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NASA-GLENN CHEMICAL EQUILIBRIUM PROGRAM CEA2, MAY 21, 2004  
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 REFS: NASA RP-1311, PART I, 1994 AND NASA RP-1311, PART II, 1996

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problem

rocket fac ac/at=3.0 tcest,k=3800  
 p,bar=100,  
 sup,ae/at=100000,  
 react  
 name=N2H4 moles=2.0 t,k=298.15  
 name=N2O4 moles=1.0 t,k=298,15

WARNING!! LITERAL EXPECTED FOR 15 (INPUT)  
 end

OPTIONS: TP=F HP=F SP=F TV=F UV=F SV=F DETN=F SHOCK=F REFL=F INCD=F  
 RKT=T FROZ=F EQL=T IONS=F SIUNIT=T DEBUGF=F SHKDBG=F DETDBG=F TRNSPT=F

TRACE= 0.00E+00 S/R= 0.000000E+00 H/R= 0.000000E+00 U/R= 0.000000E+00

Pc,BAR = 100.000000

Pc/P =

SUBSONIC AREA RATIOS =

SUPERSONIC AREA RATIOS =100000.0000

NFZ= 1 Mdot/Ac= 0.000000E+00 Ac/At= 3.000000E+00

REACTANT	MOLES	(ENERGY/R),K	TEMP,K	DENSITY
EXPLODED FORMULA				
N: N2H4	2.000000	0.114475E+05	298.15	0.0000
N	2.00000	H	4.00000	
N: N2O4	1.000000	0.133490E+04	298.00	0.0000
N	2.00000	O	4.00000	

SPECIES BEING CONSIDERED IN THIS SYSTEM  
 (CONDENSED PHASE MAY HAVE NAME LISTED SEVERAL TIMES)  
 LAST thermo.inp UPDATE: 9/09/04

g 6/97 *H	g10/01 HNO	tpis89 HNO2
g 5/99 HNO3	g 4/02 HO2	tpis78 *H2
g 8/89 H2O	g 6/99 H2O2	g 5/97 *N
g 4/99 *NH	g 3/01 NH2	tpis89 NH3
tpis89 NH2OH	tpis89 *NO	g 4/99 NO2
j12/64 NO3	tpis78 *N2	g 5/99 N2H2
tpis89 NH2NO2	g 4/99 N2H4	g 4/99 N2O
g 4/99 N2O3	tpis89 N2O4	g 4/99 N2O5
tpis89 N3	g 4/99 N3H	g 5/97 *O

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g 4/02 \*OH                    tpi89 \*O2                    g 8/01 O3  
g11/99 H2O(cr)                g 8/01 H2O(L)                g 8/01 H2O(L)

O/F = 0.000000

ENTHALPY (KG-MOL)(K)/KG	EFFECTIVE FUEL h(2)/R	EFFECTIVE OXIDANT h(1)/R	MIXTURE h0/R
	0.15521852E+03	0.00000000E+00	0.15521852E+03
KG-FORM.WT./KG	bi(2)	bi(1)	b0i
*N	0.38436574E-01	0.00000000E+00	0.38436574E-01
*H	0.51248766E-01	0.00000000E+00	0.51248766E-01
*O	0.25624383E-01	0.00000000E+00	0.25624383E-01

POINT	ITN	T	N	H	O
1	12	3450.932	-12.613	-9.753	-15.254
2	2	3446.214	-12.634	-9.771	-15.270
Pinf/Pt = 1.739576					
3	4	3245.386	-12.789	-10.022	-15.479
Pinf/Pt = 1.738994					
3	2	3245.504	-12.789	-10.022	-15.478
4	2	3438.703	-12.640	-9.780	-15.278
4	2	3437.530	-12.640	-9.781	-15.279
4	2	3437.429	-12.641	-9.781	-15.279
2	2	3448.613	-12.624	-9.762	-15.262
Pinf/Pt = 1.739665					
3	4	3247.337	-12.779	-10.013	-15.470
Pinf/Pt = 1.739089					
3	2	3247.454	-12.779	-10.013	-15.470
4	2	3441.084	-12.629	-9.771	-15.270
4	2	3439.908	-12.630	-9.772	-15.271
4	2	3439.808	-12.630	-9.772	-15.271
END OF CHAMBER ITERATIONS					
4	12	88.627	-20.310	-169.625	-29.454
ADD H2O(cr)					

SINGULAR MATRIX, ITERATION 2 VARIABLE 3(EQLBRM)

4	9	200.001	-18.396	-77.867	-26.096
4	3	207.973	-17.807	-74.000	-27.006

SINGULAR MATRIX, ITERATION 2 VARIABLE 3(EQLBRM)

4	9	207.984	-17.806	-74.747	-25.501
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THEORETICAL ROCKET PERFORMANCE ASSUMING EQUILIBRIUM

COMPOSITION DURING EXPANSION FROM FINITE AREA COMBUSTOR

Pin = 1450.4 PSIA  
Ac/At = 3.0000      Pinj/Pinf = 1.022846  
CASE =

REACTANT	MOLES	ENERGY KJ/KG-MOL	TEMP K
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NAME	N2H4	2.0000000	95180.000	298.150
NAME	N2O4	1.0000000	11099.045	298.000

O/F= 0.00000 %FUEL= 0.000000 R,EQ.RATIO= 1.000000 PHI,EQ.RATIO= 0.000000

	INJECTOR	COMB END	THROAT	EXIT
Pinj/P	1.0000	1.0473	1.7788	10200138.
P, BAR	100.00	95.486	56.217	0.00001
T, K	3450.93	3439.81	3247.45	207.98
RHO, KG/CU M	7.3413 0	7.0345 0	4.4329 0	1.3562-5
H, KJ/KG	1290.57	1258.48	563.31	-6479.63
U, KJ/KG	-71.593	-98.919	-704.87	-6551.92
G, KJ/KG	-39467.7	-39399.1	-37820.7	-8937.95
S, KJ/(KG)(K)	11.8108	11.8197	11.8197	11.8197
M, (1/n)	21.064	21.070	21.291	23.922
MW, MOL WT	21.064	21.070	21.291	22.300
(dLV/dLP)t	-1.02052	-1.02044	-1.01668	-2.17517
(dLV/dLT)p	1.3777	1.3772	1.3268	35.7089
Cp, KJ/(KG)(K)	5.0140	5.0176	4.7480	357.7110
GAMMA <sub>s</sub>	1.1480	1.1478	1.1469	1.0682
SON VEL,M/SEC	1250.5	1248.2	1206.0	277.9
MACH NUMBER	0.000	0.203	1.000	14.186

PERFORMANCE PARAMETERS

Ae/At	3.0001	1.0000	100000.0
CSTAR, M/SEC	1828.7	1828.7	1828.7
CF	0.1385	0.6595	2.1557
Ivac, M/SEC	5611.6	2257.6	3960.5
Isp, M/SEC	253.3	1206.0	3942.1

MOLE FRACTIONS

*H	0.01329	0.01323	0.00987	0.00000
HNO	0.00002	0.00002	0.00001	0.00000
HO2	0.00008	0.00008	0.00005	0.00000
*H2	0.06331	0.06304	0.05366	0.00000
H2O	0.44718	0.44775	0.46858	0.50365
H2O2	0.00002	0.00002	0.00001	0.00000
*N	0.00001	0.00001	0.00001	0.00000
*NH	0.00001	0.00001	0.00000	0.00000
NH2	0.00001	0.00000	0.00000	0.00000
NH3	0.00001	0.00001	0.00000	0.00000
*NO	0.01409	0.01395	0.01107	0.00000
NO2	0.00002	0.00002	0.00001	0.00000
*N2	0.39774	0.39792	0.40362	0.42857
N2O	0.00001	0.00001	0.00000	0.00000
*O	0.00514	0.00511	0.00372	0.00000
*OH	0.04508	0.04483	0.03672	0.00000
*O2	0.01401	0.01401	0.01267	0.00000
H2O(cr)	0.00000	0.00000	0.00000	0.06778

\* THERMODYNAMIC PROPERTIES FITTED TO 20000.K

PRODUCTS WHICH WERE CONSIDERED BUT WHOSE MOLE FRACTIONS

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WERE LESS THAN 5.000000E-06 FOR ALL ASSIGNED CONDITIONS

HNO2	HNO3	NH2OH	NO3	N2H2
NH2NO2	N2H4	N2O3	N2O4	N2O5
N3	N3H	O3	H2O(L)	