .922944  .976970  .958961  .850909 1.026494  .963463  .900433  .922944  .810390  .774372  .850909
 0.000000  .000584  .006039  .031169  .073247  .085325  .088247  .042662  .013636  .006039  .005844  .004870
 0.000000  .001558  .003896  .010325  .019481  .037987  .033896  .027273  .017143  .015390  .011299  .009545
 0.000000 0.000000 0.000000  .000779  .001169  .006818  .009545  .005065  .000195  .000974  .000584  .000195
 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000 0.000000
Y=-20                                                                                                          Y=-20
```

D16

IN PLANE Z= 15.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

```
      X=-35    X=-25    X=-15    X=-5     X=5      X=15     X=25     X=35     X=45     X=55     X=65     X=75
Y= 80                                                                                                          Y= 80
```

	1.147013	1.014026	.939221	1.022338	1.022338	1.105455	.914286	1.088831	.922597	.905974	.889351	.814545	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	.000974	.000974	.001558	.000584	
	0.000000	0.000000	0.000000	.000195	.001169	.000779	.001364	.001753	.002532	.003506	.005649	.003117	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	1.113766	1.047273	1.022338	1.088831	.964156	1.005714	1.022338	.889351	1.022338	.764675	.980779	.864416	
	0.000000	0.000000	0.000000	0.000000	.000390	.000195	.000779	.000390	.001364	.002143	.000779	.002338	
	0.000000	0.000000	0.000000	.000195	.001948	.002727	.002532	.003506	.004675	.005649	.003117	.006429	
	0.000000	0.000000	0.000000	0.000000	.000195	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	1.088831	1.038961	1.014026	.955844	1.038961	.989091	.947532	.947532	1.005714	.955844	.839481	.930909	
	0.000000	0.000000	0.000000	0.000000	.001558	.000974	.002143	.001364	.001558	.000974	.001558	.001169	
	0.000000	.000195	.000195	.001364	.002532	.002338	.003701	.005260	.007403	.005455	.007403	.006234	
	0.000000	0.000000	0.000000	0.000000	.000779	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	.930909	.955844	.964156	.872727	.989091	897662	.897662	.764675	.980779	.831169	1.014026	.814545	
	0.000000	0.000000	.000195	0.000000	.002143	.002922	.002922	.003506	.002532	.002338	.002143	.001948	
	0.000000	.000779	.001364	.001169	.004481	.004481	.005065	.007792	.008766	.009156	.007208	.007208	
	0.000000	0.000000	0.000000	0.000000	.000584	.000195	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	1.005714	.903896	.987013	.984935	1.009870	.812468	.872727	.878961	.972468	.689870	.835325	.862338	
	0.000000	.000584	.001364	.001364	.004870	.007403	.005455	.007013	.007987	.006623	.003117	.003701	
	0.000000	.000390	.000584	.002532	.004675	.005649	.011883	.011494	.011104	.011883	.009545	.009740	
	0.000000	0.000000	0.000000	0.000000	.000779	.000779	0.000000	.000390	0.000000	.000390	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 30													Y= 30
	.910130	.960000	.966234	.866494	.953766	.866494	.878961	.972468	.829091	.991169	.804156	.797922	
	0.000000	.000779	.002922	.005455	.008182	.016169	.019870	.017338	007987	.007403	.005844	.005844	
	0.000000	.001558	.002922	.004286	.008182	.012857	.015974	.021234	.016948	.016753	.015000	.010130	
	0.000000	0.000000	0.000000	.000195	.000974	.000974	.000584	.000584	.000390	.001753	.001169	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 20													Y= 20
	1.110565	1.103084	.966019	.959747	.990974	.953961	.937208	.930519	.889481	.866071	.879416	.800747	
	0.000000	.001753	.005260	.020844	.036818	.037597	.055130	.038571	.016169	.014416	.006039	.005260	
	.000584	.001948	.004675	.011299	.022987	.031169	.029416	.033896	.021039	.020260	.012857	.012078	
	0.000000	0.000000	.000195	.000584	.000974	.002532	.001558	.003312	.000974	.001753	.001169	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 10								--					Y= 10
	1.016727	.903545	.994227	.920552				/ /	.714318	.950227	.740227	.763409	
	.000974	.003117	.018117	.029805				/ /	.019091	.012078	.009156	.005844	
	.001558	.001948	.004870	.014805				/ /	.026299	.020260	.014610	.012078	
	0.000000	0.000000	0.000000	.000584				/ USA /	.002727	.001558	.001753	.000974	
	0.000000	0.000000	0.000000	0.000000	----------------------			I	0.000000	0.000000	0.000000	0.000000	
Y= 0					/			I					Y= 0
	.899167	.920314	.895093	.895318	--*●			I	.623268	.921537	.797110	.863972	

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0.000000	.001169	.009351	.036623					.015779	.007013	.006234	.005844
.000974	.001169	.004091	.012078					.029610	.017532	.014610	.012078
0.000000	.000584	0.000000	.001169					.003117	.000779	.000390	.000195
0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000
Y=-10											
1.017489	.958961	.990476	.976970	.[illegible]6450	.873420	.913939	.877922	.823896	.949957	.882424	.891429
0.000000	0.000000	.003701	.013442	.021429	.048506	.050455	.032727	.014026	.008182	.004675	.002532
0.000000	.000974	.003312	.005065	.013831	.026299	.024351	.022013	.016169	.013442	.012273	.009935
0.000000	0.000000	0.000000	0.000000	.001364	.002143	.002727	.002338	.001169	.000390	.000390	.000584
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y=-20											

IN PLANE Z= 25.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75
Y= 80											
.939221	1.072208	.989091	1.138701	1.088831	1.060519	.997403	1.088831	1.063896	1.088831	1.063896	.997403
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	0.000000	0.000000	.000584	.000779	.000584
0.000000	0.000000	0.000000	.000584	.000584	.000195	.001753	.001753	.001753	.002727	.002727	.004091
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.[illegible]0000
0.000000	0.000000	0.000000	[illegible].000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0[illegible]00000
Y= 70											
1.196883	.930909	1.088831	.955844	.964156	.997403	[illegible]97922	.972468	.8477[illegible]	.814545	.814545	.772987
0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000584	.000974	.000974	.000779	.000974	.001753
0.000000	0.000000	.000390	.000584	.000974	.001169	.002143	.002338	.0038[illegible]6	.004286	.006234	.004675
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.0000[illegible]	0.000000	0.000000	.000584
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 60											
1.014026	.997403	.972468	.964156	.964156	.964156	.989091	.872727	.897662	.839481	.905974	.748052
0.000000	0.000000	0.000000	.000195	.000195	.000195	.000974	.000584	.000974	.001948	.002532	.002532
0.000000	.000195	[illegible]000779	.001558	.001364	.002338	.002532	.003896	.007013	.006429	.008961	.007013
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000195
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 50											
.955844	1.014026	.930909	.955844	1.022338	.861039	.997403	.939221	1.072208	.822857	.930909	.980779
0.000000	0.000000	.000779	.000779	.001364	.003896	.002727	.003117	.003312	.003312	.003117	.000974
.000195	.000195	.001558	.001753	.001948	.004481	.003896	.007013	.007208	.008766	.006234	.007403
0.000000	0.000000	0.000000	0.000000	.000195	0.000000	.000195	.000195	.000195	.000195	.000779	.000584
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 40											
1.072208	.964156	.960000	.995325	.966234	1.020260	1.0 9870	.[illegible]77	.984935	.924675	.727273	.974545
0.000000	.000195	.000779	.000779	.002922	.002338	.006429	.[illegible]96	.004870	.005065	.004481	.003701
.000779	0.000000	.000584	.001558	.002922	.006039	.007597	.008182	.009935	.007208	.008571	.008571
0.000000	0.000000	0.000000	0.000000	.000390	0.000000	.000195	.0[illegible]195	.000390	.000390	.000779	.000195
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.[illegible]000	0.000000	0.000000	0.000000	0.000000

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Y= 30												
	.897662	.860260	.891429	.885195	.816623	.922597	.760519	.841558	.885195	.735584	.797922	.766753
	0.000000	0.000000	.000390	.002143	.005844	.003896	.007597	.008377	.006623	.004870	.005065	.002922
	.000195	0.000000	.000974	.002727	.006623	.008571	.009935	.013052	.014026	.009935	.012273	.008961
	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	.000195	.000584	.000974	0.000000	.000390
	0.000000	0.000000	0.000000	0.000000	.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 20												
	.891234	1.051169	.930195	.968961	.960000	.838052	1.004221	.832987	.847208	.827143	.860065	.714935
	.000779	.000584	.001169	.003506	.009935	.014610	.016948	.021234	.009156	.007597	.004675	.002922
	.000195	.000584	.002532	.004481	.011299	.014805	.023961	.020844	.020455	.015779	.013052	.012468
	0.000000	0.000000	0.000000	.000390	.000195	0.000000	.000584	.001558	.000779	.000974	0.000000	.000779
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 10												
	.988636	1.043182	1.043182	1.097727					.995455	.913636	.947727	.879545
	.000195	.000974	.005649	.007013					.014805	.007792	.006818	.003506
	.000584	.000779	.004091	.007208					.021623	.017143	.013052	.011104
	0.000000	0.000000	0.000000	0.000000				USA	.000974	.000974	.000584	.001364
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000
Y= 0												
	1.089978	.935346	.980758	.899459					.813788	.897143	.869070	.884156
	0.000000	0.000000	.004286	.006623	NASA				.010519	.008961	.004870	.005065
	.000584	.001169	.002727	.004675					.017727	.017336	.014026	.009545
	0.000000	0.000000	0.000000	.000195					.000584	0.000000	.000974	.000779
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000
Y=-10												
	.976970	.990476	.927446	.940952	.949957	.963463	.976970	.891429	.913939	.895931	.814892	.940952
	0.000000	.000195	.001753	.004870	.008162	.015779	.017727	.012468	.007013	.004286	.003701	.002727
	0.000000	.000779	.002143	.003896	.007987	.013247	.013831	.018896	.013831	.012662	.011494	.009351
	0.000000	0.000000	0.000000	0.000000	0.000000	.002727	.000390	.000974	.000584	0.000000	.000390	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y=-20												

IN PLANE Z= 35.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75
Y= 80												
	.947532	1.030649	.864416	.872727	.756364	.972468	.831169	.847792	.797922	.714805	.964156	.731429
	0.00000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	.000584	.000584	.000390	.000779	.001169
	0.000000	0.000000	0.000000	.000195	.000584	.001558	.000390	.002338	.000390	.003312	.002727	.001558
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 70												
	1.097143	.930909	1.105455	1.030649	.905974	.905974	.947532	1.014026	.980779	.822857	.897662	.822857
	0.000000	0.000000	0.000000	0.000000	.000195	.000779	.000195	.000390	.000584	.000974	.000779	.000584
	0.000000	0.000000	.000584	.000390	.000584	.001364	.001753	.003117	.004091	.003312	.003896	.005065

ALITY

	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	.980779	.822857	1.014026	.922597	.922597	.914286	.831169	.947532	.831169	1.047273	.955844	.839481	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000779	.000195	.002143	.001364	.001364	.002338	.001364	
	0.000000	0.000000	.000779	.000779	.001364	.001948	.001753	.004091	.005455	.003701	.004286	.003506	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	.000195	.000195	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	1.072208	1.047273	1.055584	1.022338	.914286	.864416	.897662	.914286	.805234	.7979	.756364	.706494	
	0.000000	0.000000	0.000000	.000390	.000195	.000584	.001948	.003117	.001753	.0025[illegible]	.002143	.002727	
	0.000000	0.000000	.000584	.000195	.000584	.001558	.003312	.005065	.004675	.005260	.006818	.007013	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	.932987	1.078442	.966000	.974545	.987013	.995325	.930909	1.053506	.889351	.905974	.970390	.818701	
	0.000000	0.000000	.000195	.000584	.000974	.001169	.001753	.002338	.004286	.002727	.003312	.002922	
	0.000000	0.000000	0.000000	.001169	.001558	.003117	.005455	.005260	.005065	.007013	.007208	.005844	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	0.000000	.000195	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 30													Y= 30
	1.047273	.997403	.978701	.953766	.935065	.854026	.966234	.841558	.922597	.935065	.891429	1.009870	
	0.000000	0.000000	.000390	.000195	.002922	.001558	.002338	.004870	.005455	.002922	.003117	.002338	
	0.000000	0.000000	.000195	.002143	.002532	.006039	.006039	.010519	.010714	.012273	.010325	.009740	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000390	.000390	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 20													Y= 20
	.972857	.933896	.907792	.886558	.935065	.947922	.883831	.838442	.955325	.883831	.982987	1.014351	
	0.000000	0.000000	0.000000	.001558	.003312	.006234	.004870	.006039	.005649	.003701	.004481	.004286	
	0.000000	.000195	.001558	.002727	.005065	.006429	.010130	.013831	.013247	.013831	.008571	.008766	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000584	.000584	.000584	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 10								--					Y= 10
	.988636	1.063636	.838636	1.097727				/ /	1.084091	.859091	.961364	.886364	
	0.000000	0.000000	.001558	.001364				/ /	.007013	.005649	.003896	.003117	
	.000390	.000390	.001558	.002727			/	/	.011104	.011104	.011688	.009156	
	0.000000	0.000000	0.000000	0.000000			/	USA /	.000584	.001169	.000779	0.000000	
	0.000000	0.000000	0.000000	0.000000	--------	--------	--------	I	0.000000	0.000000	0.000000	0.000000	
Y= 0					/			I					Y= 0
	1.108247	.865238	1.072835	.945000	--**			I	.876948	.958636	.856364	.854048	
	0.000000	0.000000	.000[illegible]4	.003312	(NASA			I	.006623	.004481	.006234	.004675	
	.000195	.000390	.002532	.002727	--------	--------	--------	--------	.012078	.013247	.009545	.012857	
	0.000000	0.000000	0.000000	0.000000					.000390	.000584	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000	
Y=-10													Y=-10
	1.067013	1.071991	.914419	.940952	1.003982	.941905	1.058009	.832900	.936450	.945455	.895931	.909437	
	0.000000	.000195	.000974	.000390	.002727	.006623	.006623	.007403	.004481	.005260	.002727	.002532	
	0.000000	.000974	.001558	.002532	.003896	.006623	.008766	.010325	.011494	.007792	.010325	.006766	
	0.000000	0.000000	0.000000	0.000000	0.000000	.001169	0.000000	.000195	.000195	.000195	0.000000	0.000000	

D20

	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y=-20												

DENSITY OF UPSTREAM MOVING MOLECULES, NORMALIZED TO THE TOTAL UNDISTURBED DENSITY

VALUES ARE AGAIN GIVEN FOR THE FIVE CLASSES OF MOLECULE IN TURN AT EACH LOCATION

MINIMUM DENSITY RESOLUTION = .0001948 BASED ON ONE MOLECULE OR .0064286 BASED ON ONE MOLECULE PER SAMPLING INTERVAL
NOTE THAT ABOVE FIGURES ASSUME UNIT WEIGHTING FACTOR

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	.000390	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	.000195	.000195	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.000390	.000195	.000195	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000779	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	.000195	.001169	.000390	.000974	.000974	.003117	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.000195	.001364	.000390	0.000000	.001169	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000974	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 30													Y= 30

	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	.001364	.004675	.009351	.007792	.005844	.012662	.000584	0.000000	0.000000	0.000000	0.000000	
	0.000000	.000195	.000779	.001364	.000195	.000195	.001169	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.001364	.000974	.000974	.001364	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 20													Y= 20
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	.001558	.013052	.046753	.045390	.039351	.048364	.009351	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.000390	.002143	.001558	.001169	.001558	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.000584	.001753	.003701	.003701	.003896	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 10													Y= 10

MEAN UPSTREAM VELOCITY COMPONENT OF UPSTREAM MOVING MOLECULES, NORMALIZED TO THE UNDISTURBED MOST PROB. SPEED

VALUES ARE AGAIN GIVEN FOR THE FIVE CLASSES OF MOLECULE IN TURN AT EACH LOCATION

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.900106	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.900106	.020330	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.172519	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	.156046	.900106	.020330	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.103218	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.172519	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.412920	.156046	.900106	.020330	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	.103218	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	

Y= 40												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	.755815	.764694	.623422	.458726	.670292	.126230	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	.743655	.324542	.156046	0.000000	.388223	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	.103218	.139969	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 30												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	.896771	.625938	.512288	.374033	.353734	.154075	.130167	0.000000	0.000000	0.000000	0.000000
	0.000000	.195534	.644064	.230876	.156046	.163941	.241594	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	.587236	.263766	.304827	.142594	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 20												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	.789262	.752950	.556342	.366734	.423915	.260737	.254543	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	.401463	.269571	.385640	.195598	.253821	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	.772654	.577330	.366667	.328443	.195278	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 10												

MOLECULAR FLUX TO SURFACE

NORMALIZED BY STATIONARY FREESTREAM FLUX

LOCATION ON BODY	SAMPLE	TOTAL FLUX	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
NOSE (X=0 TO 7) TOP	286	8.42783	6.54188	1.1197817	.7661664	0.0000000	0.0000000
NOSE UPPER SIDE	453	10.47627	8.85742	.8325511	.7862982	0.0000000	0.0000000
NOSE LOWER SIDE	347	7.05489	5.93668	.5286088	.5896021	0.0000000	0.0000000
NOSE BOTTOM	215	5.98399	5.17685	.3339902	.4453202	.0278325	0.0000000
WINDSHIELD	375	13.96890	11.32412	1.1547622	1.4155150	.0745008	0.0000000
FUSELAGE FORWARD (X=7 TO 16) UPPER (Y GT 2)	25	1.94548	.93383	.3890954	.6225526	0.0000000	0.0000000
FUSELAGE FORWARD SIDE	197	2.17843	.85147	.9952198	.2764499	.0552900	0.0000000
FUSELAGE FORWARD LOWER (Y LT -1)	88	1.22842	.92131	.1535523	.1535523	0.0000000	0.0000000
FUSELAGE CENTER (X=16 TO 24) UPPER	0	0.00000	0.00000	0.0000000	0.0000000	0.0000000	0.0000000
FUSELAGE CENTER SIDE	268	3.89572	.66867	2.5874528	.4070150	.2325800	0.0000000
FUSELAGE CENTER LOWER	22	.74753	.54366	.1019361	.1019361	0.0000000	0.0000000
FUSELAGE REAR (X=24 TO 32) UPPER	25	1.52141	.36514	.7911314	.2434250	.1217125	0.0000000
FUSELAGE REAR SIDE	136	1.92224	.25441	1.2296713	.2544147	.1837440	0.0000000
FUSELAGE REAR LOWER	63	1.01614	.62904	.1935512	.1612927	.0322585	0.0000000
OMS POD UPPER	151	3.51611	2.23541	.9314200	.2561405	.0931420	0.0000000
OMS POD LOWER	124	2.97436	2.01489	.6236554	.2878410	.0479735	0.0000000
VERTICAL TAIL	246	1.91766	.67040	.8263068	.3897674	.0311814	0.0000000
GLOVE FAIRING	369	2.83889	1.83105	.6385565	.3308195	.0384674	0.0000000

WING INNER (Z LT 7) LEADING EDGE (.10 CHORD)	258	9.42902	7.52860	1.0233050	.7674788	.1096398	0.0000000
WING OUTER LEADING EDGE	234	9.10483	8.13209	.4669144	.5058240	0.0000000	0.0000000
WING UPPER INNER FORWARD (X LT 27.5)	359	3.79769	.85686	2.3061195	.4019841	.2327277	0.0000000
WING UPPER INNER REAR	56	1.03306	.01845	.8116932	.1475806	.0553427	0.0000000
WING UPPER OUTER FORWARD	113	2.71050	1.75103	.6476422	.3110277	0.0000000	0.0000000
WING UPPER OUTER REAR	37	.69247	.11229	.2994448	.2432989	.0374306	0.0000000
WING LOWER INNER FORWARD	258	1.63398	1.29199	.1709981	.1583316	.0126665	0.0000000
WING LOWER INNER REAR	19	.25961	.06832	.1366349	.0546540	0.0000000	0.0000000
WING LOWER OUTER FORWARD	92	2.20678	1.60711	.2878410	.2158807	.0959470	0.0000000
WING LOWER OUTER REAR	19	.35559	.14972	.0187153	.1871530	0.0000000	0.0000000
WINGTIP	3	.84628	.56419	0.0000000	.2820941	0.0000000	0.0000000
BASE	0	0.00000	0.00000	0.0000000	0.0000000	0.0000000	0.0000000
PAYLOAD BAY BASE FORWARD	35	.38405	.13167	.0877829	.1426473	.0219457	0.0000000
PAYLOAD BAY BASE REAR	172	1.86733	.31821	1.2070154	.3291860	.0329166	0.0000000
PAYLOAD BAY DOORS INSIDE FORWARD	142	1.22086	.79422	.1726556	.2589835	0.0000000	0.0000000
PAYLOAD BAY DOORS INSIDE REAR	200	1.72656	.91507	.5438653	.2503507	.0172656	0.0000000
PAYLOAD BAY DOORS OUTSIDE FORWARD	251	2.16683	.82011	1.0963633	.1467573	.1035934	0.0000000
PAYLOAD BAY DOORS OUTSIDE REAR	421	3.63440	.61293	2.4517100	.3107801	.2589835	0.0000000
PAYLOAD BAY FORWARD BULKHEAD	2	.14678	0.00000	.0733903	0.0000000	.0733903	0.0000000
PAYLOAD BAY REAR BULKHEAD	290	14.93061	10.14252	3.7583948	.9267275	.1029697	0.0000000

176.327

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FLOW TO TIME .09900

NUMBER OF MOLECULES = 7067 FACTORED NUMBER = 76266.90
FACTORED COLLISIONS 368.00 3260.33 3795.73 22149.40
TOTAL SURFACE INTERACTIONS = 6351

CELL	X	Y	Z	SAMPLE	DENSITY	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	U	V	W	TX	TY	TZ
1	-4.500	-5.500	1.500	215	.9307	.7403	.147186	.043290	0.000000	0.000000	7.494	-.106	.017	24.842	2.048	1.941
2	.500	-5.500	1.500	350	1.5152	.8095	.614719	.086580	.004329	0.000000	5.210	-.266	.027	41.537	1.441	2.514
3	5.500	-5.500	1.500	350	1.5152	.9134	.515152	.051948	.034632	0.000000	5.815	-.261	.048	38.238	1.867	1.184
4	10.500	-5.500	1.500	293	1.2684	.8918	.329004	.021645	.025974	0.000000	6.574	-.173	.092	32.533	1.575	1.772
5	15.500	-5.500	1.500	336	1.4545	.9264	.406926	.090909	.030303	0.000000	6.469	-.205	.043	33.124	2.712	2.636
6	20.500	-5.500	1.500	339	1.4675	.9004	.454545	.077922	.034632	0.000000	6.128	-.259	-.023	35.161	1.979	1.965
7	25.500	-5.500	1.500	299	1.2944	.8701	.329004	.030303	.064935	0.000000	6.363	-.115	-.003	33.461	1.028	1.373
8	30.500	-5.500	1.500	288	1.2468	.9134	.207792	.064935	.060606	0.000000	7.203	-.012	.007	25.657	1.502	2.160
9	35.500	-5.500	1.500	230	.9957	.9048	.043290	.047619	0.000000	0.000000	8.638	.050	.157	4.195	1.853	2.007
10	-4.500	-2.500	1.500	305	1.3203	.9870	.277056	.056277	0.000000	0.000000	7.166	-.086	.004	30.923	2.149	2.485
11	.500	-2.500	1.500	601	2.6017	.7619	1.597403	.194805	.047619	0.000000	3.196	-.334	.146	38.026	2.890	2.710
12	5.500	-2.500	1.500	414	1.7922	.6277	.995671	.112554	.056277	0.000000	3.815	-.272	.116	38.344	2.356	2.178
13	10.500	-2.500	1.500	261	1.1299	.6494	.389610	.051948	.038961	0.000000	5.743	-.186	-.034	40.262	1.918	1.793
14	15.500	-2.500	1.500	313	1.3550	.6190	.645022	.038961	.051948	0.000000	4.434	-.225	.044	41.757	.901	1.514
15	20.500	-2.500	1.500	294	1.2739	.5200	.667299	.056330	.030332	0.000000	4.162	-.143	.037	40.291	1.727	1.572
16	25.500	-2.500	1.500	224	.9697	.3939	.445887	.038961	.090909	0.000000	4.114	-.079	.061	40.097	1.190	1.614
17	30.500	-2.500	1.500	184	.7965	.4589	.194805	.051948	.090909	0.000000	5.977	.069	-.020	34.638	2.833	2.377
18	35.500	-2.500	1.500	138	.5974	.5455	.038961	.008658	.004329	0.000000	8.629	.291	-.065	8.122	1.332	1.261
19	-4.500	.500	1.500	318	1.3766	.8918	.437229	.047619	0.000000	0.000000	5.940	-.019	.104	41.895	1.144	1.997
20	.500	.500	1.500	818	4.5376	.4382	3.494750	.554722	.049925	0.000000	1.653	.075	.239	23.646	4.059	4.260
21	5.500	.500	1.500	141	2.9240	.3111	2.260466	.290327	.062213	0.000000	1.808	.051	.272	22.829	3.337	4.241
22	10.500	.500	1.500	16	.6298	.1574	.472334	0.000000	0.000000	0.000000	2.241	.041	-.052	36.617	.402	.579
23	15.500	.500	1.500	29	1.4622	.1008	1.159696	.100843	.100843	0.000000	1.248	.092	-.114	15.672	4.209	2.102
24	20.500	.500	1.500	31	3.3337	.1075	2.580933	.215078	.430156	0.000000	1.023	-.033	-.069	11.281	3.112	2.512
25	25.500	.500	1.500	22	1.5529	0.0000	1.199993	.141176	.211763	0.000000	.939	.053	-.026	6.905	4.190	4.822
26	30.500	.500	1.500	10	.1482	0.0000	.103742	0.000000	.044461	0.000000	.268	.107	-.172	.309	.536	.124
27	35.500	.500	1.500	34	.1472	.0260	.034632	.034632	.051948	0.000000	2.725	-.140	-.189	22.198	2.530	4.819
28	-4.500	3.500	1.500	315	1.3636	.8615	.437229	.064935	0.000000	0.000000	5.857	.068	.079	41.494	2.558	1.661
29	.500	3.500	1.500	588	2.6673	.6215	1.755524	.263102	.027217	0.000000	2.719	.332	.176	35.753	2.996	3.673
30	5.500	3.500	1.500	772	6.0866	.4652	4.612426	.930370	.076845	0.000000	1.879	.271	.189	23.144	4.937	4.326
31	10.500	3.500	1.500	205	1.2786	.7235	.355526	.037424	.162170	0.000000	5.461	.097	-.106	41.378	1.468	1.527
32	15.500	3.500	1.500	212	1.3223	.7422	.467798	.062373	.049898	0.000000	5.512	-.015	-.030	40.175	2.010	1.679
33	20.500	3.500	1.500	325	2.0271	.5115	1.222511	.118509	.174644	0.000000	2.665	.100	-.043	34.887	2.103	2.255
34	25.500	3.500	1.500	798	6.2527	.2351	5.328092	.485797	.203721	0.000000	.757	.096	.068	13.481	2.682	3.062
35	30.500	3.500	1.500	13[illegible]	2.9435	.3176	2.011724	.317641	.296465	0.000000	1.969	.083	.032	20.280	3.626	3.785
36	35.500	3.500	1.500	60	.2597	.1039	.082251	.025974	.047619	0.000000	4.687	-.461	-.052	34.695	1.344	3.089
37	-4.500	6.500	1.500	276	1.1948	.8615	.277056	.051948	.004329	0.000000	6.789	.098	.047	33.357	2.177	1.992
38	.500	6.500	1.500	327	1.4156	.7792	.562771	.060606	.012987	0.000000	5.313	.281	.132	43.596	1.946	1.935
39	5.500	6.500	1.500	398	1.7229	.8052	.763550	.103896	.030303	0.000000	4.611	.351	.124	39.682	2.481	1.684
40	10.500	6.500	1.500	302	1.[illegible]74	.9048	.277056	.082251	.043290	0.000000	6.827	.117	.078	30.056	2.656	2.430

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ORIGINAL PAGE IS
OF POOR QUALITY

41	15.500	6.500	1.500	290	1.2554	.9221	.264069	.051948	.017316	0.000000	7.067	.142	.060	30.178	1.608	2.164
42	20.500	6.500	1.500	344	1.4892	.7749	.632035	.047619	.034632	0.000000	4.869	.209	.026	43.844	1.026	1.153
43	25.500	6.500	1.500	338	1.4667	.6336	.698648	.104146	.030376	0.000000	4.532	.217	.087	42.038	2.628	2.367
44	30.500	6.500	1.500	424	1.9671	.7006	.932523	.171656	.162360	0.000000	3.979	.144	.083	37.230	2.149	2.943
45	35.500	6.500	1.500	249	1.0779	.7229	.220779	.069264	.064935	0.000000	6.783	-.055	-.049	28.936	1.713	2.458
46	-4.500	9.500	1.500	294	1.2727	1.0606	.181818	.021645	.008658	0.000000	7.635	.081	.016	25.630	1.093	1.260
47	.500	9.500	1.500	341	1.4762	1.1429	.259740	.064935	.008658	0.000000	7.363	.143	.097	25.711	1.951	2.160
48	5.500	9.500	1.500	338	1.4632	.9654	.350649	.112554	.034632	0.000000	6.597	.188	.105	31.456	2.335	2.946
49	10.500	9.500	1.500	274	1.1861	1.0087	.142857	.030303	.004329	0.000000	8.042	.171	-.032	19.687	1.346	1.279
50	15.500	9.500	1.500	290	1.2554	.9913	.207792	.056277	0.000000	0.000000	7.627	.259	.048	24.555	2.286	1.649
51	20.500	9.500	1.500	291	1.2597	.8658	.324675	.051948	.017316	0.000000	6.754	.213	.039	34.459	1.539	1.938
52	25.500	9.500	1.500	278	1.2035	.8268	.285714	.086580	.004329	0.000000	6.923	.318	-.022	30.467	2.389	2.120
53	30.500	9.500	1.500	302	1.3074	.7749	.389281	.086580	.060606	0.000000	6.023	.271	-.040	34.972	2.443	2.559
54	35.500	9.500	1.500	256	1.1082	.6840	.341991	.064935	.017316	0.000000	6.251	.100	.056	33.994	2.372	1.827
55	-4.500	12.500	1.500	196	.8485	.6883	.095238	.056277	.008658	0.000000	7.712	.210	-.028	22.035	1.814	2.246
56	.500	12.500	1.500	190	.8225	.6494	.125541	.047619	0.000000	0.000000	7.495	.210	.042	23.201	2.008	2.706
57	5.500	12.500	1.500	246	1.0649	.8398	.168831	.043290	.012987	0.000000	7.578	.336	-.045	22.268	2.462	1.198
58	10.500	12.500	1.500	189	.8182	.6710	.121212	.025974	0.000000	0.000000	7.758	.365	.062	21.746	2.240	1.283
59	15.500	12.500	1.500	219	.9481	.7662	.116883	.056277	.008658	0.000000	7.980	.371	.006	15.929	2.370	2.666
60	20.500	12.500	1.500	222	.9610	.6753	.207792	.060606	.017316	0.000000	6.633	.419	-.018	29.394	2.120	2.524
61	25.500	12.500	1.500	215	.9307	.7273	.155844	.043290	.004329	0.000000	7.551	.325	.082	23.563	1.644	1.532
62	30.500	12.500	1.500	224	.9697	.6926	.207792	.034632	.034632	0.000000	7.131	.283	.060	29.172	1.467	1.979
63	35.500	12.500	1.500	209	.9048	.6797	.134199	.051948	.038961	0.000000	7.486	.277	.062	22.929	1.938	2.357
64	-4.500	-5.500	4.500	269	1.1645	.9827	.134199	.047619	0.000000	0.000000	8.022	-.131	.063	19.398	1.703	1.567
65	.500	-5.500	4.500	301	1.3030	.8571	.363636	.073593	.008658	0.000000	6.454	-.194	.106	35.021	2.462	2.362
66	5.500	-5.500	4.500	326	1.4113	.9264	.398268	.051948	.034632	0.000000	6.345	-.247	.095	36.411	1.815	1.480
67	10.500	-5.500	4.500	309	1.3377	.9437	.320346	.064935	.008658	0.000000	6.916	-.204	.070	30.747	1.982	1.768
68	15.500	-5.500	4.500	342	1.4805	.9307	.450216	.082251	.017316	0.000000	6.252	-.184	.059	35.600	3.000	1.733
69	20.500	-5.500	4.500	377	1.6320	.8745	.623377	.103896	.030303	0.000000	5.512	-.210	-.017	38.027	2.862	2.192
70	25.500	-5.500	4.500	348	1.5065	.9697	.458874	.025974	.051948	0.000000	6.176	-.144	-.021	36.652	.960	1.340
71	30.500	-5.500	4.500	262	1.1342	.9221	.142857	.056277	.012987	0.000000	8.098	-.151	-.015	15.944	1.311	2.583
72	35.500	-5.500	4.500	218	.9437	.7749	.073593	.064935	.030303	0.000000	8.241	.031	.001	12.952	1.843	2.256
73	-4.500	-2.500	4.500	283	1.2251	.9091	.255411	.060606	0.000000	0.000000	7.080	-.114	.092	31.776	3.192	1.244
74	.500	-2.500	4.500	445	1.9264	1.0087	.748918	.147186	.021645	0.000000	5.386	-.156	.257	40.581	2.698	2.917
75	5.500	-2.500	4.500	405	1.7532	1.0433	.580087	.095238	.034632	0.000000	5.819	-.161	.176	36.956	2.189	1.630
76	10.500	-2.500	4.500	399	1.7273	.8701	.692641	.108225	.056277	0.000000	5.209	-.188	.157	39.744	2.537	2.687
77	15.500	-2.500	4.500	417	1.8052	.8009	.826840	.142857	.034632	0.000000	4.784	-.195	.116	39.936	2.153	3.509
78	20.500	-2.500	4.500	447	1.9351	.6407	1.116883	.095238	.082251	0.000000	3.279	-.306	.029	38.645	1.229	1.863
79	25.500	-2.500	4.500	207	.8961	.5065	.311688	.021645	.056277	0.000000	5.492	-.145	.072	38.178	1.369	1.706
80	30.500	-2.500	4.500	195	.8442	.6104	.125541	.025974	.082251	0.000000	6.914	.058	.010	28.963	.981	1.223
81	35.500	-2.500	4.500	165	.7143	.5844	.073593	.030303	.025974	0.000000	7.890	.241	.016	18.762	1.709	1.508
82	-4.500	.500	4.500	294	1.2727	.9610	.264069	.043290	.004329	0.000000	7.075	.061	.076	31.602	1.477	2.139
83	.500	.500	4.500	472	2.0433	.7792	1.051948	.147186	.064935	0.000000	3.969	.010	.344	41.943	2.213	2.548
84	5.500	.500	4.500	556	2.4069	.8355	1.316017	.185147	.069264	0.000000	3.818	-.032	.309	38.955	2.695	2.326
85	10.500	.500	4.500	571	2.4719	.8701	1.402597	.060606	.138528	0.000000	3.389	-.063	.183	39.087	1.292	1.045
86	15.500	.500	4.500	637	2.8257	.5634	1.869734	.243980	.128644	0.000000	2.547	-.051	.155	30.210	2.608	3.427
87	20.500	.500	4.500	920	3.6029	.1523	4.513695	.621196	.310598	0.000000	1.180	.049	.139	14.905	3.532	3.449
88	25.500	.500	4.500	601	4.4402	.4285	3.442780	.206862	.362009	0.000000	1.416	.007	.088	18.208	1.642	1.897
89	30.500	.500	4.500	291	1.5331	.4004	.927262	.069565	.115908	0.000000	3.054	-.028	.013	32.310	1.647	2.138

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90	35.500	.500	4.500	137	.5931	.4632	.077922	.034632	.017316	0.000000	7.642	-.032	-.171	20.742	1.467	1.410
91	-4.500	3.500	4.500	297	1.2657	.9264	.320346	.038961	0.000000	0.000000	6.774	.054	.091	35.100	1.446	2.041
92	.500	3.500	4.500	387	1.6753	.7[illegible]9	.770563	.138528	.017316	0.000000	4.616	.127	.189	41.857	2.677	3.447
93	5.500	3.500	4.500	461	1.9957	.7662	1.030303	.155844	.043290	0.000000	4.247	.220	.295	39.531	2.330	2.889
94	10.500	3.500	4.500	378	1.6364	.8658	.610390	.082251	.077922	0.000000	5.317	.119	.024	40.500	2.192	1.917
95	15.500	3.500	4.500	343	1.4848	.7403	.584416	.099567	.060606	0.000000	5.076	.133	.039	40.621	2.562	2.123
96	20.500	3.500	4.500	402	1.7403	.7056	.826840	.108225	.099567	0.000000	4.153	.084	.069	41.911	2.495	2.319
97	25.500	3.500	4.500	537	2.3247	.5325	1.532468	.147186	.112554	0.000000	2.580	.149	.188	34.513	1.661	2.328
98	30.500	3.500	4.500	327	1.6155	.6472	.825048	.059285	.083987	0.000000	4.127	.039	.106	39.767	1.298	1.751
99	35.500	3.500	4.500	166	.7186	.5411	.116883	.034632	.025974	0.000000	7.422	-.150	-.144	25.524	1.350	1.356
100	-4.500	6.500	4.500	218	.9437	.6926	.194805	.043290	.012987	0.000000	6.956	.119	-.055	33.827	2.107	1.303
101	.500	6.500	4.500	292	1.2641	.8312	.354978	.060606	.017316	0.000000	6.281	.206	.162	36.658	1.623	2.426
102	5.500	6.500	4.500	316	1.3680	.7446	.519481	.082251	.021645	0.000000	5.508	.210	.102	40.000	2.666	2.308
103	10.500	6.500	4.500	262	1.1342	.8268	.212121	.064935	.030303	0.000000	7.134	.073	-.022	27.364	2.149	2.395
104	15.500	6.500	4.500	255	1.1039	.7100	.311688	.060606	.021645	0.000000	6.387	.128	.031	36.249	2.841	2.310
105	20.500	6.500	4.500	308	1.3333	.7273	.497835	.064935	.043290	0.000000	5.358	.179	.098	40.877	2.458	1.538
106	25.500	6.500	4.500	360	1.5584	.7143	.675325	.121212	.047619	0.000000	4.923	.183	.193	39.490	2.923	2.660
107	30.500	6.500	4.500	269	1.1645	.6537	.406926	.056277	.047619	0.000000	5.663	.178	.115	37.380	1.863	1.821
108	35.500	6.500	4.500	218	.9437	.7922	.108225	.030303	.012987	0.000000	7.992	-.065	.035	17.000	1.548	1.241
109	-4.500	9.500	4.500	252	1.0909	.8918	.160173	.030303	.008658	0.000000	7.671	.076	-.024	25.083	1.374	1.358
110	.500	9.500	4.500	324	1.4026	1.1169	.207792	.069264	.008658	0.000000	7.550	.131	.077	25.426	1.608	1.950
111	5.500	9.500	4.500	267	1.1558	.8615	.242424	.047619	.004329	0.000000	7.104	.249	.167	29.757	1.921	1.608
112	10.500	9.500	4.500	273	1.1818	.9654	.155844	.043290	.017316	0.000000	7.881	.080	.085	19.759	2.144	2.100
113	15.500	9.500	4.500	219	.9481	.7186	.168831	.047619	.012987	0.000000	7.398	.159	-.042	26.197	2.413	1.904
114	20.500	9.500	4.500	306	1.3247	.9437	.294372	.064935	.021645	0.000000	6.960	.222	.096	29.503	2.163	1.588
115	25.500	9.500	4.500	266	1.1515	.8095	.216450	.099567	.025974	0.000000	7.169	.116	.063	26.442	2.185	2.918
116	30.500	9.500	4.500	254	1.0996	.8182	.203463	.060606	.017316	0.000000	7.376	.218	.022	25.097	2.002	1.416
117	35.500	9.500	4.500	235	1.0173	.8442	.112554	.043290	.017316	0.000000	8.103	.108	.040	16.708	1.731	1.759
118	-4.500	12.500	4.500	270	1.1688	1.0433	.090909	.034632	0.000000	0.000000	8.452	.080	.025	13.265	1.681	1.792
119	.500	12.500	4.500	255	1.1039	.9567	.082251	.051948	.012987	0.000000	8.129	.129	.070	16.976	2.059	1.202
120	5.500	12.500	4.500	248	1.0736	.8658	.160173	.047619	0.000000	0.000000	7.702	.264	.105	23.443	1.849	1.534
121	10.500	12.500	4.500	241	1.0433	.8658	.125541	.047619	.004329	0.000000	7.917	.266	.035	18.903	2.[illegible]05	1.653
122	15.500	12.500	4.500	221	.9567	.8052	.103896	.047619	0.000000	0.000000	8.150	.191	.072	18.141	1.138	1.580
123	20.500	12.500	4.500	262	1.1342	.8485	.229437	.051948	.004329	0.000000	7.274	.255	.045	27.057	1.577	2.206
124	25.500	12.500	4.500	230	.9957	.8442	.103896	.043290	.004329	0.000000	8.124	.248	-.129	18.013	1.261	1.480
125	30.500	12.500	4.500	270	1.1688	.8918	.212121	.056277	.008658	0.000000	7.428	.221	-.064	23.711	2.195	1.627
126	35.500	12.500	4.500	204	.8831	.7316	.090909	.060606	0.000000	0.000000	8.296	.214	.039	13.281	1.944	2.405
127	-4.500	-5.500	7.500	303	1.3117	1.1991	.082251	.030303	0.000000	0.000000	8.607	-.067	.016	11.047	1.854	1.975
128	.500	-5.500	7.500	296	1.2814	1.0173	.194805	.056277	.012987	0.000000	7.626	-.045	.088	24.422	1.873	1.974
129	5.500	-5.500	7.500	328	1.4199	1.0779	.264069	.060606	.017316	0.000000	7.185	-.152	.196	26.900	1.740	1.838
130	10.50	-5.500	7.500	299	1.2944	.9654	.242424	.069264	.017316	0.000000	7.171	-.127	.158	27.689	1.774	2.124
131	15.500	-5.500	7.500	350	1.5152	1.0000	.406926	.082251	.025974	0.000000	6.475	-.161	.095	33.792	1.535	2.706
132	20.500	-5.500	7.500	351	1.5195	.8745	.497835	.090909	.056277	0.000000	5.733	-.227	.150	39.466	1.786	1.821
133	25.500	-5.500	7.500	316	1.3680	.9221	.329004	.064935	.051948	0.000000	6.571	-.173	.060	32.466	1.973	2.066
134	30.500	-5.500	7.500	253	1.0952	.8701	.168831	.047619	.008658	0.000000	7.713	-.033	.050	21.352	1.403	1.556
135	35.500	-5.500	7.500	212	.9177	.8139	.034632	.056277	.012987	0.000000	8.640	-.041	.166	8.116	1.639	2.046
136	-4.500	-2.500	7.500	240	1.039[illegible]	.8745	.129870	.034632	0.000000	0.000000	7.856	-.041	.079	20.185	1.450	2.509
137	.500	-2.500	7.500	273	1.1818	.8658	.255411	.051948	.008658	0.000000	6.898	-.099	.212	31.653	1.634	1.870
138	5.500	-2.500	7.500	279	1.2078	.8485	.281385	.051948	.025974	0.000000	6.717	-.107	.149	32.508	1.532	2.231

139	10.500	-2.500	7.500	299	1.2944	.7965	.398268	.060606	.038961	0.000000	6.011	-.087	.211	39.052	1.512	1.950
140	15.500	-2.500	7.500	339	1.4675	.8874	.497835	.060606	.021645	0.000000	5.866	-.106	.158	40.330	1.288	1.660
141	20.500	-2.500	7.500	496	2.1417	.8225	1.125541	.173160	.025974	0.000000	4.062	-.211	.193	39.575	2.620	2.593
142	25.500	-2.500	7.500	373	1.6147	.8364	.783550	.108225	.086580	0.000000	4.248	-.214	.086	38.673	2.440	2.186
143	30.500	-2.500	7.500	235	1.0173	.7273	.142857	.051948	.095238	0.000000	6.990	-.024	.102	28.232	1.284	1.819
144	35.500	-2.500	7.500	178	[illegible]	.6494	.064935	.025974	.030303	0.000000	8.297	.164	.065	13.309	1.177	1.794
145	-4.500	.500	7.500	234	[illegible]	.8615	.116883	.034632	0.000000	0.000000	7.850	-.042	.021	20.030	1.353	2.083
146	.500	.500	7.500	287	[illegible]	.7922	.376623	.038961	.034632	0.000000	6.082	.002	.200	37.608	2.876	1.642
147	5.500	.500	7.500	332	1.4372	.9913	.367965	.073593	.004329	0.000000	6.718	-.019	.253	33.310	2.051	1.944
148	10.500	.500	7.500	313	[illegible]	.8528	.458874	.034632	.008658	0.000000	6.026	-.053	.166	38.293	1.703	1.233
149	15.500	.500	7.500	375	1.6234	.7186	.766234	.090909	.047619	0.000000	4.502	-.016	.283	41.598	1.668	2.227
150	20.500	.500	7.500	576	2.5056	.7038	1.532218	.285064	.044541	0.000000	3.341	.137	.265	36.345	3.258	3.926
151	25.500	.500	7.500	475	2.9019	.6903	1.844979	.238259	.128293	0.000000	3.009	.173	.108	32.216	2.-76	3.374
152	30.500	.500	7.500	260	1.2110	.6800	.367967	.065209	.097814	0.000000	5.685	.001	.038	38.179	1. 76	1.789
153	35.500	.500	7.500	193	.8355	.7316	.077922	.025974	0.000000	0.000000	8.483	-.191	-.095	14.153	.983	.970
154	-4.500	3.500	7.500	226	.9784	.7835	.151515	.034632	.008658	0.000000	7.514	.029	.122	25.338	1.822	1.715
155	.500	3.500	7.500	290	1.2554	.8312	.329004	.077922	.017316	0.000000	6.437	.075	.214	35.312	1.733	2.109
156	5.500	3.500	7.500	290	1.2554	.8095	.367965	.060606	.017316	0.000000	6.391	.058	.249	35.571	1.756	2.250
157	10.500	3.500	7.500	301	1.3030	.8268	.359307	.086580	.030303	0.000000	6.209	.103	.194	36.802	1.871	2.017
158	15.500	3.500	7.500	337	1.4589	.8571	.497835	.086580	.017316	0.000000	5.847	.117	.225	37.996	2.047	2.456
159	20.500	3.500	7.500	369	1.5974	.7100	.709957	.125541	.051948	0.000000	4.649	.189	.180	40.669	2.255	2.507
160	25.500	3.500	7.500	403	1.7446	.7100	.878788	.121212	.034632	0.000000	4.414	.226	.146	40.211	2.235	2.363
161	30.500	3.500	7.500	295	1.2771	.7186	.419913	.077922	.060606	0.000000	5.748	.023	.113	37.349	1.846	1.819
162	35.500	3.500	7.500	226	.9784	.8009	.099567	.043290	.034632	0.000000	7.988	.137	.049	16.920	1.148	1.583
163	-4.500	6.500	7.500	239	1.0346	.9048	.086580	.043290	0.000000	0.000000	8.346	.093	.086	14.861	1.499	1.909
164	.500	6.500	7.500	257	1.1126	.8268	.225108	.056277	.004329	0.000000	7.206	.161	.145	28.156	2.168	2.187
165	5.500	6.500	7.500	293	1.2684	.9221	.285714	.056277	.004329	0.000000	6.927	.150	.124	30.208	2.089	1.778
166	10.500	6.500	7.500	251	1.0866	.9221	.125541	.034632	.004329	0.000000	8.110	.123	.027	17.864	1.537	1.759
167	15.500	6.500	7.500	256	1.1082	.8528	.194805	.043290	.017316	0.000000	7.411	.137	.084	26.656	1.980	1.936
168	20.500	6.500	7.500	301	1.3030	.8139	.385281	.077922	.025974	0.000000	6.211	.140	.189	37.956	1.946	1.563
169	25.500	6.500	7.500	330	1.4286	.7922	.502165	.121212	.012987	0.000000	5.928	.203	.175	35.499	3.277	3.303
170	30.500	6.500	7.500	287	1.2424	.7403	.385281	.073593	.043290	0.000000	6.071	.135	.155	35.411	2.154	2.439
171	35.500	6.500	7.500	254	1.0996	.8831	.147186	.060606	.008658	0.000000	7.860	-.112	.146	20.445	1.291	1.309
172	-4.500	9.500	7.500	248	1.0736	.9221	.112554	.038961	0.000000	0.000000	8.181	.040	.030	17.756	2.070	1.776
173	.500	9.500	7.500	273	1.1818	.9827	.164502	.034632	0.000000	0.000000	7.799	.093	.124	21.200	1.646	1.845
174	5.500	9.500	7.500	269	1.1645	.8961	.199134	.064935	.004329	0.000000	7.254	.185	.160	27.033	1.982	1.726
175	10.500	9.500	7.500	260	1.1255	.9004	.173160	.043290	.008658	0.000000	7.523	.150	.111	24.773	1.675	2.045
176	15.500	9.500	7.500	229	.9913	.8442	.064935	.047619	.034632	0.000000	8.089	.073	.023	16.864	1.462	1.847
177	20.500	9.500	7.500	266	1.1515	.8788	.199134	.060606	.012987	0.000000	7.377	.163	.123	28.031	1.351	2.203
178	25.500	9.500	7.500	273	1.1818	.8485	.281385	.051948	0.000000	0.000000	7.096	.232	.212	28.452	1.654	1.806
179	30.500	9.500	7.500	264	1.1429	.8918	.212121	.034632	.004329	0.000000	7.485	.039	.042	23.179	1.678	1.527
180	35.500	9.500	7.500	218	.9437	.7749	.099567	.047619	.021645	0.000000	8.166	.120	.131	14.706	2.207	1.932
181	-4.500	12.500	7.500	254	1.0996	.9827	.099567	.017316	0.000000	0.000000	8.382	.092	.024	14.837	1.654	1.993
182	.500	12.500	7.500	242	1.0476	.9784	.043290	.025974	0.000000	0.000000	8.707	-.130	-.002	8.246	1.611	1.663
183	5.500	12.500	7.500	270	1.1688	.9957	.121212	.043290	.008658	0.000000	8.159	.160	.086	16.723	2.398	1.877
184	10.500	12.500	7.500	256	1.1082	.9870	.069264	.038961	.012987	0.000000	8.482	.109	.106	12.520	2.327	1.674
185	15.500	12.500	7.500	253	1.0952	.8918	.116883	.060606	.025974	0.000000	8.008	.203	.078	16.783	2.340	2.409
186	20.500	12.500	7.500	237	1.0260	.8745	.112554	.038961	0.000000	0.000000	8.270	.187	.180	14.635	1.915	1.825
187	25.500	12.500	7.500	224	.9697	.8139	.090909	.060606	.004329	0.000000	8.186	.270	.092	14.519	2.458	1.945

188	30.500	12.500	7.500	268	1.1602	.9740	.138528	.034632	.012987	0.000000	7.935	.174	.172	19.490	1.264	1.273
189	35.500	12.500	7.500	213	.9221	.7965	.112554	.012987	0.000000	0.000000	8.197	.129	.121	15.033	1.722	1.160
190	-4.500	-5.500	10.500	227	.9827	.9264	.030303	.021645	.004329	0.000000	8.760	-.059	.006	7.361	1.364	.943
191	.500	-5.500	10.500	247	1.0693	.9351	.112554	.012987	.008658	0.000000	8.142	-.098	.086	17.158	1.750	1.344
192	5.500	-5.500	10.500	283	1.2251	1.0390	.121212	.060606	.004329	0.000000	8.187	-.078	.181	15.536	2.419	1.910
193	10.500	-5.500	10.500	273	1.1818	1.0000	.142857	.034632	.004329	0.000000	8.003	-.133	.157	18.403	1.691	1.801
194	15.500	-5.500	10.500	260	1.1255	.8874	.160173	.069264	.008658	0.000000	7.714	-.120	.109	21.106	2.394	1.934
195	20.500	-5.500	10.500	296	1.2814	.8788	.320346	.064935	.017316	0.000000	6.823	-.175	.124	33.007	1.643	1.791
196	25.500	-5.500	10.500	265	1.1472	.8788	.203463	.043290	.021645	0.000000	7.458	-.204	.133	25.166	1.743	1.429
197	30.500	-5.500	10.500	226	.9784	.8312	.082251	.047619	.017316	0.000000	8.246	-.129	-.008	13.569	1.957	2.176
198	35.500	-5.500	10.500	230	.9957	.9221	.017316	.051948	.004329	0.000000	8.818	-.028	.117	5.521	1.343	1.840
199	-4.500	-2.500	10.500	227	.9827	.9134	.056277	.012987	0.000000	0.000000	8.653	-.026	-.002	9.283	1.290	2.152
200	.500	-2.500	10.500	248	1.0736	.9048	.138528	.030303	0.000000	0.000000	7.969	-.032	.072	19.873	1.779	1.375
201	5.500	-2.500	10.500	229	.9913	.8139	.129870	.043290	.004329	0.000000	7.820	-.080	.218	20.377	1.875	2.080
202	10.500	-2.500	10.500	248	1.0736	.8009	.203463	.064935	.004329	0.000000	7.148	.004	.174	26.719	2.137	2.291
203	15.500	-2.500	10.500	270	1.1688	.8874	.225108	.051948	.004329	0.000000	7.165	-.112	.230	29.135	1.561	1.346
204	20.500	-2.500	10.500	315	1.3636	.6797	.541126	.125541	.017316	0.000000	5.224	-.150	.285	41.084	2.751	2.228
205	25.500	-2.500	10.500	369	1.5974	.7446	.696970	.095238	.060606	0.000000	4.814	-.178	.137	42.089	1.446	2.420
206	30.500	-2.500	10.500	194	.8398	.6580	.125541	.034632	.021645	0.000000	7.586	.039	.185	23.235	1.233	1.354
207	35.500	-2.500	10.500	196	.8485	.7619	.038961	.047619	0.000000	0.000000	8.712	.033	.103	6.231	2.345	2.078
208	-4.500	.500	10.500	234	1.0130	.9091	.082251	.021645	0.000000	0.000000	8.402	.031	.046	14.192	1.614	2.022
209	.500	.500	10.500	242	1.0476	.8528	.142857	.034632	.017316	0.000000	7.686	-.030	.090	23.678	1.411	2.178
210	5.500	.500	10.500	272	1.1775	.8745	.229437	.073593	0.000000	0.000000	7.246	-.046	.209	26.656	2.175	2.587
211	10.500	.500	10.500	264	1.1429	.9134	.203463	.021645	.004329	0.000000	7.536	-.087	.146	25.928	1.255	1.759
212	15.500	.500	10.500	295	1.2771	.8658	.329004	.069264	.012987	0.000000	6.636	.015	.213	32.581	2.296	2.447
213	20.500	.500	10.500	328	1.4199	.7316	.567100	.095238	.025974	0.000000	5.126	.092	.227	40.562	2.298	2.527
214	25.500	.500	10.500	406	1.9229	.7341	1.018276	.132613	.037889	0.000000	4.025	.244	.184	38.942	1.962	2.397
215	30.500	.500	10.500	270	1.2184	.6078	.288805	.094764	.027076	0.000000	6.721	-.028	.149	29.117	1.723	2.343
216	35.500	.500	10.500	164	.7100	.6017	.056277	.051948	0.000000	0.000000	8.290	-.048	.148	11.585	2.048	2.187
217	-4.500	3.500	10.500	221	.9567	.8615	.051948	.034632	.008658	0.000000	8.480	.026	.075	12.987	1.157	2.096
218	.500	3.500	10.500	265	1.1472	.9351	.151515	.060606	0.000000	0.000000	7.816	.027	.172	21.438	2.322	2.592
219	5.500	3.500	10.500	263	1.1385	.8788	.186147	.060606	.012987	0.000000	7.373	.122	.271	26.059	1.385	2.492
220	10.500	3.500	10.500	285	1.2338	.9437	.194805	.082251	.012987	0.000000	7.612	.042	.141	22.789	1.936	2.893
221	15.500	3.500	10.500	297	1.2857	.7792	.398268	.090909	.017316	0.000000	6.011	.204	.296	37.412	1.775	2.132
222	20.500	3.500	10.500	307	1.3290	.7835	.432900	.086580	.025974	0.000000	5.687	.164	.274	37.627	2.226	2.243
223	25.500	3.500	10.500	328	1.4199	.8312	.467532	.108225	.012987	0.000000	6.035	.078	.226	33.974	2.824	2.640
224	30.500	3.500	10.500	267	1.1558	.8788	.225108	.034632	.017316	0.000000	7.394	.128	.075	24.829	1.701	2.191
225	35.500	3.500	10.500	218	.9437	.8701	.038961	.025974	.008658	0.000000	8.819	-.005	-.010	7.542	1.188	.987
226	-4.500	6.500	10.500	231	1.0000	.9307	.060606	.008658	0.000000	0.000000	8.585	.103	-.005	11.779	1.178	1.473
227	.500	6.500	10.500	235	1.0173	.8312	.121212	.051948	.012987	0.000000	7.824	.084	.169	20.964	1.935	2.302
228	5.500	6.500	10.500	268	1.1602	.8961	.181818	.077922	.004329	0.000000	7.470	.192	.307	23.829	2.122	2.580
229	10.500	6.500	10.500	243	1.0519	.8225	.164502	.060606	.004329	0.000000	7.714	.075	.222	23.271	1.703	3.039
230	15.500	6.500	10.500	260	1.1255	.8355	.233766	.047619	.008658	0.000000	7.127	.135	.193	29.386	1.192	2.562
231	20.500	6.500	10.500	266	1.1515	.8095	.255411	.073593	.012987	0.000000	6.888	.151	.198	29.799	1.787	2.153
232	25.500	6.500	10.500	288	1.2468	.8312	.285714	.108225	.021645	0.000000	6.697	.219	.236	31.264	2.375	2.645
233	30.500	6.500	10.500	241	1.0433	.7922	.177489	.051948	.021645	0.000000	7.421	.144	.148	24.990	1.423	1.974
234	35.500	6.500	10.500	221	.9567	.8052	.082251	.043290	.025974	0.000000	8.258	.016	.148	13.434	1.508	2.359
235	-4.500	9.500	10.500	231	1.0000	.9481	.034632	.017316	0.000000	0.000000	8.930	-.026	.097	5.789	1.112	1.412
236	.500	9.500	10.500	221	.9567	.8095	.082251	.060606	.004329	0.000000	8.249	.148	.087	14.310	2.619	1.821

237	5.500	9.500	10.500	237	1.0260	.8831	.108225	.034632	0.000000	0.000000	8.133	.042	.106	18.244	1.368	1.877
238	10.500	9.500	10.500	228	.9870	.8658	.086580	.034632	0.000000	0.000000	8.399	.161	.173	13.622	1.604	2.100
239	15.500	9.500	10.500	225	.9740	.7706	.134199	.043290	.025974	0.000000	7.656	.130	.158	23.620	1.615	2.347
240	20.500	9.500	10.500	274	1.1861	.9610	.173160	.047619	.004329	0.000000	7.925	.143	.153	21.347	1.567	2.329
241	25.500	9.500	10.500	249	1.0779	.8615	.168831	.043290	.004329	0.000000	7.855	.100	.253	21.473	1.722	1.845
242	30.500	9.500	10.500	249	1.0779	.8874	.134199	.047619	.008658	0.000000	7.878	.184	.177	18.965	1.767	1.813
243	35.500	9.500	10.500	212	.9177	.8095	.038961	.051948	.017316	0.000000	8.635	.234	.265	8.099	2.093	1.873
244	-4.500	12.500	10.500	218	.9437	.8442	.060606	.038961	0.000000	0.000000	8.471	.117	.091	12.445	1.791	1.925
245	.500	12.500	10.500	251	1.0866	.9597	.108225	.008658	0.000000	0.000000	8.170	.082	.023	17.039	1.300	1.075
246	5.500	12.500	10.500	230	.9957	.8701	.099567	.025974	0.000000	0.000000	8.144	.029	.091	17.088	1.514	1.420
247	10.500	12.500	10.500	221	.9567	.8745	.047619	.034632	0.000000	0.000000	8.648	.081	.057	8.591	1.566	1.599
248	15.500	12.500	10.500	213	.9221	.7965	.077922	.038961	.008658	0.000000	8.327	.165	.158	14.903	2.085	1.725
249	20.500	12.500	10.500	220	.9524	.7879	.108225	.051948	.004329	0.000000	7.941	.271	.114	19.572	2.068	1.628
250	25.500	12.500	10.500	220	.9524	.7532	.125541	.069264	.004329	0.000000	7.740	.179	.176	21.791	2.219	2.134
251	30.500	12.500	10.500	200	.8658	.7532	.064935	.038961	.008658	0.000000	8.445	.175	-.013	12.067	2.051	1.641
252	35.500	12.500	10.500	212	.9177	.7965	.047619	.069264	.004329	0.000000	8.495	.028	.180	10.242	2.364	1.615
253	-4.500	-5.500	13.500	245	1.0606	.9913	.043290	.025974	0.000000	0.000000	8.728	.005	-.021	8.189	1.228	1.621
254	.500	-5.500	13.500	241	1.0433	.9870	.038961	.017316	0.000000	0.000000	8.861	.055	.097	6.461	1.389	1.463
255	5.500	-5.500	13.500	260	1.1255	.9957	.082251	.047619	0.000000	0.000000	8.383	-.022	.163	13.809	1.523	2.385
256	10.500	-5.500	13.500	225	.9740	.8528	.086580	.034632	0.000000	0.000000	8.276	-.019	.143	16.204	1.629	1.225
257	15.500	-5.500	13.500	252	1.0909	.9177	.138528	.030303	.004329	0.000000	7.863	-.069	.232	21.203	1.329	2.017
258	20.500	-5.500	13.500	241	1.0433	.8225	.173160	.047619	0.000000	0.000000	7.598	-.096	.182	22.828	1.629	2.086
259	25.500	-5.500	13.500	273	1.1818	.9524	.151515	.064935	.012987	0.000000	7.679	-.068	.197	20.478	1.773	2.639
260	30.500	-5.500	13.500	223	.9654	.8312	.056277	.060606	.017316	0.000000	8.450	.007	.045	12.069	1.838	1.661
261	35.500	-5.500	13.500	177	.7662	.6970	.038961	.030303	0.000000	0.000000	8.852	-.041	.133	5.604	1.878	2.060
262	-4.500	-2.500	13.500	206	.8918	.7879	.069264	.030303	.004329	0.000000	8.425	.018	.042	12.455	1.747	1.665
263	.500	-2.500	13.500	214	.9264	.8095	.077922	.034632	.004329	0.000000	8.291	.067	.119	13.512	1.968	2.279
264	5.500	-2.500	13.500	249	1.0779	.9264	.112554	.030303	.008658	0.000000	8.027	-.054	.164	19.381	1.198	2.178
265	10.500	-2.500	13.500	227	.9827	.7749	.147186	.051948	.008658	0.000000	7.541	-.090	.300	22.036	2.145	2.274
266	15.500	-2.500	13.500	241	1.0433	.8745	.125541	.043290	0.000000	0.000000	7.945	-.044	.317	21.212	1.399	2.242
267	20.500	-2.500	13.500	279	1.2078	.9307	.203463	.064935	.008658	0.000000	7.429	-.040	.156	25.418	1.423	1.967
268	25.500	-2.500	13.500	271	1.1732	.9831	.186147	.086580	.017316	0.000000	7.616	-.046	.237	21.588	2.129	2.953
269	30.500	-2.500	13.500	251	1.0866	.9784	.073593	.025974	.008658	0.000000	8.579	.022	.071	9.631	1.517	1.724
270	35.500	-2.500	13.500	224	.9697	.8874	.043290	.038961	0.000000	0.000000	8.846	-.121	.064	6.374	1.525	1.679
271	-4.500	.500	13.500	211	.9134	.8528	.056277	.004329	0.000000	0.000000	8.522	-.016	.057	12.229	.989	1.189
272	.500	.500	13.500	260	1.1255	.9957	.099567	.030303	0.000000	0.000000	8.318	.020	.156	14.814	1.466	1.949
273	5.500	.500	13.500	257	1.1126	.9740	.108225	.030303	0.000000	0.000000	8.307	-.020	.143	14.309	1.778	2.022
274	10.500	.500	13.500	267	1.1554	.9091	.173160	.073593	0.000000	0.000000	7.513	-.051	.316	21.890	1.968	2.842
275	15.500	.500	13.500	230	.9957	.8009	.142857	.047619	.004329	0.000000	7.738	-.085	.249	22.248	1.435	2.341
276	20.500	.500	13.500	303	1.3117	.8961	.320346	.090909	.004329	0.000000	6.836	-.011	.371	30.746	2.510	2.564
277	25.500	.500	13.500	273	1.1818	.8095	.264069	.077922	.030303	0.000000	6.688	.004	.393	31.508	2.061	2.112
278	30.500	.500	13.500	231	1.0000	.8052	.129870	.064935	0.000000	0.000000	7.924	.099	.158	19.537	1.838	1.176
279	35.500	.500	13.500	226	.9784	.8355	.077922	.056277	.008658	0.000000	8.326	.023	.208	11.004	1.878	1.990
280	-4.500	3.500	13.500	207	.8961	.8442	.021645	.030303	0.000000	0.000000	8.911	.025	-.059	4.813	1.289	1.468
281	.500	3.500	13.500	251	1.0866	.9394	.116883	.030303	0.000000	0.000000	8.150	-.074	.164	16.884	1.967	1.179
282	5.500	3.500	13.500	230	.9957	.8874	.082251	.021645	.004329	0.000000	8.333	.071	.112	13.469	1.755	1.724
283	10.500	3.500	13.500	242	1.0476	.8528	.155844	.038961	0.000000	0.000000	7.831	.064	.154	22.293	1.658	2.318
284	15.500	3.500	13.500	244	1.0563	.8398	.164502	.043290	.008658	0.000000	7.569	.068	.149	24.733	1.967	1.762
285	20.500	3.500	13.500	246	1.0649	.7532	.212121	.082251	.017316	0.000000	7.149	.198	.411	27.833	1.894	3.027

286	25.500	3.500	13.500	243	1.0519	.7619	.220779	.064935	.004329	0.000000	7.042	.128	.295	28.039	2.303	2.596
287	30.500	3.500	13.500	271	1.1732	.9437	.155844	.069264	.004329	0.000000	7.892	.035	.147	17.792	1.772	2.754
288	35.500	3.500	13.500	209	.9048	.8095	.043290	.047619	.004329	0.000000	8.698	-.020	.116	6.127	1.716	2.489
289	-4.500	6.500	13.500	237	1.0260	.9654	.030303	.030303	0.000000	0.000000	8.921	.008	.020	5.635	2.038	1.340
290	.500	6.500	13.500	228	.9870	.8768	.060606	.043290	.004329	0.000000	8.464	.034	.157	12.879	1.380	2.108
291	5.500	6.500	13.500	239	1.0346	.8701	.090909	.069264	.004329	0.000000	8.239	.041	.283	16.439	1.810	2.257
292	10.500	6.500	13.500	244	1.0563	.8095	.186147	.060606	0.000000	0.000000	7.371	.126	.376	25.453	1.857	2.755
293	15.500	6.500	13.500	265	1.1472	.9134	.177489	.047619	.008658	0.000000	7.595	.059	.195	24.685	1.505	1.613
294	20.500	6.500	13.500	262	1.1342	.8831	.190476	.056277	.004329	0.000000	7.[illegible]10	.181	.165	24.813	1.307	2.399
295	25.500	6.500	13.500	246	1.0649	.8528	.151515	.034632	.025974	0.000000	7.638	.136	.184	22.953	1.597	1.651
296	30.500	6.500	13.500	213	.9221	.7879	.108225	.021645	.004329	0.000000	8.252	.060	.184	16.701	1.294	1.810
297	35.500	6.500	13.500	217	.9394	.8398	.056277	.025974	.017316	0.000000	8.553	.042	.103	10.942	1.353	1.533
298	-4.500	9.500	13.500	213	.9221	.8831	.012987	.025974	0.000000	0.000000	9.117	.030	.052	3.218	1.454	1.687
299	.500	9.500	13.500	200	.8658	.7576	.056277	.034632	.017316	0.000000	8.247	.034	.137	15.176	1.187	2.199
300	5.500	9.500	13.500	198	.8571	.7532	.073593	.030303	0.000000	0.000000	8.300	.045	.093	14.867	1.501	2.097
301	10.500	9.500	13.500	201	.8701	.7706	.064935	.034632	0.000000	0.000000	8.433	.071	.235	13.556	1.325	2.194
302	15.500	9.500	13.500	206	.8918	.7835	.064935	.043290	0.000000	0.000000	8.400	.084	.233	13.866	1.508	1.497
303	20.500	9.500	13.500	248	1.0736	.9004	.116883	.056277	0.000000	0.000000	8.014	.109	.162	17.971	1.304	1.792
304	25.500	9.500	13.500	264	1.1429	.9091	.173160	.051948	.008658	0.000000	7.588	.146	.151	22.789	1.796	1.904
305	30.500	9.500	13.500	215	.9307	.7619	.103896	.047619	.017316	0.000000	7.862	.146	.110	20.065	1.327	1 945
306	35.500	9.500	13.500	215	.9307	.8615	.034632	.034632	0.000000	0.000000	8.845	.069	.072	5.858	1.237	1.465
307	-4.500	12.500	13.500	207	.8961	.8442	.017316	.034632	0.000000	0.000000	8.810	.050	.109	5.221	1.563	1.922
308	.500	12.500	13.500	185	.8009	.7186	.060606	.021645	0.000000	0.000000	8.575	.113	.179	12.833	1.052	2.384
309	5.500	12.500	13.500	185	.8009	.6926	.064935	.043290	0.000000	0.000000	8.354	.237	.193	15.918	1.218	1.713
310	10.500	12.500	13.500	197	.8528	.7273	.056277	.064935	.004329	0.000000	8.320	.105	.120	12.965	3.158	1.993
311	15.500	12.500	13.500	212	.9177	.7965	.056277	.060606	.004329	0.000000	8.418	.101	.100	12.533	2.053	1.665
312	20.500	12.500	13.500	205	.8874	.7662	.077922	.043290	0.000000	0.000000	8.356	.056	.093	12.337	1.723	2.004
313	25.500	12.500	13.500	207	.8961	.7792	.090909	.025974	0.000000	0.000000	8.359	.206	.075	13.536	1.424	1.595
314	30.500	12.500	13.500	201	.8701	.7662	.064935	.038961	0.000000	0.000000	8.499	.089	.134	11.131	1.890	1.899
315	35.500	12.500	13.500	218	.9437	.8398	.047619	.030303	.025974	0.000000	8.648	.045	.087	9.269	2.043	1.746
316	-36.700	-3.500	3.750	226	.9784	.9784	0.000000	0.000000	0.000000	0.000000	9.116	-.030	.043	1.065	1.206	1.109
317	-30.100	-3.500	3.750	243	1.0519	1.0519	0.000000	0.000000	0.000000	0.000000	9.159	-.045	.062	.913	.974	.926
318	-23.500	-3.500	3.750	260	1.0690	1.0606	.004498	.003935	0.000000	0.000000	9.181	-.023	-.094	1.792	1.318	1.152
319	-16.900	-3.500	3.750	246	.9519	.9351	.012369	.004498	0.000000	0.000000	9.013	-.023	.058	3.357	1.182	1.029
320	-10.300	-3.500	3.750	326	.9618	.9177	.032848	.011244	0.000000	0.000000	8.658	-.056	.050	11.235	1.203	1.210
321	-36.700	3.500	3.750	222	.9610	.9610	0.000000	0.000000	0.000000	0.000000	9.215	-.041	.041	1.038	.993	.678
322	-30.100	3.500	3.750	227	.9450	.9394	.001124	.004498	0.000000	0.000000	9.168	-.030	-.035	1.201	1.068	1.105
323	-23.500	3.500	3.750	221	.8211	.8009	.011806	.008433	0.000000	0.000000	9.022	-.047	.008	3.629	1.294	1.248
324	-16.900	3.500	3.750	304	1.0034	.9567	.034295	.012369	0.000000	0.000000	8.802	-.064	.011	7.544	1.291	1.357
325	-10.300	3.500	3.750	393	.9329	.8182	.094451	.019115	.001124	0.000000	8.130	.059	-.000	19.259	1.180	1.648
326	-36.700	10.500	3.750	249	1.0779	1.0779	0.000000	0.000000	0.000000	0.000000	9.190	.038	.006	1.058	.954	1.020
327	-30.100	10.500	3.750	231	1.0000	1.0000	0.000000	0.000000	0.000000	0.000000	9.232	.012	.008	.853	1.027	1.095
328	-23.500	10.500	3.750	237	.9619	.9524	.005060	.004498	0.000000	0.000000	9.187	-.026	.024	1.996	1.012	1.151
329	-16.900	10.500	3.750	256	.9651	.9437	.015180	.006174	0.000000	0.000000	9.052	.009	-.008	4.260	1.236	1.006
330	-10.300	10.500	3.750	311	.9470	.8874	.043852	.013493	.002249	0.000000	8.734	.139	.069	10.115	1.201	1.208
331	-36.700	-3.500	11.250	210	.9091	.9091	0.000000	0.000000	0.000000	0.000000	9.272	-.057	-.036	1.053	1.053	.932
332	-30.100	-3.500	11.250	212	.[illegible]914	.8874	0.000000	.003373	.000562	0.000000	9.121	-.006	.019	.927	.866	.695
333	-23.500	-3.500	11.250	241	1.0094	1.0043	.[illegible]00562	.003373	.001124	0.000000	9.097	-.014	-.010	1.393	.952	1.166
334	-16.900	-3.500	11.250	246	.9218	.9004	.012369	.007871	.001124	0.000000	9.073	.026	.003	3.631	1.175	1.185

335	-10.300	-3.500	11.250	281	.9226	.8768	.035419	.007871	.000562	0.000000	8.813	.038	.064	7.989	1.061	1.259
336	-36.700	3.500	11.250	235	.9985	.9957	.000562	.002249	0.000000	0.000000	9.113	.001	.044	.902	.929	1.078
337	-30.100	3.500	11.250	220	.9147	.9091	.003373	.002249	0.000000	0.000000	9.164	.014	.011	1.835	.772	1.162
338	-23.500	3.500	11.250	236	.9840	.9784	.003935	.001687	0.000000	0.000000	9.116	-.006	-.041	1.940	1.031	1.032
339	-16.900	3.500	11.250	269	.9950	.9697	.017428	.007871	0.000000	0.000000	8.960	-.007	-.045	4.259	1.071	1.205
340	-10.300	3.500	11.250	298	.9473	.8961	.044977	.005622	.000562	0.000000	8.623	.027	.052	10.196	.945	.988
341	-36.700	10.500	11.250	217	.9394	.9394	0.000000	0.000000	0.000000	0.000000	9.215	-.039	.074	.988	1.072	1.290
342	-30.100	10.500	11.250	237	1.0034	1.0000	0.000000	.003373	0.000000	0.000000	9.257	.006	.084	1.008	1.128	1.156
343	-23.500	10.500	11.250	222	.9234	.9177	.003373	.002249	0.000000	0.000000	9.167	-.056	.039	1.584	1.125	.951
344	-16.900	10.500	11.250	239	.8953	.8745	.012369	.008433	0.000000	0.000000	9.021	-.003	.073	3.893	1.221	1.255
345	-10.300	10.500	11.250	255	.9156	.8874	.020802	.006184	.001124	0.000000	8.932	-.027	.136	5.261	1.212	1.274
346	41.500	-3.500	3.750	269	.6896	.6234	.027034	.032335	.006691	0.000000	8.736	.081	.062	6.047	1.443	1.756
347	48.500	-3.500	3.750	190	.5452	.5065	.019083	.016433	.003180	0.000000	8.930	.164	-.089	3.276	1.252	1.594
348	55.500	-3.500	3.750	216	.6881	.6537	.011132	.021203	.002120	0.000000	9.071	.145	.093	2.592	1.204	1.081
349	62.500	-3.500	3.750	197	.6553	.6277	.011132	.015902	.000530	0.000000	9.070	.235	-.021	1.591	.983	1.160
350	69.500	-3.500	3.750	170	.6220	.6061	.004241	.011132	.000530	0.000000	9.178	.262	-.054	1.077	.931	.897
351	76.500	-3.500	3.750	182	.6321	.6104	.006361	.013782	.001590	0.000000	9.040	.191	.059	1.061	1.049	.948
352	41.500	3.500	3.750	236	.4708	.3939	.043997	.020673	.012192	0.000000	8.166	-.108	-.072	11.693	1.463	2.021
353	48.500	3.500	3.750	223	.4867	.4199	.031275	.029685	.005831	0.000000	8.736	-.170	-.060	7.130	1.556	1.817
354	55.500	3.500	3.750	183	.5339	.4978	.015902	.015433	.003711	0.000000	9.102	-.179	-.139	2.847	1.364	1.285
355	62.500	3.500	3.750	153	.4876	.4632	.009541	.012722	.002120	0.000000	9.138	-.209	-.210	2.170	1.125	1.173
356	69.500	3.500	3.750	151	.4979	.4762	.007951	.011662	.002120	0.000000	9.042	-.206	-.174	1.840	1.224	1.141
357	76.500	3.500	3.750	172	.5774	.5541	.009011	.012192	.002120	0.000000	9.154	-.128	-.062	1.717	1.309	1.110
358	41.500	10.500	3.750	350	.8655	.7749	.048768	.029155	.012722	0.000000	8.633	.096	-.100	8.290	1.374	1.5[illegible]
359	48.500	10.500	3.750	244	.7182	.6710	.018553	.026504	.002120	0.000000	9.031	.031	-.055	3.026	1.334	1.171
360	55.500	10.500	3.750	210	.7153	.6883	.007951	.017493	.001590	0.000000	9.164	-.021	-.032	1.988	.872	1.361
361	62.500	10.500	3.750	232	.7688	.7359	.011132	.020143	.001590	0.000000	8.982	.014	.016	2.200	1.053	1.130
362	69.500	10.500	3.750	198	.6710	.6450	.008481	.017493	0.000000	0.000000	9.102	-.046	-.152	1.845	.958	1.031
363	76.500	10.500	3.750	201	.6992	.6753	.007421	.015902	.000530	0.000000	9.084	-.113	-.017	1.725	1.024	1.196
364	41.500	-3.500	11.250	284	.7926	.7316	.018553	.034455	.007951	0.000000	8.797	.008	.101	4.657	1.499	1.505
365	48.500	-3.500	11.250	236	.7291	.6883	.008481	.029685	.002650	0.000000	8.992	-.083	-.047	2.946	1.061	1.411
366	55.500	-3.500	11.250	214	.7479	.7229	.010602	.014312	0.000000	0.000000	9.086	.027	.042	1.893	1.062	1.235
367	62.500	-3.500	11.250	216	.7603	.7359	.007951	.015902	.000530	0.000000	9.147	-.005	.002	1.543	1.151	1.014
368	69.500	-3.500	11.250	192	.6435	.6234	.007421	.012192	.000530	0.000000	9.176	-.023	-.070	1.318	.943	.966
369	76.500	-3.500	11.250	187	.6994	.6840	.005831	.009541	0.000000	0.000000	9.157	-.023	-.023	.959	1.143	1.056
370	41.500	3.500	11.250	301	.8548	.7922	.024384	.032865	.005301	0.000000	8.920	.013	.134	4.685	1.679	1.462
371	48.500	3.500	11.250	252	.7680	.7229	.021203	.022263	.001590	0.000000	9.055	-.018	.034	2.782	1.377	1.414
372	55.500	3.500	11.250	234	.7395	.7013	.012192	.021733	.004241	0.000000	9.002	.028	.069	2.851	1.202	1.058
373	62.500	3.500	11.250	234	.8268	.8009	.007951	.015902	.002120	0.000000	9.127	-.092	-.039	1.915	1.084	1.342
374	69.500	3.500	11.250	189	.6852	.6667	.007951	.010602	0.000000	0.000000	9.192	-.085	-.081	1.709	1.040	.993
375	76.500	3.500	11.250	207	.7631	.7446	.004771	.012722	.001060	0.000000	9.072	-.041	-.133	1.403	1.059	.909
376	41.500	10.500	11.250	298	.8076	.7403	.037106	.027564	.002650	0.000000	8.775	.018	.106	5.944	1.418	1.586
377	48.500	10.500	11.250	289	.9016	.8528	.022794	.022794	.003180	0.000000	9.024	.034	.120	3.500	1.355	1.281
378	55.500	10.500	11.250	265	.8889	.8526	.014842	.019083	.002120	0.000000	9.083	-.026	.158	2.439	1.213	1.186
379	62.500	10.500	11.250	228	.7591	.7273	.011662	.018553	.001590	0.000000	9.118	-.001	.089	1.919	1.324	1.182
380	69.500	10.500	11.250	242	.8501	.8225	.008481	.018023	.001060	0.000000	9.101	-.060	-.027	1.286	.97[illegible]	1.173
381	76.500	10.500	11.250	231	.8328	.8095	.005301	.016963	.001060	0.000000	9.181	-.025	.076	1.170	1.046	1.097
382	-34.000	-1.750	21.250	248	1.0442	1.0433	.000371	.000495	0.000000	0.000000	9.202	.037	-.057	1.030	.910	.974
383	-22.000	-1.750	21.250	227	.8649	.8615	.001484	.001979	0.000000	0.000000	9.159	.033	.024	1.442	1.110	.895

384	-10.000	-1.750	21.250	336	.9499	.9351	.011132	.003711	0.000000	0.000000	9.061	.036	-.031	3.140	.977	1.103
385	2.000	-1.750	21.250	476	.7654	.7273	.025108	.012245	.000742	0.000000	8.854	-.048	.112	6.848	1.438	1.472
386	14.000	-1.750	21.250	758	.8045	.7316	.045764	.025603	.001484	0.000000	8.509	-.027	.101	10.333	1.354	2.185
387	26.000	-1.750	21.250	786	.5769	.4935	.049845	.030921	.002597	0.000000	8.228	-.052	.121	13.225	1.685	2.670
388	38.000	-1.750	21.250	589	.8424	.7922	.018677	.029932	.001608	0.000000	8.992	-.104	.136	3.693	1.209	1.990
389	50.000	-1.750	21.250	439	.7776	.7446	.013358	.018429	.001237	0.000000	9.042	.003	.095	2.518	1.274	1.426
390	62.000	-1.750	21.250	369	.9312	.9091	.005442	.015708	.000989	0.000000	9.135	-.146	.144	1.549	1.052	1.397
391	74.000	-1.750	21.250	347	.8630	.8442	.006184	.011998	.000618	0.000000	9.167	-.025	.065	1.300	.991	1.149
392	-34.000	8.750	21.250	237	.9797	.9764	.000495	.000866	0.000000	0.000000	9.224	-.040	.101	1.127	.972	1.006
393	-22.000	8.750	21.250	258	.9781	.9740	.002968	.001113	0.000000	0.000000	9.207	-.084	-.061	1.634	1.122	1.087
394	-10.000	8.750	21.250	306	.9546	.9437	.005566	.005318	0.000000	0.000000	9.127	-.029	.070	2.044	.921	1.178
395	2.000	8.750	21.250	502	.8821	.8442	.020161	.016574	.001237	0.000000	8.974	.005	.038	5.879	1.301	1.491
396	14.000	8.750	21.250	694	.6998	.6320	.037972	.028324	.001484	0.000000	8.635	.008	.203	9.981	1.699	1.914
397	26.000	8.750	21.250	800	.6961	.6147	.045764	.034385	.001237	0.000000	8.488	.107	.113	11.004	1.764	2.317
398	38.000	8.750	21.250	628	.9271	.8745	.023871	.026592	.002226	0.000000	8.883	.082	.127	4.487	1.280	1.719
399	50.000	8.750	21.250	447	.8375	.8052	.010513	.021027	.000742	0.000000	9.077	-.021	.112	2.326	1.126	1.432
400	62.000	8.750	21.250	397	.9322	.9091	.007421	.014842	.000865	0.0[illegible]00	9.124	.053	.091	1.342	1.006	1.199
401	74.000	8.750	21.250	317	.8172	.8009	.004576	.010761	.000989	0.0[illegible]000	9.156	-.014	.090	1.157	1.045	1.168
402	-34.000	-1.750	33.750	253	1.0700	1.0693	0.000000	.000742	0.000000	0.000000	9.205	-.062	.021	.959	.916	1.054
403	-22.000	-1.750	33.750	229	.9367	.9351	.000495	.001113	0.000000	0.000000	9.158	-.075	-.027	1.188	.973	1.023
404	-10.000	-1.750	33.750	255	.9483	.9437	.002103	.002474	0.000000	0.000000	9.162	.017	.004	1.274	.997	.986
405	2.000	-1.750	33.750	[illegible]	.8743	.8658	.004700	.003711	.000124	0.000000	9.080	.005	-.116	2.114	1.031	1.227
406	14.000	-1.750	33.750	374	.7990	.7749	.010019	.014100	0.000000	0.000000	9.023	.022	.107	3.031	1.188	1.419
407	26.000	-1.750	33.750	404	.7523	.7229	.012369	.016450	.000495	0.000000	8.982	.010	.075	3.716	1.159	1.644
408	38.000	-1.750	33.750	405	.8449	.8182	.009524	.015821	.0[illegible]371	0.000000	9.057	-.008	.127	2.449	1.164	1.737
409	50.000	-1.750	33.750	372	.8955	.8745	.007669	.012492	.000866	0.000000	9.133	.030	.016	1.562	1.013	1.417
410	62.000	-1.750	33.750	225	.8266	.8095	.006432	.010266	.000371	0.000000	9.167	-.023	-.001	1.524	1.019	1.354
411	74.000	-1.750	33.750	206	.7572	.7403	.003463	.013234	.000247	0.000000	9.222	.074	.029	1.340	.926	1.209
412	-34.000	8.750	33.750	214	.9264	.9264	0.000000	0.000000	0.000000	0.000000	9.181	-.006	-.061	1.136	1.128	1.067
413	-22.000	8.750	33.750	255	1.0409	1.0390	.000742	.001113	0.000000	0.000000	9.221	.003	.030	1.142	1.039	1.039
414	-10.000	8.750	33.750	224	.8898	.8874	.000495	.001855	0.000000	0.000000	9.161	.091	.048	1.290	.879	.952
415	2.000	8.750	33.750	272	.8747	.8658	.002968	.005813	.000124	0.000000	9.177	-.049	.012	2.004	.984	1.062
416	14.000	8.750	33.750	318	.8383	.8225	.006432	.009400	0.000000	0.000000	9.110	.140	.027	2.568	.986	1.255
417	26.000	8.750	33.750	359	.8771	.8571	.007669	.012121	.000124	0.000000	9.056	-.057	.027	2.624	1.047	1.369
418	38.000	8.750	33.750	370	.8195	.7965	.007792	.014471	.000742	0.000000	9.169	.024	.104	2.471	1.117	1.526
419	50.000	8.750	33.750	357	.8936	.8745	.006061	.012121	.000989	0.000000	9.094	-.057	.026	1.838	.916	1.238
420	62.000	8.750	33.750	321	.8303	.8139	.004453	.011503	.000495	0.000000	9.107	.018	-.030	1.363	1.090	1.251
421	74.000	8.750	33.750	327	.9824	.9697	.003711	.009029	0.000000	0.000000	9.194	-.029	-.010	1.134	1.086	1.183
422	-34.000	-16.750	6.667	237	1.0260	1.0260	0.000000	0.000000	0.000000	0.000000	9.177	-.010	-.031	.985	.987	1.011
423	-22.000	-16.750	6.667	225	.9202	.9177	.000937	.001499	0.000000	0.000000	9.151	-.033	-.026	1.155	.968	1.012
424	-10.000	-16.750	6.667	334	1.0441	1.0260	.012550	.005432	.000187	0.000000	9.068	-.088	.006	3.260	1.203	1.189
425	2.000	-16.750	6.667	456	.8268	.7749	.039148	.012363	.000375	0.000000	8.766	-.087	-.059	8.723	1.569	1.234
426	14.000	-16.750	6.667	628	.7140	.6234	.059565	.027160	.003934	0.000000	8.265	-.253	.047	13.212	2.242	1.669
427	26.000	-16.750	6.667	679	.8893	.7965	.062375	.023769	.006556	0.000000	8.453	-.116	.097	11.971	1.964	1.486
428	38.000	-16.750	6.667	449	.8545	.8052	.027722	.020230	.001311	0.000000	8.792	-.107	.169	4.523	1.86[illegible]	1.377
429	50.000	-16.750	6.667	328	.8608	.8355	.009740	.015360	.000187	0.000000	9.157	-.034	.115	1.720	1.587	1.228
430	62.000	-16.750	6.667	278	.7810	.7619	.005994	.012175	.000937	0.000000	9.057	-.011	.039	1.633	1.220	1.116
431	74.000	-16.750	6.667	246	.7916	.7792	.004496	.007680	.000187	0.000000	9.249	-.032	.063	1.088	1.134	1.079
432	-34.000	-10.250	6.667	242	1.0519	1.0519	0.000000	0.000000	0.000000	0.000000	9.222	-.062	.035	.976	1.266	.900

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433	-22.000	-10.250	6.667	240	.9313	.9264	.002622	.002248	0.000000	0.000000	9.146	.016	-.045	1.499	1.017	1.142
434	-10.000	-10.250	6.667	395	.8609	.8225	.026786	.013677	.000937	0.000000	8.918	-.071	.001	6.866	1.410	1.271
435	2.000	-10.250	6.667	874	.6524	.5106	.108454	.029970	.003184	0.000000	7.494	-.159	.036	24.478	2.222	2.132
436	14.000	-10.250	6.667	1236	.5380	.3203	.155657	.052073	.009928	0.000000	6.205	-.371	.154	33.214	3.336	2.979
437	26.000	-10.250	6.667	1287	.7472	.5238	.153784	.048514	.016109	0.000000	7.067	-.219	.042	28.293	2.072	2.244
438	38.000	-10.250	6.667	524	.7898	.7229	.034840	.029221	.002810	0.000000	8.814	-.161	.004	6.249	1.551	1.667
439	50.000	-10.250	6.667	371	.9144	.8831	.011239	.018731	.001311	0.000000	9.097	.035	.054	1.914	1.229	1.400
440	62.000	-10.250	6.667	317	.9499	.9307	.004683	.014048	.000375	0.000000	9.127	-.051	-.039	1.463	1.032	1.129
441	74.000	-10.250	6.667	284	.8525	.8355	.004496	.012175	.000375	0.000000	9.162	.112	-.005	1.261	1.101	1.180
442	-34.000	-16.750	20.000	229	.9913	.9913	0.000000	0.000000	0.000000	0.000000	9.138	-.022	-.036	.923	.876	.921
443	-22.000	-16.750	20.000	215	.8935	.8918	.000375	.001311	0.000000	0.000000	9.232	-.046	.017	1.050	1.040	1.137
444	-10.000	-16.750	20.000	244	.9362	.9307	.003372	.002060	0.000000	0.000000	9.183	-.003	-.060	1.668	.959	1.037
445	2.000	-16.750	20.000	288	.9568	.9437	.00842	.004308	.000375	0.000000	9.117	-.056	.017	2.663	1.139	1.310
446	14.000	-16.750	20.000	352	.7549	.7143	.024163	.014236	.002248	0.000000	8.847	-.114	.032	6.656	1.233	1.446
447	26.000	-16.750	20.000	451	.8465	.7965	.028472	.020230	.001311	0.000000	8.875	-.119	.098	6.195	1.688	1.452
448	38.000	-16.750	20.000	345	.7521	.7186	.015360	.016109	.002060	0.000000	8.930	-.138	.014	3.679	1.429	1.399
449	50.000	-16.750	20.000	328	.9809	.9610	.006931	.012737	.000187	0.000000	9.116	-.040	.045	1.692	1.118	1.142
450	62.000	-16.750	20.000	278	.8721	.8571	.005807	.009178	0.000000	0.000000	9.091	.001	.001	1.366	1.163	1.181
451	74.000	-16.750	20.000	284	.9768	.9654	.001499	.009740	.000187	0.000000	9.160	.003	.061	1.080	1.062	1.140
452	-34.000	-10.250	20.000	215	.9307	.9307	0.000000	0.000000	0.000000	0.000000	9.191	.105	-.075	1.039	.887	.872
453	-22.000	-10.250	20.000	257	1.0753	1.0736	.000749	.000937	0.000000	0.000000	9.161	.027	-.040	1.077	.995	1.020
454	-10.000	-10.250	20.000	284	.9602	.9481	.008429	.003746	0.000000	0.000000	8.997	.051	-.077	2.673	1.078	1.102
455	2.000	-10.250	20.000	369	.9057	.8745	.019461	.011426	.000375	0.000000	8.934	-.031	.054	4.720	1.160	1.428
456	14.000	-10.250	20.000	500	.8516	.7922	.034653	.021728	.002997	0.000000	8.668	-.021	.084	8.594	1.382	1.737
457	26.000	-10.250	20.000	516	.8744	.8182	.039523	.018731	.002997	0.000000	8.729	-.065	.044	8.180	1.399	1.543
458	38.000	-10.250	20.000	381	.8044	.7662	.015734	.021728	.000749	0.000000	8.931	-.039	.059	3.280	1.320	1.606
459	50.000	-10.250	20.000	327	.8399	.8139	.007493	.017420	.001124	0.000000	9.063	-.089	-.032	1.905	1.128	1.461
460	62.000	-10.250	20.000	314	.8457	.8225	.005994	.016671	.000562	0.000000	9.127	-.059	.014	1.384	1.170	1.303
461	74.000	-10.250	20.000	256	.7893	.7749	.004308	.008991	.001124	0.000000	9.117	.090	-.015	1.310	1.121	1.296
462	-34.000	-16.750	33.333	219	.9461	.9461	0.000000	0.000000	0.000000	0.000000	9.222	.074	-.028	1.114	.876	1.171
463	-22.000	-16.750	33.333	250	1.0326	1.0303	.000749	.001499	0.000000	0.000000	9.219	-.039	.022	1.080	.960	1.152
464	-10.000	-16.750	33.333	203	.8125	.8095	.001311	.001686	0.000000	0.000000	9.207	.044	-.020	1.449	.876	1.061
465	2.000	-16.750	33.333	250	.9621	.9567	.001873	.003559	0.000000	0.000000	9.183	.038	.002	1.577	.905	1.053
466	14.000	-16.750	33.333	286	.8902	.8745	.007680	.007118	.000937	0.000000	9.034	.013	.010	2.868	1.133	1.328
467	26.000	-16.750	33.333	337	1.0240	1.0043	.008242	.011239	.000187	0.000000	9.127	.076	.074	2.600	1.073	1.379
468	38.000	-16.750	33.333	299	.8346	.8139	.007680	.012737	.000375	0.000000	9.075	-.022	.123	2.403	1.252	1.330
469	50.000	-16.750	33.333	296	.9169	.9004	.005245	.010864	.000375	0.000000	9.185	.025	.016	1.656	1.115	1.404
470	62.000	-16.750	33.333	270	.8789	.8658	.003372	.009740	0.000000	0.000000	9.120	.024	.042	1.373	1.145	1.259
471	74.000	-16.750	33.333	260	.8695	.8788	.003184	.007493	0.000000	0.000000	9.154	.037	.015	1.170	1.178	1.220
472	-34.000	-10.250	33.333	255	1.1039	1.1039	0.000000	0.000000	0.000000	0.000000	9.200	.013	.059	.926	.806	.788
473	-22.000	-10.250	33.333	214	.9264	.9264	0.000000	0.000000	0.000000	0.000000	9.206	-.003	-.120	.881	1.022	1.097
474	-10.000	-10.250	33.333	271	1.0820	1.0779	.001311	.002810	0.000000	0.000000	9.218	.008	.060	1.276	.999	[illegible]
475	2.000	-10.250	33.333	257	.9592	.9524	.002622	.004308	0.000000	0.000000	9.201	-.005	.041	1.625	1.023	1.099
476	14.000	-10.250	33.333	295	.9374	.9221	.007118	.007305	.000937	0.000000	9.133	-.049	.059	2.544	1.179	1.243
477	26.000	-10.250	33.333	311	.9114	.8918	.003553	.009928	.000187	0.000000	9.017	-.046	.037	2.620	1.139	1.471
478	38.000	-10.250	33.333	317	.9001	.8788	.006931	.014236	.000187	0.000000	9.067	-.062	.105	2.165	1.255	1.570
479	50.000	-10.250	33.333	296	.8879	.8701	.005057	.012737	0.000000	0.000000	9.183	.027	.030	1.691	1.099	1.341
480	62.000	-10.250	33.333	295	.8519	.8745	.006181	.011051	.000187	0.000000	9.116	.020	.057	1.484	1.158	1.507
481	74.000	-10.250	33.333	273	.8795	.8658	.003997	.010495	.000187	0.000000	9.238	-.015	.013	1.124	1.022	1.159

482	-34.000	18.500	6.667	211	.8925	.8918	.000135	.000541	0.000000	0.000000	9.170	.094	-.059	1.022	1.047	.880
483	-22.000	18.500	6.667	261	1.0319	1.0260	.003788	.002029	.000135	0.000000	9.156	-.002	.054	1.672	.843	1.101
484	-10.000	18.500	6.667	412	.7812	.7489	.022186	.009740	.000406	0.000000	8.872	.145	-.008	6.305	1.201	1.259
485	2.000	18.500	6.667	599	1.0456	.9957	.035444	.011769	.002706	0.000000	8.847	.061	.060	7.695	1.177	1.195
486	14.000	18.500	6.667	738	.6324	.5498	.050325	.029221	.003111	0.000000	8.249	.215	.006	12.932	2.344	1.727
487	26.000	18.500	6.667	663	.9219	.8312	.062365	.025433	.002976	0.000000	8.567	.138	.037	11.483	1.732	1.456
488	38.000	18.500	6.667	630	.6640	.5974	.032197	.031926	.002435	0.000000	8.707	.173	.047	6.998	2.224	1.637
489	50.000	18.500	6.667	458	.8042	.7662	.014205	.021239	.002570	0.000000	8.986	.071	.095	2.455	1.493	1.342
490	62.000	18.500	6.667	357	.8157	.7922	.005411	.017316	.000812	0.000000	9.148	.121	.019	1.694	1.258	1.119
491	74.000	18.500	6.667	312	.8055	.7879	.004464	.017852	.000271	0.000000	9.208	-.009	.000	1.146	1.172	1.165
492	-34.000	27.500	6.667	194	.8398	.8398	0.000000	0.000000	0.000000	0.000000	9.241	-.023	-.046	.947	.919	1.106
493	-22.000	27.500	6.667	235	.8915	.8874	.002165	.001894	0.000000	0.000000	9.242	.033	.013	1.434	.988	.882
494	-10.000	27.500	6.667	240	.7790	.7706	.006223	.001623	.000541	0.000000	9.122	.033	-.063	2.635	1.045	.907
495	2.000	27.500	6.667	305	.8213	.8052	.009605	.006088	.000406	0.000000	9.170	.039	.058	3.252	1.277	1.056
496	14.000	27.500	6.667	366	.7163	.6863	.014205	.012446	.001353	0.000000	8.947	.105	-.096	4.641	1.598	.975
497	26.000	27.500	6.667	487	.8375	.7965	.023539	.016369	.001082	0.000000	8.919	.111	-.003	5.761	1.644	1.255
498	38.000	27.500	6.667	426	.6825	.6450	.017316	.019616	.000541	0.000000	8.902	.126	-.097	3.634	1.956	1.284
499	50.000	27.500	6.667	385	.7734	.7446	.009740	.019075	0.000000	0.000000	9.122	.164	-.029	2.064	1.418	1.095
500	62.000	27.500	6.667	313	.7553	.7359	.005411	.013799	.000135	0.000000	9.155	.008	-.085	1.381	1.297	1.182
501	74.000	27.500	6.667	323	.8363	.8182	.004194	.013663	.000271	0.000000	9.169	.087	-.052	1.285	1.126	1.133
502	-34.000	18.500	20.000	236	1.0093	1.0087	.000135	.000541	0.000000	0.000000	9.139	.021	-.020	1.000	.967	.684
503	-22.000	18.500	20.000	211	.8715	.8701	.000541	.000812	0.000000	0.000000	9.260	-.026	-.006	.965	.921	.844
504	-10.000	18.500	20.000	266	.9487	.9394	.005141	.004194	0.000000	0.000000	9.104	.036	.035	2.008	1.134	1.071
505	2.000	18.500	20.000	350	.8316	.8095	.013528	.006117	.000406	0.000000	8.933	-.052	.012	4.120	1.341	1.125
506	14.000	18.500	20.000	398	.6913	.6580	.014205	.018669	.000406	0.000000	8.827	.135	.111	4.778	1.609	1.613
507	26.000	18.500	20.000	503	.7558	.7100	.022321	.023268	.000271	0.000000	8.779	.145	.048	6.093	1.399	1.516
508	38.000	18.500	20.000	510	.8197	.7749	.021374	.021239	.002165	0.000000	8.932	.106	.132	4.610	1.395	1.650
509	50.000	18.500	20.000	366	.7501	.7229	.008929	.017045	.001218	0.000000	9.028	.113	.029	2.344	1.293	1.304
510	62.000	18.500	20.000	335	.7960	.7749	.006088	.014475	.000541	0.000000	9.093	.036	.123	1.595	1.124	1.224
511	74.000	18.500	20.000	282	.7008	.6840	.003247	.012987	.000541	0.000000	9.205	.076	.024	1.328	1.146	1.127
512	-34.000	27.500	20.000	219	.9481	.9481	0.000000	0.000000	0.000000	0.000000	9.217	.000	-.040	.987	.844	1.059
513	-22.000	27.500	20.000	218	.9060	.9046	.000406	.000812	0.000000	0.000000	9.130	-.015	-.064	1.177	.903	1.061
514	-10.000	27.500	20.000	226	.8525	.8485	.002435	.001623	0.000000	0.000000	9.115	.063	-.044	1.680	.804	.989
515	2.000	27.500	20.000	287	.8860	.8745	.006088	.005005	.000406	0.000000	9.047	.062	-.053	2.439	.954	1.160
516	14.000	27.500	20.000	327	.8620	.8442	.008793	.003793	.000271	0.000000	8.998	.044	-.008	2.941	1.286	1.087
517	26.000	27.500	20.000	355	.7735	.7469	.011634	.012987	0.000000	0.000000	9.015	.080	-.027	3.249	1.562	1.484
518	38.000	27.500	20.000	350	.7561	.7316	.009334	.014746	.000406	0.000000	8.997	.056	.056	2.897	1.460	1.142
519	50.000	27.500	20.000	332	.7998	.7792	.006764	.012716	.001082	0.000000	9.152	.097	.004	1.853	1.386	1.487
520	62.000	27.500	20.000	308	.7965	.7792	.005547	.010417	.001353	0.000000	8.969	.093	.027	1.383	1.389	1.603
521	74.000	27.500	20.000	287	.8398	.8268	.004870	.007711	.000406	0.000000	9.152	.049	.029	1.260	1.184	1.066
522	-34.000	18.500	33.333	218	.9437	.9437	0.000000	0.000000	0.000000	0.000000	9.169	-.097	.088	.830	.979	1.095
523	-22.000	18.500	33.333	217	.9394	.9394	0.000000	0.000000	0.000000	0.000000	9.232	.067	.003	.899	.865	.961
524	-10.000	18.500	33.333	209	.8586	.8571	.000947	.000541	0.000000	0.000000	9.238	-.098	.084	1.232	1.007	.846
525	2.000	18.500	33.333	251	.8769	.8701	.002165	.004600	0.000000	0.000000	9.138	.003	.069	1.397	.958	1.035
526	14.000	18.500	33.333	290	.8444	.8312	.006088	.007170	0.000000	0.000000	9.177	-.046	.064	2.563	1.126	1.115
527	26.000	18.500	33.333	302	.8041	.7879	.005682	.010552	0.000000	0.000000	9.097	-.011	.118	2.382	1.170	1.195
528	38.000	18.500	33.333	351	.7940	.7706	.007440	.015557	.000406	0.000000	9.069	-.011	.035	2.786	1.318	1.428
529	50.000	18.500	33.333	333	.9046	.8874	.004058	.012652	.000406	0.000000	9.108	-.074	.070	1.894	1.142	1.250
530	62.000	18.500	33.333	332	.9717	.9567	.0044[illegible]	.010011	.000541	0.000000	9.207	-.055	-.030	1.277	1.253	1.217

531	74.000	18.500	33.333	296	.8494	.8355	.002976	.010417	.000541	0.000000	9.123	-.037	.008	1.183	.997	1.273
532	-34.000	27.500	33.333	225	.9740	.9740	0.000000	0.000000	0.000000	0.000000	9.226	-.096	.102	1.111	.902	.981
533	-22.000	27.500	33.333	229	.9913	.9913	0.000000	0.000000	0.000000	0.000000	9.207	-.008	.034	.656	1.159	.881
534	-10.000	27.500	33.333	231	.9581	.9567	.000406	.000947	0.000000	0.000000	9.259	-.058	.007	1.085	.867	1.083
535	2.000	27.500	33.333	238	.8667	.8615	.002029	.003247	0.000000	0.000000	9.121	-.063	-.023	1.426	1.126	1.003
536	14.000	27.500	33.333	249	.8850	.8788	.001623	.004600	0.000000	0.000000	9.176	-.002	.014	1.521	.977	1.078
537	26.000	27.500	33.333	267	.9042	.8961	.002300	.005817	0.000000	0.000000	9.155	-.152	-.004	1.595	1.175	1.192
538	38.000	27.500	33.333	220	.9324	.9177	.005952	.008658	0.000000	0.000000	9.142	-.030	-.001	1.890	1.236	1.196
539	50.000	27.50	33.333	308	.8972	.8831	.004058	.010011	0.000000	0.000000	9.136	-.101	-.061	1.628	1.260	1.432
540	62.000	27.500	33.333	295	.8493	.8355	.002841	.010687	.000271	0.000000	9.174	-.020	.055	1.395	1.266	1.320
541	74.000	27.500	33.333	305	.9136	.9004	.002841	.010146	.000135	0.000000	9.199	-.103	-.030	1.256	1.201	1.414
542	-34.000	38.000	6.667	222	.9610	.9610	0.000000	0.000000	0.000000	0.000000	9.227	.031	-.024	1.087	1.036	.986
543	-22.000	38.000	6.667	235	.9666	.9654	.000101	.001116	0.000000	0.000000	9.159	.036	-.025	1.080	1.170	1.032
544	-10.000	38.000	6.667	256	.9687	.9654	.000913	.002435	0.000000	0.000000	9.213	.044	.013	1.605	1.149	1.184
545	2.000	38.000	6.667	273	.9239	.9177	.001928	.004261	0.000000	0.000000	9.064	-.017	.009	1.710	1.132	.966
546	14.000	38.000	6.667	333	.9554	.9437	.005682	.005580	.000406	0.000000	9.223	.096	.025	2.479	1.181	1.149
547	26.000	38.000	6.667	355	.7843	.7662	.008320	.009436	.000304	0.000000	9.066	.028	.042	3.028	1.375	1.074
548	38.000	38.000	6.667	355	.8519	.8355	.005073	.011161	.000203	0.000000	9.201	.104	-.012	2.356	1.334	1.207
549	50.000	38.000	6.667	341	.8082	.7922	.004261	.011668	.000101	0.000000	9.172	.057	-.006	1.665	1.417	1.194
550	62.000	38.000	6.667	304	.7453	.7316	.004160	.009537	0.000000	0.000000	9.247	.085	.073	1.587	1.335	1.045
551	74.000	38.000	6.667	322	.9035	.8918	.002334	.009334	.000101	0.000000	9.153	.033	.048	1.281	1.246	1.147
552	-34.000	50.000	6.667	249	1.0779	1.0779	0.000000	0.000000	0.000000	0.000000	9.203	-.041	-.046	1.110	.879	1.026
553	-22.000	50.000	6.667	238	1.0092	1.0087	0.000000	.000507	0.000000	0.000000	9.174	.025	-.019	.931	.900	.902
554	-10.000	50.000	6.667	222	.9188	.9177	0.000000	.001015	0.000000	0.000000	9.236	.005	-.031	1.162	.865	1.081
555	2.000	50.000	6.667	271	1.0379	1.0346	.000304	.002942	0.000000	0.000000	9.122	.027	.008	1.206	1.051	1.027
556	14.000	50.000	6.667	237	.7977	.7922	.001928	.003044	.000507	0.000000	9.160	.064	.035	1.591	.908	1.051
557	26.000	50.000	6.667	307	.9781	.9697	.002537	.005885	0.000000	0.000000	9.105	-.000	.105	1.644	1.053	1.091
558	38.000	50.000	6.667	300	.9140	.9046	.002638	.006595	0.000000	0.000000	9.064	.126	.105	1.628	1.175	1.065
559	50.000	50.000	6.667	277	.8017	.7922	.002029	.007407	.000101	0.000000	9.111	.002	.103	1.481	1.057	1.069
560	62.000	50.000	6.667	281	.8444	.8355	.002029	.006798	.000101	0.000000	9.089	.147	.013	1.271	1.166	.961
561	74.000	50.000	6.667	275	.7085	.6970	.002942	.008421	.000203	0.000000	9.176	.068	.015	1.252	.969	1.009
562	-34.000	62.000	6.667	212	.9177	.9177	0.000000	0.000000	0.000000	0.000000	9.138	.091	-.028	1.128	1.061	1.101
563	-22.000	62.000	6.667	237	1.0260	1.0260	0.000000	0.000000	0.000000	0.000000	9.136	.038	.003	1.029	.969	1.021
564	-10.000	62.000	6.667	209	.8879	.8874	0.000000	.000406	0.000000	0.000000	9.165	.016	-.115	1.135	.961	1.037
565	2.000	62.000	6.667	224	.9232	.9221	0.000000	.001116	0.000000	0.000000	9.152	.066	.115	1.197	.899	1.020
566	14.000	62.000	6.667	238	.8908	.8874	.000507	.002334	.000507	0.000000	9.240	-.007	-.156	1.395	1.039	1.148
567	26.000	62.000	6.667	272	.9746	.9697	.001522	.003348	0.000000	0.000000	9.155	.094	.017	1.478	1.071	1.056
568	38.000	62.000	6.667	256	.8503	.8442	.001319	.004870	0.000000	0.000000	9.220	.010	-.061	1.438	1.116	1.186
569	50.000	62.000	6.667	281	.9459	.9394	.001420	.005073	0.000000	0.000000	9.199	.009	.015	1.365	1.159	1.130
570	62.000	62.000	6.667	261	.8255	.8182	.001218	.006088	0.000000	0.000000	9.194	-.007	-.054	1.391	1.194	1.273
571	74.000	62.000	6.667	288	.9381	.9307	.001116	.006291	0.000000	0.000000	9.243	-.025	-.008	1.345	1.198	1.201
572	-34.000	74.000	6.667	234	1.0130	1.0130	0.000000	0.000000	0.000000	0.000000	9.267	-.140	-.047	1.116	.969	1.006
573	-22.000	74.000	6.667	236	1.0216	1.0216	0.000000	0.000000	0.000000	0.000000	9.254	-.001	.044	1.094	1.004	1.047
574	-10.000	74.000	6.667	248	1.0735	1.0736	0.000000	0.000000	0.000000	0.000000	9.233	-.085	-.033	1.131	.849	1.056
575	2.000	74.000	6.667	240	1.0094	1.0087	0.000000	.000710	0.000000	0.000000	9.285	-.051	-.033	1.112	1.110	1.071
576	14.000	74.000	6.667	239	.9754	.9740	0.000000	.001319	.000101	0.000000	9.190	-.087	.016	1.257	.964	1.056
577	26.000	74.000	6.667	251	.9555	.9524	.000507	.002638	0.000000	0.000000	9.346	.046	-.114	1.194	1.088	.970
578	38.000	74.000	6.667	241	.9080	.9046	.000507	.002739	0.000000	0.000000	9.208	.028	.015	1.315	1.058	.974
579	50.000	74.000	6.667	252	.8668	.8615	.000812	.004566	0.000000	0.000000	9.257	.069	-.047	1.220	1.197	1.025

580	62.000	74.000	6.667	258	.9140	.9091	.001116	.003754	0.000000	0.000000	9.253	.004	.126	1.251	1.026	.924
581	74.000	74.000	6.667	250	.8709	.8658	.001218	.003856	0.000000	0.000000	9.230	.029	.079	1.174	1.249	1.066
582	-34.000	38.000	20.000	221	.9662	.9654	.000101	.000710	0.000000	0.000000	9.146	-.035	.079	1.185	.921	1.006
583	-22.000	38.000	20.000	227	.9489	.9481	.000304	.000507	0.000000	0.000000	9.205	.044	-.043	1.082	.990	.904
584	-10.000	38.000	20.000	253	.9853	.9827	.001015	.001623	0.000000	0.000000	9.179	-.029	.045	1.384	.918	1.100
585	2.000	38.000	20.000	260	.9099	.9048	.001826	.003247	.000101	0.000000	9.177	.027	-.085	1.704	1.013	1.050
586	14.000	38.000	20.000	293	.8414	.8312	.004464	.005073	.000710	0.000000	9.194	-.029	.027	2.096	1.037	1.094
587	26.000	38.000	20.000	330	.8536	.8395	.004464	.009233	.000101	0.000000	9.076	.048	-.095	2.135	1.335	1.093
588	38.000	38.000	20.000	328	.8872	.8745	.005276	.007407	.000101	0.000000	9.166	.019	-.001	1.934	1.242	1.001
589	50.000	38.000	20.000	336	.7824	.7662	.006696	.009131	.000304	0.000000	9.055	.067	.033	1.962	1.471	1.177
590	62.000	38.000	20.000	325	.8193	.8052	.003551	.010146	.000406	0.000000	9.186	-.027	.029	1.514	1.244	1.068
591	74.000	38.000	20.000	284	.7698	.7792	.003145	.007001	.000406	0.000000	9.165	-.035	.049	1.332	1.131	1.036
592	-34.000	50.000	20.000	24[illegible]	1.0390	1.0390	0.000000	0.000000	0.000000	0.000000	9.195	-.007	-.001	1.075	1.111	.878
593	-22.000	50.000	20.000	227	.9658	.9654	.000101	.000304	0.000000	0.000000	9.153	.024	.007	1.011	.892	1.010
594	-10.000	50.000	20.000	236	.9751	.9740	.000203	.000913	0.000000	0.000000	9.200	.007	.028	1.069	1.1[illegible]3	.931
595	2.000	50.000	20.000	239	.9036	.9004	.000507	.002638	0.000000	0.000000	9.157	.008	.032	1.223	.910	.999
596	14.000	50.000	20.000	278	.9202	.9134	.002537	.003754	.000507	0.000000	9.167	.009	-.002	1.545	1.104	1.046
597	26.000	50.000	20.000	270	.9405	.9351	.001623	.003856	0.000000	0.000000	9.193	-.009	.000	1.393	1.031	.989
598	38.000	50.000	20.000	284	.9081	.9004	.001576	.005885	0.000000	0.000000	9.154	-.007	.028	1.340	1.263	1.093
599	50.000	50.000	20.000	316	.9959	.9870	.002232	.006696	0.000000	0.000000	9.179	-.107	-.004	1.488	1.086	1.014
600	62.000	50.000	20.000	315	.8986	.8874	.002739	.008218	.000203	0.000000	9.231	-.011	.075	1.491	1.326	1.009
601	74.000	50.000	20.000	300	.8971	.8874	.001623	.007914	.000101	0.000000	9.226	-.065	.026	1.297	1.186	1.163
602	-34.000	62.000	20.000	242	1.0476	1.0476	0.000000	0.000000	0.000000	0.000000	9.286	-.031	.009	1.111	1.069	1.024
603	-22.000	62.000	20.000	237	1.0260	1.0260	0.000000	0.000000	0.000000	0.000000	9.267	.045	.031	.951	.935	1.050
604	-10.000	62.000	20.000	235	.9962	.9957	0.000000	.000507	0.000000	0.000000	9.273	-.041	.047	.954	1.116	1.113
605	2.000	62.000	20.000	230	.9407	.9394	.000101	.001015	.000203	0.000000	9.252	-.019	.014	1.259	1.061	1.012
606	14.000	62.000	20.000	242	.9631	.9610	.000609	.001420	0.000000	0.000000	9.251	.009	-.010	1.127	1.182	1.112
607	26.000	62.000	20.000	240	.8699	.8658	.001015	.003044	0.000000	0.000000	9.158	-.095	.043	1.430	1.019	1.094
608	38.000	62.000	20.000	259	.9267	.9221	.000812	.003856	0.000000	0.000000	9.211	-.006	-.016	1.307	1.063	.973
609	50.000	62.000	20.000	250	.8[illegible]32	.7965	.001319	.005377	0.000000	0.000000	9.197	.073	.028	1.325	1.157	1.068
610	62.000	62.000	20.000	267	.8472	.8396	.001218	.006189	0.000000	0.000000	9.172	.049	-.028	1.282	1.200	.934
611	74.000	62.000	20.000	240	.7304	.7229	.001116	.006088	.000203	0.000000	9.172	.021	.050	1.204	1.178	1.086
612	-34.000	74.000	20.000	256	1.1082	1.1082	0.000000	0.000000	0.000000	0.000000	9.220	-.085	.033	.963	1.000	1.131
613	-22.000	74.000	20.000	239	1.0346	1.0346	0.000000	0.000000	0.000000	0.000000	9.239	.049	-.006	1.133	.990	.931
614	-10.000	74.000	20.000	245	1.0606	1.0606	0.000000	0.000000	0.000000	0.000000	9.151	-.005	.007	1.217	1.114	1.228
615	2.000	74.000	20.000	246	1.0184	1.0173	0.000000	.001116	0.000000	0.000000	9.228	.086	-.052	1.241	.887	.898
616	14.000	74.000	20.000	243	1.0139	1.0130	.000101	.000812	0.000000	0.000000	9.097	.045	.008	.936	.894	1.031
617	26.000	74.000	20.000	257	1.0449	1.0433	.000203	.001420	0.000000	0.000000	9.199	.034	.034	1.340	.909	1.081
618	38.000	74.000	20.000	252	.9894	.9870	.000609	.001826	0.000000	0.000000	9.140	.034	.051	1.149	.972	1.105
619	50.000	74.000	20.000	271	.9956	.9913	.000507	.003754	0.000000	0.000000	9.156	-.049	.074	1.478	1.078	.950
620	62.000	74.000	20.000	262	.9270	[illegible]21	.001116	.003856	0.000000	0.000000	9.138	.012	.032	1.250	1.011	1.110
621	74.000	74.000	20.000	265	.9400	[illegible]351	.000609	.004363	0.000000	0.000000	9.197	-.021	.029	1.475	1.102	.861
622	-34.000	38.000	33.333	222	.9610	[illegible]610	0.000000	0.000000	0.000000	0.000000	9.268	.048	-.001	1.021	.963	.999
623	-22.000	38.000	33.333	248	1.0736	1.0736	0.000000	0.000000	0.000000	0.000000	9.190	-.013	.041	.955	1.034	1.086
624	-10.000	38.000	33.333	206	.8622	.8615	.000304	.000406	0.000000	0.000000	9.250	.016	-.105	1.207	1.121	.703
625	2.000	38.000	33.333	261	1.0242	1.0216	.001116	.001319	.000101	0.000000	9.226	-.044	.006	1.057	1.071	1.035
626	14.000	38.000	33.333	234	.8948	.8919	.000710	.002334	0.000000	0.000000	9.205	-.081	.012	1.136	1.163	.845
627	26.000	38.000	33.333	268	.9297	.9221	.003145	.004261	.000203	0.000000	9.173	-.045	-.015	1.665	1.159	1.180
628	38.000	38.000	33.333	279	.8104	.8009	.002636	.006798	.000101	0.000000	9.165	-.057	-.000	1.693	1.287	1.064

629	50.000	38.000	33.333	277	.7722	.7619	.002942	.007204	.000101	0.000000	9.173	-.011	-.057	1.497	1.275	1.233
630	62.000	38.000	33.333	283	.8066	.7965	.003044	.006899	.000101	0.000000	9.227	.017	-.018	1.301	1.145	1.079
631	74.000	[illegible]	33.333	277	.7722	.7619	.002942	.007001	.000304	0.000000	9.187	.111	-.015	1.245	1.194	1.210
632	-34.000	50.000	33.333	220	.9524	.9524	0.000000	0.000000	0.000000	0.000000	9.200	.043	-.067	.924	1.162	1.031
633	-22.000	50.000	33.333	240	1.0390	1.0390	0.000000	0.000000	0.000000	0.000000	9.177	.063	.004	1.005	1.147	1.090
634	-10.000	50.000	33.333	220	.8932	.8918	.000101	.001319	0.000000	0.000000	9.191	.049	-.045	.930	1.105	1.005
635	2.000	50.000	33.333	225	.9233	.9221	.000203	.001015	0.000000	0.000000	9.187	.042	-.068	1.072	1.033	1.103
636	14.000	50.000	33.333	237	.9245	.9221	.000710	.001725	0.000000	0.000000	9.184	-.002	-.051	1.145	.995	1.070
637	26.000	50.000	33.333	245	.8957	.8918	.001015	.002841	.000101	0.000000	9.173	.043	-.054	1.262	.914	1.068
638	38.000	50.000	33.333	280	.9246	.9177	.002435	.004363	.000101	0.000000	9.200	-.077	-.060	1.450	1.152	.997
639	50.000	50.000	33.333	298	.9222	.9134	.002638	.006189	0.000000	0.000000	9.145	.096	-.002	1.522	1.078	1.115
640	62.000	50.000	33.332	291	.9215	.9134	.001826	.005986	.000304	0.000000	9.127	-.057	-.092	1.146	1.214	1.058
641	74.000	50.000	33.333	269	.8432	.8355	.002131	.005479	.000101	0.000000	9.120	.036	-.032	1.170	1.109	1.100
642	-34.000	62.000	33.333	264	1.1429	1.1429	0.000000	0.000000	0.000000	0.000000	9.077	-.006	-.013	.956	1.028	.845
643	-22.000	62.000	33.333	216	.9437	.9437	0.000000	0.000000	0.000000	0.000000	9.215	-.073	-.052	1.251	.872	.920
644	-10.000	62.000	33.333	247	1.0228	1.0216	0.000000	.001116	0.000000	0.000000	9.129	-.107	-.027	1.116	1.063	1.015
645	2.000	62.000	33.333	230	.9534	.9524	.000203	.000812	0.000000	0.000000	9.211	-.022	-.006	1.169	1.040	.861
646	14.000	62.000	33.333	247	.9932	.9913	.000507	.001319	0.000000	0.000000	9.221	.049	.052	1.122	1.099	.934
647	26.000	62.000	33.333	231	.9112	.9091	.000406	.001725	0.000000	0.000000	9.172	-.023	.049	1.120	1.148	1.110
648	38.000	62.000	33.333	251	.8837	.8788	.001015	.003856	0.000000	0.000000	9.253	.041	.016	1.376	1.096	1.035
649	50.000	62.000	33.333	258	.9436	.9394	.000710	.003450	0.000000	0.000000	9.200	.026	-.009	1.274	1.158	1.337
650	62.000	62.000	33.333	259	.8591	.8528	.001319	.004870	.000101	0.000000	9.274	.026	.013	1.309	1.199	1.180
651	74.000	62.000	33.333	245	.7858	.7792	.001522	.004667	.000406	0.000000	9.197	.092	-.039	1.418	1.019	1.265
652	-34.000	74.000	33.333	213	.9221	.9221	0.000000	0.000000	0.000000	0.000000	9.306	-.033	-.053	1.043	1.037	1.048
653	-22.000	74.000	33.333	245	1.0606	1.0606	0.000000	0.000000	0.000000	0.000000	9.225	-.017	-.011	1.100	.872	.971
654	-10.000	74.000	33.333	213	.9221	.9221	0.000000	0.000000	0.000000	0.000000	9.271	.020	-.013	1.090	.934	.917
655	2.000	74.000	33.333	195	.8103	.8095	.000101	.000710	0.000000	0.000000	9.195	-.031	-.042	1.050	1.129	.849
656	14.000	74.000	33.333	222	.9061	.9046	0.000000	.001319	0.000000	0.000000	9.267	.016	-.004	1.213	.968	1.085
657	26.000	74.000	33.333	192	.7931	.7922	0.000000	.000913	0.000000	0.000000	9.236	-.095	-.062	1.137	1.179	1.044
658	38.000	74.000	33.333	234	.9369	.9351	.000304	.001522	0.000000	0.000000	9.253	-.007	.034	1.314	.873	1.012
659	50.000	74.000	33.333	201	.7856	.7835	.000406	.001623	0.000000	0.000000	9.193	-.052	.049	1.176	1.070	.890
660	62.000	74.000	33.332	233	.8522	.8485	.000406	.003348	0.000000	0.000000	9.346	-.018	.061	1.158	1.010	.818
661	74.000	74.000	33.333	226	.8600	.8571	.001015	.001826	0.000000	0.000000	9.227	-.042	.126	1.209	.968	1.082

0 0 0 0 0 0 0 0 0 0

1.000000

D 38

FLOWFIELD OF ORBITING SPACE SHUTTLE

ATOMIC OXYGEN STREAM 7820.00000 M/SEC AT INCIDENCE 0.00000 DEGREES
FREESTREAM MEAN FREE PATH = 96.0 METRES AND SPEED RATIO= 9.2000
THE SURFACE OUTGASSES AT A RATE EQUAL TO .12400 TIMES THE NUMBER FLUX (1/4NV) IN THE UNDISTURBED FREESTREAM GAS
0 CONTROL JETS IN OPERATION
PAYLOAD BAY DOORS ARE OPEN
THE SURFACE TEMPERATURE IS ASSUMED TO BE EQUAL TO .43000 TIMES THE ATMOSPHERIC TEMPERATURE

THE FIVE NUMBERS AT EACH POINT REPRESENT DENSITIES NORMALIZED TO THE FREESTREAM DENSITY

DENSITY OF UNDISTURBED FREESTREAM MOLECULES
DENSITY OF MOLECULES THAT HAVE STRUCK SURFACE
DENSITY OF INDIRECTLY AFFECTED MOLECULES
DENSITY OF OUTGASSED MOLECULES
DENSITY OF JET MOLECULES

MINIMUM DENSITY RESOLUTION = .0001948 BASED ON ONE MOLECULE OR .0064286 BASED ON ONE MOLECULE PER SAMPLING INTERVAL
NOTE THAT ABOVE FIGURES ASSUME UNIT WEIGHTING FACTOR

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	1.030649	.980779	.947532	1.072208	.955844	1.030649	1.105455	1.063896	1.072208	1.005714	1.038961	1.022338	
	0.000000	0.000000	.000195	.000974	.004286	.001753	.001169	.000779	.001948	.005260	.004870	.001948	
	0.000000	.000195	.001753	.000974	.002727	.002532	.005260	.004870	.003896	.004481	.005649	.006039	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000974	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	1.047273	1.014026	1.122078	1.063896	1.122078	1.105455	1.047273	.972468	.989091	1.030649	.980779	.964156	
	0.000000	.000390	.000779	.000779	.003896	.002922	.002922	.002338	.003117	.005649	.004091	.002922	
	0.000000	.000390	.001169	.001558	.001169	.003117	.005455	.006234	.004091	.006818	.009545	.006429	
	0.000000	0.000000	.000195	.000584	0.000000	0.000000	.000195	.000195	.000390	.001364	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	1.155325	1.196883	.989091	1.122078	1.163636	1.055584	1.147013	.947532	1.147013	.972468	1.138701	1.038961	
	.000390	.000390	.001753	.000584	.005649	.004091	.005260	.003701	.006818	.006623	.004675	.003117	
	0.000000	.000390	.001753	.001753	.001753	.005844	.010519	.007013	.008182	.008571	.007987	.008961	
	0.000000	0.000000	0.000000	.000584	0.000000	.000195	0.000000	0.000000	.001169	.000195	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	.980779	1.030649	1.022338	1.022338	1.038961	1.038961	.889351	1.097143	.980779	1.022338	.872727	.980779	
	.000390	.003506	.004091	.002532	.007792	.008961	.007208	.010714	.011494	.008377	.005649	.003506	

```
      .000195   .000974   .001948   .003312   .004461   .007013   .011883   .012857   .011104   .014610   .011494   .012857
     0.000000  0.000000  0.000000  0.000000   .000584   .000195  0.000000   .000779   .000584   .000584   .000390   .000195
     0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000
Y= 40                                                                                                                       Y= 40
      .899740  1.022338   .942377  1.007792   .989091   .935065  1.024416   .980779   .930909  1.022338   .941299   .972468
      .000779   .001558   .005065   .008377   .013636   .013442   .019481   .024156   .016558   .010519   .008571   .007597
      .000779   .001948   .002922   .004675   .007792   .014416   .018506   .018506   .021818   .020260   .016753   .012857
     0.000000  0.000000  0.000000  0.000000   .000974   .000390  0.000000   .001169   .000584   .000584   .000390   .000390
     0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000
Y= 30                                                                                                                       Y= 30
      .772987   .960000   .791688   .947532   .804156   .847792   .891429   .922597   .947532  1.009870  1.022338   .972468
      .001558   .007208   .014221   .020455   .038377   .035649   .042078   .037597   .030974   .015584   .014610   .005260
      .000974   .002922   .003506   .008961   .018117   .029221   .036234   .030779   .037013   .022013   .017532   .017922
     0.000000  0.000000   .000195   .000390   .002143   .001753   .003117   .001558   .002143   .000195   .000974   .001558
     0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000
Y= 20                                                                                                                       Y= 20
     1.082513  1.004474   .966039  1.048227  1.028961   .978896  1.042987   .927857  1.086364   .894708   .904416   .997240
      .004286   .008377   .020455   .081429   .146494   .148247   .180195   .130909   .046948   .019091   .011688   .010325
      .000779   .003701   .005455   .025519   .047338   .057273   .068766   .059416   .036039   .025325   .019091   .015000
     0.000000  0.000000   .001169  0.000000   .004286   .007403   .009545   .007792   .002727   .000974   .001753   .000390
     0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000
Y= 10                                                                    --                                                 Y= 10
      .984000  1.018500  1.022000   .991734                             /  /      .634773   .657045  ..637955   .738182
      .001753   .012662   .051623   .331948                           /   /       .038182   .022208   .010130   .013636
      .002727   .004481   .014416   .063312                         /   /        .036234   .024156   .017727   .018896
     0.000000  0.000000   .000390   .003896                       / USA /         .006818   .002532   .000779   .000779
     0.000000  0.000000  0.000000  0.000000     --------------------     I        0.000000  0.000000  0.000000  0.000000
Y=  0                                          /                       I                                                    Y=  0
     1.036636   .952626   .960139   .992390  --**                     I           .725909   .785043   .743680   .818149
      .001753   .011688   .042078   .247013 (  NASA                   I           .034286   .015000   .012662   .007013
      .002922   .002727   .006377   .046169  --------------------------------    .037792   .022987   .019481   .014610
     0.000000   .000390   .001364   .006623                                       .002727   .002143   .000390   .001169
     0.000000  0.000000  0.000000  0.000000                                      0.000000  0.000000  0.000000  0.000000
Y=-10                                                                                                                       Y=-10
      .895931   .859913   .949957   .837403   .823896   .846407   .819394   .985974   .623896   .886926   .810390   .895931
      .003506   .009351   .016364   .076753   .108896   .127208   .116688   .054156   .023571   .013831   .009351   .008961
      .001364   .004091   .008182   .015390   .026104   .046169   .044416   .035065   .026104   .019286   .015974   .010909
     0.000000   .000584   .000390   .000584   .006039   .007403   .009545   .006039   .003701   .001948   .001364   .001169
     0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000  0.000000
Y=-20                                                                                                                       Y=-20


IN PLANE Z=   15.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

          X=-35     X=-25     X=-15     X=-5      X=5       X=15      X=25      X=35      X=45      X=55      X=65      X=75
Y= 80                                                                                                                       Y= 80
```

	1.080519	.980779	1.246753	.897662	1.014026	1.080519	.856104	1.014026	.947532	.872727	.980779	1.055584
	0.000000	0.000000	0.000000	0.000000	.001169	.002922	.003117	.003117	.001558	.002727	.002143	.002143
	0.000000	.000195	.000779	.000390	.001364	.000974	.002143	.002727	.004481	.006039	.005844	.006623
	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	.000195	0.000000	0.000000	.000584	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 70												
	1.171948	.930909	1.072208	.980779	.872727	1.072208	1.030649	.955844	.980779	.905974	.897662	.864416
	0.000000	0.000000	.001169	.001558	.002532	.002532	.002143	.003701	.001753	.002532	.002143	.002922
	0.000000	.000195	.001169	.002532	.001948	.002338	.003701	.005260	.005260	.007208	.006623	.007792
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	.000195	.000390
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 60												
	.889351	1.055584	.997403	.847792	1.005714	.930909	.964156	.914286	.955844	.964156	1.005714	.971468
	0.000000	.001364	.002727	.001169	.003117	.002338	.003117	.006039	.003701	.003506	.003117	.003506
	.000195	.001169	.001558	.002727	.003312	.004481	.005065	.009935	.008182	.010714	.008766	.011299
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	.000584	.000195
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 50												
	1.030649	1.072208	1.097143	.989091	1.072208	1.038961	1.030649	1.047273	1.097143	1.105455	.997403	.914286
	0.000000	.001948	.001948	.004091	.005649	.009351	.006818	.008182	.007597	.006234	.006039	.005065
	.000584	.001364	.001364	.003506	.003506	.009351	.008961	.011104	.013831	.014221	.011494	.012662
	0.000000	0.000000	0.000000	.000779	.000195	.000390	0.000000	.000195	.000584	0.000000	.000195	.000195
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 40												
	.970390	1.088831	1.024416	1.030649	1.176104	.831169	1.103377	1.030649	1.001558	1.147013	1.047273	1.066052
	.000195	.003312	.006429	.008377	.015195	.013052	.017338	.011299	.013247	.009351	.008571	.009545
	.000779	.001948	.003312	.005260	.009182	.008766	.013442	.020455	.019286	.014416	.018117	.012468
	.000390	0.000000	0.000000	0.000000	.001753	.001169	.000390	.000974	.001753	.000779	.000195	.000390
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 30												
	.922597	1.034805	.910130	.841558	.984935	.860260	1.003636	.997403	.916364	.960000	.947532	.947532
	.001364	.006039	.013442	.019481	.027078	.028442	.031948	.026831	.024545	.017143	.014805	.010325
	.000974	.002532	.003117	.006234	.017338	.016948	.027273	.032922	.024156	.022208	.020065	.016948
	.000584	.000779	0.000000	0.000000	.001948	.000974	.000584	.003701	.001169	.000779	.000584	.000584
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 20												
	.919364	.978351	.934149	.990643	1.000909	1.095000	.930779	1.015487	1.063279	.954026	.990487	.926623
	.002727	.005649	.019286	.048701	[illegible]	084545	.091364	.062727	.034481	.022792	.012468	.008766
	.001364	[illegible]	.006039	.014026	.030000	41299	.038571	.045000	.041299	.029026	.020649	.013636
	0.000000	.000584	.000390	.001364	.002532	06618	.003896	.004870	.003506	.001169	.001169	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 10								--				
	1.068000	1.044545	.988091	1.049299				/ /	.805909	.915455	.960000	.848409
	.008377	.021429	.042273	.081818				/ /	.037597	.019286	.011883	.010130
	.001558	.002532	.004091	.021429			/	/	.036429	.028636	.023571	.017922
	0.000000	.000974	.000584	.003896			/ USA	/	.003896	.002338	.001558	.002143
	0.000000	0.000000	0.000000	0.000000	-------	-------	-------	I	0.000000	0.000000	0.000000	0.000000
Y= 0					/			I				
	.879545	1.056035	.979346	1.020666	--**			I	.935227	.966926	.978301	1.013344

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
	.004675	.010909	.022208	.062143	(NASA			I	.026494	.014416	.013247	.009351	
	.001169	.003312	.006234	.015390	----------	----------	----------	----------	.036818	.021234	.018506	.017532	
	0.000000	.000584	.002143	.000974					.001753	.001169	.000584	.000779	
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000	
Y=-10													Y=-10
	.9[illegible]1472	.922944	.990476	.891429	.949957	.922944	.976970	.958961	.954459	1.030996	.963463	.981472	
	.000779	.006234	.012662	.034286	.058442	.071104	.075584	.037792	.023377	.011688	.007792	.007987	
	.001169	.002143	.004286	.010519	.017532	.031169	.033117	.032727	.024935	.021818	.018701	.012662	
	.001169	.000584	.000974	.001558	.004091	.004286	.009740	.005065	.002338	.000974	.001364	.000584	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y=-20													Y=-20

IN PLANE Z= 25.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	1.072208	.955844	1.088831	1.047273	1.138701	1.022338	1.122078	1.113766	1.105455	1.030649	1.097143	.947532	
	0.000000	0.000000	0.000000	.000195	.001364	.001753	.001948	.001364	.001169	.002532	.001558	.002727	
	0.000000	.000390	.000779	.000195	.002338	.002338	.001948	.003506	.002922	.003701	.005844	.003896	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000.	
Y= 70													Y= 70
	.922597	1.080519	.964156	.947532	1.063896	.847792	1.063896	.897662	.997403	.664416	1.055584	.972468	
	0.000000	0.000000	.000584	.000779	.001364	.002727	.002143	.001364	.002532	.003506	.003896	.001558	
	0.000000	.000195	.000974	.001364	.002143	.001364	.003312	.004286	.005065	.007208	.006234	.009935	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	.000974	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	1.047273	.997403	1.030649	1.055584	1.022338	1.047273	1.163636	.955844	1.221818	1.055584	1.122078	.980779	
	0.000000	0.000000	.000195	.001364	.001948	.003701	.003701	.002532	.005065	.004675	.004091	.004481	
	.000195	.000584	.002143	.002338	.002532	.002532	.004286	.009545	.009740	.010714	.010909	.009935	
	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	.000195	.000195	.000779	.000195	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	.889351	.997403	.914286	.914286	1.030649	1.030649	1.088831	.922597	.939221	.897662	1.072208	.997403	
	0.000000	0.000000	.000974	.007403	.005844	.006429	.004675	.006429	.007403	.007987	.005455	.002338	
	.000195	.000390	.001753	.003506	.003117	.007403	.006234	.013247	.011883	.015195	.013247	.011688	
	0.000000	0.000000	0.000000	0.000000	.000779	.000390	0.000000	.000390	.000195	.001169	.000195	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	.962078	1.030649	.926753	1.063896	.987013	.991169	.995325	.995325	.793766	.970390	.932987	1.034805	
	0.000000	.000195	.003701	.006429	.013052	.011299	.012273	.013831	.008182	.010714	.005649	.007013	
	.000779	.002338	.002727	.005455	.006039	.007403	.012468	.013636	.013247	.014805	.013247	.014416	
	.000195	0.000000	0.000000	0.000000	.000195	.000584	0.000000	.002143	.001364	.000195	.000779	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	

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ORIGINAL PAGE IS
OF POOR QUALITY

Y= 30													Y= 30
	1.252987	.991169	1.271688	.991169	1.078442	1.190649	1.097143	1.009870	1.090909	1.065974	1.072208	1.047273	
	0.000000	.001169	.000779	.010519	.013442	.027273	.037792	.017143	.011494	.010130	.010325	.008182	
	.000584	.001558	.003117	.006039	.007987	.011104	.016364	.021429	.018896	.021429	.016753	.015974	
	0.000000	0.000000	0.000000	.000390	.000195	.003896	.000974	.002532	.001169	.001558	.000195	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 20													Y= 20
	1.000130	1.172143	.673506	1.060909	1.166688	.898442	1.124416	.905844	.922403	.922987	.924156	.905455	
	.004286	.006039	.009740	.015779	.027076	.049481	.051623	.031169	.018896	.013247	.012273	.006623	
	.000779	.001948	.003701	.007597	.015000	.021039	.018701	.028636	.025714	.026299	.019091	.016169	
	0.000000	0.000000	.000779	.002143	.002727	.002143	.000974	.001753	.000974	.000974	.000390	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 10								--					Y= 10
	.961364	.845455	1.036364	.913636				/ /	1.070455	1.002273	1.009091	1.118182	
	.004870	.014026	.022403	.019286				/ /	.027468	.016948	.010519	.007403	
	.001753	.001558	.007792	.011494				/ /	.030195	.023182	.022597	.018701	
	0.000000	0.000000	.001364	.000195				/ USA /	.001753	.001364	.000584	.000390	
	0.000000	0.000000	0.000000	0.000000	------	------	------	I	0.000000	0.000000	0.000000	0.000000	
Y= 0					/			I					Y= 0
	1.044697	1.201775	.929048	1.083420	--**			I	1.094221	.924675	.975996	.876948	
	.002532	.002532	.014416	.016558	(NASA			I	.020260	.013831	.009935	.008961	
	.000195	.002532	.003506	.012468	------	------	------	------	.028247	.020455	.017338	.013052	
	0.000000	0.000000	0.000000	.000584					.001169	.000779	.000390	.000584	
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000	
Y=-10													Y=-10
	.940952	1.035498	.686926	.976970	.877922	.972468	.913939	.904935	.931948	.981472	.864416	.994978	
	.000584	.002338	.006429	.020844	.032922	.031948	.034286	.022403	.015390	.010714	.006623	.006623	
	.000584	.000974	.003701	.006234	.011104	.015195	.022597	.021818	.021234	.017922	.017143	.012662	
	0.000000	0.000000	.000390	.000974	.000195	.000779	.003701	.003312	.000584	.000974	.001364	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y=-20													Y=-20

IN PLANE Z= 35.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	.905974	.939221	.947532	.897662	.939221	.989091	.881039	.980779	.955844	.930909	.922597	.964156	
	0.000000	0.000000	0.000000	0.000000	.000584	.000195	.003117	.000779	.000584	.002338	.001558	.001558	
	0.000000	.000584	.000390	.001169	.000974	.000974	.001169	.002338	.003701	.003896	.003506	.003312	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000390	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	.980779	1.038961	.930909	.905974	1.022338	.897662	1.155325	.964156	.972468	1.147013	.8145[illegible]	.997403	
	0.000000	0.000000	.000195	0.000000	.001558	.000779	.001753	.001753	.001169	.002143	.002143	.002532	
	0.000000	0.000000	.000390	.000584	.001753	.002532	.003312	.004675	.004286	.004481	.005260	.005260	

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	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000195	0.000000	0.000000	0.000000	0.000000	.000195	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	1.005714	1.022338	.980779	1.060519	1.088831	1.038961	1.105455	.889351	1.196883	.980779	1.138701	1.130390	
	0.000000	0.000000	.000390	.000974	.001753	.001753	.002922	.002922	.001753	.003701	.003506	.003506	
	0.000000	0.000000	.001169	.002727	.003312	.002727	.004286	.004670	.007792	.008182	.008182	.007013	
	0.000000	0.000000	0.000000	.000195	.000195	0.000000	.000195	.000195	0.000000	0.000000	.000195	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	.847792	1.080519	.739740	1.055584	.964156	.797922	1.063896	.905974	.831169	1.122078	.831169	.897662	
	0.000000	0.000000	.001558	.002338	.003896	.003896	.006818	.004286	.005649	.003896	.002922	.004481	
	0.000000	.000390	.001169	.002532	.004675	.005455	.006234	.007792	.008766	.009545	.007792	.007792	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	.000584	.000584	.000390	.000390	.000390	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	1.028571	.939221	1.020260	.928831	.947532	.947532	.972468	.970390	1.030649	1.045195	.903896	.995325	
	0.000000	0.000000	.000390	.004286	.004091	.007987	.010714	.010130	.005649	.005455	.006623	.005260	
	0.000000	.000390	.001948	.002532	.007013	.005065	.009545	.008961	.012468	.010714	.011494	.010130	
	0.000000	0.000000	0.000000	0.000000	.000779	.000974	0.000000	.002338	.000779	.000195	.001169	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 30													Y= 30
	1.003636	1.034805	1.003636	1.009870	.941299	.953766	.835325	.947532	.872727	.885195	1.072208	.903896	
	.000974	0.000000	.000779	.004091	.008571	.013636	.014221	.014221	.008766	.008377	.006818	.005065	
	.000390	.001169	.001948	.002312	.007792	.007208	.012468	.012078	.013052	.014610	.012662	.012662	
	0.000000	0.000000	0.000000	.000390	.000195	.000195	.001169	.001753	.000390	.000390	.001169	.000584	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 20													Y= 20
	.928636	.988377	.979286	.948701	1.018247	.983571	1.069481	.964870	1.136299	1.128701	.996818	.990974	
	.000779	.002922	.006039	.007403	.008961	.016948	.024740	.013636	.013247	.010325	.008377	.007013	
	.000779	.002143	.004675	.002338	.009351	.012078	.015779	.016948	.021618	.014610	.013831	.011104	
	0.000000	0.000000	.000779	.000195	0.000000	0.000000	.000779	.000195	.000195	.000584	.000584	.000390	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 10								--					Y= 10
	1.036364	1.179545	1.043182	1.097727				/ /	.961364	1.138636	.900000	1.056818	
	.002338	.003701	.005065	.006429				/ /	.014610	.011104	.007013	.006623	
	.000779	.001169	.003896	.006623				/ /	.017338	.014805	.014221	.012273	
	0.000000	0.000000	.000390	0.000000				/ USA /	.000974	.001558	.000390	.000195	
	0.000000	0.000000	0.000000	0.000000	--------------------			I	0.000000	0.000000	0.000000	0.000000	
Y= 0					/			I					Y= 0
	1.165108	.999805	1.105931	1.106980	--**			I	.899589	.968485	.904091	.935606	
	.000974	.003312	.007597	.005649	(NASA			I	.012662	.010325	.007013	.007013	
	.000390	.000974	.002506	.004675	--------------------------------				.017532	.019091	.012857	.011104	
	0.000000	0.000000	.000390	.000974					.000779	.000584	.000195	.000195	
	0.000000	0.000000	0.000000	0.000000					0.000000	0.000000	0.000000	0.000000	
Y=-10													Y=-10
	.990476	.972468	.945455	.981472	.927446	.927446	1.053506	.891429	1.040000	.886926	1.053506	.954459	
	0.000000	.001364	.002727	.008182	.014805	.014026	.014610	.009935	.006429	.008766	.003896	.006039	
	.000390	.000584	.001753	.004481	.007403	.006039	.007987	.013442	.011299	.014026	.013052	.011104	
	0.000000	0.000000	0.000000	0.000000	.001169	.000779	.001364	.000195	0.000000	.000974	.000390	.000584	

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0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Y=-20 Y=-20

DENSITY OF UPSTREAM MOVING MOLECULES, NORMALIZED TO THE TOTAL UNDISTURBED DENSITY

VALUES ARE AGAIN GIVEN FOR THE FIVE CLASSES OF MOLECULE IN TURN AT EACH LOCATION

MINIMUM DENSITY RESOLUTION = .0001948 BASED ON ONE MOLECULE OR .0064286 BASED ON ONE MOLECULE PER SAMPLING INTERVAL
NOTE THAT ABOVE FIGURES ASSUME UNIT WEIGHTING FACTOR

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.000779	.002922	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	.000195	.000779	.000584	.002922	.000974	.000974	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.000195	.000195	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	.000390	.000390	.001169	0.000000	.003896	.001948	.001364	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.000584	0.000000	.000390	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	.000390	.003117	.002922	.001364	.004481	.004286	.002143	.000779	0.000000	0.000000	0.000000	0.000000	
	0.000000	.000195	.000584	.000390	0.000000	.000390	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 40													Y= 40
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000	0.000000	0.000000	0.000000	0.000000	
	.000584	.001558	.004286	.006623	.006818	.006818	.003312	.001364	0.000000	0.000000	0.000000	0.000000	
	0.000000	.001169	.000390	.000584	.000390	.001169	.000390	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	.000584	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 30													Y= 30

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	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	.000974	.006234	.010714	.015390	.022597	.012857	.010909	.001948	0.000000	0.000000	0.000000	0.000000
	.000390	.000584	.000779	.000974	.001364	.001364	.000390	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	.001558	.001753	.000974	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 20												Y= 20
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	.003506	.007403	.016753	.069545	.080260	.072857	.077338	.013052	0.000000	0.000000	0.000000	0.000000
	0.000000	.000779	.000584	.004091	.005649	.001169	.001948	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	.000974	0.000000	.003117	.005065	.003506	.000584	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 10												Y= 10

MEAN UPSTREAM VELOCITY COMPONENT OF UPSTREAM MOVING MOLECULES, NORMALIZED TO THE UNDISTURBED MOST PROB. SPEED

VALUES ARE AGAIN GIVEN FOR THE FIVE CLASSES OF MOLECULE IN TURN AT EACH LOCATION

IN PLANE Z= 5.0 METRES FROM THE VERTICAL PLANE OF SYMMETRY

	X=-35	X=-25	X=-15	X=-5	X=5	X=15	X=25	X=35	X=45	X=55	X=65	X=75	
Y= 80													Y= 80
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.521938	.280735	0.000000	.027836	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 70													Y= 70
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	.253346	.370199	.521938	.292756	.269810	.027120	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.605001	.823211	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.676421	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 60													Y= 60
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	.955254	.253346	.469657	0.000000	.366476	.278262	.057090	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	.635962	0.000000	.556369	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	.676421	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
Y= 50													Y= 50
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	.955254	.580181	.640910	.256737	.366569	.330146	.109109	.016577	0.000000	0.000000	0.000000	0.000000	
	0.000000	.157374	.493149	.651445	0.000000	.556369	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	.676421	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	

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ORIGINAL PAGE IS
OF POOR QUALITY

Y= 40												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	.561972	.597948	.724244	.482200	.164141	.366751	.125900	.016577	0.000000	0.000000	0.000000	0.000000
	0.000000	.456726	.605001	.524111	.103664	.369464	.065833	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	.676421	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 30												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	.787340	.464620	.619491	.491230	.290909	.343472	.150431	.078319	0.000000	0.000000	0.000000	0.000000
	.143646	.364954	.386182	.755579	.239732	.277810	.065833	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	.369524	.466256	.393466	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 20												
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	.853629	.755210	.670850	.495265	.332952	.458120	.257233	.181233	0.000000	0.000000	0.000000	0.000000
	0.000000	.499145	.288446	.509612	.357445	.478612	.100122	0.000000	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	.751506	0.000000	.302069	.385635	.292461	.279674	0.000000	0.000000	0.000000	0.000000
	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Y= 10												

MOLECULAR FLUX TO SURFACE

NORMALIZED BY STATIONARY FREESTREAM FLUX

LOCATION ON BODY	SAMPLE	TOTAL FLUX	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5
NOSE (X=0 TO 7) TOP	394	11.61037	9.31187	1.2376535	1.0608458	0.0000000	0.0000000
NOSE UPPER SIDE	454	10.49939	8.67241	.9944360	.8094247	.0231264	0.0000000
NOSE LOWER SIDE	407	8.27476	7.19721	.4676155	.6099333	0.0000000	0.0000000
NOSE BOTT[illegible]	234	6.51281	5.53867	.3618227	.6123153	0.0000000	0.0000000
WINDSHIEL[illegible]	456	16.98618	13.33564	2.3840252	1.2665134	0.0000000	0.0000000
FUSELAGE FORWARD (X=7 TO 16) UPPER (Y GT 2)	41	3.19058	1.47856	1.0116479	.7003716	0.0000000	0.0000000
FUSELAGE FORWARD SIDE	226	2.49911	.89570	1.1389738	.3870299	.0774060	0.0000000
FUSELAGE FORWARD LOWER (Y LT -1)	95	1.32613	.90735	.1675116	.2373081	.0139593	0.0000000
FUSELAGE CENTER (X=16 TO 24) UPPER	0	0.00000	0.00000	0.0000000	0.0000000	0.0000000	0.0000000
FUSELAGE CENTER SIDE	313	4.54985	.63960	3.0380766	.6541313	.2180438	0.0000000
FUSELAGE CENTER LOWER	30	1.01936	.54366	.2378510	.2038723	.0339787	0.0000000
FUSELAGE REAR (X=24 TO 32) UPPER	47	2.56024	.73028	1.7648316	.2434250	.1217125	0.0000000
FUSELAGE REAR SIDE	213	3.01057	.26855	1.9505131	.6219027	.1696098	0.0000000
FUSELAGE REAR LOWER	62	1.000[illegible]	.59678	.1290341	.2741975	0.0000000	0.0000000
OMS POD UPPER	163	3.79[illegible]	2.53812	.7917070	.3492825	.1164275	0.0000000
OMS POD LOWER	163	3.90984	2.1108[illegible]	1.1513638	.5996687	.0479735	0.0000000
VERTICAL TAIL	283	2.20[illegible]	.77[illegible]	1.0133952	.3663813	.0467721	0.0000000
GLOVE FAIRING	443	3.40821	2.015[illegible]	.9924584	.3154325	.0[illegible]46282	0.0000000

WING INNER (Z LT 7) LEADING EDGE (.10 CHORD)	284	10.37924	7.67479	1.2791313	1.2791313	.1461864	0.0000000
WING OUTER LEADING EDGE	308	11.9[illegible]414	10.[illegible]7212	.8560098	.7392812	.1157286	0.0000000
WING UPPER INNER FORWARD (X LT 27.5)	420	4.44298	.78281	2.6562031	.5818191	.2221491	0.0000000
WING UPPER INNER REAR	114	2.10302	.01845	1.7325194	.3136087	.0184476	0.0000000
WING UPPER OUTER FORWARD	143	3.43010	1.77502	.8635229	.6956156	.0959470	0.0000000
WING UPPER OUTER REAR	56	1.04806	.13101	.5427437	.3368754	.0374306	0.0000000
WING LOWER INNER FORWARD	284	1.79865	1.17799	.2976634	.2849969	.0379996	0.0000000
WING LOWER INNER REAR	36	.49189	.08198	.1502984	.2459428	.0136635	0.0000000
WING LOWER OUTER FORWARD	113	2.71050	2.11083	.2398675	.3598012	0.0000000	0.0000000
WING LOWER OUTER REAR	23	.43045	.14972	.1497224	.1122918	.0187153	0.0000000
WINGTIP	5	1.41047	1.12838	0.0000000	.2820941	0.0000000	0.0000000
BASE	0	0.00000	0.00000	0.0000000	0.0000000	0.0000000	0.0000000
PAYLOAD BAY BASE FORWARD	51	.55962	.12070	.2523759	.1865367	0.0000000	0.0000000
PAYLOAD BAY BASE REAR	183	2.00803	.32919	1.[illegible]7170	.3072403	.0438915	0.0000000
PAYLOAD BAY DOORS INSIDE FORWARD	195	1.68339	.94097	.[illegible]13	.3884752	.0086328	0.0000000
PAYLOAD BAY DOORS INSIDE REAR	211	1.62152	.77695	.[illegible]63[illegible]	.4575374	.0172656	0.0000000
PAYLOAD BAY DOORS OUTSIDE FORWARD	329	2.84019	.93234	1.[illegible]2451	.4230063	.1035934	0.0000000
PAYLOAD BAY DOORS OUTSIDE REAR	549	4.73940	.50070	3.4185816	.5524980	.2676162	0.0000000
PAYLOAD [illegible] FORWARD BULKHEAD	4	.29356	0.00000	.2935614	0.0000000	0.0000000	0.0000000
PAYLOAD B[illegible] REAR BULKHEAD	314	16.16625	11.12073	4.1187888	.6752426	.0514849	0.0000000

95[illegible].533

FLOW TO TIME .49500

NUMBER OF MOLECULES = 7549 FACTORED NUMBER = 76577.21
FACTORED COLLISIONS 2125.00 20978.98 22759.73 108515.54
TOTAL SURFACE INTERACTIONS = 36029

CELL	X	Y	Z	SAMPLE	DENSITY	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	U	V	W	TX	TY	TZ
1	-4.500	-5.500	1.500	327	1.4156	1.0390	.367359	.069264	0.000000	0.000000	6.965	-.035	.009	31.280	1.963	2.175
2	.500	-5.500	1.500	427	1.8485	.9610	.783550	.077922	.025974	0.000000	5.073	-.295	.039	42.894	2.351	1.464
3	5.500	-5.500	1.500	391	1.6926	1.0303	.523810	.099567	.038961	0.000000	6.136	-.218	.039	35.700	2.770	2.153
4	10.500	-5.500	1.500	368	1.5931	.9437	.432900	.121212	.095238	0.000000	5.926	-.157	-.031	37.640	2.177	2.825
5	15.500	-5.500	1.500	421	1.8225	.9740	.696970	.090909	.060606	0.000000	5.299	-.186	.000	40.271	2.447	1.895
6	20.500	-5.500	1.500	418	1.8095	.9524	.692641	.121212	.043290	0.000000	5.448	-.176	-.032	38.189	2.120	3.130
7	25.500	-5.500	1.500	319	1.3810	.8766	.380952	.082251	.038961	0.000000	6.462	-.144	-.064	33.544	1.439	2.458
8	30.500	-5.500	1.500	315	1.3636	.9784	.246753	.069264	.069264	0.000000	7.100	-.127	.057	28.435	1.572	1.549
9	35.500	-5.500	1.500	221	.9567	.8788	.034632	.038961	.004329	0.000000	8.736	.023	.161	8.212	1.017	1.542
10	-4.500	-2.500	1.500	310	1.3420	.9004	.376623	.056277	.008658	0.000000	6.271	-.059	.054	39.678	2.406	1.113
11	.500	-2.500	1.500	653	2.8268	.6450	1.926407	.233766	.021645	0.000000	2.568	-.339	.141	33.465	3.164	2.982
12	5.500	-2.500	1.500	436	1.8874	.6797	1.012987	.103896	.090909	0.000000	3.729	-.310	.070	39.506	1.923	2.103
13	10.500	-2.500	1.500	309	1.3377	.6797	.510823	.043290	.103896	0.000000	4.971	-.156	.041	41.384	1.921	1.499
14	15.500	-2.500	1.500	349	1.5108	.5974	.796537	.030303	.086580	0.000000	3.779	-.226	.042	40.569	.928	1.199
15	20.500	-2.500	1.500	338	1.4646	.5416	.758295	.099662	.064997	0.000000	3.896	-.236	-.047	40.094	1.826	2.705
16	25.500	-2.500	1.500	212	.9177	.4416	.350649	.07[illegible]593	.051948	0.000000	5.073	.077	-.026	37.100	2.444	2.737
17	30.500	-2.500	1.500	213	.9221	.4589	.337662	.051948	.073593	0.000000	5.174	.014	.075	37.761	1.980	2.106
18	35.500	-2.500	1.500	170	.7359	.6147	.060606	.051948	.008658	0.000000	8.061	.329	-.115	17.543	1.255	1.645
19	-4.500	.500	1.500	419	1.8139	1.0433	.632035	.138528	0.000000	0.000000	5.598	.113	.089	42.526	2.025	3.004
20	.500	.500	1.500	912	5.0591	.3550	4.055020	.615742	.033283	0.000000	1.402	.109	.261	21.652	4.033	3.658
21	5.500	.500	1.500	164	3.4010	.6429	2.509258	.207377	.041475	0.000000	2.213	.120	.235	29.345	1.977	2.446
22	10.500	.500	1.500	24	.9447	.1181	.747861	.039361	.039361	0.000000	.958	.020	.072	19.241	.572	.587
23	15.500	.500	1.500	26	1.3110	.2521	.907588	.050422	.100843	0.000000	2.169	-.080	.032	30.177	2.311	1.836
24	20.500	.500	1.500	32	3.4412	0.0000	3.333705	0.000000	.107539	0.000000	-.044	-.020	.110	.230	.436	.525
25	25.500	.500	1.500	36	2.5412	.1412	2.117635	.211763	.070588	0.000000	1.316	-.027	-.046	13.639	2.035	3.786
26	30.500	.500	1.500	17	.2519	.0296	.177843	.014820	.029640	0.000000	1.566	-.157	.071	17.894	.562	.803
27	35.500	.500	1.500	25	.1082	.0260	.017316	.034632	.030303	0.000000	3.637	.216	-.349	28.695	3.635	3.069
28	-4.500	3.500	1.500	347	1.5022	.8831	.528139	.082251	.008658	0.000000	5.481	.141	.010	44.017	2.063	1.826
29	.500	3.500	1.500	696	3.1572	.7576	2.050379	.335682	.013609	0.000000	2.652	.287	.120	35.150	3.404	3.302
30	5.500	3.500	1.500	900	7.0960	.3075	5.[illegible]05872	1.151135	.031538	0.000000	1.724	.301	.176	20.241	5.777	4.521
31	10.500	3.500	1.500	262	1.7589	.8296	.654917	.062373	.212068	0.000000	4.707	.124	.005	41.396	1.955	1.394
32	15.500	3.500	1.500	306	1.9086	.6861	.973019	.081085	.168407	0.000000	3.687	.064	-.076	38.829	1.961	2.380
33	20.500	3.500	1.500	363	2.[illegible]641	.5675	1.372206	.17[illegible]544	.149695	0.000000	2.682	.057	-.006	35.696	3.065	3.001
34	25.500	3.500	1.500	896	7.0205	.0705	6.150813	.603328	.195886	0.000000	.594	.142	.044	10.703	2.836	2.846
35	30.500	3.500	1.500	174	3.6846	.4659	2.731710	.254113	.232937	0.000000	1.808	.111	.037	22.811	1.865	2.930
36	35.500	3.500	1.500	[illegible]0	.3463	.1818	.116883	.025974	.021645	0.000000	5.509	-.345	.051	32.377	2.166	2.741
37	-4.500	6.500	1.500	312	1.3506	1.0346	.272727	.038961	.004329	0.000000	7.073	.095	.078	31.386	1.891	1.360
38	.500	6.500	1.500	439	1.9004	1.0866	.701299	.103896	.008658	0.000000	5.521	.299	.077	41.367	1.631	2.507
39	5.500	6.500	1.500	470	2.0346	.8745	.969697	.186147	.004329	0.000000	4.605	.336	.039	39.372	2.895	2.987
40	10.500	6.500	1.500	344	1.4[illegible]92	1.0087	.337662	.099567	.043290	0.000000	6.630	.161	.006	32.275	2.602	1.457

41	15.500	6.500	1.500	363	1.5714	1.0519	.380952	.086580	.051948	0.000000	6.516	.122	.057	33.833	1.965	1.935
42	20.500	6.500	1.500	354	1.5325	.8615	.575758	.051948	.043290	0.000000	5.354	.169	.113	41.512	1.644	1.799
43	25.500	6.500	1.500	497	2.1567	.7698	1.162968	.151880	.052073	0.000000	3.939	.251	.082	41.228	2.290	2.734
44	30.500	6.500	1.500	488	2.2640	.8629	1.196969	.120625	.063509	0.000000	4.038	.100	.086	39.901	1.657	1.480
45	35.500	6.500	1.500	280	1.2121	.9091	.229437	.047619	.025974	0.000000	7.238	-.067	-.064	26.742	1.276	1.516
46	-4.500	9.500	1.500	314	1.3593	1.0909	.207792	.056277	.004329	0.000000	7.511	.162	.090	24.467	1.886	1.993
47	.500	9.500	1.500	342	1.4805	1.1602	.264069	.056277	0.000000	0.000000	7.425	.194	.019	27.152	1.878	1.447
48	5.500	9.500	1.500	332	1.4372	.9654	.398268	.073593	0.000000	0.000000	6.556	.298	.059	34.307	2.658	1.647
49	10.500	9.500	1.500	315	1.3636	1.0087	.264069	.073593	.017316	0.000000	7.245	.220	.076	28.162	2.441	1.646
50	15.500	9.500	1.500	331	1.4329	1.0823	.285714	.051948	.012987	0.000000	7.151	.215	.017	30.191	1.483	1.715
51	20.500	9.500	1.500	332	1.4377	.8485	.502165	.069264	.017316	0.000000	5.807	.250	.046	39.647	2.273	1.920
52	25.500	9.[illegible]	1.500	346	1.5065	.8961	.484848	.108225	.017316	0.000000	6.002	.291	.022	37.543	2.054	2.593
53	30.500	9.[illegible]	1.500	330	1.4286	.7965	.502165	.108225	.021645	0.000000	5.853	.277	.036	36.385	2.626	2.481
54	35.500	9.[illegible]	1.500	333	1.4416	.8961	.445867	.077922	.021645	0.000000	6.256	.130	.054	33.171	2.070	1.904
55	-4.500	12.500	1.500	222	.9610	.8139	.116883	.030303	0.000000	0.000000	7.951	.137	.003	19.830	2.062	1.607
56	.500	12.500	1.500	241	1.0432	.8182	.173160	.051948	0.000000	0.000000	7.436	.2[illegible]	-.[illegible]45	27.468	1.438	1.3[illegible]
57	5.500	12.500	1.500	251	1.0866	.7749	.255411	.056277	0.000000	0.000000	6.923	.396	.071	30.286	2.175	2.318
58	10.500	12.500	1.500	252	1.0909	.8095	.173160	.090909	.017316	0.000000	7.347	.335	.051	24.975	3.061	2.132
59	15.500	12.500	1.500	248	1.0736	.7835	.259740	.025974	.004329	0.000000	6.891	.230	.011	32.408	1.447	1.471
60	20.500	12.500	1.500	257	1.1126	.7965	.233766	.069264	.012987	0.000000	7.127	.415	.125	28.572	2.915	1.971
61	25.500	12.500	1.500	302	1.3074	.8918	.311688	.082251	.021645	0.000000	6.724	.313	-.036	31.789	2.188	2.040
62	30.500	12.500	1.500	279	1.2944	.9740	.242424	.064935	.012987	0.000000	7.387	.137	.014	26.479	1.669	1.664
63	35.500	12.500	1.500	289	1.2511	.9264	.246753	.069264	.008658	0.000000	7.207	.193	.046	26.185	1.398	1.831
64	-4.500	-5.500	4.500	283	1.2251	.9654	.220779	.030303	.008658	0.000000	7.348	-.053	-.009	27.934	1.676	1.748
65	.500	-5.500	4.500	367	1.5887	1.0303	.484848	.060606	.012987	0.000000	6.069	-.206	.158	39.199	1.695	1.455
66	5.500	-5.500	4.500	328	1.4199	.9870	.337662	.082251	.012987	0.000000	6.812	-.213	.130	30.152	2.371	2.311
67	10.500	-5.500	4.500	334	1.4026	.9004	.406926	.064935	.030303	0.000000	6.230	-.170	.144	35.221	2.668	1.562
68	15.500	-5.500	4.500	358	1.5499	.8701	.532468	.099567	.047619	0.000000	5.562	-.266	.072	37.760	2.261	2.296
69	20.500	-5.500	4.500	348	1.5065	.8009	.541126	.103896	.060606	0.000000	5.414	-.248	.076	39.230	2.495	2.337
70	25.500	-5.500	4.500	307	1.3290	.8182	.372294	.082251	.056277	0.000000	6.277	-.182	.119	33.885	1.742	2.298
71	30.500	-5.500	4.500	271	1.1732	.9177	.168831	.069264	.017316	0.000000	7.669	-.037	.113	21.090	1.430	1.975
72	35.500	-5.500	4.500	258	1.1169	.9870	.082251	.034632	.012987	0.000000	8.434	-.026	.038	12.171	1.247	1.578
73	-4.500	-2.500	4.500	303	1.3117	.9654	.285714	.051948	.008658	0.000000	6.902	-.066	.157	33.375	1.[illegible]99	1.889
74	.500	-2.500	4.500	452	1.9567	.9221	.874459	.121212	.038961	0.000000	4.675	-.178	.243	43.322	1.024	2.357
75	5.500	-2.500	4.500	442	1.9134	.8658	.874459	.142857	.030303	0.000000	4.663	-.227	.213	39.117	2.348	2.220
76	10.500	-2.500	4.500	422	1.8268	.8571	.740260	.134199	.095238	0.000000	4.930	-.206	.150	40.025	3.016	2.304
77	15.500	-2.500	4.500	480	2.0779	.7922	1.108225	.103896	.073593	0.000000	3.934	-.183	.125	41.299	1.572	1.649
78	20.500	-2.500	4.500	449	1.9437	.6320	1.125541	.138528	.047619	0.000000	3.538	-.302	.081	38.737	1.775	2.989
79	25.500	-2.500	4.500	285	1.2338	.6580	.428571	.082251	.064935	0.000000	5.593	-.056	.006	37.448	1.915	2.575
80	30.500	-2.500	4.500	209	.9048	.5801	.212121	.030303	.082251	0.000000	6.235	.071	.076	34.823	1.314	1.609
81	35.500	-2.500	4.500	188	.8139	.6234	.099567	.060606	.030303	0.000000	7.780	.175	.083	19.467	2.309	2.683
82	-4.500	.500	4.500	332	1.4372	1.0173	.363[illegible]	.051948	.004329	0.000000	6.497	-.000	.166	39.232	1.345	1.085
83	.500	.500	4.500	521	2.2554	.9307	1.212121	.090909	.021645	0.000000	3.955	.006	.325	43.855	1.065	1.685
84	5.500	.500	4.500	534	2.3117	.8009	1.251082	.220779	.038961	0.000000	3.863	-.008	.284	36.918	3.538	3.066
85	10.500	.500	4.500	674	2.9177	.6537	1.820840	.303030	.134199	0.000000	2.933	-.121	.158	32.778	3.576	3.349
86	15.500	.500	4.500	790	3.5044	.4968	2.426490	.381496	.199620	0.000000	2.226	-.044	.166	26.482	3.764	3.680
87	20.500	.500	4.500	1176	7.1620	.0974	5.828276	.925704	.310598	0.000000	1.218	.029	.107	13.890	4.192	4.041
88	25.500	.500	4.500	[illegible]	7.3536	.1625	5.245437	.546708	.298949	0.000000	1.104	.001	.079	12.199	2.668	3.013
89	30.500	.500	4.500	403	2.1232	.3583	1.505801	.121176	.136982	0.000000	2.116	.098	.099	24.765	2.322	1.636

050

90	35.500	.500	4.500	141	.6104	.3810	.155844	.047619	.025974	0.000000	6.366	-.173	-.268	31.455	1.109	1.281
91	-4.500	3.500	4.500	350	1.5152	1.0043	.437229	.073593	0.000000	0.000000	6.331	.057	.152	37.602	3.023	1.442
92	.500	3.500	4.500	496	2.1472	.8874	1.043290	.181818	.034632	0.000000	4.181	.158	.276	41.799	2.751	2.278
93	5.500	3.500	4.500	553	2.3939	.8355	1.393939	.151515	.012987	0.000000	3.737	.188	.300	38.590	2.600	2.203
94	10.500	3.500	4.500	447	1.9351	.8874	.857143	.129870	.060606	0.000000	4.757	.136	.072	40.459	1.978	2.227
95	15.500	3.500	4.500	416	1.8009	.7792	.822511	.138528	.060606	0.000000	4.590	.093	.037	40.565	2.206	2.418
96	20.500	3.500	4.500	432	1.8701	.6883	.952381	.155844	.073593	0.000000	3.936	.104	.019	33.346	3.046	2.959
97	25.500	3.500	4.500	587	2.5411	.5325	1.705628	.229437	.073593	0.000000	2.630	.125	.167	32.470	2.645	2.692
98	30.500	3.500	4.500	377	1.8625	.6274	1.086890	.079047	.064166	0.000000	3.513	.033	.154	35.876	1.500	1.489
99	35.500	3.500	4.500	196	.8485	.5974	.177489	.038961	.034632	0.000000	7.012	-.098	-.114	28.505	1.560	1.424
100	-4.500	6.500	4.500	301	1.3030	.9524	.285714	.056277	.008658	0.000000	6.868	.133	.131	32.219	2.201	1.762
101	.500	6.500	4.500	357	1.5455	.8918	.584416	.051948	.017316	0.000000	5.383	.251	.161	42.854	1.546	1.453
102	5.500	6.500	4.500	423	1.8312	.9827	.727273	.108225	.012987	0.000000	5.350	.318	.174	39.790	2.192	1.572
103	10.500	6.500	4.500	365	1.5801	1.0087	.437229	.090909	.043290	0.000000	6.347	.190	.100	33.391	2.202	2.217
104	15.500	6.500	4.500	367	1.5887	1.0000	.459674	.099567	.030303	0.000000	6.241	.106	.103	35.036	2.578	2.541
105	20.500	6.500	4.500	382	1.6537	.9351	.614719	.086580	.017316	0.000000	5.586	.189	.071	40.250	2.199	2.178
106	25.500	6.500	4.500	446	1.9307	.8312	.909091	.142857	.047619	0.000000	4.601	.211	.117	40.186	2.851	2.202
107	30.500	6.500	4.500	418	1.8095	.9221	.735931	.103[illegible]	.047619	0.000000	5.228	.101	.158	39.288	1.349	2.169
108	35.500	6.500	4.500	299	1.2944	1.0216	.220779	.025974	.025974	0.000000	7.674	-.011	-.044	22.506	1.768	1.634
109	-4.500	9.500	4.500	250	1.0823	.9351	.129870	.017316	0.000000	0.000000	8.009	.069	.064	20.514	1.621	1.185
110	.500	9.500	4.500	300	1.2987	.9307	.303030	.064935	0.000000	0.000000	6.842	.166	.147	33.077	2.177	1.426
111	5.500	9.500	4.500	347	1.5022	.9654	.445887	.086580	.004329	0.000000	6.170	.231	.080	36.128	2.421	1.575
112	10.500	9.500	4.500	349	1.5108	1.1212	.307359	.060606	.021645	0.000000	7.104	.109	.140	28.946	1.646	1.763
113	15.500	9.500	4.500	305	1.3203	.9524	.272727	.077922	.017316	0.000000	7.004	.241	.066	29.634	2.018	2.013
114	20.500	9.500	4.500	339	1.4675	.9264	.432900	.095238	.012987	0.000000	6.186	.194	.093	36.587	1.572	1.814
115	25.500	9.500	4.500	36[illegible]	1.5671	.9091	.497835	.134199	.025974	0.000000	6.270	.247	.093	33.179	3.487	3.223
116	30.500	9.500	4.500	315	1.3636	.9048	.363636	.064935	.030303	0.000000	6.530	.180	.100	33.197	1.524	1.754
117	35.500	9.500	4.500	317	1.3723	.9870	.259740	.095238	.030303	0.000000	7.227	.119	.053	25.465	1.799	2.320
118	-4.500	12.500	4.500	256	1.1082	.9264	.129870	.051948	0.000000	0.000000	7.825	.144	-.103	23.725	1.159	1.321
119	.500	12.500	4.500	297	1.2857	1.0996	.155844	.030303	0.000000	0.000000	7.872	.078	-.029	21.926	1.420	1.149
120	5.500	12.500	4.500	307	1.3290	1.0563	.207792	.060606	.004329	0.000000	7.615	.197	.001	24.103	2.365	1.790
121	10.500	12.500	4.500	280	1.2121	.9264	.216450	.056277	.012987	0.000000	7.298	.268	.063	25.818	2.507	1.359
122	15.500	12.500	4.500	318	1.3766	1.0649	.225108	.073593	.012987	0.000000	7.535	.233	-.024	24.247	2.317	1.753
123	20.500	12.500	4.500	335	1.4502	1.0866	.303030	.051948	.008658	0.000000	7.266	.238	.002	27.551	1.749	1.682
124	25.500	12.500	4.500	310	1.3420	.9827	.329004	.025974	.004329	0.000000	6.977	.229	.086	30.926	1.324	1.106
125	30.500	12.500	4.500	273	1.1818	.9437	.177489	.043290	.017316	0.000000	7.767	.168	-.012	19.993	2.096	2.071
126	35.500	12.500	4.500	298	1.2900	.9870	.242424	.051948	.008658	0.000000	7.481	.192	.055	21.903	2.160	1.[illegible]15
127	-4.500	-5.500	7.500	223	.9654	.7273	.173160	.051948	.012987	0.000000	7.231	-.110	-.005	29.609	2.039	2.383
128	.500	-5.500	7.500	254	1.0996	.7879	.264069	.043290	.004329	0.000000	6.660	-.203	.276	33.797	1.373	1.653
129	5.500	-5.500	7.500	289	1.2511	.8[illegible]2	.333333	.060606	.012987	0.000000	6.438	-.237	.199	35.114	1.485	1.615
130	10.500	-5.500	7.500	305	1.3203	.8485	.354978	.064935	.051948	0.000000	6.151	-.216	.143	35.222	2.239	2.093
131	15.500	-5.500	7.500	326	1.4113	.8961	.424242	.056277	.034632	0.000000	6.085	-.135	.246	37.525	1.816	1.670
132	20.500	-5.500	7.500	354	1.5325	.7922	.610390	.112554	.017316	0.000000	5.191	-.285	.105	39.497	2.588	2.121
133	25.500	-[illegible]500	7.500	311	1.3463	.8831	.406926	.034632	.021645	0.000000	6.169	-.222	.077	35.745	1.140	1.199
134	30.500	-5.500	7.500	273	1.1818	.9221	.164502	.034632	.060606	0.000000	7.596	-.064	.026	22.780	1.289	1.922
135	35.500	-5.500	7.500	241	1.0433	.8831	.073593	.047619	.038961	0.000000	8.269	.003	.097	14.826	1.258	1.740
136	-4.500	-2.500	7.500	263	1.1385	.8485	.225108	.051948	.012987	0.000000	6.969	.009	.128	32.358	1.605	1.833
137	.[illegible]00	-2.500	7.500	337	1.4589	.9870	.367965	.090909	.012987	0.000000	6.537	-.059	.214	34.212	2.335	1.785
138	5.500	-2.500	7.500	311	1.3463	.87[illegible]	.372294	.073593	.021645	0.000000	6.304	-.111	.286	35.218	2.019	2.012

139	10.500	-2.500	7.500	367	1.5887	.9957	.497835	.082251	.012987	0.000000	6.068	-.068	.254	38.234	1.808	1.765
140	15.500	-2.500	7.500	399	1.7273	.8052	.718615	.151515	.051948	0.000000	4.887	-.260	.224	41.075	2.336	2.901
141	20.500	-2.500	7.500	613	2.6537	.7403	1.601732	.259740	.051948	0.000000	3.290	-.252	.165	36.434	2.900	3.579
142	25.500	-2.500	7.500	419	1.8139	.8052	.896104	.077922	.034632	0.000000	4.469	-.172	.076	41.436	1.934	1.182
143	30.500	-2.500	7.500	242	1.0476	.7879	.186147	.025974	.047619	0.000000	7.194	.067	-.006	27.244	1.376	1.653
144	35.500	-2.500	7.500	177	.7662	.6061	.086580	.051948	.021645	0.000000	7.917	.055	.071	18.864	1.934	1.936
145	-4.500	.500	7.500	307	1.3290	.9351	.303030	.086580	.004329	0.000000	6.744	.011	.178	33.367	1.917	2.906
146	.500	.500	7.500	349	1.5108	.9437	.489177	.064935	.012987	0.000000	5.963	-.032	.260	39.775	1.704	2.344
147	5.500	.500	7.500	361	1.5628	.9177	.545455	.086580	.012987	0.000000	5.760	-.075	.296	38.744	2.275	1.892
148	10.500	.500	7.500	323	1.3983	.7835	.510823	.090909	.012987	0.000000	5.664	-.041	.275	37.376	2.031	3.390
149	15.500	.500	7.500	416	1.8009	.8355	.740260	.155844	.069264	0.000000	4.917	-.085	.263	40.199	2.117	3.285
150	20.500	.500	7.500	694	3.0912	.7750	1.812827	.387509	.115807	0.000000	3.337	.109	.266	34.331	3.659	4.706
151	25.500	.500	7.500	612	3.7388	.8003	2.278733	.458190	.201604	0.000000	3.069	.199	.146	30.736	3.513	3.868
152	30.500	.500	7.500	326	1.5184	.6987	.647435	.069867	.102472	0.000000	4.843	-.008	.112	39.557	1.744	1.534
153	35.500	.500	7.500	193	.8355	.6364	.125541	.030303	.043290	0.000000	7.402	-.152	-.073	22.643	1.351	1.437
154	-4.500	3.500	7.500	253	1.0952	.7879	.251082	.056277	0.000000	0.000000	6.764	.018	.069	34.739	1.768	1.845
155	.500	3.500	7.500	311	1.3463	.9264	.354978	.047619	.017316	0.000000	6.457	.053	.197	36.115	1.493	1.863
156	5 500	3.500	7.500	356	1.5411	.9481	.549784	.038961	.004329	0.000000	5.779	.076	.280	39.563	1.390	1.297
157	10.500	3.500	7.500	302	1.3074	.8571	.380952	.038961	.030303	0.000000	6.134	.076	.169	36.800	1.254	1.383
158	15.500	3.500	7.500	345	1.4935	.9307	.437229	.086580	.038961	0.000000	6.137	.080	.195	37.137	2.548	2.132
159	20.500	3.500	7.500	411	1.7792	.7922	.779221	.151515	.056277	0.000000	4.766	.189	.209	40.888	2.433	3.038
160	25.500	3.500	7.500	411	1.7792	.8052	.809524	.129870	.034632	0.000000	4.849	.188	.163	38.838	2.668	2.346
161	30.500	3.500	7.500	370	1.6017	.8658	.571429	.116883	.047619	0.000000	5.727	.071	.143	36.262	2.425	2.179
162	35.500	3.500	7.500	259	1.1212	.8701	.173160	.073593	.004329	0.000000	7.817	-.091	.089	20.104	1.774	1.832
163	-4.500	6.500	7.500	277	1.1991	.9870	.168831	.038961	.004329	0.000000	7.593	.078	.097	24.937	1.455	1.541
164	.500	6.500	7.500	357	1.5455	.9524	.424242	.151515	.017316	0.000000	6.087	.119	.311	37.104	2.476	2.994
165	5.500	6.500	7.500	354	1.5325	.9870	.424242	.082251	.038961	0.000000	6.351	.206	.197	35.736	2.311	1.726
166	10.500	6.500	7.500	357	[illegible]	1.0606	.380952	.090909	.012987	0.000000	6.743	.180	.140	32.395	2.106	2.111
167	15.500	6.500	7.500	326	1.4113	1.0000	.294372	.095238	.021645	0.000000	7.016	.072	.193	29.386	2.595	2.445
168	20.500	6.500	7.500	329	1.4242	.8961	.437229	.077922	.012987	0.000000	6.219	.170	.120	36.492	2.013	1.928
169	25.500	6.500	7.500	368	1.5931	.8312	.575758	.134199	.051948	0.000000	5.496	.153	.218	37.834	3.007	2.133
170	30.500	6.500	7.500	321	1.3896	.9870	.333333	.047619	.021645	0.000000	6.896	.045	.119	30.587	1.444	1.460
171	35.500	6.500	7.500	306	1.3247	1.1039	.168831	.034632	.017316	0.000000	7.940	-.077	.010	18.422	[illegible]	1.372
172	-4.500	9.500	7.500	290	1.2554	[illegible]	.155844	.034632	0.000000	0.000000	7.928	.103	.071	21.904	1.570	1.095
173	.500	9.500	7.500	293	1.2684	.9827	.238095	.043290	.004329	0.000000	7.390	.091	.154	[illegible]	2.084	1.578
174	5.500	9.500	7.500	312	1.3506	1.0346	.233766	.082251	0.000000	0.000000	7.383	.188	.122	25.687	2.591	2.103
175	10.500	9.500	7.500	311	1.3463	1.0130	.251082	.051948	.030303	0.000000	7.290	.231	.198	27.059	2.100	1.787
176	15.500	9.500	7.500	290	1.2554	.9351	.216450	.095238	.008658	0.000000	7.382	.135	.142	25.589	2.781	2.293
177	20.500	9.500	7.500	340	1.4719	1.0216	.346320	.082251	.021645	0.000000	6.992	.194	.171	29.136	3.156	2.345
178	25.500	9.500	7.500	317	1.3723	.8961	.346320	.095238	.034632	0.000000	6.633	.194	.213	32.918	2.719	2.528
179	30.500	9.500	7.500	320	1.3853	1.0476	.242424	.082251	.012987	0.000000	7.450	.215	.126	23.759	2.134	2.086
180	35.500	9.500	7.500	272	1.1775	.9913	.116883	.047619	.021645	0.000000	8.175	.044	.123	15.175	1.434	1.759
181	-4.500	12.500	7.500	281	1.2165	1.1342	.064935	.017316	0.000000	0.000000	8.666	.011	.021	11.087	1.367	1.190
182	.500	12.500	7.500	288	1.2468	1.0173	.199134	.025974	.004329	0.000000	7.495	.113	.074	26.408	1.361	1.191
[illegible]	5.500	12.500	7.500	281	1.2165	1.0087	.173160	.030303	.004329	0.000000	7.737	.150	.123	21.476	1.868	1.646
[illegible]	10.500	12.500	7.500	310	1.3420	1.1342	.099567	.090909	.017316	0.000000	8.151	.237	.084	14.900	2.962	1.830
185	15.500	12.500	7.500	306	1.3247	1.0909	.151515	.077922	.004329	0.000000	7.973	.192	.116	17.206	3.002	2.172
186	20.500	12.500	7.500	357	1.5455	1.2208	.246753	.077922	0.000000	0.000000	7.601	.098	.187	24.518	2.072	1.134
187	25.500	12.500	7.500	[illegible]	1.1255	.9004	.136526	.073593	.012987	0.000000	7.733	.143	.017	19.722	2.497	2.132

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188	30.500	12.500	7.500	316	1.3680	1.0303	.242424	.086580	.008658	0.000000	7.330	.174	.057	24.059	2.440	2.005
189	35.500	12.500	7.500	256	1.1082	.9004	.116883	.060606	.030303	0.000000	8.005	.160	.131	16.130	2.215	1.978
190	-4.500	-5.500	10.500	232	1.0043	.9134	.069264	.021645	0.000000	0.000000	8.595	-.044	-.027	11.365	1.501	1.504
191	.500	-5.500	10.500	304	1.3160	1.0909	.186147	.034632	.004329	0.000000	7.709	-.092	.142	22.704	1.566	1.412
192	5.500	-5.500	10.500	279	1.2078	.9307	.203463	.051948	.021645	0.000000	7.181	-.060	.162	26.039	1.597	2.136
193	10.500	-5.500	10.500	340	1.4719	1.1385	.290043	.038961	.004329	0.000000	7.289	-.123	.134	27.385	1.836	1.645
194	15.500	-5.500	10.500	291	1.2597	.9654	.216450	.056277	.021645	0.000000	7.320	-.091	.123	27.993	1.674	1.614
195	20.500	-5.500	10.500	348	1.5065	.9394	.441558	.103896	.021645	0.000000	6.308	-.099	.188	34.312	2.627	2.517
196	25.500	-5.500	10.500	346	1.4978	.9177	.415584	.129870	.034632	0.000000	6.300	-.184	.181	32.568	2.098	3.113
197	30.500	-5.500	10.500	273	1.1818	.9134	.212121	.051948	.004329	0.000000	7.578	-.096	.005	22.139	2.153	1.375
198	35.500	-5.500	10.500	256	1.1082	.9784	.056277	.064935	.008658	0.000000	8.449	-.099	.076	10.474	1.749	1.518
199	-4.500	-2.500	10.500	315	1.3636	1.2468	.086580	.021645	.008658	0.000000	8.518	.027	.150	13.782	1.200	1.168
200	.500	-2.500	10.500	305	1.3203	1.1472	.138528	.034632	0.000000	0.000000	8.092	.025	.048	17.962	1.635	1.757
201	5.500	-2.500	10.500	280	1.2121	.9740	.177489	.047619	.012987	0.000000	7.596	.013	.098	24.611	1.441	1.657
202	10.500	-2.500	10.500	293	1.2684	.9134	.307359	.043290	.004329	0.000000	6.859	-.062	.147	32.316	1.801	1.739
203	15.500	-2.500	10.500	351	1.5195	1.0433	.359307	.086580	.030303	0.000000	6.690	-.109	.191	32.639	1.985	2.271
204	20.500	-2.500	10.500	403	1.7446	.9264	.666667	.116883	.034632	0.000000	5.442	-.095	.286	40.341	2.194	2.632
205	25.500	-2.500	10.500	475	2.0563	.8052	.982684	.216450	.051948	0.000000	4.512	-.233	.166	38.141	2.476	3.453
206	30.500	-2.500	10.500	280	1.2121	.8701	.233766	.086580	.021645	0.000000	7.078	-.071	.021	27.606	1.917	1.552
207	35.500	-2.500	10.500	253	1.0952	.9004	.108225	.051948	.034632	0.000000	8.100	-.052	.124	14.927	2.287	2.015
208	-4.500	.500	10.500	243	1.0519	.8745	.151515	.021645	.004329	0.000000	7.718	.064	.109	24.712	1.163	1.175
209	.500	.500	10.500	286	1.2381	.9567	.203463	.069264	.008658	0.000000	7.376	.027	.169	26.137	1.602	2.634
210	5.500	.500	10.500	284	1.2294	.8745	.264069	.082251	.008658	0.000000	6.895	-.023	.181	31.363	2.163	2.192
211	10.500	.500	10.500	282	1.2208	.9351	.229437	.051948	.004329	0.000000	7.326	.074	.234	25.267	1.788	2.486
212	15.500	.500	10.500	348	1.5065	1.1039	.303030	.090909	.008658	0.000000	7.095	-.024	.155	28.048	1.768	2.547
213	20.500	.500	10.500	414	1.7922	.9394	.705628	.112554	.034632	0.000000	5.397	.068	.288	39.232	2.271	2.606
214	25.500	.500	10.500	519	2.4581	.9567	1.283502	.184711	.033153	0.000000	4.221	.144	.250	39.572	2.153	2.841
215	30.500	.500	10.500	290	1.3086	.7762	.388082	.076714	.067689	0.000000	6.002	.027	.117	33.147	2.369	2.008
216	35.500	.500	10.500	237	1.0260	.8052	.151515	.060606	.008658	0.000000	7.815	-.095	.084	17.786	1.864	2.130
217	-4.500	3.500	10.500	326	1.4113	1.1688	.199134	.038961	.004329	0.000000	7.696	.026	.033	23.860	1.529	1.343
218	.500	3.500	10.500	310	1.3420	.9957	.277056	.060606	.008658	0.000000	7.054	.040	.096	30.096	2.178	2.069
219	5.500	3.500	10.500	285	1.2338	.9177	.238095	.064935	.012987	0.000000	7.160	.088	.217	28.597	1.742	2.644
220	10.500	3.500	10.500	289	1.2511	.9351	.203463	.073593	.038961	0.000000	7.197	.091	.119	27.248	2.199	2.177
221	15.500	3.500	10.500	291	1.2597	.9264	.264069	.060606	.008658	0.000000	7.064	.141	.206	30.698	1.942	1.957
222	20.500	3.500	10.500	380	1.6450	1.0476	.437229	.134199	.025974	0.000000	6.379	.134	.098	33.654	2.818	2.933
223	25.500	3.500	10.500	379	1.6407	.8831	.610390	.108225	.038961	0.000000	5.614	.201	.153	38.722	2.309	2.363
224	30.500	3.500	10.500	345	1.4935	.9870	.367965	.090909	.047619	0.000000	6.637	.124	.117	31.768	2.085	1.940
225	35.500	3.500	10.500	245	1.0606	.8788	.138528	.043290	0.000000	0.000000	8.156	.097	-.057	15.200	1.960	1.556
226	-4.500	6.500	10.500	291	1.2597	1.0866	.103896	.069264	0.000000	0.000000	8.161	-.037	.146	15.393	2.140	2.187
227	.500	6.500	10.500	298	1.2900	1.0087	.225108	.038961	.017316	0.000000	7.446	.088	.123	28.498	1.735	1.689
228	5.500	6.500	10.500	324	1.4026	1.0216	.307359	.069264	.004329	0.000000	6.918	.104	.165	32.089	1.368	1.790
229	10.500	6.500	10.500	306	1.3247	1.0087	.207792	.095238	.012987	0.000000	7.452	.050	.157	24.740	2.077	2.609
230	15.500	6.500	10.500	334	1.4459	1.1169	.264069	.060606	.004329	0.000000	7.344	.068	.096	25.344	1.893	2.102
231	20.500	6.500	10.500	303	1.3117	.8918	.285714	.099567	.034632	0.000000	6.696	.197	.209	32.052	2.143	2.132
232	25.500	6.500	10.500	353	1.5281	1.0390	.359307	.116883	.012987	0.000000	6.840	.192	.217	29.499	2.035	2.449
233	30.500	6.500	10.500	308	1.3333	.9048	.329004	.082251	.017316	0.000000	6.621	.163	.211	30.168	2.182	2.068
234	35.500	6.500	10.500	301	1.3030	1.0476	.168831	.069264	.017316	0.000000	7.841	.100	.204	17.550	1.523	2.257
235	-4.500	9.500	10.500	243	1.0519	.8658	.147186	.038961	0.000000	0.000000	7.700	.117	.190	23.841	1.544	2.281
236	.500	9.500	10.500	267	1.1558	.9221	.181818	.043290	.008658	0.000000	7.565	.126	.097	24.849	2.266	1.724

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2?7	[illegible]	[illegible]	10.500	264	1.1429	.9004	.181818	.043290	.017316	0.000000	7.401	.152	.115	25.154	1.686	2.002
[illegible]	[illegible]	[illegible]	10.500	271	1.1732	.9437	.173160	.056277	0.000000	0.000000	7.682	.059	.124	21.071	2.027	2.024
[illegible]	[illegible]	9.500	10.500	284	1.2294	.9957	.138528	.077922	.017316	0.000000	7.780	.183	.148	21.253	1.722	2.084
[illegible]	[illegible]	[illegible]	10.500	269	1.1645	.8961	.207792	.047619	.0129[illegible]	0.000000	7.483	.155	.214	24.553	2.437	1.989
24'	[illegible]	9.500	10.500	290	1.2554	.9697	.225108	.056277	.004329	0.000000	7.527	.173	.166	23.497	2.779	2.022
[illegible]	[illegible]	9.500	10.500	304	1.3160	1.0087	.173160	.112554	.021645	0.000000	7.671	.239	.171	21.675	2.362	2.071
[illegible]	[illegible]	9.500	10.500	290	1.2554	1.0216	.142857	.069264	.021645	0.000000	8.005	-.011	.194	15.110	2.098	2.608
24[illegible]	4.500	12.500	10.500	254	1.0996	.9827	.095238	.021645	0.000000	0.000000	8.350	.045	.083	13.615	1.465	1.764
2[illegible]	.500	12.500	10.500	296	1.2814	1.0519	.212121	.017316	0.000000	0.000000	7.632	.058	.155	25.056	1.466	1.032
24[illegible]	5.500	12.500	10.500	297	1.2857	1.1082	.134199	.043290	0.000000	0.000000	8.201	-.022	.110	14.821	2.301	2.377
247	10.500	12.500	10.500	303	1.3117	1.0909	.142857	.069264	.008658	0.000000	8.022	.140	.172	18.572	2.217	2.079
248	15.500	12.500	10.500	315	1.3636	1.1602	.147186	.047619	.008658	0.000000	7.921	.024	.068	18.134	2.034	1.574
249	20.500	12.500	10.500	298	1.2900	1.0563	.151515	.051948	.030303	0.000000	7.890	.041	.083	20.962	1.991	1.814
250	25.500	12.500	10.500	302	1.3074	1.1082	.142857	.051948	.004329	0.000000	8.045	.032	.096	17.209	1.677	1.798
251	30.500	12.500	10.500	27[illegible]	1.1732	.9740	.108225	.073593	.017316	0.000000	7.990	.209	.138	15.343	2.798	1.696
252	35.500	12.500	10.500	294	1.2727	1.0563	.129870	.077922	.008658	0.000000	8.207	.142	.130	13.773	2.171	1.634
253	-4.500	-5.500	13.500	272	1.1775	1.1212	.043290	.012987	0.000000	0.000000	8.758	-.080	.054	8.207	.995	.995
254	.500	-5.500	13.500	250	1.0823	.9134	.125541	.043290	0.000000	0.000000	8.004	-.024	.164	21.682	1.509	1.354
255	5.500	-5.500	13.500	273	1.1818	1.0346	.108225	.038961	0.000000	0.000000	8.308	-.127	.054	15.577	1.622	2.138
256	10.500	-5.500	13.500	294	1.2727	1.0606	.190476	.021645	0.000000	0.000000	7.708	-.125	.135	22.998	1.302	1.311
257	15.500	-5.500	13.500	260	1.1255	.8961	.199134	.025974	.004329	0.000000	7.538	-.146	.168	26.232	1.462	1.372
258	20.500	-5.500	13.500	309	1.3377	.9567	.277056	.090909	.012987	0.000000	7.037	-.230	.260	28.820	2.158	2.157
259	25.500	-5.500	13.500	315	1.3636	1.0303	.229437	.077922	.025974	0.000000	7.247	-.248	.261	26.554	1.392	2.247
260	30.500	-5.500	13.500	215	.9307	.8182	.073593	.030303	.008658	0.000000	8.440	-.083	.166	13.270	1.301	1.525
261	35.500	-5.500	13.500	230	.9957	.9134	.043290	.034632	.004329	0.000000	8.699	-.182	.010	7.435	1.972	1.536
262	-4.500	-2.500	13.500	294	1.2727	1.1732	.064935	.034632	0.000000	0.000000	8.632	-.052	.025	9.939	1.471	1.473
263	.500	-2.500	13.500	286	1.2381	1.0952	.108225	.034632	0.000000	0.000000	8.127	-.062	.062	16.129	1.274	1.857
264	5.500	-2.500	13.500	284	1.2294	1.0433	.125541	.056277	.004329	0.000000	8.104	-.066	.069	17.028	1.996	1.691
265	10.500	-2.500	13.500	308	1.3333	1.0606	.229437	.030303	.012987	0.000000	7.488	-.130	.205	26.901	1.230	1.491
266	15.500	-2.500	13.500	331	1.4329	1.0909	.229437	.090909	.021645	0.000000	7.553	-.143	.320	24.177	2.294	2.187
267	20.500	-2.500	13.500	288	1.2468	.8745	.290043	.077922	.004329	0.000000	6.866	-.178	.282	29.869	2.027	2.446
268	25.500	-2.500	13.500	291	1.2597	.8701	.311688	.064935	.012987	0.000000	6.612	-.099	.305	33.021	1.518	1.727
269	30.500	-2.500	13.500	263	1.1385	1.0260	.069264	.038961	.004329	0.000000	8.534	-.032	.124	10.001	1.590	1.762
270	35.500	-2.500	13.500	229	.9913	.8918	.064935	.025974	.008658	0.000000	8.517	-.025	.098	9.806	1.586	1.341
271	-4.500	.500	13.500	307	1.3290	1.1818	.103896	.034632	.008658	0.000000	8.285	-.098	.108	15.032	1.719	1.284
272	.500	.500	13.500	317	1.3723	1.2208	.108225	.043290	0.000000	0.000000	8.342	.020	.050	13.611	1.821	1.362
273	5.500	.500	13.500	316	1.3680	1.1775	.138528	.047619	.004329	0.000000	8.142	.047	.085	17.030	1.794	2.267
274	10.500	.500	13.500	292	1.2641	1.0606	.138528	.051948	.012987	0.000000	8.080	.030	.192	16.537	2.316	2.301
275	15.500	.500	13.500	303	1.3117	1.0087	.212121	.090909	0.000000	0.000000	7.569	-.099	.187	22.214	2.447	3.146
276	20.500	.500	13.500	331	1.4329	1.1255	.242424	.047619	.017316	0.000000	7.356	-.028	.188	25.667	1.094	1.830
277	25.500	.500	13.500	355	1.5368	1.0736	.372294	.090909	0.000000	0.000000	6.709	.037	.178	31.374	1.357	2.155
278	30.500	.500	13.500	279	1.2078	.9307	.177489	.086580	.012987	0.000000	7.683	.013	.186	20.117	2.031	3.399
279	35.500	.500	13.500	273	1.1818	1.0130	.116883	.043290	.008658	0.000000	8.207	-.048	.135	13.604	1.725	2.015
280	-4.500	3.500	13.500	288	1.2468	1.0866	.121212	.038961	0.000000	0.000000	8.265	-.027	.108	17.005	1.893	1.270
281	.500	3.500	13.500	291	1.2597	1.0996	.129870	.025974	.004329	0.000000	8.118	.105	.028	17.769	1.341	2.044
282	5.500	3.500	13.500	264	1.1429	.9654	.134199	.038961	.004329	0.000000	7.965	.021	.122	18.482	1.587	2.488
283	10.500	3.500	13.500	313	1.3550	1.1039	.168831	.069264	.012987	0.000000	7.776	.061	.131	21.244	1.866	2.537
284	15.500	3.500	13.500	293	1.2684	1.0173	.186147	.060606	.004329	0.000000	7.673	.128	.170	24.127	1.345	2.553
285	20.500	3.500	13.500	314	1.3593	1.0390	.242424	.064935	.012987	0.000000	7.265	.071	.133	28.690	1.459	1.987

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286	25.500	3.500	13.500	346	1.4978	1.0823	.311688	.077922	.025974	0.000000	6.856	.192	.262	29.800	1.005	1.915
287	30.500	3.500	13.500	257	1.1126	.8355	.212121	.051948	.012987	0.000000	7.290	.109	.227	25.279	1.273	2.066
288	35.500	3.500	13.500	277	1.1991	.9957	.142857	.060606	0.000000	0.000000	8.049	.051	.133	15.257	1.646	1.727
289	-4.500	6.500	13.500	237	1.0260	.9351	.056277	.021645	.012987	0.000000	8.466	-.003	.054	13.858	1.457	1.623
290	.500	6.500	13.500	281	1.2165	1.0649	.112554	.025974	.012987	0.000000	8.206	.053	.024	16.618	1.882	1.443
291	5.500	6.500	13.500	257	1.1126	.9221	.147186	.034632	.008658	0.000000	7.796	.095	.067	22.248	1.586	1.394
292	10.500	6.500	13.500	270	1.1688	.9524	.164502	.043290	.008658	0.000000	7.862	.026	.274	20.577	1.725	2.745
293	15.500	6.500	13.500	281	1.2165	.9307	.203463	.069264	.012987	0.000000	7.519	.092	.313	24.115	2.235	2.740
294	20.500	6.500	13.500	266	1.1515	.8658	.220779	.056277	.008658	0.000000	7.195	.097	.351	27.948	1.936	1.646
295	25.500	6.500	13.500	255	1.1039	.7835	.233766	.077922	.008658	0.000000	7.208	.153	.406	25.407	3.087	2.189
296	30.500	6.500	13.500	231	1.0000	.7186	.199134	.082251	0.000000	0.000000	7.222	.183	.389	25.898	2.699	2.299
297	35.500	6.500	13.500	218	.9437	.7922	.099567	.051948	0.000000	0.000000	8.263	.147	.280	11.862	2.346	1.917
298	-4.500	9.500	13.500	247	1.0693	.9524	.090909	.021645	.004329	0.000000	8.224	-.019	.085	17.150	1.108	1.194
299	.500	9.500	13.500	256	1.1082	.9481	.121212	.034632	.004329	0.000000	8.032	.090	.164	17.032	1.599	2.316
300	5.500	9.500	13.500	224	.9697	.8485	.073593	.038961	.008658	0.000000	8.286	-.018	.191	15.163	1.164	2.227
301	10.500	9.500	13.500	248	1.0736	.8701	.129870	.064935	.008658	0.000000	7.716	.026	.273	21.543	1.725	1.645
302	15.500	9.500	13.500	[illegible]	.9913	.7792	.147186	.056277	.008658	0.000000	7.704	.110	.299	21.611	2.530	2.066
303	20.500	9.500	13.500		1.0952	.8268	.203463	.056277	.008658	0.000000	7.442	.192	.303	24.630	1.991	2.577
304	25.500	9.500	13.500	26[illegible]	1.1602	.8961	.173160	.086580	.004329	0.000000	7.658	.139	.279	20.485	2.574	3.090
305	30.500	9.500	13.500	246	1.0649	.8398	.142857	.064935	.017316	0.000000	7.841	.249	.303	18.866	2.663	2.045
306	35.500	9.500	13.500	233	1.0087	.8268	.095238	.086580	0.000000	0.000000	8.140	.064	.165	14.721	1.936	1.974
307	-4.500	12.500	13.500	264	1.1429	1.0649	.056277	.012987	.008658	0.000000	8.601	.056	-.032	10.503	1.216	1.475
308	.500	12.500	13.500	238	1.0303	.9481	.060606	.021645	0.000000	0.000000	8.577	.051	.078	11.168	1.536	1.757
309	5.500	12.500	13.500	278	1.2035	1.0736	.069264	.056277	.004329	0.000000	8.405	.067	.071	11.635	1.874	2.089
310	10.500	12.500	13.500	266	1.1515	.9913	.112554	.047619	0.000000	0.000000	8.237	.097	.195	15.449	2.202	1.912
311	15.500	12.500	13.500	299	1.2944	1.1126	.112554	.051948	.017316	0.000000	8.193	.034	.197	16.251	2.079	2.104
312	20.500	12.500	13.500	243	1.0519	.8918	.112554	.043290	.004329	0.000000	8.046	.158	.254	17.805	1.878	1.631
313	25.500	12.500	13.500	221	.9567	.7706	.164502	.021645	0.000000	0.000000	7.595	.110	.236	22.418	1.810	1.368
314	30.500	12.500	13.500	259	1.1212	.9567	.103896	.047619	.012987	0.000000	8.148	.094	.228	15.167	2.301	1.848
315	35.500	12.500	13.500	233	1.0087	.9048	.090909	.008658	.004329	0.000000	8.469	.082	.227	11.850	1.292	1.427
316	-36.700	-3.500	3.750	268	1.1376	1.1342	.001124	.002249	0.000000	0.000000	9.170	.096	-.040	1.012	1.045	1.042
317	-30.100	-3.500	3.750	262	1.0815	1.0736	.005060	.002811	0.000000	0.000000	9.108	.114	-.115	1.979	1.114	1.104
318	-23.500	-3.500	3.750	265	1.0040	.9827	.016866	.004498	0.000000	0.000000	9.002	.055	.026	4.059	.978	1.270
319	-16.900	-3.500	3.750	291	.9998	.9610	.030359	.007871	.000562	0.000000	8.826	.020	-.090	7.368	1.133	1.075
320	-10.300	-3.500	3.750	425	1.0865	.9740	.089953	.019115	.003373	0.000000	8.241	.018	.003	16.519	1.198	1.510
321	-36.700	3.500	3.750	239	1.0196	1.0173	.001124	.001124	0.000000	0.000000	9.155	-.040	-.003	1.171	1.143	1.083
322	-30.100	3.500	3.750	244	1.0035	.9957	.003935	.003935	0.000000	0.000000	9.107	.046	.116	1.894	1.158	1.018
323	-23.500	3.500	3.750	258	1.0227	1.0087	.008433	.005622	0.000000	0.000000	9.158	-.029	-.112	2.763	1.212	1.152
324	-16.900	3.500	3.750	310	.9766	.9221	.042166	.012369	0.000000	0.000000	8.715	.091	-.007	9.145	1.396	1.226
325	-10.300	3.500	3.750	489	1.0433	.8831	.124248	.035419	.000562	0.000000	7.911	.021	.008	21.335	1.788	1.720
326	-36.700	10.500	3.750	234	1.0055	1.0043	0.000000	.001124	0.000000	0.000000	9.145	.021	-.034	1.121	.762	1.042
327	-30.100	10.500	3.750	270	1.1349	1.1299	.001687	.003373	0.000000	0.000000	9.239	-.025	-.030	1.234	1.129	1.251
328	-23.500	10.500	3.750	269	1.0440	1.0260	.011806	.006184	0.000000	0.000000	9.037	.101	-.078	3.535	.973	1.148
329	-16.900	10.500	3.750	278	1.0377	1.0130	.020802	.003935	0.000000	0.000000	9.033	-.019	.007	5.367	.979	.959
330	-10.300	10.500	3.750	378	1.0789	.9957	.057907	.021976	.003373	0.000000	8.552	.020	.046	10.868	1.334	1.660
331	-36.700	-3.500	11.250	222	.9460	.9437	0.000000	.002249	0.000000	0.000000	9.121	-.003	.022	1.217	1.021	.929
332	-30.100	-3.500	11.250	246	1.0084	1.0000	.005060	.003373	0.000000	0.000000	9.149	.036	-.012	2.237	1.064	.989
333	-23.500	-3.500	11.250	249	.9197	.8961	.017991	.005060	.000562	0.000000	8.976	-.045	-.066	5.109	1.003	1.149
334	-16.900	-3.500	11.250	304	1.0636	1.0260	.030359	.006184	.001124	0.000000	8.876	-.015	.023	6.538	1.090	1.074

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335	-10.300	-3.500	11.250	351	1.0449	.9740	.054534	.011806	.004498	0.000000	8.614	.016	.065	10.809	1.398	1.490
336	-36.700	3.500	11.250	248	1.0397	1.0346	.003373	.001687	0.000000	0.000000	9.208	.043	-.034	1.616	1.176	1.127
337	-30.100	3.500	11.250	262	1.0702	1.0606	.008433	.001124	0.000000	0.000000	9.220	.073	-.026	2.545	1.055	1.108
338	-23.500	3.500	11.250	279	1.0270	1.0000	.024737	0.000000	.002249	0.000000	8.934	.008	.075	6.077	.802	.973
339	-16.900	3.500	11.250	324	1.0448	.9913	.048350	.003373	.001687	0.000000	8.704	-.001	-.035	10.037	.959	1.087
340	-10.300	3.500	11.250	390	1.0781	.9870	.079834	.011244	0.000000	0.000000	8.460	.040	-.036	14.722	1.068	1.270
341	-36.700	10.500	11.250	251	1.0414	1.0346	.003935	.002811	0.000000	0.000000	9.176	.003	-.008	1.554	1.165	1.194
342	-30.100	10.500	11.250	240	.9486	.9351	.010120	.003373	0.000000	0.000000	9.040	.069	-.068	3.034	.956	1.041
343	-23.500	10.500	11.250	266	.9858	.9610	.016304	.007871	.000562	0.000000	8.959	-.059	.063	4.115	1.182	1.247
344	-16.900	10.500	11.250	268	1.0133	.9913	.016304	.004498	.001124	0.000000	9.002	.062	.007	4.102	1.148	1.038
345	-10.300	10.500	11.250	328	1.0206	.9610	.048912	.010682	0.000000	0.000000	8.733	.015	-.011	9.246	1.387	1.305
346	41.500	-3.500	3.750	311	.6207	.5195	.048237	.047707	.005301	0.000000	8.449	.039	.041	9.269	2.060	2.304
347	48.500	-3.500	3.750	245	.6747	.6190	.025974	.027034	.002650	0.000000	8.885	.077	-.050	3.599	1.58[illegible]	1.726
348	55.500	-3.500	3.750	242	.7589	.7186	.015372	.023324	.001590	0.000000	9.012	.122	-.076	2.693	1.16[illegible]	1.358
349	62.500	-3.500	3.750	227	.7358	.7013	.014842	.019613	0.000000	0.000000	9.176	.078	.028	1.925	1.253	1.489
350	69.500	-3.500	3.750	204	.6628	.6320	.009541	.021203	0.000000	0.000000	9.118	.192	-.105	1.547	1.213	1.613
351	76.500	-3.500	3.750	200	.7062	.6840	.008481	.012722	.001060	0.000000	9.039	.177	-.007	1.425	1.075	1.337
352	41.500	3.500	3.750	274	.5707	.4848	.040816	.031275	.013782	0.000000	8.466	-.159	-.061	10.754	1.942	1.861
353	48.500	3.500	3.750	232	.5067	.4372	.028624	.035516	.005301	0.000000	8.831	-.196	-.136	5.462	1.653	1.783
354	55.500	3.500	3.750	201	.5472	.5022	.017493	.024914	.002650	0.000000	8.987	-.186	-.241	2.838	1.586	1.542
355	62.500	3.500	3.750	189	.5978	.5671	.011662	.019023	.001060	0.000000	9.090	-.165	-.083	1.632	1.273	1.499
356	6[illegible].500	3.500	3.750	198	.6292	.5974	.013252	.018023	.000530	0.000000	9.218	-.179	-.179	1.395	1.264	1.164
357	76.500	3.500	3.750	206	.6752	.6450	.011132	.017493	.001590	0.000000	9.023	-.102	-.230	1.762	1.311	1.266
358	41.500	10.500	3.750	403	.8442	.7186	.075272	.045587	.004771	0.000000	8.507	.111	.061	10.698	2.050	1.947
359	48.500	10.500	3.750	328	.9906	.9307	.028624	.025974	.005301	0.000000	9.039	.045	-.066	3.244	1.437	1.283
360	55.500	10.500	3.750	280	.8778	.8312	.018553	.027564	.000530	0.000000	9.034	.016	-.063	2.301	1.160	1.491
361	62.500	10.500	3.750	237	.7676	.7316	.013782	.021203	.001060	0.000000	9.099	-.015	-.016	2.338	1.248	1.104
362	69.500	10.500	3.750	246	.8636	.8355	.010072	.017493	.000530	0.000000	9.192	-.119	.005	1.896	.952	1.137
363	76.500	10.500	3.750	264	.9187	.8874	.012192	.019083	0.000000	0.000000	9.187	-.042	-.009	1.415	1.135	1.284
364	41.500	-3.500	11.250	359	.8969	.8052	.042937	.042937	.005831	0.000000	8.771	-.056	.098	6.314	1.933	1.946
365	48.500	-3.500	11.250	285	.8311	.7749	.025974	.027034	.003180	0.000000	8.968	.015	.080	3.167	1.351	1.517
366	55.500	-3.500	11.250	265	.8319	.7879	.017493	.024914	.001590	0.000000	9.008	-.076	.078	2.614	1.201	1.467
367	62.500	-3.500	11.250	275	.9625	.9[illegible]07	.013782	.016433	.001590	0.000000	9.200	.038	.035	1.974	1.294	1.050
368	69.500	-3.500	11.250	262	.8949	.[illegible]615	.010072	.020673	.002650	0.000000	9.112	.033	.023	1.638	1.120	1.016
369	76.500	-3.500	11.250	224	.7835	.7576	.007421	.015902	.002650	0.000000	9.114	-.000	-.132	1.552	1.364	1.128
370	41.500	3.500	11.250	360	.8556	.7576	.054598	.041346	.002120	0.000000	8.650	-.072	.127	7.342	1.670	1.891
371	48.500	3.500	11.250	320	.8800	.8095	.028094	.039226	.003180	0.000000	8.985	.001	-.003	3.554	1.334	1.546
372	55.500	3.500	11.250	265	.8243	.7792	.020143	.022263	.002650	0.000000	8.989	-.042	-.099	2.235	1.395	1.256
373	62.500	3.500	11.250	263	.8802	.8442	.008481	.024384	.003180	0.000000	9.055	-.119	.006	2.187	1.346	1.213
374	6[illegible].500	3.500	11.250	260	.8634	.8268	.014312	.022263	0.000000	0.000000	9.098	.018	-.036	1.806	1.158	1.035
375	76.500	3.500	11.250	229	.8052	.7792	.008481	.017493	0.000000	0.000000	8.966	-.127	-.087	1.449	1.086	.909
376	41.500	10.500	11.250	423	.9764	.8571	.057779	.054068	.007421	0.000000	8.519	.160	.204	8.625	1.890	1.888
377	48.500	10.500	11.250	321	.8958	.8268	.031805	.034985	.002120	0.000000	8.888	.014	.093	3.735	1.686	1.639
378	55.500	10.500	11.250	293	.9417	.8961	.019613	.025444	.000530	0.000000	9.036	.030	.095	2.024	1.236	1.191
379	62.500	10.500	11.250	276	.9859	.9567	.011662	.016963	.000530	0.000000	9.093	-.110	.023	1.507	1.120	1.168
380	69.500	10.500	11.250	251	.8776	.8465	.007421	.018023	.003711	0.000000	9.062	-.065	.069	1.992	1.170	1.128
381	76.500	10.500	11.250	291	1.0394	1.0087	.016433	.011662	.002650	0.000000	9.132	.003	.038	1.749	.950	.991
382	-34.000	-1.750	21.250	265	.9874	.9827	.004205	.000371	.000124	0.000000	9.124	-.048	-.063	1.910	.942	1.133
383	-22.000	-1.750	21.250	336	.9247	.9091	.009647	.005937	0.000000	0.000000	9.052	-.111	-.001	3.068	1.099	1.211

384	-10.000	-1.750	21.250	504	.9749	.9394	.029190	.006184	.000124	0.000000	8.846	-.105	-.022	6.832	1.148	1.306
385	2.000	-1.750	21.250	657	.7121	.6494	.035498	.024985	.002226	0.000000	8.605	-.050	.137	10.480	1.598	1.748
386	14.000	-1.750	21.250	1026	.6442	.5325	.070625	.034756	.006308	0.000000	7.796	-.067	.156	18.235	2.074	2.387
387	26.000	-1.750	21.250	1146	.5370	.4069	.078912	.048361	.002845	0.000000	7.625	-.035	.363	21.000	2.343	3.215
388	38.000	-1.750	21.250	818	.9212	.8442	.039085	.034879	.003092	0.000000	8.739	-.107	.153	6.642	1.480	2.005
389	50.000	-1.750	21.250	571	.8024	.7532	.020532	.027335	.001237	0.000000	8.953	-.046	-.022	3.720	1.257	1.689
390	62.000	-1.750	21.250	482	.9259	.8918	.013976	.019419	.000742	0.000000	9.102	-.052	.054	2.168	1.116	1.452
391	74.000	-1.750	21.250	428	.9823	.9567	.008163	.016945	.000495	0.000000	9.042	-.037	.029	1.576	1.363	1.264
392	-34.000	8.750	21.250	308	.9506	.9394	.009524	.001732	0.000000	0.000000	9.017	-.051	.063	3.088	1.128	.984
393	-22.000	8.750	21.250	390	1.0491	1.0303	.017563	.001237	0.000000	0.000000	8.935	.015	.076	4.217	1.014	.892
394	-10.000	8.750	21.250	527	.9062	.8658	.030179	.008040	.002226	0.000000	8.702	-.005	.027	7.543	1.203	1.250
395	2.000	8.750	21.250	708	.8866	.8225	.045022	.016574	.002474	0.000000	8.552	-.019	.171	10.272	1.078	1.345
396	14.000	8.750	21.250	1011	.8484	.7446	.071861	.027953	.003958	0.000000	8.173	.047	.102	15.117	1.544	1.652
397	26.000	8.750	21.250	1161	.7323	.6061	.082127	.041435	.002721	0.000000	7.965	.065	.202	16.573	1.924	2.559
[illegible]	38.000	8.750	21.250	855	.7113	.6234	.044032	.041187	.002721	0.000000	8.582	.104	.269	9.343	1.838	2.392
399	50.000	8.750	21.250	654	1.0481	.9957	.020656	.029437	.002350	0.000000	8.984	-.031	.058	3.118	1.285	1.721
400	62.000	8.750	21.250	507	.8912	.8528	.013234	.024490	.000618	0.000000	9.054	-.020	.054	2.218	1.381	1.385
401	74.000	8.750	21.250	444	.9422	.9134	.008534	.019295	.000989	0.000000	9.125	-.044	-.041	1.363	1.131	1.301
402	-34.000	-1.750	33.750	284	1.1832	1.1818	.000866	.000495	0.000000	0.000000	9.233	-.002	.036	1.061	1.132	.915
403	-22.000	-1.750	33.750	295	1.0668	1.0606	.004947	.001237	0.000000	0.000000	9.078	.088	-.002	1.788	1.016	1.139
404	-10.000	-1.750	33.750	353	1.0571	1.0433	.007792	.005690	.000371	0.000000	9.109	-.005	.019	2.627	1.248	1.065
405	2.000	-1.750	33.750	373	1.0680	1.0519	.008787	.006926	.000371	0.000000	9.099	.026	.057	2.780	.988	1.268
406	14.000	-1.750	33.750	452	.9558	.9264	.015090	.013234	.001113	0.000000	8.964	.046	.082	4.021	1.375	1.343
407	26.000	-1.750	33.750	488	.9351	.9004	.015832	.017811	.000989	0.000000	8.952	.017	.065	4.071	1.203	1.821
408	38.000	-1.750	33.750	508	1.0132	.9784	.013111	.021150	.000618	0.000000	8.992	.015	.043	2.918	1.286	1.802
409	50.000	-1.750	33.750	443	.8790	.8485	.011998	.018058	.000495	0.000000	9.085	.065	.170	2.650	1.318	1.772
410	62.000	-1.750	33.750	418	.9811	.9567	.008658	.015090	.000618	0.000000	9.093	.021	.095	1.501	1.192	1.305
411	74.000	-1.750	33.750	366	.9326	.9134	.007669	.011255	.000247	0.000000	9.137	.059	.076	1.558	1.088	1.278
412	-34.000	8.750	33.750	257	.9275	.9221	.004082	.001361	0.000000	0.000000	9.158	-.008	-.013	1.966	1.105	1.029
413	-22.000	8.750	33.750	292	.9487	.9394	.005937	.003092	.000247	0.000000	9.129	-.011	-.055	2.395	.965	1.208
414	-10.000	8.750	33.750	297	.9451	.9351	.006432	.003463	.000124	0.000000	9.127	-.015	.034	2.604	1.056	1.207
415	2.000	8.750	33.750	405	1.0383	1.0173	.012740	.008287	0.000000	0.000000	8.985	.044	-.051	3.488	1.076	1.343
416	14.000	8.750	33.750	468	.8653	.8312	.019295	.014719	.000124	0.000000	8.963	.043	.105	5.245	1.331	1.651
417	26.000	8.750	33.750	586	.9514	.9048	.027087	.019295	.000247	0.000000	8.903	.024	.017	5.650	1.110	1.767
418	38.000	8.750	33.750	498	.8312	.7922	.018306	.020037	.000618	0.000000	8.928	.098	.108	3.825	1.352	1.746
419	50.000	8.750	33.750	496	.9739	.9394	.013853	.019171	.001464	0.000000	9.018	.076	.042	2.849	1.203	1.747
420	62.000	8.750	33.750	415	.9639	.9394	.008163	.015708	.000618	0.000000	9.072	.043	.031	1.816	1.186	1.603
421	74.000	8.750	33.750	387	.9562	.9351	.007050	.013853	.000247	0.000000	9.128	.058	.032	1.455	1.106	1.379
422	-34.000	-16.750	6.667	229	.8464	.8398	.003934	.001873	.000749	0.000000	9.105	-.041	.009	1.979	1.097	1.198
423	-22.000	-16.750	6.667	248	.8582	.8485	.005994	.003372	.000375	0.000000	9.116	-.083	.064	2.573	1.170	1.052
424	-10.000	-16.750	6.667	381	.7796	.7403	.029970	.009366	0.000000	0.000000	8.764	-.083	.011	8.168	1.247	1.281
425	2.000	-16.750	6.667	706	.7949	.6926	.077173	.020979	.004121	0.000000	8.133	-.201	.085	16.936	1.980	1.406
426	14.000	-16.750	6.667	795	.5424	.4113	.087100	.038212	.005807	0.000000	7.351	-.293	.154	22.296	3.112	2.040
427	26.000	-16.750	6.667	818	.8573	.7359	.082980	.031281	.007118	0.000000	8.202	-.130	.069	15.477	2.074	1.531
428	38.000	-16.750	6.667	565	.9590	.8918	.036526	.025475	.005245	0.000000	8.810	-.084	.131	6.294	1.716	1.460
429	50.000	-16.750	6.667	417	.8816	.8398	.017795	.021916	.002060	0.000000	9.020	-.078	-.048	2.874	1.750	1.400
430	62.000	-16.750	6.667	320	.8013	.7749	.008804	.016296	.001311	0.000000	9.090	.061	.092	1.764	1.264	1.179
431	74.000	-16.750	6.667	306	.8442	.8225	.005429	.011801	.001499	0.000000	9.160	-.012	-.032	1.556	1.118	.985
432	-34.000	-10.250	6.667	235	.8846	.8788	.002610	.002622	.000562	0.000000	9.123	.060	-.029	1.716	1.010	.944

433	-22.000	-10.250	6.667	323	.9551	.9351	.016671	.002060	.001311	0.000000	9.001	.004	.022	4.550	.980	.962
434	-10.000	-10.250	6.667	512	.6716	.6017	.051136	.017045	.001686	0.000000	8.344	.037	-.001	14.191	1.540	1.399
435	2.000	-10.250	6.667	1212	.7654	.5626	.168019	.029033	.005619	0.000000	6.946	-.229	.141	31.093	1.891	1.575
436	14.000	-10.250	6.667	1552	.5682	.2900	.207917	.054321	.015922	0.000000	5.363	-.335	.135	36.941	3.464	2.635
437	26.000	-10.250	6.667	1477	.4133	.1429	.184503	.070430	.015547	0.000000	4.602	-.509	.153	33.609	4.372	4.291
438	38.000	-10.250	6.667	694	.7761	.6753	.050012	.041021	.009740	0.000000	8.564	-.073	.042	9.518	1.774	1.981
439	50.000	-10.250	6.667	435	.8063	.7576	.017045	.029783	.001873	0.000000	9.081	.022	-.010	2.967	1.307	1.443
440	62.000	-10.250	6.667	376	.9360	.9046	.012550	.017607	.001124	0.000000	9.157	.028	-.048	1.495	1.180	1.313
441	74.000	-10.250	6.667	352	.9978	.9740	.008429	.015172	.000187	0.000000	9.133	.040	-.082	1.210	1.073	1.241
442	-34.000	-16.750	20.000	223	.9322	.9307	.000562	.000749	.000187	0.000000	9.220	.019	-.080	1.311	.922	1.036
443	-22.000	-16.750	20.000	253	.9296	.9221	.005432	.001499	.000562	0.000000	9.085	-.005	-.079	2.148	1.024	1.020
444	-10.000	-16.750	20.000	309	.9069	.8874	.012363	.005619	.001499	0.000000	9.078	-.054	-.001	3.962	1.118	1.189
445	2.000	-16.750	20.000	469	.8996	.8485	.039710	.009740	.001686	0.000000	8.749	.004	.001	8.931	1.261	1.216
446	14.000	-16.750	20.000	494	.8753	.8182	.036151	.019106	.001873	0.000000	8.690	-.049	.033	8.209	1.670	1.378
447	26.000	-16.750	20.000	645	.9569	.9177	.048701	.026224	.006181	0.000000	8.666	-.113	.056	9.847	1.641	1.472
448	38.000	-16.750	20.000	485	.8819	.8268	.025662	.026224	.003164	0.000000	8.840	-.037	.052	5.153	1.814	1.620
449	50.000	-16.750	20.000	389	.9178	.8831	.012550	.021354	.000749	0.000000	9.071	-.067	.098	2.931	1.491	1.293
450	62.000	-16.750	20.000	355	.9073	.8786	.008054	.018919	.001499	0.000000	9.069	.027	.049	1.749	1.310	1.392
451	74.000	-16.750	20.000	310	.9237	.9048	.007305	.011239	.000375	0.000000	9.190	-.124	.055	1.347	1.239	1.047
452	-34.000	-10.250	20.000	256	1.0171	1.0130	.003934	.000187	0.000000	0.000000	9.092	.013	.041	1.692	1.135	1.026
453	-22.000	-10.250	20.000	275	1.0331	1.0260	.004121	.002248	.000749	0.000000	9.163	.036	.008	1.875	1.159	1.072
454	-10.000	-10.250	20.000	371	1.0552	1.0303	.018731	.005807	.000375	0.000000	8.991	.013	.035	4.382	1.065	1.304
455	2.000	-10.250	20.000	590	.9057	.8312	.056194	.016671	.001686	0.000000	8.538	-.034	-.051	11.718	1.209	1.583
456	14.000	-10.250	20.000	753	.9487	.8442	.074550	.026598	.003372	0.000000	8.378	-.102	.167	13.391	1.471	1.754
457	26.000	-10.250	20.000	785	.9671	.8571	.067807	.034653	.007493	0.000000	8.393	-.104	.059	12.662	1.517	1.747
458	38.000	-10.250	20.000	562	1.0496	.9870	.026598	.034276	.001686	0.000000	8.936	-.077	.128	3.967	1.600	1.892
459	50.000	-10.250	20.000	455	1.1455	1.1082	.014236	.021916	.001124	0.000000	9.068	-.070	-.037	2.742	1.428	1.351
460	62.000	-10.250	20.000	409	1.1162	1.0866	.008242	.020042	.001311	0.000000	9.072	-.066	-.010	1.866	1.210	1.294
461	74.000	-10.250	20.000	375	1.0477	1.0216	.009553	.016296	.000187	0.000000	9.212	-.035	.012	1.471	1.281	1.204
462	-34.000	-16.750	33.333	234	1.0047	1.0043	0.000000	.000375	0.000000	0.000000	9.195	-.009	.059	.983	1.081	.912
463	-22.000	-16.750	33.333	234	.9716	.9697	.001311	.000562	0.000000	0.000000	9.197	.090	-.046	1.266	1.043	.977
464	-10.000	-16.750	33.333	270	.9742	.9654	.006931	.001873	0.000000	0.000000	9.165	-.032	.079	2.562	.993	.929
465	2.000	-16.750	33.333	348	.9515	.9264	.016858	.007867	.000375	0.000000	8.967	.052	-.043	4.091	1.312	1.302
466	14.000	-16.750	33.333	340	.9583	.9351	.015484	.006369	.000375	0.000000	9.073	-.010	.147	4.245	1.205	1.359
467	26.000	-16.750	33.333	387	1.0499	1.0216	.016484	.010864	.000937	0.000000	8.971	-.002	-.036	3.814	1.216	1.418
468	38.000	-16.750	33.333	355	.9818	.9567	.012550	.012363	.000187	0.000000	9.107	-.012	.111	3.101	1.370	1.536
469	50.000	-16.750	33.333	334	.9903	.9697	.007867	.011988	.000749	0.000000	9.028	-.094	-.015	2.023	1.187	1.547
470	62.000	-16.750	33.333	315	.9205	.9004	.005432	.014048	.000562	0.000000	9.173	-.046	.089	1.632	1.159	1.378
471	74.000	-16.750	33.333	316	.9952	.9784	.005057	.010864	.000937	0.000000	9.070	-.038	.008	1.500	1.220	1.312
472	-34.000	-10.250	33.333	229	.9831	.9827	.000187	.000187	0.000000	0.000000	9.141	.064	-.029	.984	1.025	1.128
473	-22.000	-10.250	33.333	249	.9330	.9264	.004496	.002060	0.000000	0.000000	9.231	.010	.010	1.951	1.173	.926
474	-10.000	-10.250	33.333	264	.9399	.9307	.004683	.004121	.000375	0.000000	9.131	.052	.039	1.922	1.369	1.277
475	2.000	-10.250	33.333	317	.9416	.9221	.013112	.004870	.001499	0.000000	9.049	.061	.039	3.698	1.080	1.197
476	14.000	-10.250	33.333	354	.9982	.9740	.015734	.005619	.002810	0.000000	9.135	-.039	.044	4.253	1.198	1.254
477	26.000	-10.250	33.333	356	.9696	.9437	.013112	.011239	.001499	0.000000	9.026	.016	.114	3.511	1.309	1.549
478	38.000	-10.250	33.333	365	.9920	.9654	.009740	.016296	.000562	0.000000	9.155	-.147	.097	2.946	1.270	1.491
479	50.000	-10.250	33.333	362	.9376	.9091	.013299	.014985	.000187	0.000000	9.115	-.019	.041	2.783	1.321	1.582
480	62.000	-10.250	33.333	328	.8856	.8615	.007867	.015734	.000562	0.000000	9.207	-.063	.129	1.841	1.148	1.475
481	74.000	-10.250	33.333	331	.9980	.9784	.006743	.012925	0.000000	0.000000	9.165	-.007	.052	1.522	1.137	1.228

482	-34.000	18.500	6.667	266	.9838	.9784	.004464	.000947	0.000000	0.000000	9.122	-.025	.039	1.677	1.107	1.187
483	-22.000	18.500	6.667	326	.9648	.9697	.011228	.003247	.000676	0.000000	9.056	-.092	.052	3.354	1.060	1.177
484	-10.000	18.500	6.667	546	.9587	.9134	.038014	.007170	.000135	0.000000	8.762	.056	.133	7.999	1.405	1.261
485	2.000	18.500	6.667	930	.6626	.5541	.075216	.032738	.000541	0.000000	7.859	.063	.119	18.655	2.211	2.050
486	14.000	18.500	6.667	1066	.4548	.3203	.080628	.049378	.004464	0.000000	7.142	.469	.225	24.164	3.462	2.907
487	26.000	18.500	6.667	1223	.4129	.2554	.093750	.057359	.006358	0.000000	6.796	.497	.187	27.464	3.983	3.406
488	38.000	18.500	6.667	1006	.7610	.6450	.064529	.048295	.003111	0.000000	8.295	.266	.099	11.406	2.515	2.163
489	50.000	18.500	6.667	666	1.0085	.9481	.031385	.028815	.000271	0.000000	8.954	.055	.046	3.909	1.719	1.525
490	62.000	18.500	6.667	482	.8956	.8571	.015016	.021916	.001488	0.000000	9.005	.074	.024	2.198	1.390	1.319
491	74.000	18.500	6.667	395	.9299	.9048	.009740	.014610	.000812	0.000000	9.144	.056	.064	1.518	1.185	1.260
492	-34.000	27.500	6.667	201	.7569	.7532	.001894	.001623	.000135	0.000000	9.168	-.057	-.043	1.648	1.126	.979
493	-22.000	27.500	6.667	280	.9521	.9437	.005547	.002841	0.000000	0.000000	9.049	-.026	-.038	2.006	.921	1.000
494	-10.000	27.500	6.667	301	.7620	.7446	.011228	.006088	.000135	0.000000	8.960	-.022	-.012	3.925	1.182	1.251
495	2.000	27.500	6.667	486	.7955	.7532	.027597	.013663	.000947	0.000000	8.741	.015	-.014	7.804	1.483	1.152
496	14.000	27.500	6.667	543	.7486	.6970	.027327	.022321	.002029	0.000000	8.670	.124	-.064	7.772	1.857	1.558
497	26.000	27.500	6.667	631	.8402	.7792	.030844	.028544	.001623	0.000000	8.745	.156	-.036	7.076	2.078	1.316
498	38.000	27.500	6.667	617	.9138	.8571	.028544	.025974	.002165	0.000000	8.744	.137	.004	5.430	2.017	1.374
499	50.000	27.500	6.667	532	.7639	.7143	.020427	.027868	.001353	0.000000	8.832	.050	-.068	4.037	1.985	1.405
500	62.000	27.500	6.667	460	.9681	.9351	.014610	.017722	.000676	0.000000	8.990	.024	-.023	2.112	1.479	1.264
501	74.000	27.500	6.667	432	.9978	.9657	.008252	.018804	.001082	0.000000	9.017	.025	-.057	1.527	1.497	1.173
502	-34.000	18.500	20.000	232	.9330	.9307	.001353	.000947	0.000000	0.000000	9.199	.017	.016	1.268	.977	1.068
503	-22.000	18.500	20.000	313	1.0153	1.0043	.007711	.003111	.000135	0.000000	9.113	-.018	-.010	2.428	1.152	1.115
504	-10.000	18.500	20.000	350	.8651	.8442	.012852	.007440	.000676	0.000000	9.094	-.048	.013	3.824	1.233	1.283
505	2.000	18.500	20.000	529	.9355	.8916	.026650	.015267	.001759	0.000000	8.840	.026	.070	6.479	1.389	1.424
506	14.000	18.500	20.000	713	.8513	.7792	.045184	.023674	.003247	0.000000	8.588	.111	.059	10.618	1.657	1.801
507	26.000	18.500	20.000	820	1.1342	1.0563	.053571	.021374	.002976	0.000000	8.708	.146	.095	8.877	1.479	1.574
508	38.000	18.500	20.000	649	.7378	.6710	.032197	.032738	.001894	0.000000	8.734	.239	.223	6.600	1.752	2.055
509	50.000	18.500	20.000	569	.8696	.8182	.018669	.029897	.002841	0.000000	9.010	.167	.100	3.491	1.548	1.550
510	62.000	18.500	20.000	494	1.0440	1.0087	.014205	.020698	.000405	0.000000	9.123	.155	.077	1.981	1.233	1.472
511	74.000	18.500	20.000	408	1.0030	.9784	.009470	.015152	0.000000	0.000000	9.240	.066	.056	1.540	.925	1.176
512	-34.000	27.500	20.000	261	1.0712	1.0693	.000406	.000812	.000676	0.000000	9.229	.026	-.027	1.190	.934	1.159
513	-22.000	27.500	20.000	260	.9578	.9524	.002976	.002300	.000135	0.000000	9.140	-.038	.085	1.753	1.035	.955
514	-10.000	27.500	20.000	325	1.0295	1.0173	.008793	.003382	0.000000	0.000000	9.161	.010	-.004	2.738	.941	1.073
515	2.000	27.500	20.000	416	1.0460	1.0216	.017451	.006223	.000676	0.000000	9.019	-.002	.024	4.206	1.204	1.064
516	14.000	27.500	20.000	481	1.0925	1.0606	.020563	.009470	.001894	0.000000	9.028	.021	-.003	4.501	1.136	1.222
517	26.000	27.500	20.000	570	.9494	.9004	.028003	.020022	.000947	0.000000	8.894	.057	.066	5.994	1.568	1.448
518	38.000	27.500	20.000	530	.8559	.8095	.017181	.027192	.002029	0.000000	8.937	.015	.056	4.481	1.735	1.383
519	50.000	27.500	20.000	464	.9686	.9351	.015422	.017316	.000812	0.000000	9.100	.048	.006	3.066	1.531	1.305
520	62.000	27.500	20.000	431	1.0187	.9913	.010687	.016504	.000135	0.000000	9.154	.038	.025	1.855	1.440	1.037
521	74.000	27.500	20.000	382	.8778	.8528	.008117	.016234	.000676	0.000000	9.148	.058	.003	1.755	1.278	1.277
522	-34.000	18.500	33.333	220	.9272	.9264	.000541	.000271	0.000000	0.000000	9.215	-.121	.056	1.068	.916	1.096
523	-22.000	18.500	33.333	260	.9830	.9784	.002435	.002029	.000135	0.000000	9.157	-.075	-.009	1.582	.964	.933
524	-10.000	18.500	33.333	284	.9191	.9091	.005276	.003517	.001218	0.000000	9.115	-.064	.012	2.264	.902	1.173
525	2.000	18.500	33.333	397	1.0183	.9957	.014205	.007305	.001082	0.000000	8.982	-.086	.043	4.228	.875	1.117
526	14.000	18.500	33.333	445	.9409	.9091	.020022	.011364	.000406	0.000000	8.973	-.049	.141	4.913	1.011	1.258
527	26.000	18.500	33.333	481	.8661	.8268	.021510	.016504	.001218	0.000000	8.883	-.004	.111	5.401	1.151	1.593
528	38.000	18.500	33.333	465	.9226	.8874	.013258	.021104	.000812	0.000000	8.956	.050	.151	3.424	1.314	1.726
529	50.000	18.500	33.333	414	.9283	.9064	.010011	.017587	.000271	0.000000	9.067	.063	.147	2.394	1.254	1.526
530	62.000	18.500	33.333	417	1.0000	.9740	.009876	.015693	.000406	0.000000	9.132	.027	.109	2.022	1.118	1.387

ORIGINAL PAGE IS
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531	74.000	18.500	33.333	362	1.0471	1.0303	.005276	.011093	.000406	0.000000	9.159	.072	.049	1.437	1.198	1.285
532	-34.000	27.500	33.333	249	1.0486	1.0476	.000676	.000271	0.000000	0.000000	9.167	.016	-.073	1.207	.810	.993
533	-22.000	27.500	33.333	231	.9748	.9740	.000135	.000676	0.000000	0.000000	9.135	.060	.085	1.040	.874	1.034
534	-10.000	27.500	33.333	276	1.0312	1.0260	.002029	.003111	.000135	0.000000	9.179	.055	-.065	1.618	.857	1.101
535	2.000	27.500	33.333	328	1.0215	1.0087	.006764	.006088	0.000000	0.000000	9.081	.007	.100	2.558	1.093	.997
536	14.000	27.500	33.333	371	.8680	.8442	.014881	.008117	.000812	0.000000	9.048	-.014	.011	3.998	1.200	1.215
537	26.000	27.500	33.333	429	.9597	.9307	.017587	.010823	.000541	0.000000	8.911	.058	.084	4.334	1.099	1.191
538	38.000	27.500	33.333	400	.9893	.9654	.011228	.010552	.002165	0.000000	9.040	.036	.089	3.049	1.182	1.174
539	50.000	27.500	33.333	385	.9915	.9697	.007711	.013663	.000406	0.000000	9.062	-.009	.085	1.792	1.106	1.384
540	62.000	27.500	33.333	371	.9309	.9091	.006764	.013799	.001218	0.000000	9.122	.056	.068	1.882	1.183	1.106
541	74.000	27.500	33.333	379	.9823	.9610	.006629	.013934	.000676	0.000000	9.133	.037	.095	1.569	1.057	1.280
542	-34.000	38.000	6.667	213	.8629	.8633	.000406	.001015	0.000000	0.000000	9.145	.001	.002	1.156	1.011	.966
543	-22.000	38.000	6.667	282	1.0305	1.0260	.003348	.001218	0.000000	0.000000	9.146	-.030	.012	1.790	.937	1.047
544	-10.000	38.000	6.667	311	.9870	.9784	.006169	.002435	0.000000	0.000000	9.069	.057	.006	2.292	.957	1.131
545	2.000	38.000	6.667	261	.9582	.9437	.008726	.005479	.000304	0.000000	9.053	-.013	-.027	2.698	1.087	1.106
546	14.000	38.000	6.667	454	1.0269	1.0043	.012074	.009740	.000710	0.000000	8.985	.041	.030	3.611	1.407	1.255
547	26.000	38.000	6.667	526	.9496	.9177	.017350	.014407	.000101	0.000000	8.911	.043	-.019	4.217	1.529	1.189
548	38.000	38.000	6.667	549	.9393	.9048	.014915	.018770	.000812	0.000000	8.918	.093	.039	3.663	1.719	1.243
549	50.000	38.000	6.667	513	.8511	.8182	.013596	.018770	.000507	0.000000	9.026	.085	.021	2.821	1.724	1.327
550	62.000	38.000	6.667	467	.9859	.9610	.006494	.017959	.000406	0.000000	9.051	.035	.039	1.557	1.392	1.234
551	74.000	38.000	6.667	429	.9102	.8474	.008624	.013697	.000406	0.000000	9.130	.075	.085	1.510	1.428	1.012
552	-34.000	50.000	6.667	249	1.0399	1.0390	.000609	.000304	0.000000	0.000000	9.156	-.072	.013	1.205	.954	.991
553	-22.000	50.000	6.667	274	1.0340	1.0303	.002435	.001218	0.000000	0.000000	9.151	-.003	-.058	1.533	1.108	.989
554	-10.000	50.000	6.667	290	1.0525	1.0476	.002841	.002029	0.000000	0.000000	9.111	-.110	.013	1.632	1.232	1.047
555	2.000	50.000	6.667	312	1.0040	.9957	.003856	.004058	.000406	0.000000	9.134	.041	-.051	1.855	1.108	.940
556	14.000	50.000	6.667	348	1.0288	1.0173	.005986	.005276	.000203	0.000000	9.058	-.049	.077	2.334	1.305	1.041
557	26.000	50.000	6.667	393	.9742	.9567	.006494	.010958	0.000000	0.000000	9.055	.007	-.052	2.424	1.418	1.014
558	38.000	50.000	6.667	370	.9718	.9567	.005580	.008929	.000609	0.000000	9.051	.028	.002	2.068	1.387	1.069
559	50.000	50.000	6.667	444	1.1146	1.0952	.007813	.011262	.000304	0.000000	9.061	-.060	-.086	2.179	1.390	1.086
560	62.000	50.000	6.667	389	1.0287	1.0130	.004972	.010248	.000507	0.000000	9.056	.007	.039	1.589	1.337	1.032
561	74.000	50.000	6.667	373	1.0017	.9870	.003348	.011161	.000203	0.000000	9.149	-.071	.006	1.598	1.227	1.151
562	-34.000	62.000	6.667	251	1.0866	1.0866	0.000000	0.000000	0.000000	0.000000	9.174	.015	-.099	.998	1.293	.925
563	-22.000	62.000	6.667	267	1.0924	1.0909	.000913	.000609	0.000000	0.000000	9.173	.063	.004	1.151	1.164	1.103
564	-10.000	62.000	6.667	271	1.0548	1.0519	.000609	.001826	.000406	0.000000	9.167	.013	-.038	1.206	1.182	.918
565	2.000	62.000	6.667	306	1.1344	1.1299	.003044	.001522	0.000000	0.000000	9.116	.064	-.002	1.616	1.048	1.032
566	14.000	62.000	6.667	322	1.0980	1.0909	.003856	.003247	0.000000	0.000000	9.150	.064	.019	1.829	1.056	.992
567	26.000	62.000	6.667	321	1.0387	1.0303	.003247	.005073	.000101	0.000000	9.113	-.002	.006	1.940	1.242	1.140
568	38.000	62.000	6.667	338	1.1292	1.1212	.002841	.005073	.000101	0.000000	9.159	.040	-.038	1.589	1.102	1.101
569	50.000	62.000	6.667	352	.9658	.9524	.005682	.006696	.001015	0.000000	9.079	.044	-.058	2.018	1.328	1.265
570	62.000	62.000	6.667	353	1.0547	1.0433	.004058	.007305	0.000000	0.000000	9.114	.032	-.089	1.831	1.196	1.000
571	74.000	62.000	6.667	300	.9055	.8961	.002131	.007102	.000203	0.000000	9.071	-.025	-.013	1.318	1.239	1.134
572	-34.000	74.000	6.667	243	1.0519	1.0519	0.000000	0.000000	0.000000	0.000000	9.218	.026	.074	.860	1.081	.675
573	-22.000	74.000	6.667	212	.8839	.8831	.000101	.000710	0.000000	0.000000	9.167	.083	-.019	.986	.880	1.151
574	-10.000	74.000	6.667	269	1.1011	1.0996	.000507	.000913	.000101	0.000000	9.204	.026	-.037	1.222	1.062	.906
575	2.000	74.000	6.667	257	.9139	.9091	.002435	.002334	0.000000	0.000000	9.131	.043	-.035	1.521	1.011	1.169
576	14.000	74.000	6.667	304	1.1300	1.1255	.002334	.002131	0.000000	0.000000	9.176	.021	.005	1.490	1.102	1.067
577	26.000	74.000	6.667	296	.9897	.9827	.001928	.004972	.000101	0.000000	9.185	.101	-.024	1.616	1.126	1.080
578	38.000	74.000	6.667	265	.9801	.9740	.001218	.004870	0.000000	0.000000	9.193	.077	-.026	1.544	1.090	.990
579	50.000	74.000	6.667	309	1.0248	1.0173	.002942	.004160	.000406	0.000000	9.148	.105	.011	1.602	1.220	1.197

580	62.000	74.000	6.667	329	.9296	.9177	.004769	.006595	.000507	0.000000	9.189	.119	.014	1.927	1.194	1.058
581	74.000	74.000	6.667	314	1.0253	1.0173	.002029	.005985	.000101	0.000000	9.171	.073	.036	1.502	1.299	1.121
582	-34.000	38.000	20.000	231	.9620	.9610	.000203	.000609	.000101	0.000000	9.152	-.018	-.021	1.100	.924	.979
583	-22.000	38.000	20.000	293	1.0528	1.0476	.002537	.002638	0.000000	0.000000	9.168	.064	.013	1.541	1.290	1.014
584	-10.000	38.000	20.000	281	.9374	.9307	.003348	.003348	0.000000	0.000000	9.085	-.021	-.014	1.758	1.033	1.143
585	2.000	38.000	20.000	402	.9497	.9307	.013291	.004363	[illegible]	0.000000	9.045	.017	.034	3.896	1.232	.999
586	14.000	38.000	20.000	404	.8992	.8786	.010653	.009233	[illegible]	0.000000	9.046	.031	.060	3.575	1.254	1.133
587	26.000	38.000	20.000	422	.8799	.8571	.011364	.011262	[illegible]	0.000000	9.152	-.007	.100	3.318	1.373	1.038
588	38.000	38.000	20.000	[illegible]	.8833	.8571	.010146	.015118	.000913	0.000000	9.039	-.022	.074	3.061	1.567	1.329
589	50.000	38.000	20.000	497	.9678	.9394	.010248	.016944	.001218	0.000000	9.100	.047	.171	2.710	1.495	1.169
590	62.000	38.000	20.000	446	.9922	.9697	.007001	.015118	.000406	0.000000	9.128	.003	.076	1.832	1.479	1.250
591	74.000	38.000	20.000	418	1.0147	.9957	.006494	.012480	.000101	0.000000	9.110	-.020	.078	1.606	1.220	1.027
592	-34.000	50.000	20.000	242	1.0223	1.0216	.000101	.000507	0.000000	0.000000	9.237	-.133	-.044	.943	.937	.845
593	-22.000	50.000	20.000	242	.9758	.9740	.000406	.001319	0.000000	0.000000	9.228	-.040	-.000	1.132	[illegible]	1.016
594	-10.000	50.000	20.000	266	.9993	.9957	.001015	.002638	0.000000	0.000000	9.157	-.071	-.001	1.317	1.016	.757
595	2.000	50.000	20.000	310	1.0841	1.0779	.003348	.002739	.000101	0.000000	9.223	.041	-.031	1.666	1.187	1.016
596	14.000	50.000	20.000	334	.9428	.9307	.005479	.006595	0.000000	0.000000	9.148	-.101	-.020	2.012	1.169	.998
597	26.000	50.000	20.000	370	1.1113	1.0996	.004566	.007204	0.000000	0.000000	9.142	.096	-.027	1.978	1.075	.939
598	38.000	50.000	20.000	383	.8717	.8528	.009682	.012886	.000304	0.000000	9.123	-.016	.048	2.042	1.389	1.122
599	50.000	50.000	20.000	403	.9826	.9654	.006696	.010856	.000710	0.000000	9.104	.134	.039	1.983	1.307	.909
600	62.000	50.000	20.000	392	1.0037	.9870	.004769	.011262	.000609	0.000000	9.182	.030	-.003	1.588	1.304	1.092
601	74.000	50.000	20.000	378	1.0022	.9870	.003145	.011972	.000101	0.000000	9.142	.069	.039	1.355	1.217	1.096
602	-34.000	62.000	20.000	226	.9784	.9784	0.000000	0.000000	0.000000	0.000000	9.154	-.068	.046	.997	.780	.983
603	-22.000	62.000	20.000	240	.9967	.9957	.000406	.000609	0.000000	0.000000	9.173	.080	-.058	1.064	.943	1.154
604	-10.000	62.000	20.000	222	.8723	.8701	.000609	.001522	0.000000	0.000000	9.147	-.059	.042	1.197	.927	1.096
605	2.000	62.000	20.000	266	.9824	.9784	.001928	.002131	0.000000	0.000000	9.072	.093	.004	1.433	.968	1.061
606	14.000	62.000	20.000	242	.8658	.8615	.002638	.001725	0.000000	0.000000	9.131	.007	-.041	1.773	1.055	1.031
607	26.000	62.000	20.000	291	.9427	.9351	.003653	.003957	0.000000	0.000000	9.094	.004	.049	1.672	1.088	1.109
608	38.000	62.000	20.000	264	.8300	.8225	.001826	.005682	0.000000	0.000000	9.088	.060	-.024	1.843	1.195	1.020
609	50.000	62.000	20.000	337	.9516	.9394	.002942	.009131	.000101	0.000000	9.028	.039	.058	1.653	1.295	.921
610	62.000	62.000	20.000	316	.8522	.8398	.004769	.007102	.000507	0.000000	9.059	.054	.007	1.628	1.293	1.087
611	74.000	62.000	20.000	339	.9095	.8961	.003044	.010146	.000203	0.000000	9.103	.052	.073	1.392	1.211	1.025
612	-34.000	74.000	20.000	260	1.1255	1.1255	0.000000	0.000000	0.000000	0.000000	9.201	.041	-.003	[illegible]	.952	.980
613	-22.000	74.000	20.000	225	.9613	.9610	0.000000	.000304	0.000000	0.000000	9.176	.009	.021	1.137	.888	1.030
614	-10.000	74.000	20.000	268	1.1306	1.1299	.000101	.000609	0.000000	0.000000	9.229	.061	-.037	1.007	.875	1.003
615	2.000	74.000	20.000	244	.9760	.9740	.000609	.001319	0.000000	0.000000	9.193	-.034	.099	1.178	.955	1.182
616	14.000	74.000	20.000	297	1.0701	1.0649	.002942	.002131	.000101	0.000000	9.194	.031	.003	1.461	1.047	1.000
617	26.000	74.000	20.000	287	[illegible]	1.0130	.002739	.002638	0.000000	0.000000	9.130	.054	.015	1.583	.956	1.232
618	38.000	74.000	20.000	291	1.0230	1.0173	.002131	.003551	0.000000	0.000000	9.188	.008	.047	1.249	1.033	1.004
619	50.000	74.000	20.000	271	.9322	.9264	.002232	.003551	0.000000	0.000000	9.194	.007	.059	1.461	.965	1.108
620	[illegible]	74.000	20.000	316	1.0213	1.0130	.001725	.006392	.000203	0.000000	9.155	.026	.093	1.294	1.188	1.219
621	74.000	74.000	20.000	292	.9216	.9134	.002435	.005783	0.000000	0.000000	[illegible]	.028	.004	1.424	1.179	1.027
622	-34.000	38.000	33.333	211	.9050	.9048	0.000000	.000203	0.000000	0.000000	[illegible]	-.081	.067	1.002	1.028	1.095
623	-22.000	38.000	33.333	231	.9662	.9654	.000101	.000710	0.000000	0.000000	9.266	.006	.002	1.020	1.061	.941
624	-10.000	38.000	33.333	255	.9221	.9177	.002435	.001928	0.000000	0.000000	9.101	-.065	.105	1.463	1.075	1.043
625	2.000	38.000	33.333	324	.9460	.9351	.006088	.004769	.000101	0.000000	9.093	.040	.049	2.067	1.260	1.135
626	14.000	38.000	33.333	331	.9214	.9091	.006291	.005175	.000812	0.000000	9.017	.054	.065	2.483	1.137	1.041
627	26.000	38.000	33.333	394	.9320	.9134	.010248	.008320	0.000000	0.000000	9.079	.064	.075	2.809	1.321	1.116
628	38.000	38.000	33.333	413	.9001	.8788	.009030	.010146	.002131	0.000000	9.084	.068	.019	2.893	1.173	1.216

629	50.000	38.000	33.333	371	.8916	.8745	.005073	.011668	.000406	0.000000	9.142	.006	.054	1.892	1.178	1.293
630	62.000	38.000	33.333	371	.8240	.8052	.005885	.012480	.000406	0.000000	9.107	.0[illegible]7	.014	1.745	1.291	1.381
631	74.000	38.000	33.333	370	.9211	.9046	.004464	.011364	.000507	0.000000	9.222	.008	.010	1.513	1.171	1.276
632	-34.000	50.000	33.333	221	.9567	.9567	0.000000	0.000000	0.000000	0.000000	9.240	-.006	.022	1.062	.964	.905
633	-22.000	50.000	33.333	238	1.0176	1.0173	0.000000	.000304	0.000000	0.000000	9.141	-.057	.026	.878	1.033	1.042
634	-10.000	50.000	33.333	251	.9386	.9351	.001522	.002029	0.000000	0.000000	9.261	-.004	-.059	1.348	1.016	.671
635	2.000	50.000	33.333	298	.9053	.8961	.003754	.004972	.000507	0.000000	9.098	-.023	044	1.689	1.096	1.163
636	14.000	50.000	33.333	289	.9467	.9394	.003551	.003551	.000203	0.000000	9.157	-.052	.079	1.630	1.271	1.029
637	26.000	50.000	33.333	311	.9785	.9697	.003346	.005175	.000304	0.000000	9.223	.046	.002	1.573	1.220	1.208
638	38.000	50.000	33.333	304	.8637	.8528	.003856	.006696	.000304	0.000000	9.111	-.060	-.014	1.737	1.325	1.013
639	50.000	50.000	33.333	364	1.0219	1.0057	.004058	.009233	0.000000	0.000000	9.185	.073	-.047	1.630	1.322	1.048
640	62.000	50.000	33.333	319	.8736	.8615	.003348	.008624	.000203	0.000000	9.099	.036	.014	1.330	1.220	1.098
641	74.000	50.000	33.333	360	1.0765	1.0649	.004058	.007204	.000304	0.000000	9.204	.033	-.013	1.442	1.1[illegible]6	1.099
642	-34.000	62.000	33.333	227	.9827	.9827	0.000000	0.000000	0.000000	0.000000	9.224	-.008	.026	1.019	1.[illegible]2	.927
643	-22.000	62.000	33.333	225	.9656	.9654	0.000000	.000203	0.000000	0.000000	9.1[illegible]	.005	-.063	.817	.927	1.020
644	-10.000	62.000	33.333	237	.9626	.9610	.000507	.001015	0.000000	0.000000	9.236	.003	-.007	1.202	1.016	.947
645	2.000	62.000	33.333	268	1.0629	1.0606	.000710	.001623	0.000000	0.000000	9.196	-.002	-.018	1.209	1.011	1.052
646	14.000	62.000	33.333	241	.8869	.8831	.001522	.002232	0.000000	0.000000	9.196	.110	.065	1.191	.955	1.052
647	26.000	62.000	33.333	320	1.1189	1.1126	.002131	.004160	.000101	0.000000	9.160	-.056	.011	1.529	1.029	.923
648	38.000	62.000	33.333	285	.9336	.9264	.001928	.005175	.000101	0.000000	9.146	.087	-.001	1.433	1.191	1.211
649	50.000	62.000	33.333	318	1.0849	1.0779	.002435	.004566	0.000000	0.000000	9.155	-.046	.022	1.506	1.039	.977
650	62.000	62.000	33.333	331	1.0101	1.0000	.003044	.006899	.000203	0.000000	9.122	.016	-.029	1.396	1.320	1.151
651	74.000	62.000	33.333	299	.9858	.9784	.001928	.005377	.000101	0.000000	9.230	.037	.014	1.302	1.201	1.064
652	-34.000	74.000	33.333	230	.9957	.9957	0.000000	0.000000	0.000000	0.000000	9.147	-.006	.032	1.016	1.232	1.271
653	-22.000	74.000	33.333	211	.8965	.8961	0.000000	.000406	0.000000	0.000000	9.215	.052	-.026	1.032	.861	1.079
654	-10.000	74.000	33.333	235	.9877	.9870	.000101	.000609	0.000000	0.000000	9.093	.020	.061	1.129	1.076	.968
655	2.000	74.000	33.333	229	.9533	.9524	.000101	.000812	0.000000	0.000000	9.236	.003	-.049	1.086	.936	.949
656	14.000	74.000	33.333	233	.9241	.9221	.000609	.001420	0.000000	0.000000	9.125	.008	.084	1.314	1.045	.973
657	26.000	74.000	33.333	262	.9693	.9654	.002232	.001623	.000101	0.000000	9.158	.050	.055	1.460	1.013	1.075
658	38.000	74.000	33.333	255	.9390	.9351	.000609	.003145	.000203	0.000000	9.194	-.049	.024	1.392	1.289	1.066
659	50.000	74.000	33.333	284	1.0307	1.0260	.001725	.003044	0.000000	0.000000	9.218	.050	-.010	1.291	1.073	1.106
660	62.000	74.000	33.333	277	.9370	.9307	.001826	.004160	.000304	0.000000	9.203	-.011	.056	1.563	1.210	1.030
661	74.000	74.000	33.333	292	1.0020	.9957	.001928	.004261	.000101	0.000000	9.175	.071	-.001	1.424	1.191	1.206

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