FileEditor:junk.out

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

 ******************************************************************************



 problem
     rocket  fac   ac/at=3.0  tcest,k=3800
   p,bar=100,
   sup,ae/at=100000,
 react
   fuel=RP-1 wt=1.0  t,k=298.15
   oxid=O2 wt=3.4  t,k=298.15
 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          WT.FRAC   (ENERGY/R),K   TEMP,K  DENSITY
        EXPLODED FORMULA
 F: RP-1             1.000000  -0.297284E+04   298.15  0.0000
          C  1.00000  H  1.95000
 O: O2               1.000000  -0.154035E-05   298.15  0.0000
          O  2.00000

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

  g 7/97  *C               tpis79  *CH              g 4/02  CH2
  g 4/02  CH3              g11/00  CH2OH            g 7/00  CH3O
  g 8/99  CH4              g 7/00  CH3OH           srd 01  CH3OOH
  tpis79  *CO              g 9/99  *CO2             tpis91  COOH
  tpis91  *C2              g 6/01  C2H             g 1/91  C2H2,acetylene
  g 5/01  C2H2,vinylidene  g 4/02  CH2CO,ketene    g 3/02  O(CH)2O
  srd 01  HO(CO)2OH        g 7/01  C2H3,vinyl      g 6/96  CH3CO,acetyl
  g 1/00  C2H4             g 8/88  C2H4O,ethylen-o  g 8/88  CH3CHO,ethanal
  g 6/00  CH3COOH          srd 01  OHCH2COOH       g 7/00  C2H5
  g 7/00  C2H6             g 8/88  C2H5OH          g 7/00  CH3OCH3
  srd 01  CH3O2CH3         g 8/00  C2O             tpis79  *C3
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n 4/98	C3H3,1-propynl	n 4/98	C3H3,2-propynl	g 2/00	C3H4,allene
g 1/00	C3H4,propyne	g 5/90	C3H4,cyclo-	g 3/01	C3H5,allyl
g 2/00	C3H6,propylene	g 1/00	C3H6,cyclo-	g 6/01	C3H6O,propylox
g 6/97	C3H6O,acetone	g 1/02	C3H6O,propanal	g 7/01	C3H7,n-propyl
g 9/85	C3H7,i-propyl	g 2/00	C3H8	g 2/00	C3H8O,1propanol
g 2/00	C3H8O,2propanol	g 7/88	C3O2	g tpis	*C4
g 7/01	C4H2,butadiyne	g 8/00	C4H4,1,3-cyclo-	n10/92	C4H6,butadiene
n10/93	C4H6,1butyne	n10/93	C4H6,2butyne	g 8/00	C4H6,cyclo-
n 4/88	C4H8,1-butene	n 4/88	C4H8,cis2-buten	n 4/88	C4H8,tr2-butene
n 4/88	C4H8,isobutene	g 8/00	C4H8,cyclo-	g10/00	(CH3COOH)2
n10/84	C4H9,n-butyl	n10/84	C4H9,i-butyl	g 1/93	C4H9,s-butyl
g 1/93	C4H9,t-butyl	g12/00	C4H10,n-butane	g 8/00	C4H10,isobutane
g 8/00	*C5	g 5/90	C5H6,1,3cyclo-	g 1/93	C5H8,cyclo-
n 4/87	C5H10,1-pentene	g 2/01	C5H10,cyclo-	n10/84	C5H11,pentyl
g 1/93	C5H11,t-pentyl	n10/85	C5H12,n-pentane	n10/85	C5H12,i-pentane
n10/85	CH3C(CH3)2CH3	g 2/93	C6H2	g11/00	C6H5,phenyl
g 8/00	C6H5O,phenoxy	g 8/00	C6H6	g 8/00	C6H5OH,phenol
g 1/93	C6H10,cyclo-	n 4/87	C6H12,1-hexene	g 6/90	C6H12,cyclo-
n10/83	C6H13,n-hexyl	g 6/01	C6H14,n-hexane	g 7/01	C7H7,benzyl
g 1/93	C7H8	g12/00	C7H8O,cresol-mx	n 4/87	C7H14,1-heptene
n10/83	C7H15,n-heptyl	n10/85	C7H16,n-heptane	n10/85	C7H16,2-methylh
n 4/89	C8H8,styrene	n10/86	C8H10,ethylbenz	n 4/87	C8H16,1-octene
n10/83	C8H17,n-octyl	n 4/85	C8H18,n-octane	n 4/85	C8H18,isooctane
n10/83	C9H19,n-nonyl	g 3/01	C10H8,naphthale	n10/83	C10H21,n-decyl
g 8/00	C12H9,o-bipheny	g 8/00	C12H10,biphenyl	g 6/97	*H
g 1/01	HCO	g 6/01	HCCO	g 4/02	HO2
tpis78	*H2	g 5/01	HCHO,formaldehy	g 6/01	HCOOH
g 8/89	H2O	g 6/99	H2O2	g 6/01	(HCOOH)2
g 5/97	*O	g 4/02	*OH	tpis89	*O2
g 8/01	O3	n 4/83	C(gr)	n 4/83	C(gr)
n 4/83	C(gr)	g11/99	H2O(cr)	g 8/01	H2O(L)
g 8/01	H2O(L)				

O/F = 3.400000

ENTHALPY (KG-MOL)(K)/KG	EFFECTIVE FUEL h(2)/R	EFFECTIVE OXIDANT h(1)/R	MIXTURE h0/R
	-0.21270751E+03	-0.48137850E-07	-0.48342615E+02

KG-FORM.WT./KG	bi(2)	bi(1)	b0i
*C	0.71550294E-01	0.00000000E+00	0.16261430E-01
*H	0.13952307E+00	0.00000000E+00	0.31709789E-01
*O	0.00000000E+00	0.62502344E-01	0.48297266E-01

POINT	ITN	T	C	H	O
1	22	3787.011	-15.990	-10.188	-14.512
2	2	3779.566	-16.015	-10.205	-14.530
Pinf/Pt = 1.730015					
3	3	3602.620	-16.410	-10.420	-14.721
Pinf/Pt = 1.726676					
3	2	3603.217	-16.408	-10.419	-14.720
4	2	3772.865	-16.029	-10.213	-14.537
4	2	3771.809	-16.032	-10.214	-14.538
4	2	3771.717	-16.032	-10.214	-14.538
2	2	3783.388	-16.002	-10.196	-14.521
Pinf/Pt = 1.730077					
3	3	3606.044	-16.397	-10.411	-14.712

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 Pinf/Pt = 1.726737
   3    2    3606.643     -16.395     -10.410     -14.711
   4    2    3776.672     -16.016     -10.204     -14.528
   4    2    3775.613     -16.018     -10.205     -14.529
   4    2    3775.522     -16.019     -10.205     -14.529
 END OF CHAMBER ITERATIONS
   4   12     468.341     -12.798     -17.340     -63.865
   4    5     708.655     -19.548     -16.709     -42.829
   4    2     705.404     -19.485     -16.715     -43.020
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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 = 1.022588
CASE =

REACTANT		WT FRACTION (SEE NOTE)	ENERGY KJ/KG-MOL	TEMP K
FUEL	RP-1	1.0000000	-24717.700	298.150
OXIDANT	O2	1.0000000	0.000	298.150

O/F=   3.40000 %FUEL= 22.727273 R,EQ.RATIO= 1.001667 PHI,EQ.RATIO= 1.001667

	INJECTOR	COMB END	THROAT	EXIT
Pinj/P	1.0000	1.0467	1.7657	4091556.
P, BAR	100.00	95.536	56.633	0.00002
T, K	3787.01	3775.52	3606.64	705.40
RHO, KG/CU M	8.1212 0	7.7845 0	4.8999 0	1.2975-5
H, KJ/KG	-401.95	-430.62	-1053.38	-9692.25
U, KJ/KG	-1633.30	-1657.87	-2209.19	-9880.62
G, KJ/KG	-40428.5	-40363.2	-39199.8	-17153.1
S, KJ/(KG)(K)	10.5694	10.5767	10.5767	10.5767
M, (1/n)	25.571	25.579	25.945	31.137
(dLV/dLP)t	-1.05486	-1.05482	-1.05178	-1.00000
(dLV/dLT)p	1.9208	1.9231	1.9156	1.0000
Cp, KJ/(KG)(K)	6.9879	7.0137	7.1412	1.4051
GAMMAs	1.1323	1.1320	1.1273	1.2346
SON VEL,M/SEC	1180.8	1178.6	1141.4	482.2
MACH NUMBER	0.000	0.203	1.000	8.938

PERFORMANCE PARAMETERS

Ae/At	3.0001	1.0000	100000.0
CSTAR, M/SEC	1748.5	1748.5	1748.5
CF	0.1370	0.6528	2.4653
Ivac, M/SEC	5364.1	2154.0	4354.2
Isp, M/SEC	239.5	1141.4	4310.5

MOLE FRACTIONS

*CO	0.21326	0.21301	0.20282	0.00026
*CO2	0.20251	0.20289	0.21905	0.50607
COOH	0.00003	0.00003	0.00002	0.00000
*H	0.02090	0.02090	0.01869	0.00000
HCO	0.00002	0.00002	0.00001	0.00000
HO2	0.00040	0.00039	0.00028	0.00000
*H2	0.03749	0.03747	0.03538	0.00225
H2O	0.30847	0.30878	0.32214	0.49142
H2O2	0.00004	0.00004	0.00003	0.00000
*O	0.02895	0.02889	0.02519	0.00000
*OH	0.09752	0.09718	0.08863	0.00000
*O2	0.09042	0.09040	0.08776	0.00000

 * THERMODYNAMIC PROPERTIES FITTED TO 20000.K

   PRODUCTS WHICH WERE CONSIDERED BUT WHOSE MOLE FRACTIONS
   WERE LESS THAN 5.000000E-06 FOR ALL ASSIGNED CONDITIONS

*C	*CH	CH2	CH3	CH2OH
CH3O	CH4	CH3OH	CH3OOH	*C2
C2H	C2H2,acetylene	C2H2,vinylidene	CH2CO,ketene	O(CH)2O
HO(CO)2OH	C2H3,vinyl	CH3CO,acetyl	C2H4	C2H4O,ethylen-o
CH3CHO,ethanal	CH3COOH	OHCH2COOH	C2H5	C2H6
C2H5OH	CH3OCH3	CH3O2CH3	C2O	*C3
C3H3,1-propynl	C3H3,2-propynl	C3H4,allene	C3H4,propyne	C3H4,cyclo-
C3H5,allyl	C3H6,propylene	C3H6,cyclo-	C3H6O,propylox	C3H6O,acetone
C3H6O,propanal	C3H7,n-propyl	C3H7,i-propyl	C3H8	C3H8O,1propanol
C3H8O,2propanol	C3O2	*C4	C4H2,butadiyne	C4H4,1,3-cyclo-
C4H6,butadiene	C4H6,1butyne	C4H6,2butyne	C4H6,cyclo-	C4H8,1-butene
C4H8,cis2-buten	C4H8,tr2-butene	C4H8,isobutene	C4H8,cyclo-	(CH3COOH)2
C4H9,n-butyl	C4H9,i-butyl	C4H9,s-butyl	C4H9,t-butyl	C4H10,n-butane
C4H10,isobutane	*C5	C5H6,1,3cyclo-	C5H8,cyclo-	C5H10,1-pentene
C5H10,cyclo-	C5H11,pentyl	C5H11,t-pentyl	C5H12,n-pentane	C5H12,i-pentane
CH3C(CH3)2CH3	C6H2	C6H5,phenyl	C6H5O,phenoxy	C6H6
C6H5OH,phenol	C6H10,cyclo-	C6H12,1-hexene	C6H12,cyclo-	C6H13,n-hexyl
C6H14,n-hexane	C7H7,benzyl	C7H8	C7H8O,cresol-mx	C7H14,1-heptene
C7H15,n-heptyl	C7H16,n-heptane	C7H16,2-methylh	C8H8,styrene	C8H10,ethylbenz
C8H16,1-octene	C8H17,n-octyl	C8H18,n-octane	C8H18,isooctane	C9H19,n-nonyl
C10H8,naphthale	C10H21,n-decyl	C12H9,o-bipheny	C12H10,biphenyl	HCCO
HCHO,formaldehy	HCOOH	(HCOOH)2	O3	C(gr)
H2O(cr)	H2O(L)			

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