U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF SYSTEMS DEVELOPMENT
TECHNIQUES DEVELOPMENT LABORATORY

TDL OFFICE NOTE 89-3

WIND PROFILER
APPLICATIONS SOFTWARE DEVELOPMENT PLAN

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May 1989

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1. INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) plans to implement a Wind Profiler Demonstration Network (WPDN) in the central United States. The first prototype profiler was installed in Platteville, Colorado in September 1988 for testing of hardware, meteorological performance, and satellite interference. Deployment of the remainder of this 30-station network of Doppler radar wind profilers is scheduled to start in 1989, and to be completed in 1990. The profilers will provide data at 6-minute intervals; however, for initial use on the Automation of Field Operations and Services (AFOS) system, these data will be averaged to produce hourly average wind components.

The National Weather Service (NWS) plans to begin integrating the wind profiler data into its normal operations. The NWS Wind Profiler Assessment Plan requires applications programs on AFOS to provide a means for the Weather Service Forecast Offices (WSFO's) and some Weather Service Offices (WSO's) to display profiler winds and derived products. This profiler information will be assessed by the field forecasters to determine the value of the new data, either alone or integrated with existing data, for interpreting weather events and preparing forecasts. While it has been demonstrated that new information can be derived from the profiler, the adequacy, quality, and utility of this information in meeting operational needs is yet to be determined.

General Sciences Corporation (GSC) is providing the Techniques Development Laboratory (TDL) of the NWS with support to develop applications software on its AFOS system for the display of wind profiler data and derived products. This applications software development plan was prepared to describe the proposed software system.

Meteorological techniques and applications programs have been collected in order to identify those programs which are related to the analysis of wind profiler data. These techniques have been reviewed and evaluated to determine whether they meet NWS requirements. Existing software has been evaluated to determine whether it will be more cost-effective to modify that software or to develop new software. During the development process, these techniques and programs will be examined in much greater detail before modifying or adapting them for use.

Existing software on AFOS and at other facilities is being reviewed to evaluate its usefulness in meeting NWS needs for displaying profiler data. Relevant AFOS applications are being identified, studied, and tested to determine how they can be best applied to develop profiler products. Applications developed by researchers at universities and government agencies are also potential sources of such software.

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[1] General Sciences Corporation, under contract to the National Weather Service.

This plan, which describes the proposed software system in detail, has been approved by the NWS Office of Meteorology (OM). In addition, specifications have been prepared for each of the subsystems corresponding to the broad categories of time sections, plan views, and cross sections, which represent the major types of displays being proposed. These plans will discuss the products to be developed and their characteristics. Each specification was written in Advanced Weather Interactive Processing System for the 1990s (AWIPS-90) specification format, but with additional functional details. It is expected that many of the techniques described in the specifications will eventually be used in the AWIPS-90 era. The following procedure is being applied in developing a detailed plan and preparing the software for each application program:

1. Prepare specifications according to the format being used for AWIPS-90 applications. The specifications will consist of these items:

   Requirements
   Description
   Algorithms
   Performance requirements
   Input
   Output
   Working/Related Code
   Documentation
   References

2. Obtain reviews and approval of the specifications.

3. Commence development of the applications software and periodically present design reviews to TDL and OM.

4. Test and evaluate final product. This test will include an Integrated Test Bed (ITB) AFOS test, if possible, and a full field test at one or more WSFO's. Discuss adequacy of final product with OM.

5. Prepare documentation.

6. Revise programs based on local and field test results.

2. SOFTWARE DESIGN

This profiler applications software plan incorporates a mix of automated and interactive procedures in the generation of meteorological products. The plan specifies that any WSFO or WSO will have the capability to individually perform the processes to produce the meteorological profiler displays. The processes will allow manual interaction for initial product selection and for later changes. Once initialized, the entire procedure may be scheduled to run automatically each hour as new profiler data are received. This procedure will retain original profiler messages, and develop intermediate data files containing raw wind profiler data and intermediate parameter files of meteorological values derived from the raw wind profiler data. These parameter files will contain all of the necessary information from which the meteorological profiler products can be composed. The meteorological variables needed for plotting or by objective analysis and contouring routines will be computed from information in the parameter files. The composition may be performed automatically according to preset selections. The display of a product will be done by retrieving the

AFOS product via the standard AFOS commands currently in use. Upon command, the display will be a plan view, a time section, or a cross section. Plan view products especially, and cross sections to a lesser extent, will lend themselves to more effective interpretation through animation. Existing AFOS programs can be used to create loops of these products.

New software will be structured to incorporate the following design features wherever applicable:

1. Modularity. The software will be partitioned into functional segments, allowing the logic of each segment to be apparent.

2. Documentation. The internal and external documentation will be clear, accurate, and complete.

3. Readability. The software will be designed so that its structure is apparent to the user. Variable names will be chosen to be descriptive of the data they represent. Similarly, emphasis will be placed on good comments within the code placed strategically for clarity. Statement numbers will be assigned in numerical order.

4. Transportability. Emphasis will be placed on reducing the amount of machine-dependent code. Machine-dependent code will be isolated from the body of the program as much as possible.

5. Error-handling. Whenever possible, the software will check for invalid input.

6. Conformance to standards. The software will be coded and documented in such a manner as to conform to AFOS standards.

Each office will have the same complete set of AFOS software. Because the total number of proposed graphics is quite large, no individual site will be able to routinely produce all of them each hour, and some of the products may never be produced at some of the sites. However, a division of labor between the WSFO's and WSO's may represent a more efficient use of time and resources in producing all of the desired products, and this can be worked out by each area manager. For example, it may be best for the WSFO to produce the cross section products, while one WSO produces the plan view products and another produces the time section products. Since AFOS provides a manner to transfer products from one station to another, the work load may be shared among WSFO's and WSO's.

Additionally, the applications software may be run in a manual mode, which may be desirable if only a few products are requested.

A. Characteristics of the Proposed Products

The products to be developed will possess the following characteristics:

Visually Informative

The products will be prepared for display in an easily read and readily comprehended format to assist in quickly recognizing developing patterns. The product will be clearly identified for content, time, altitude, and location where applicable.

Valuable to Field Operations

The products will be developed with consideration to their value to the forecasters. Data displays which are currently believed to contain the most important information to forecasters will be allotted a higher development priority. This also means that some refinements, such as multiple smoothing passes, which are important to researchers may be omitted from these products, if the improvement to the visual display is nearly transparent.

Wind profiler information will be prepared for display in the operational environment for short-term, local forecasts and services at field offices. Also, the data will be displayed in such a manner as to complement data from other weather observing systems, when possible. The information from wind profilers will help to improve NWS operational forecasts and services.

Efficient

Because of the wealth of information that can be derived from wind profilers, and the frequency with which the profiler data will be received in the operational environment, evaluations have been made to estimate the relative importance of the following items in order to decide upon the most efficient products to be developed. Judgments concerning which products provide the most useful data, how much detail and accuracy needs to be incorporated into each product, and how much computer time and storage will be needed to generate each product were considered in this evaluation and may need to be revised as product development takes place.

B. Processes for the Generation of Meteorological Product Displays

The processes listed below and shown in Fig. 1 will be used to generate the meteorological product displays:

- System Organization
- Data acquisition
- Data file preparation
- Parameter derivation and analysis
- Significant wind forecaster alert
- Meteorological products composition
- Product transfer
- Storage and display

Prior to installation of the profiler software system, the user must set up the AFOS database to store the new incoming data and products and to specify the number of versions to retain and the associated map background, if any. The AFOS preformat screen input parameters may also be selected at this time (see Figs. 2 through 4).

The processes are discussed in the following sections.

System Organization

In order to execute programs in automatic (batch) mode, the user will edit an AFOS preformat screen to select the products he/she wishes to generate and the options for each of these products (see Figs. 2 through 4). The u, v, and w plots represent actual measurements, while the remaining products are calculated from these data. The options include station selection, height interval, time interval, and contour interval to be plotted. In order to execute programs manually, the user needs to set the appropriate switches in the command line to select the products and options.

The output files resulting from the preformat screen will contain the selected stations and options, and will be used as input to the data processing programs. Each station will be able to save several versions of this output file, each with a different set of options. This should eliminate the need to make frequent changes to the control file. This is especially important for time section plots, where only a few sets of options will probably ever be selected. Cross section plots, however, may need to be changed more frequently than time section plots in order to adequately depict the phenomena of concern.

Acquisition

AFOS software will store incoming binary profiler data in the database. The most recent 24 versions will be saved, with the oldest version being dropped when the new product is acquired. Each version represents an hour of data.

Data File Preparation

Because the hourly profiler data received on the AFOS loop are not in a format easily accessed by applications software, applications data files will be created. The files will be created in three formats, one for each type of display product as depicted in Fig. 1. The time section files will be organized by station in such a manner that all the hours, and then all the levels for each hour are in sequence for each station. A maximum of 24 hours of data for each of 10 stations is proposed in order to keep the files to a reasonable size. In order to generate a time series plot, information for the same stations needs to be collected for an extended number of hours. The cross section files are organized in the same manner; however, only one hour of information will be maintained in the file for all the profilers. This organization allows the user to change cross sections as needed. These choices seem reasonable since forecasters may wish to choose their cross sections to bisect a meteorological feature which is progressing each hour, whereas the time section plots are likely to be chosen to watch evolving conditions in the forecast area.

The plan view plots will display information for the entire network. Therefore, the data are most efficiently organized by hour, so that all of the stations and all of the selected levels for each station are in sequence for each hour. Six hours of data will be maintained in this file, so that time difference fields can be calculated readily. The data included in all of these files are the same: station information; time of observation; surface data; u, v, and w wind components; quality control flags; spectral moment data; and the calculated wind direction and wind speed. Wind direction and wind speed are the only calculated variables which will appear in these files; the frequency of their use will be very large.

Parameter Derivation and Analysis

In addition to wind direction and wind speed, several additional parameters may need to be calculated, depending on which products and options have been chosen during the scheduling phase. From the u, v, w, wind direction, and wind speed values stored in the file, and the control file of options, the following variables may be calculated: vorticity, divergence, vertical velocity, thermal wind velocity, wind direction and wind speed shear, and the perturbation wind. The kinematic variables vorticity, divergence, and vertical velocity will be developed on two scales: a local scale based on a triangle of stations for the time sections, and a network scale for plan view and cross section products.

The u and v components of the wind which have passed all the quality control checks will be objectively analyzed to develop grid files. Then, the derived products will be calculated from values at grid points, and plots will be developed for each of the products. Where required, the data will then be smoothed and contoured, and streamlines will be drawn for the wind velocity data. The purpose of objectively analyzing the u and v components of the wind is that gridded data fields are required input for most computer contour routines.

Significant Wind Forecaster Alert

The incoming wind profiler data will be monitored for features which will alert the forecasters to unusual wind conditions that may be dangerous to life or property. Examples of these conditions may be wind speeds at certain levels which exceed threshold values, an hourly increase in wind speed which exceeds a certain value, or wind direction or wind speed shear with height which exceeds a threshold value. The forecaster will be able to select the stations, the altitude, and the limits of the wind products to be monitored. When conditions warrant, a message file will be updated by the programs which process the data. At the end of the processing, an AFOS product will be created containing all the messages. Depending upon the characteristics of the file established by each office, these messages may be displayed on the screen alerting the operator to the significant conditions. The AFOS product will be transferred to other offices during the product transfer process. Upon receipt at the forecast office, an audible or visual AFOS alert containing all the messages may be generated, depending upon the characteristics of this product file established at the receiving office.

Meteorological Products Composition

To display the data, AFOS graphics products will be created. AFOS products have the dual advantage of convenient display (a 3- or 6-character code is normally all that is needed to display a product), and convenient transfer by using existing AFOS software.

Product Transfer

This process is necessary only when products are not generated locally, and therefore need to be distributed to other offices. Stations receiving the products can be alerted that the products have been transferred if AFOS product alert features have been set.

Storage and Display

The final products, whether generated locally or generated remotely and then transferred, will be stored on the AFOS database. Therefore, the AFOS product can be displayed by keying in the appropriate 9-character identification for the AFOS graphics product. In many instances, preexisting AFOS conventions will allow a 9-character product to be displayed with a 3- or 6-character code. Procedures may be developed to assist in the display. Macros can be written to simplify animated display of products using AFOS applications LOOP, AUTOLOOP, and ANIMATE.

3. PRODUCT DESCRIPTION

The categories of products planned for development are time sections, cross sections, plan views, and significant wind forecaster alert. They are discussed below:

A. Time Section Plots

Time section backgrounds are labeled graphs of height and corresponding standard atmospheric pressure on the y-axis versus time on the x-axis. Time section background borders will be generated internally by the programs, since there needs to be a different scale for each combination of height and time selection. Therefore, these will have no assigned AFOS map background.

Time series plots of profiler wind data are useful to the meteorologist because they provide a display of the vertical structure of the wind with good temporal resolution. These plots may reveal correlations between small waves in the middle troposphere and the initiation of convection.

The background displays will be designed to provide the user with several options and features:

1. User-selectable altitude range in thousands of feet above mean sea level. The corresponding standard pressure levels (mb) will also be plotted.
2. User-selectable time/date window.
3. Station selection.
4. Labels for the station(s), time, and date.

The time section meteorological products being considered for development are:

1. Single station
   a. Horizontal wind velocity (wind symbols).
   b. Horizontal wind speed (isopleths).
   c. U, v, and w wind components (isopleths).
   d. Thermal wind (wind symbols).
   e. Perturbation wind (wind symbols).
   f. Wind shear (direction and speed) (isopleths).
   g. Spectral peak power (isopleths).

2. Multiple stations
   a. Relative vorticity from triangular site measurements (isopleths).
   b. Horizontal divergence from triangular site measurements (isopleths).
   c. Vertical velocity from triangular site measurements (isopleths).

Single station horizontal wind velocity products will use conventional wind symbols to display the winds at selected altitudes above the site. One plot for each selected station will be generated. Scalar wind speeds; u, v, and w components; wind direction and wind speed shear; and spectral peak power will also be contoured on separate displays. A time-height series of horizontal winds provides a wide range of meteorological information and is a basic tool in weather analysis. The horizontal winds show slopes of weather systems, sub-synoptic scale circulations, vertical extent of air masses, and air mass advection. Wind shears can be readily detected which helps to define the jet stream. Isopleths of spectral peak power indicate the strength of the returned signal. Higher values indicate the presence of more atmospheric scattering agents, which implies that the data are more reliable. Moreover, stronger signals are positively correlated with greater moisture, and this indicator may be useful as a forecast tool. These products will probably be among the most used of profiler products.

Conventional wind symbols will be used to display thermal wind, wind shear, and perturbation winds at all altitudes above the site. One plot for each selected station will be generated. These winds provide information on frontal passages, and temperature advection.

On separate displays, time sections of vorticity, divergence, and vertical wind speed will be shown, based on a triangle of stations at all altitudes above the centroid of the triangle. Each set of stations will be shown separately. Some features of the dynamics of the atmosphere are explained by these kinematic properties. Persistent surface convergence, upper-level divergence, mid-level positive vorticity advection, and rising motion through a vertical atmospheric column will result in atmospheric destabilization and probably clouds and precipitation.

B. Cross Section Plots

Cross section backgrounds are labeled graphs of height and corresponding standard atmospheric pressure on the y-axis versus horizontal distance on the x-axis. Cross section background borders will be generated internally by the programs, since there needs to be a different scale for each combination of height and distance selection. Therefore, these will have no assigned AFOS map background.

Cross section plots of profiler wind data provide a display of the vertical and horizontal structure of the wind over a selected area.

The background displays will be designed to provide the user with a wide range of options and features:

1. User-selectable altitude range in thousands of feet above mean sea level. The corresponding standard pressure levels will also be plotted.
2. User-selectable time.
3. Station selection.
4. Labels for the stations, time, and date.

The cross section meteorological products being considered for development are:

1. Horizontal wind velocity (wind symbols).
2. Orthogonal and parallel wind components (isopleths).
3. Thermal wind (wind symbols).
4. Spectral peak power (isopleths).
5. Vertical wind speed (isopleths).

Conventional wind symbols will be used on cross sections of horizontal winds and the thermal wind to show the winds of selected stations at selected altitudes. The stations need to be roughly the same distance apart in a linear arrangement. Displays containing different sets of stations may also be selected. The horizontal winds as a cross section product provide a wide range of meteorological information. The distribution of the winds shows the slopes of weather systems, sub-synoptic scale circulations, vertical extent of air masses, and air mass advection. The jet stream can also be depicted.

The thermal wind plots provide information on frontal passages and thermal advection. Contoured plots of spectral power may indicate the distribution of moisture in the region of concern and the reliability of the data. On separate displays, orthogonal and parallel components of the wind with respect to the plane of the cross section will appear at all altitudes for all stations. These products should provide a great deal of information concerning areas of convergence, air mass advection, vertical depth of air masses, fronts, and locations of jet streams.

C. Plan View Plots

Plan view background maps are polar stereographic projections of the profiler area, showing state boundaries. Plan view plots of the profiler wind data show the horizontal structure of the wind at various atmospheric levels. Recent plots are useful to the meteorologist because they indicate synoptic and sub-synoptic scale features over a region of interest.

Existing map backgrounds will be used in order to be consistent with National Meteorological Center products with which they may be compared. The background displays will provide the user with a wide range of options and features:

1. User-selectable altitudes corresponding to standard pressure levels.
2. User-selectable time.
3. Labels for the level, time, and date.
4. Animation.

The meteorological products being considered for development are listed below. By taking advantage of AFOS software, as many as three products with the same map background may be combined into one display.

1. Horizontal wind velocity (wind symbols).
2. Streamlines.
3. Horizontal wind speed (isopleths).
4. Thermal wind (wind symbols).
5. Relative vorticity (isopleths).
6. Horizontal divergence (isopleths).
7. Vertical velocity (isopleths).
8. Fields indicating differences in time of products (5) through (7) (iso pleths).
9. Fields indicating differences in time of u, v, and w wind components (isopleths).
10. Spectral peak power (isopleths).

Horizontal winds at all stations in the network will be used to show horizontal wind velocity or streamlines at selected altitudes. Each selected altitude will be plotted onto a separate display for velocity or streamlines. Scalar wind speeds; u, v, and w components; and returned power will also be plotted and optionally contoured on separate displays. These plan view products provide a wide range of meteorological information indicating the locations of troughs and ridges, short wave patterns, mesoscale circulations, high level jet, low level jet, and horizontal shear. Multiple levels provide information of the vertical extent of systems. AFOS sites should save several versions to allow for animation.

Conventional wind symbols will be used to display the thermal wind at a selected altitude above the sites. Each selected altitude will be plotted separately. These winds provide information on frontal, ridge, and trough passages, and temperature advection. The user will select the levels surrounding the altitude from which to generate the thermal wind.

Vorticity, divergence, and vertical velocity will be shown on separate displays for all stations in the network at selected altitudes. One plot will be generated for each parameter and altitude. These kinematic properties provide a great deal of information concerning the horizontal and vertical dynamics of the atmosphere. Atmospheric instability and precipitation will be found where there is surface convergence, upper-level divergence, increasing positive vorticity advection with height, and rising vertical motion through this vertical atmospheric column.

On separate displays, changes over a user-selected time interval of the values of the derived wind field products (divergence, vorticity, and vertical velocity) from all of the network stations at selected altitudes will be shown. One plot will be generated for each altitude. Intensification and movement of storms may be portrayed on maps of time differences of these kinematic properties.

Changes over a user-selected time interval of the values of u, v, and w wind components from all of the network stations at selected altitudes will be depicted on separate displays. Each selected altitude will be depicted separately. Changes in the slopes of weather systems, movements of minor scale circulations, changes in the vertical extent of air masses, and air mass advection can be detected.

Isopleths of returned power indicate not only the strength and reliability of the measured winds, but are also positively correlated with moisture. Other factors such as turbulent eddies also play an important role. In this manner, returned power plots may be able to assist in precipitation forecasts.

D. Significant Wind Forecaster Alert

Significant wind forecaster alerts are message files containing worded reports, drawing attention to unusual wind conditions. These automated alerts will call attention to the forecaster of a significant change in the winds above the selected sites. This product will incorporate sufficient flexibility to allow the forecaster to select stations and altitudes to be monitored and set significant wind speed and wind shear limits. It will provide constant monitoring of incoming reports and assure that significant events are not overlooked. The product will free the forecaster to attend to other tasks, while providing an automatic alert when attention is needed.

4. TIME SCHEDULE FOR PRODUCT DEVELOPMENT

The schedule for the development of the applications software is responsive both to the forecaster needs to develop the most important products first, and to the order in which data becomes available to the AFOS system from the profiler network (see Fig. 5).

Time section displays will receive first consideration because these products are based on data from a single site. These products will be useful from the initial stages of the profiler network. Plan view and cross section products will not be very useful until several of the profilers have been installed, since plan views and cross sections span the entire network. Therefore, the software development of these products will not take place until after the time section products have been developed, as shown in Fig. 5.

5. IMPLEMENTATION

The objective of the implementation of the applications programs at the WSFO's will be to support NWS assessment activities, which are primarily to understand the ways in which profiler data may be used to improve operational forecasts and services, and to determine the profiler characteristics required for a fully operational network. After the time section programs have been designed and developed, and if possible, tested and approved by ITB personnel, they will be installed and tested in the field at WSFO's. A system description and user's guide will accompany each application implemented, and the forecasters will be trained in using these programs.

The forecasters will be given the opportunity to evaluate these programs in terms of ease of implementation, run time, meteorological content, and accuracy of display. Their comments will be evaluated and discussed to determine what modifications need to be made to the time section subsystem, including any procedures which need to be established to make the software more user-friendly. After the modifications have been made, a new field test will be carried out before disseminating the programs to the other interested field sites. A similar implementation schedule will be followed upon completion of the plan view and cross section subsystems.

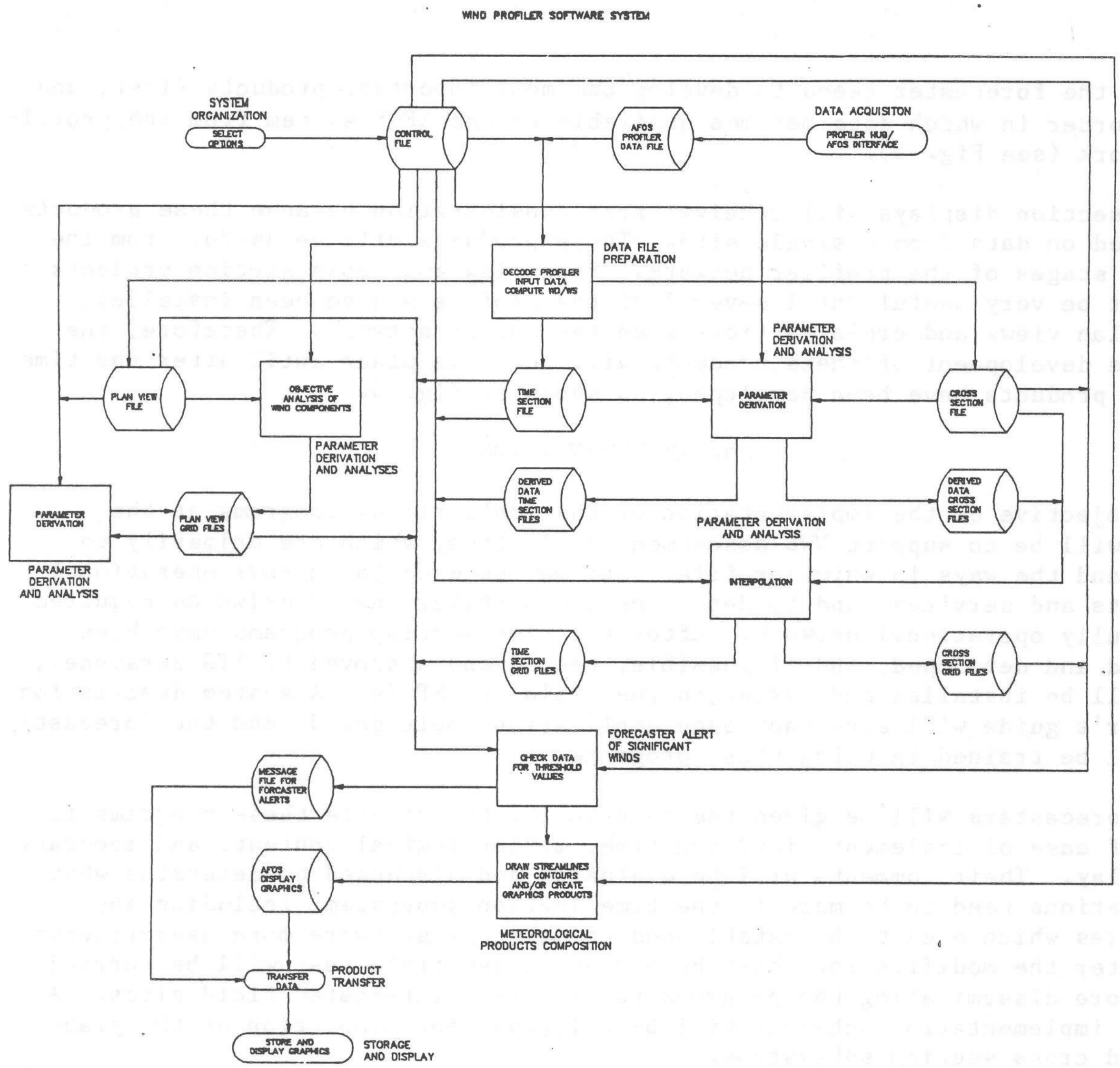

Figure 1. Wind profiler software flow chart diagram indicating the software processes and data files accessed for each step in the system.

```
TDLMCP009
TTAA00 KTDL 211037
                    TIME SECTION AND WIND ALERT THRESHOLD MENU
PRODUCTS                STA  LOWER HT  HOURS   CONTOUR  ALERT      FLAGGED  HEIGHT
                              (FT*1000) #   END  INTERVAL THRESHOLD  DATA?   INTERVAL
HORIZONTAL WIND         [ ]     [  ]  [  ]  [  ]                      [ ]     (M*10)
HORIZONTAL SPEED        [ ]     [  ]  [  ]  [  ] [    ]A  [    ]G
THERMAL WIND            [ ]     [  ]  [  ]  [  ]                             [   ]E
WIND SPEED SHEAR        [ ]     [  ]  [  ]  [  ] [    ]A  [    ]D            [   ]E
WIND DIRECTION SHEAR    [ ]     [  ]  [  ]  [  ] [    ]I                     [   ]E
U/V-WIND COMPONENTS     [ ]     [  ]  [  ]  [  ] [    ]A           KINEMATIC STATION
W-WIND COMPONENT        [ ]     [  ]  [  ]  [  ] [    ]B  [    ]H     SELECTIONS
PERTURBATION WIND       [ ]     [  ]  [  ]  [  ]
RETURNED POWER          [ ]     [  ]  [  ]  [  ] [    ]F           [W]=[   ,   ,   ]
DERIVED DIVERGENCE      [    ] [  ]  [  ]  [  ] [    ]C           [X]=[   ,   ,   ]
DERIVED VERT. VEL.      [    ] [  ]  [  ]  [  ] [    ]B           [Y]=[   ,   ,   ]
DERIVED VORTICITY       [    ] [  ]  [  ]  [  ] [    ]C           [Z]=[   ,   ,   ]
  DEFAULTS: STA - NONE; HEIGHTS - ALL; HOURS - 16 TO PRESENT; FLAGGED DATA? - Y
A - 10 KT          F - 10 DB                 STATION SELECTIONS
B - 2 CM/S         G - 100 KT    [1]=[   ,   ,   ,   ,   ,   ,   ,   ,   ]
C - .00002 RAD/S   H - 10 CM/S   [2]=[   ,   ,   ,   ,   ,   ,   ,   ,   ]
D - 25 KT/250 M    I - 20 DEG    [3]=[   ,   ,   ,   ,   ,   ,   ,   ,   ]
E - 1000 M BETWEEN LAYERS        [4]=[   ,   ,   ,   ,   ,   ,   ,   ,   ]  [ ]
```

Figure 2. The preformat to be used in specifying options for time sections and wind alert thresholds. Two kinds of output result from the use of this screen -- user selections which control the generation of time section products, and user selections which control the parameters and threshold values used in the generation of forecaster alerts.

```
                              CROSS SECTION MENU
PRODUCTS                    STATION  LOWER HT  HOUR    CONTOUR   FLAGGED   HEIGHT
                             GROUPS (FT*1000)          INTERVAL   DATA?   INTERVAL
HORIZONTAL WIND             [      ]  [   ]   [   ]              [ ]       (M*10)
ORTHOGONAL COMPONENTS       [      ]  [   ]   [   ]  [     ]A
W-WIND COMPONENT            [      ]  [   ]   [   ]  [     ]B
THERMAL WIND                [      ]  [   ]   [   ]                        [    ]C
RETURNED POWER              [      ]  [   ]   [   ]  [     ]D
  DEFAULTS: STATIONS - NONE; HEIGHTS - ALL; HOUR - CURRENT; FLAGGED DATA? - Y
  A - 10 KT                                    STATION SELECTIONS
  B - 2 CM/S                         [W]=[   ,   ,   ,   ,   ,   ,   ,   ]
  C - 1000 M BETWEEN LAYERS          [X]=[   ,   ,   ,   ,   ,   ,   ,   ]
  D - 10 DB                          [Y]=[   ,   ,   ,   ,   ,   ,   ,   ]
                                     [Z]=[   ,   ,   ,   ,   ,   ,   ,   ]
```

Figure 3. The preformat to be used in specifying options for cross sections. The output from this screen will be the user selections which control the generation of cross section products.

```
                                          PLAN VIEW MENU
PRODUCTS                  PRESSURE  HOUR     #HOURS    CONTOUR   FLAGGED  HEIGHT
                           LEVELS             DIFF     INTERVAL   DATA?  INTERVAL
HORIZONTAL WIND             [ ]     [   ]                          [ ]    (M*10)
HORIZONTAL SPEED            [ ]     [   ]              [    ]A
W-WIND COMPONENT            [ ]     [   ]              [    ]B
STREAMLINES                 [ ]     [   ]
DERIVED VORTICITY           [ ]     [   ]              [    ]D
DERIVED DIVERGENCE          [ ]     [   ]              [    ]D
DERIVED VERT. VEL.          [ ]     [   ]              [    ]B
THERMAL WIND                [ ]     [   ]                                 [    ]E
TIME DIFF OF U-WIND         [ ]     [   ]   [   ]      [    ]A
TIME DIFF OF V-WIND         [ ]     [   ]   [   ]      [    ]A
TIME DIFF OF W-WIND         [ ]     [   ]   [   ]      [    ]B
TIME DIFF OF DIV.           [ ]     [   ]   [   ]      [    ]D
TIME DIFF OF VORT.          [ ]     [   ]   [   ]      [    ]D
RETURNED POWER              [ ]     [   ]   [   ]      [    ]C
  DEFAULTS: HEIGHTS - STD; HOUR - CURRENT; #HOURS DIFF - 3; FLAGGED DATA? - Y
A - 10 KT                                 PRESSURE LEVEL SELECTIONS
B - 2 CM/S                          [1]=[   ,   ,   ,   ,   ,   ,   ]
C - 10 DB                           [2]=[   ,   ,   ,   ,   ,   ,   ]
D - .00002 RAD/S                    [3]=[   ,   ,   ,   ,   ,   ,   ]
E - 1000 M BETWEEN LAYERS           [4]=[   ,   ,   ,   ,   ,   ,   ]          [ ]
```

Figure 4. The preformat to be used in specifying options for plan views. The output from this screen will be the user selections which control the generation of plan view products.

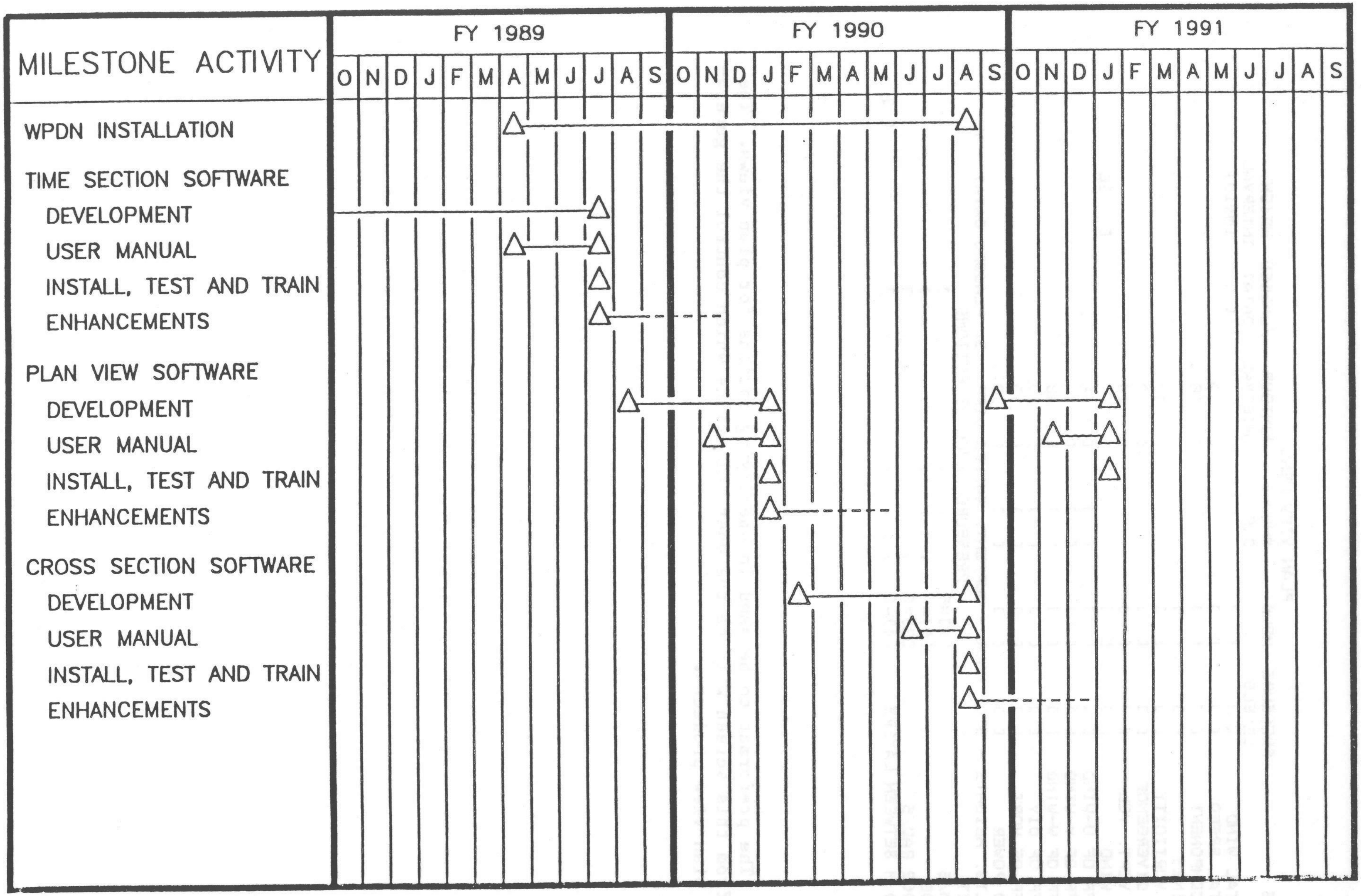

Figure 5. Wind profiler software system schedule indicating the activities and time periods required to complete the activity.

DEPARTMENT OF COMMERCE
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