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A USER-FRIENDLY MENU-DRIVEN LANGUAGE-FREE LASER CHARACTERISTICS CURVES GRAPHING PROGRAM

by

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The facility for laser researchers and engineers to have available a menu-driven language-free program to be able to graph the interrelationship of the many physical parameters of laser materials is an expressed concern of the Environmental Sensors Branch of the Flight Electronics Division.

The accuracy to which atmospheric composition can be measured is in some part dependent upon the known characteristics of the measuring instruments and the recording and interpretation of the data measured. Unique demands of space-based lasers used for atmospheric remote sensing include long life; high reliability; minimal weight, physical size and electrical energy demands; narrow spectral bandwidth; high output power and temperature insensitivity. In the selection of laser materials to use as active sensors from airborne platforms it is essential that the researcher or engineer know how various factors of the specific material composition interact. Questions such as how does rod size and frequency or absorption relate and how might this be affected by temperature variations must be answered before the material is selected.

The branch has already established a facility that takes collected data and feeds this into mathematical models that generate improved data arrays by correcting for various losses, base line drift, and conversion to unity scaling. This is then stored in a data base of laser materials. The data base contains the physical parameters of laser, nonlinear, and optical materials which are used by the laser models. One section contains ASCII files of absorption spectra, emission spectra, and laser diode emission spectra. The transmission or absorption spectra are acquired on a Perkin-Elmer IR-9 spectrophotometer. The spectra are transferred from the Perkin-Elmer's host computer to an IBM PC where headers are added to the files to identify the contents of the spectra. The emission spectra are acquired on a SPEX monochrometer. The laser diode emission spectra were provided by NASA and Night Vision Labs. This data base is under continuing updating and expansion to include all available laser material regardless of source.

The tabulated section of the data base is divided into several parts: crystalline, optical, mechanical, and thermal properties; absorption and emission spectra information; chemical name and formulas; and miscellaneous.

This summer's project was an extensive revision of the program developed during the 1989 summer fellowship. At that time a

menu-driven language-free graphing program was developed that would reduce and or remove the requirement that all users become competent FORTRAN programmers and concomitant requirement that they also spend several days to a few weeks becoming conversant with the GEOGRAF library and sequence of calls and the continual refreshers of both. It was, and still is, the consensus within the Branch that their time is more important in their specific research specialties.

The work during the 1989 summer included becoming thoroughly conversant or at least very familiar, in the FORTRAN language mode, with the GEOCOMP Corporation's GEOGRAF. GEOGRAF is a FORTRAN callable graphics library that helps plot to screen, printer, or plotter during execution or to a disk file during execution for actual plotting at a later time. In GEOGRAF the programmer instructs the plotter, be it screen, printer, or plotter, with FORTRAN call statements rather than through the symbolic language required by the graphics device. Learning the FORTRAN language, how to actually run each of the subroutines in the GEOGRAF library, and sequence of calls in actually setting up to graph a new set of data would require a large block of time. The 1989 development involved trial runs of the various callable library routines on dummy data then with actual data base files and some additional data from current research that was not in the data base but currently needed graphs. These actual runs provided the knowledge as to which actual subroutines would need to be included in the menu-driven program to provide for graphing all files from the data base. The result was a menu-driven language-free implementation of a program which would require that the user only know how to use microcomputers in order to graph a two dimensional array of data. The user would simply be responding to items displayed on the video screen.

Talking with various researchers, and making special runs on data they had collected directly, it became evident that methods would need to be provided for them graph more than one graph-line on the same chart, to generate a paralleling array of data to serve as the other axis when their data collection system had provided for only one array of data, and to plot parametric data in a meaningful manner. This was all accomplished during the summer of 1990.

The program is now generic in that it will take any data file whether in the data base or not and plot it for the user with him/her responding to a few simple yes/no or provide a selection or number questions. The program generates the format for the data read statement if it is not contained in the file header and the user who do not know how to write them.

There are several areas that need additional investigation. One includes the possibility of plotting only segments of the data file when the users sees need for an enlargement of specific areas such as emission and absorption spectra. A second would be plotting from two or more files on the same plot. And a third would be to investigate the possibility of loading these onto a host computer for the Division or even Center wide use.