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        NASA-GLENN CHEMICAL EQUILIBRIUM PROGRAM CEA2, FEBRUARY 5, 2004
                    BY  BONNIE MCBRIDE AND SANFORD GORDON
     REFS: NASA RP-1311, PART I, 1994 AND NASA RP-1311, PART II, 1996

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prob case=12366958 ro equilibrium


 ! iac problem
o/f 4.5
p,psia  500
pip 56.41016312
reac
 fuel  paraffin wt%=100 t,k=298.15
  oxid  N2O wt%=100.  t,k=298.15
output    short
output trace=1e-5
end

             THEORETICAL ROCKET PERFORMANCE ASSUMING EQUILIBRIUM

          COMPOSITION DURING EXPANSION FROM INFINITE AREA COMBUSTOR

Pin =   500.0 PSIA
CASE = 12366958

            REACTANT                    WT FRACTION      ENERGY      TEMP
                                         (SEE NOTE)     KJ/KG-MOL      K
FUEL        paraffin                     1.0000000  -1860600.000    298.150
OXIDANT     N2O                          1.0000000     82050.000    298.150

O/F=    4.50000  %FUEL= 18.181818  R,EQ.RATIO= 2.030784  PHI,EQ.RATIO= 2.030784

                CHAMBER   THROAT     EXIT
Pinf/P            1.0000   1.8051   56.410
P, BAR            34.474   19.098  0.61112
T, K             2833.63  2527.77  1202.23
RHO, KG/CU M    3.3826 0 2.1056 0 1.4188-1
H, KJ/KG          1187.58   619.16 -1594.40
U, KJ/KG           168.44  -287.87 -2025.14
G, KJ/KG        -28388.9 -25764.8 -14142.9
S, KJ/(KG)(K)    10.4376  10.4376  10.4376

M, (1/n)          23.118   23.171   23.207
(dLV/dLP)t      -1.00196 -1.00077 -1.00002
(dLV/dLT)p        1.0395   1.0171   1.0003
Cp, KJ/(KG)(K)    2.0007   1.8292   1.6153
GAMMAs            1.2381   1.2534   1.2852
SON VEL,M/SEC     1123.3   1066.2    744.0
MACH NUMBER        0.000    1.000    3.170

PERFORMANCE PARAMETERS

Ae/At                        1.0000   6.7084
CSTAR, M/SEC                 1535.5   1535.5
CF                           0.6944   1.5361
Ivac, M/SEC                  1916.9   2541.4
Isp, M/SEC                   1066.2   2358.8
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MOLE FRACTIONS

*CO	2.8172-1	2.8039-1	2.4827-1
*CO2	2.4554-2	2.6611-2	5.9196-2
*H	6.2541-3	2.6214-3	1.1671-7
*H2	1.5888-1	1.6251-1	1.9638-1
H2O	9.7497-2	9.6727-2	6.4739-2
NH3	1.1094-5	8.3613-6	6.6345-6
*NO	1.605 -4	3.597 -5	1.800-12
*N2	4.2966-1	4.3072-1	4.3140-1
*O	2.723 -5	3.505 -6	1.884-16
*OH	1.210 -3	3.671 -4	3.820-10

* THERMODYNAMIC PROPERTIES FITTED TO 20000.K

NOTE. WEIGHT FRACTION OF FUEL IN TOTAL FUELS AND OF OXIDANT IN TOTAL OXIDANTS