**TIPS ON PEP**

PEP is an equilibrium code that was developed by the Naval Weapons Center at China Lake. PEP stands for propellant equilibrium program.

**Using PEP**

PEP is started by typing *newpep*. Once the program is started, the following will appear.

```
 ************************************************
 *                                              *
 *  June 1989 VAX and PC VERSION OF PEP         *
 *                                              *
 ************************************************

$TYPE IN OUTPUT FILE NAME (DEFAULT: PEPOUT.DAT)
 If you wish to direct to a printer, type in printer name.
 such as "LPT1" for the IBM PC or "LPA0:" for the VAX.
 To send output to screen, type "TT:" (VAX & PC)
```

Here, you should enter in the file name to send the output to (i.e. *output.dat*). If the output is desired to go to the screen, *TT:* should be entered (don't forget the colon).

```
$PROPELLANT TITLE (17 CHAR.)
```

Next, you are prompted for the propellant title. This will be printed at the top of the output file for your reference. Your entry here will not affect the program.

```
$NO. OF CODED ING., NO. OF USER DEFINED ING., AND NO. OF RUNS =
```

PEP then prompts for the number of coded ingredients, number of user defined ingredients, and the number of runs. The number of coded ingredients is the number of ingredients to be used directly from the *PEPCODED.DAT* data file. If the fuel desired is not found in the data file you can enter in your own user defined ingredients. The number of runs specifies the number of different calculations desired. For example, if I was doing a propane-air flame at two different pressures I would enter *2,0,2*.

```
$DENSITY EXPONENT (DEFAULTS TO 1.0) =
```

Enter in *1.0* or press enter.

```
$PROPELLANT TEMPERATURE (DEFAULTS TO 298.0) =
```

Enter in the desired initial temperature.

```
 ENTER THREE VALUES FOR CSUBP FIT
 FIRST VALUE = 0.0 DEFAULTS TO 0.30
```

Enter in *0.,0.,0.*

```
OPTIONS:  1-DELETE EXIT CALCULATIONS
        2-INCLUDE IONIC SPECIES IN CALCULATIONS
        3-INCLUDE BOOST VELOCITIES AND NOZZLE DESIGN DATA
        4-INPUT PRESSURES IN ATMOSPHERES INSTEAD OF PSI
        5-"N" ORDERS OF MAGNITUDE SPECIES PRECISION INCREASE
        6-OUTPUT A LIST OF ALL COMBUSTION SPECIES CONSIDERED
        7-DEBUG OPTIONS
```

```
      8-"P-T-H-S" MAP OPTION
      9-"0"=exact throat calcs  "1"=approximate throat calcs.
      0-"1"=do not normalize weights to 100 gms "0"=normalize
1234567890**PUT 0-NO OR 1-YES UNDER NUMBER (OPT 5 TAKES 0 OR  "N")
```

Next you are prompted to set the desired options. For most calculations, a response of *1000000000* is sufficient. How this works is that the first number is the setting for the first option, the second number is the setting for the second option, etc. An entry of *1* answers yes to the corresponding question. An entry of *0* answers no.

```
READ IN 2 INGREDIENT CODE NUMBERS SEP. BY COMMAS
```

Now it is time to specify which ingredients to use. Here, the ingredient numbers (the line number in the PEPCODED.DAT file) are entered in separated by commas. For example, for propane and air you would enter *1046, 44.*

```
READ IN CHAMBER PRESSURE, EXHAUST PRESSURE, WT1, WT2,  + ETC.
 INCLUDE DECIMAL POINT AND SEPARATE BY COMMAS
 INPUT A ZERO CHAMBER PRESSURE TO ADD INGREDIENTS AGAIN
 INPUT A -1.0 TO END PROGRAM
```

Finally, the program will prompt for the pressure and weight fraction.
An input of *100.0,14.7,12.346,137.4086* indicates pressure of 100.0 atmospheres and weight fractions of 12.346 and 137.4086 for propane and air respectively. Note that the second pressure is only used for nozzle calculations. If only one run was specified, pressing enter will execute the program. If more than one run was specified, press enter and then input the second run information. Once all of the required input has been entered, the program will run and the results printed to the screen or the data file.

**Compiling PEP for different platforms**

Three FORTRAN source files are required to run PEP. These three are *newdsign.f*, *newequil.f*, and *newpep.f*. The three source files are used in creating the executable to run PEP.

To compile, link, and create the executable, a makefile called *newmake* has been set up. Entering *newmake* at the prompt and pressing enter will compile the *newpep* executable file. The *newmake* file contains the following:

*f77 +E1 newdsign.f newpep.f newequil.f -g -o newpep*