



## **TERMS OF REFERENCE FOR THE SUPPLY, DELIVERY, INSTALLATION, TRAINING AND COMMISSIONING OF ONE (1) LOT UPGRADING OF INTERACTIVE DATA PROCESSING SYSTEM AT WFFC BUILDING**

### **A. BACKGROUND**

In line with the Modernization Project of PAGASA, the automation of meteorological collection and dissemination of weather data and other weather-related information is one of the aspects to be enhanced due to ever growing amount of meteorological data and products, available from a wide variety of sources and in different formats: surface and upper-air observations, numerical weather predictions (models), satellite and radar imagery, forecasts. The challenge is to add value to this amount of meteorological information by bringing it to the end-users and end-customers, inside and outside the premises of PAGASA.

Automatic Message Switching System (AMSS) is the heart of meteorological telecommunication, the main functions are to receive, check and forward automatically, the meteorological data and products according to the WMO standards. Under the modernization, the availability of timely weather data, images and graphics is critical for effective weather forecasting that needs to be addressed. The system is capable of automatic message reception and distributions switch all types of data products and image type products and connect to all type of subscribers.

### **B. APPROVED BUDGET FOR THE CONTRACT (ABC)**

The Approved Budget for the Contract is **SEVENTY FIVE Million Pesos (PhP 75,000,000.00)** inclusive of VAT and all applicable government taxes.

### **C. QUALIFICATIONS OF THE BIDDER**

(Please refer to Section II. Instructions to Bidders, the Bid Data Sheet and Checklist of Eligibility and Technical Requirements of the Bidding Documents)

### **D. DELIVERY PERIOD AND PLACE OF DELIVERY**

The winning bidder shall supply and deliver the set of equipment (120 c.d.) calendar days from receipt of the Purchase Order (PO) at the PAGASA Central Office located at PAGASA Science Garden Complex, BIR Road, Diliman, Quezon City.

### **E. BID PROPOSAL CONTENTS**

The prospective bidder is expected to comply and respond in accordance with the specific instructions to bidders and submit all the documentary requirements under the Checklist of Eligibility, Technical and Financial Requirements. The submission of documentary requirements must be properly arranged in order and with label.

The prospective bidder shall respond paragraph by paragraph and shall clearly indicate compliance to all the required specifications (*Please see Section VII. Compliance Matrix*) and shall specify the number of days or schedules within which to complete the delivery of all the goods required (*Please see Section VI. Schedule of Requirements*).

The prospective bidder shall be required also to include in this proposal, original descriptive literatures and unamended brochures of all equipment/materials to be supplied. If applicable, plans, drawings and diagrams/configurations must likewise be provided.

These details will allow the **PAGASA-Bids and Awards Committee** to fully evaluate and determine compliance from the prospective bidders.

## **F. TECHNICAL SPECIFICATIONS**

These specifications set out the requirements to be met in the supply, delivery, installation, training and commissioning, on a turn-key basis, of the Automatic Message Switching System Server, Central Operational Database Servers, Forecasters Workstations, and Forecaster and Pilot Web Application server. All designs, materials, manufacturing techniques and workmanship shall be in accordance with the highest accepted international standards for this type of systems.

### **1. Automatic Message Switching System**

The Automatic Message Switching System (AMSS) shall ensure the proper reception, local and remote distribution of all types of meteorological data and products, including charts and images. This system shall deal with the national data as well as data received from international networks and meteorological satellites. The following are the components:

- a) Two (2) State of the art Servers, rack mount, Intel processor, 32GB RAM, 2 x 2TB disk capacity, RAID controller, 4 Ethernet ports, redundant power supply, Windows server (recent version).
- b) One (1) 16-port Gigabit LAN Switch
- c) One (1) Rack console and KVM
- d) One (1) System rack cabinet
- e) Two (2) Supervision PCs, Intel processor, 8GB RAM, 500 GB hard disk, Ethernet port, 22" Flat monitor, DVD writer, Windows OS (recent version)
- f) AMSS application software with license

#### **AMSS requirements**

##### **AMSS Central Unit**

The AMSS shall include two Intel-based servers under Windows (recent version), one *main* and one *stand-by*.

##### **AMSS Operator terminals**

- The monitoring terminal need to be non-web based, a fully desktop client.
- Operations and supervision shall be performed from Windows PCs connected on the LAN. It shall be possible for Windows PC connected to the LAN to take the role of Operator Terminal, provided that valid username and password are entered.

##### **AMSS high availability**

- The AMSS shall offer High Availability (HA). Each of the two identical servers shall be able to handle all operations by itself: for example, one server shall be able to handle all operations while the second server is under maintenance, version update. There shall not be situation where the AMSS (both servers) shall be entirely stopped for maintenance, update

- Shall a failure occur in the main server, the stand-by server shall detect this failure and shall automatically take over operations, without human intervention or server restart.
- Each server shall contain inside its own internal disk unit its own copy of the bulletins and products database, with an automatic mechanism to keep the two databases in step.

### **AMSS General Requirements**

- The AMSS shall come with a module for TAF Verification for checking the accuracy of airports forecast
- The TAF Verification module shall allow the decoding and comparing of METAR, SPECI and TAF to show various statistics and score charts.
- The Data Processing described in the requirements hereunder shall be performed according to WMO formats as specified within WMO – n°. 386, and WMO – n°. 306.
- The proposed AMSS shall include the following telecommunication capabilities:
  - Ethernet LAN (FTP - TCP/IP protocol)
  - Internet VPN connections
  - FTP and TCP-IP socket, according to Attachment II-15 (Use of TCP/IP on the GTS)
  - Distribution and switching of files via FTP on Internet.
  - Automatic retrieval of files on meteorological HTTP servers (ex: NOAA WIFS server)
  - GSM networks for reception and transmission of SMS messages containing either meteorological data or warnings

### **Types of Data**

- The proposed AMSS shall be able to handle all kinds of data: Text Data, Binary Bulletins (GRIB, BUFR), PNG-coded charts, Image files (satellite, radar, other).
- The proposed AMSS shall include conversion of OPMET messages from TAC to AvXML according to latest ICAO/WMO standards.
- The proposed AMSS shall be able to switch the OPMET messages in AvXML and display them as text messages.
- The meteorological radar products shall be made available under the following formats: GeoTIFF, BUFR (WMO standard, OPERA), WMO/GRIB.
- The AWOS data shall be made available under the following formats: WMO SYNOP / BUFR.

### **AMSS Supervision**

- The supervision terminal must be non-web based, full desktop client.
- All the functions shall be available on each supervision terminal.
- Dictionary modification shall be protected by password.
- The AMSS supervision shall be menu-driven and shall not require software programming, editing of "system" files, SQL language access nor complicated Database manipulations.
- The required AMSS supervision functions for circuits are:
  - circuit monitoring (active, ready, open, day/hour/minute of last input/output, queue status...)
  - circuit management (start, stop, ...)
- The required AMSS supervision functions for messages are:
  - editing of new bulletins (from template or from scratch)
  - correction of faulty bulletins (ex : wrong heading format)
  - reception of service and addressed messages
- The required AMSS supervision functions for alert are:
  - monitoring of system technical status (warning)
  - notification of anomaly for data transmission/reception
- The required AMSS supervision functions for statistics are:
  - statistics on circuits, messages, circuit and message error conditions

### Circuit Monitoring

- A general screen shall allow for the monitoring of the status of all circuits at once.
- For each circuit, this screen shall display at least after the circuit name:
  - A color representing the reception circuit status (currently receiving, ready, faulty or reception time-out (Red), closed by operator, etc....)
  - A color representing the transmission circuit status: active, ready, faulty (red), closed
  - day/hour/minute of last input/output
  - transmission queues status (number of messages waiting for transmission for each level of priority),

### Service and urgent message consultation

- The addressed messages are the messages sent by the subscribers AMSS supervisors, generally for service purpose. Those messages shall be queued for consultation by supervisor as well as other message, according to its abbreviated heading. Each new message to consult shall increment a service counter that shall be seen from all supervisors.
- The urgent messages are detected by their WMO Header. The system administrator shall be able to configure which WMO headers shall be considered as urgent and be queued for consultation by the supervisor. The reception of an urgent message shall trigger and audio (and visual alarm, and increment an "urgent message" counter.
- The supervisor shall have the possibility to:
  - Print the service / urgent message
  - Transmit it to another station
  - Reintroduce the message in the queue, for a subsequent action
  - Acknowledge the message (decrementing by this way the counter).

### Alert consultation

- Abnormal event shall be issued as a warning to the supervisors. Each new warning shall increment a warning counter, reset to 0 (zero) when the last warnings have been consulted.
- New Warnings shall draw the attention of the operator by visual (red flashing button) and sound alerts (beep or WAV triggering for output on loud speakers).

### Bulletin Compilation

- The AMSS shall be able to automatically compile, at the required hour, the national bulletins (SYNOP, TEMP, PILOT, METAR, TAF, CLIMAT, CLIMAT TEMP, SHIP).
- The tenderer shall describe how its AMSS handles automatic compilation, particularly regarding data check, missing data, and delayed data.
- The AMSS shall be able to compile TAC reports as well as TDCF reports

### TDCF codes processing and compilation

- The proposed TDCF module shall allow for the handling of BUFR code as required by the WMO/TDCF migration plan.
- The TAC (Traditional Alphanumeric Codes) to BUFR codes and BUFR codes to TAC codes conversion process shall be triggered on data type identification (from abbreviated header).
- The proposed TDCF module shall allow to display the content of BUFR-coded observation as readable text.
- The proposed TDCF module shall extract individual BUFR-coded reports from received collective bulletins.
- The proposed TDCF module shall be able to uncompress the compressed BUFR-code reports prior to the storage in the database.
- The proposed TDCF module shall use standard WMO BUFR templates when compiling BUFR-coded reports.
- The proposed TDCF module shall allow for the compilation of BUFR-coded surface observation reports.

- The AMSS shall be able to support digital exchange of OPMET information like exchange of METAR, SPECI, TAF and SIGMET, Volcanic Ash Advisory (VAA), Tropical Cyclone Advisory (TCA) and AIRMET using the IWXXM format.

#### WMO monitoring

- The proposed AMSS shall be able to perform IWM WMO monitoring (according to GTS Manual) for both TAC and TDCF (BUFR) messages
- The proposed AMSS shall be able to perform AGM WMO monitoring (according to GTS Manual) as well as real time monitoring and Special MTN Monitoring (SMM).

#### Statistics

- Circuit status : The circuit status for the current day shall be displayed in a graphical way ( colored bars or similar), showing at what time the circuit was receiving, transmitting, ready, faulty, closed by operator, ... The colors shall be the same as those used in other screens.
- Channel status and activity: These statistics shall show in a graphical way (colored bars or similar) the availability of a circuit, reception / transmission activity on this circuit.
- Hourly statistics: These statistics shall show in a graphical way (colored bars ...) the number of received messages, number of transmitted messages, at each hour, on this circuit.
- Daily statistics: These statistics shall show in a table, for each circuit, the number and average length of received messages, number of transmitted messages.
- Monthly statistics: These statistics shall show in a table, for each circuit, the number and average length of received messages, number of transmitted messages.

#### AMSS Database

- The AMSS database shall perform quality control checks and allow users and systems to access to the stored meteorological data.
- The AMSS database shall be non-proprietary for interoperability with existing systems.
- The AMSS database shall not require maintenance neither attendance by a Database administrator. It shall be a service offered to the users via clear and simple menus.
- The observation data entering the system shall go through several stages of quality control.
- Quality control shall be performed on abbreviated heading, report station identification and report text.
- Quality control shall be performed to detect dubious values in reports.
- Quality control shall be performed to detect inconsistency between different parameters in in reports.
- Quality control shall be performed to detect values out of range in reports.
- The database search shall allow for various criteria as abbreviated heading TTAii CCCC YYGGgg BBB, input/output circuit, input/output time ....
- It shall be possible to re-send immediately the retrieved data (for example, in case this data is missing for a user)
- Bulletin Databases: The stored traffic and journal shall be available in less than 5 seconds from the supervisory PC's.
- By clicking one message of the list, the supervisor shall have access to the complete text of the message and the list of all transmissions of the message.
- Report database: The proposed AMSS shall:
  - produce automatically compiled bulletins TAC reports as well as TDCF (BUFR) reports for surface observation, SHIP, upper air, AMDAR/AIREP, CLIMAT, METAR and TAF
  - respond to report requests from 'in-house' or remote users
  - respond to report requests from the supervisors or operators.

## 2. Central Operational Database Servers

The Central Operational Database shall ensure after quality control the historical storage of the daily operational data and products received from the AMSS and enable an easy access to this data by local users and systems. This database shall be external to the AMSS in order to avoid storage processes to slow the message switching capability. The following are the components:

- a) Two (2) State-of-the-art Server, rack mount, Intel processor, 32GB RAM, 4 x 4TB disk capacity, RAID controller, 4 Ethernet ports, redundant power supply, Windows Server (recent version)
- b) Central Operational Database application software with license

### Functional requirements

- The proposed system shall receive all the meteorological data from the AMSS through WMO/TCP-IP procedure.
- The observation data entering the system shall go through several stages of quality control.
- Quality control shall be performed on abbreviated heading, report station identification and report text.
- Quality control shall be performed to detect dubious values in reports.
- Quality control shall be performed to detect inconsistency between different parameters in reports.
- Quality control shall be performed to detect values out of range in reports.

### Database requirements

- The database of the system shall rely on open source object relational database management system in order to store all types of real-time meteorological data and make them available to all in-house users by standard mechanisms as SQL.
- The proposed database shall allow user to develop its own set of functions either using built-in language, scripting language or compiled language.

## 3. Forecaster and Pilot Web Application Server

The Forecaster and Pilot Web Application Server shall allow remote users connected through the Internet/Intranet to access web pages regularly updated with fresh meteorological data, shall enable authorized observers to enter their observation messages and shall automatically supply the appropriate meteorological information to users. The following are the components:

- a) Four (4) State-of-the-art Server, rack mount, Intel processor, 32GB RAM, 2 x 2TB disk capacity, RAID controller, 4 Ethernet ports, redundant power supply, Linux CentOS 7.X (recent version)
- b) Forecaster and Pilot Web Application Server application software with license

### Hardware/Architecture requirements

- All the web services must be natively compatible with Linux, Windows, BSD and OS X distributions.
- All the applications components and services must be deployed and run under Docker containers technology
- The web application must be compatible with the latest versions of Chrome, Firefox and Internet Explorer 11 (or Edge).
- The web application must be accessible through Windows, Linux, IOS, OS X or Android based platforms.

- The web services shall be connected to the LAN via Ethernet TCP-IP, in order to receive data from the AMSS.
- The web application shall have local caching mechanisms to store data that was already accessed, in order to speed up response times and reduce load on the application servers.
- The web application shall be developed using Bootstrap as front-end framework, Angular Javascript as programming language, HTML 5 for structuring and presenting the web pages and NoSQL Technologies to store the data and RESTful services for external communications.
- The whole Web Application need to be packaged using Docker Application Container for an ease of integration and installation.
- The application is separated in several JARs, each is a service.

#### Functional requirements

- The web application shall be able to receive process and display graphically:
  - Observation and forecast messages
  - Graphical products
  - Numerical Weather Prediction (NWP) products
  - Satellite images
  - Radar images
  - Lightning impacts
  - Climatological outputs, such as Time Series, Wind Roses, Bar Charts.
- The web application shall help forecasters and users to display on screen, combine in multiple windows, animate, overlay and manipulate the available meteorological data and products.
- The User Interface shall be responsive, in order to adapt to any screen size or device (PC, Smartphone and Tablets). The interface shall resize itself automatically depending on screen size, browser resolution. The menu and buttons shall also adapt automatically.

#### Computing indexes:

- The web application must have a dedicated module to allow the administrators to create their own calculations and processing, such as: Fog, Icing risks, road and rails related hazards, clouds displacement, impact of severe weather on Business and industries and people safety.
- This module needs to allow the administrators to create their own calculations directly from the user interface, without addition of any third party system or module.
- It is required that the “Computing Indexes” module allow the end users to define functions for an easy supervision, exploitation and evaluation of the weather database (metadata series and raw data series – observation, model, lightning data, radar image and satellite image).
- The “Computing indexes” allows to create calculations with all the data available on the NoSQL Database.
- By using functions defined with “Computing indexes” module, users (weather forecasters or others), obtain an access to a filtered selections of data, coordinates of a vector, coordinates of a data series, calculation of index (or derived data series) or a counting of occurrences.
- The results and outputs of the processing are exploitable and displayable under the form of charts, graphics, tables, texts or maps.
- By using scheduled tasks outputs of “Computing indexes” module can be feeding widgets of presentation of weather or administration data.

- The “Computing indexes” module need to have a user friendly interface to define new indexes:
    - definition of the name of the index
    - choice (via a scrolling menu) of access right user by user or user group by user group (accessible or not),
  - addition (deletion) then definition step by step of index displayed,
  - user may follow his new index configuration in a dedicated window,
  - saving index in the directory of library index selected by user .
  - The functions defined with “Computing indexes” module are stored in the category chosen by user. They apply to the data and the metadata stored in the system’s database.
  - The choice of each input field is done by access to a data and metadata list structured as the system’s data catalog. Input fields can be a variable define by user based on:
    - any data series (for example observation, model, image, ....) or metadata series stored in system’s database,
    - 3D coordinates of a data series (for example 3D coordinates of pixels of images from satellite or radar),
    - a constant number or a characters string chosen by user,
    - any “Output” computed in a step before of the calculation of index (among which the 3D coordinates of a vector)
  - Choice list of conditions applicable between two inputs:
    - Equal (=)
    - Not equal (<>)
    - Superior or equal (>=)
    - Inferior or equal (=<)
    - Superior(>)
    - Inferior(<)
  - Choice list of « Process » applicable between two inputs if previous conditions are or not true (this list is not closed and will be completed gradually when new needs of calculation will appear):
  - Math functions: Sum; Subtraction; Multiplication; Division; Square root; Cosinus; Sinus...
  - Statistical functions (User may define number of data computed): Averages (running or not, arithmetic, geometric); Percentile; Count; Maximum; Minimum...
  - Vectorial functions: Vector addition...
  - « Ouput » may be :
  - Data series; 3D coordinates of a data series; 3D coordinates of a vector, Constant number, Characters string , Boulean variable...
- The web application must have Customization capabilities such as:
    - Customizable Dashboard: The end-user shall be able to create, edit, and change his personal dashboard.
    - The layout of the Dashboard can be changed easily, with one click.
    - The customizable dashboard shall be capable of displaying: Free Text format, Iframes to internal or external links, weather maps with observations (including isolines, color shading, NWP models, radar, lightning and satellite images), tables, decision aid indicators web cams and Local time and date.
    - The customizable dashboard shall enable the user to display an all-in-one customized display of observations from his automatic weather sensors network and specific indicators needed for managing weather impact on his specific activity.
    - End user should be capable of creating his own dashboards and save up to 10 personal dashboards.
    - In his workspace, the user shall be able to synchronize or not the windows temporally and/or geographically.



- The user shall be able to define a workspace directly through a Map menu, after selecting desired overlays and weather data.
- The user shall be able to display and superimpose all meteorological data fields according to his needs.
- The theme of the web application (main colors of the User Interface) must be customizable by the end user.
- The User Interface icons shall be configurable and customizable directly by the administrator
- The administrator shall be able to configure the main settings, such as WMO code categories, Palettes categories, Units and the configuration of the Map Base layers
- The web application shall provide visual/sound notification in case of urgent/addressed message
- Most of the Man-Machine Interface shall be understandable without training.
- The main functions shall be the following:
  - Observations processing and display
  - NWP model outputs processing and display
  - Chart production framework
  - Display and printing of BUFR-coded SIGWX charts
  - PNG chart display
  - Text data processing
  - Customizable map backgrounds
  - Remote sensing imagery display
  - Flight folder production
  - Data Monitoring and alerts with emails, SMS and Apps notifications
- The User interface standard functions SHALL include:
  - Data overlay
  - user interface exclusively driven by mouse and/or keyboard
  - Various language support
  - Zooming/Panning
  - Save of user preferences and workspaces
  - Movie loops
  - Export to standard image formats (raster and vector)
  - Export to standard video formats (for movie loops)
  - Copy to clipboard
  - High quality printing (not reduced to screen copy) on standard printer, monochrome or color, from A4 to A0 size.
  - Layout printing allowing for printing of multiple charts on a single page
  - Multi-windowing
  - Multi-screen support (with appropriate video card)

#### Observations

- It shall be possible to plot dynamically on the screen the observed data as SYNOP, buoys, upper-air, using the standard meteorological representation as Bjerkness scheme and weather pictograms, isolines/contouring and color shading with selection of the color palette, either coded as BUFR (FM 94or text)
- It shall be possible to overlay the observational data (surface, altitude) with other geo-referenced met data layers.
- It shall be possible to display AIRMET / GAMET / SIGMET and advisories for Cyclone and Volcanic activities on maps with display of one related message.
- Observations filtering based on user-defined criteria shall be possible.
- There shall be a facility for dumping the content of BUFR-coded observation as plain text.
- It shall be possible to add virtual observations directly on the plotting chart with mouse.

- The Export of observed values in tabular form (CSV file, table) shall be possible.
- It shall be possible to compare the observation data with NWP model outputs.
- It shall be possible to perform objective analysis using model data and data filtering.
- It shall be possible to display observation data as Time series including comparison with time series from forecast data.
- The web application shall include Customization of display, curve smoothing, interpolation algorithm.
- It shall be possible to display output from a webcam using https or http protocols in a widget implemented on a personal dashboard

#### Observation Vertical profiles

- The vertical profile shall be elaborated from radiosonde and AMDAR data with overlay and construction facility.
- It shall be possible to define the projection used to build the vertical profile chart: Skew-T, Tephigram, Stuve or Stuve extended.
- It shall be possible to display the vertical profile only by clicking on a upper-air plotting.
- From the vertical profile, it shall be possible to display the relative humidity or the helicity.

#### NWP model outputs

- The application shall enable the reception, decoding and storage of GRIB coded NWP model outputs.
- GRIB1 and GRIB2 format shall be supported
- NWP outputs (model, parameters, level, validity) shall be proposed for selection and display only if they are available and cover at least a part of the display area.
- The web application shall display and print the NWP model outputs by using barbs (wind), grid values, isolines, streamlines, contouring and color filling, depending on meteorological parameters selected and user requests
- The operator shall be enable to select the parameter, area, level, model origin, model date, time range, display mode (contours, color filling, ...)
- The Customization of the display shall be easy
- The web application shall display additional parameters defined by the operator using mathematical formulas
- The system shall include a 3D editor for field modification/correction
- It shall be possible to overlay of NWP outputs with other geo-referenced met data layers or other NWP fields
- It shall be possible to display Particle trajectory
- It shall be possible to retime NWP fields up to one hour step for preparing smooth animations
- It shall be possible to produce Temporal and cross sections with annotation/drawing facility
- It shall be possible to produce Forecasted vertical profile and Time series (possible comparison with time series from observation data) for point on the map

#### Chart production framework

- The chart production tool shall include Local "on-screen" production of charts (analysis, SIGWX, various) initialized from geo-referenced met data layer (plotted values, objective analysis, NWP) or overlaid layers

- It shall be possible to add/remove layer during construction of the chart
- Annotation and freehand drawing shall be possible using a Library of standard meteorological pictograms or imported user-defined pictograms
- It shall be possible to import
  - Library of standard meteorological objects (fronts, clouds...) and drawing tools (isolines, zone delimitations...)
  - Auto save and undo/redo facility
  - Chart saving as standard image format, T4/PNG format or as objects for later reworking
  - Export as SIGWX-BUFR for further dissemination
  - User defined context/workspace allowing for instant access to latest data

#### SIGWX charts

- It shall be possible to:
  - display and print the BUFR-coded SIGWX charts
  - modify "on-screen" the SIGWX objects
  - display BUFR object on cross section
  - dump the content of SIGWX-BUFR individual message as plain text

#### PNG/T4 charts

- It shall be possible to display, rotate and print PNG charts

#### Text data

- It shall be possible to display bulletins and reports
- It shall be possible to display individual decoded parameters as table and export them as CSV/HTML,

#### Message Edition

- It shall be possible to create and send messages
- The application shall include templates for easy message creation.
- The templates shall include all necessary fields as per WMO and ICAO standards for the messages.
- The UI of the messages forms shall provide on-line help and guidance (using list of choices for example) for filling the message fields.
- For each field of the form, a mouse over tooltip must give the user some details of the expected input.
- The web application shall perform quality control on the entered values for detecting syntax errors
- When fields have been entered by the user, the entered message must be displayed in WMO form for the user to review it before sending the message. or parameters consistency errors.
- The web application shall include an Assistance to TAF preparation using NWP model outputs.

#### Remote sensing imagery:

- The remote sensing images shall be proposed for selection and display only if they are available and cover at least a part of the display area
- It shall be possible to display satellite images and overlay them with geo-referenced met data layer (NWP, objective analysis, SIGWX-BUFR, radar...)
- It shall be possible to display radar images and overlay them with geo-referenced met data layer (NWP, objective analysis, SIGWX-BUFR, satellite...)

- It shall be possible to display Lightning impacts display and overlay them with geo-referenced met data layer (NWP, objective analysis, SIGWX-BUFR, satellite, radar...)

#### Flight Folders

- The web application shall allow the users to query and download (as PDF) flight folders compliant with SADIS/ICAO standards.
- The criteria form shall at least feature the following fields/lists: ID/destination of the flight, show/hide unscheduled flights.
- For the requested flight folder, it shall be possible to: download as PDF, add to favorites.

#### Customizable map backgrounds

- The map shall include the following details: shoreline, boundaries, rivers, cities, airports, elevation, FIR contours, Standard ICAO area maps presets.
- The web application shall include an option for adding NAVAID static data to map background
- It shall be possible to import additional background details like regional borders
- The map shall propose several projections: cylindrical, space view, Mercator, polar stereographic, Lambert
- It shall be possible to import User-defined maps library
- It shall be possible to re-project the current display over area presets without closing the current working session

#### User management

- The web application shall include a section dedicated to the management of the users authorized to access the system and their rights.

#### Data monitoring and alerts

- The web application shall enable:
  - Monitoring of observation and forecast data
  - Setup of thresholds for individual parameters
  - Graphical display of alert
  - TAF / METAR comparison and operator alerting

## 4. Forecaster Workstations

The forecaster Workstations shall make full use of the received data and products, especially to convert these data and products into vivid images on screen. The forecaster workstations shall allow the forecasters to overlay data and elaborate products, as forecasts and charts for various end-users. The following are the components:

- a) Two state-of-the-art PC, Intel processor, 16GB RAM, 1 TB disk capacity, Ethernet port, Two (2) 22" LCD monitors, DVD writer, Windows Pro OS (recent version)
- b) Forecaster application software with licenses for 2 workstations

#### Functional requirements

- The forecaster workstation shall be able to receive, process, display graphically and overlay:
  - Observation and forecast messages
  - Graphical products
  - Numerical Weather Prediction (NWP) products
  - Satellite, radar or lightning images

- The forecaster workstation shall allow to overlay SYNOP, METAR, Satellite images, models, radar images, lightning images and SIGWX charts
- The Workstation shall help forecasters and users to display on screen, combine in multiple windows, animate, overlay and manipulate all the available meteorological data and products.
- Most of the Man-Machine Interface shall be understandable without training.
- The main functions shall be the following:
  - Observations processing, display and overlay
  - NWP model outputs processing, display and overlay
  - Chart production framework
  - Display and printing of BUFR-coded SIGWX charts and PNG chart
  - Text data processing (TAC, TDCF and AvXML formats)
  - Customizable map backgrounds
  - Remote sensing imagery display.
  - User interface and standard functions
    - Data overlay of geo-referenced meteorological data
    - Exclusively driven by mouse and/or keyboard
    - Zooming/Panning
    - Save of user preferences and workspaces
    - Animations / Movie loops
    - Export to standard image formats (raster and vector)
    - Export to standard video formats (for movie loops)
    - Copy to clipboard
    - High quality printing (not reduced to screen copy) on standard printer from A4 to A0 size; layout printing allowing for printing of multiple charts on a single page
    - Multi-windowing
    - Multi-screen support (with appropriate video card)
- It shall be possible to rearrange windows on the screen (tile, cascade).
- It shall be possible to increase / decrease symbols size.
- It shall be possible to customize color palettes (gradient, number of colors, opacity...).
- It shall be possible to annotate and draw directly on the screen
- It shall be possible to copy window content to clipboard
- It shall be possible to setup preferences.

#### Main Menu

- All functions shall be available from a graphical user interface providing access to all software functions using only 1 click to action button (data plotting, NWP model, section display...) within 2 seconds.
- Buttons layout shall be customizable according to user habits and preferences
- Main menu shall feature histogram allowing for the visual check of data entering the system
- In case of non-reception of data for a user configurable time or of arrival of Urgent messages, a sound signal shall be triggered for alerting the operators

#### Data plotting

- Parameter selection window shall feature the following sections:
  - Type of surface data to be plotted: SYNOP, METAR/SPECI, TAF
  - Type of upper air data to be plotted: TEMP/PILOT, AMDAR/AIREP, Graphical SIGMET, AIRMET...
  - Type of display for upper air data plotting: Hodograph, thickness, Air masses
  - Time range of data to be plotted using: UTC time, date (using standard calendar control)
- Data display shall feature the following functions:
  - Plotting of data using Bjerkness scheme, isolines with automatic drawing of pressure centers, hodographs, air masses...
- It shall be possible to display isotherms, isobars, streamlines, isolines, weather pictogram, color code, temperature / pressure values, wind barbs

### Vertical profiles – Soundings /

- Vertical profile shall be displayed from upper air plotting or NWP model.
- Parameter selection window shall feature the following sections:
  - Station selection:
  - Validity time (Hour, Date (calendar control))
  - Display type: Skew-T / Tephigram / Stuve / Stuve Ext
  - Data type: TEMP / Prognosis TEMP / GRIB (proposed to operator among the available NWP model data sets) / BUFR-coded TEMP reports / AMDAR to get a profile from an ascending or descending aircraft.
- It shall be possible to display previous/next validity with 1 mouse click, edit TEMP message and superimpose several profiles.
- From single click on the diagram, it shall be possible to:
  - Zoom in/out or
  - Draw saturated adiabatic, dry adiabatic, isobar, isotherm, iso saturation
  - Activate the read-off function: reading gauge on the vertical profile diagram while moving horizontally with mouse

### Time series – Meteograms

- Time series shall be displayed from surface observation plotting display or from NWP model output chart display.
- It shall be possible to filter parameters to be:
  - displayed: Temperature, Pressure sea level, Rel humidity, phenomenon
  - compared : could ceiling, visibility, phenomenon, wind speed and direction
- Time series shall allow graphical comparison of airport observation and forecast (METAR /TAF).
- For time series, it shall be possible to:
  - display the evolution of a weather parameter (ex: temperature) over several days on a table with time in X-axis and weather parameter in Y-axis.
- toggle on/off displayed parameters in one click
- have on the same window the time series and Bjerkness symbols
- display missing data as dashed line
- use different colors when comparing time series (2nd station, NWP model data)

### NWP (Numerical Weather Prediction) models

- The Forecaster Workstation shall be able to display the NWP models received in GRIB format (GRIB / GRIB2 editions) from various meteorological centers.
- It shall be possible to display (when received) a wide range of meteorological parameters such as wind, vertical speed, temperature, Geopotential, humidity, MSL pressure, rain...
- The proposed software shall allow for 3D edition for filed modification/correction.
- The parameter selection window shall feature the following sections:
  - Geographical area
  - Model origin, Run date or archived previous runs
  - Parameter, Level (hPa / FL), Validity
- NWP model display shall feature the following functions:
  - It shall be possible to display NWP model in modes: Isolines / Color shading / Wind barbs / Values / Streamlines
  - It shall be possible to display previous / next validity, upper / lower level or to start animation with 1 mouse click
- The proposed software shall allow for production of sections (temporal and spatial) using the NWP model output data.
- For sections from NWP, parameter selection window shall feature the following sections:
  - Model date/hour, GRIB run, Model origin
  - Vertical scale parameters
  - List of parameters available from selected model
  - Type of display for each selected parameters : isoline, all isolines, color shading, barbs

- It shall be possible to insert table below the section (Free text for user comments...)
- Horizontal scale definition: Show/hide validity / time / distance...

#### SIGWX BUFR processing

- The system shall be able to display and print SIGWX charts received in BUFR format from the WIFS WAFS broadcast. The chart shall be displayed in color using different colors for each parameter: jets, CATs, clouds, fronts...

#### Interactive Chart production

- The Forecaster Workstation shall include a specific module, allowing the forecaster to draw SIGWX charts and surface analysis charts on screen by using the mouse and weather icons.
- Chart production facilities offered to the forecaster shall include:
  - Drawing of met charts with a minimum of mouse clicks, using symbols and icons
  - Initialization of a chart from different types of data: NWP model display, SIGWX BUFR data, satellite image, radar image, observation data ...
  - Drawing of fronts, isolines, clouds, CATs, jets, pressure centers, tropopause levels
  - Insertion of weather symbols (rain, drizzle, icing, turbulence, precipitation, ...), free text with font customization
  - Chart Legend content with Validity, Origin (WAFs or locally produced), Level (H/M)
- It shall be also possible by drawing with the mouse:
  - to highlight "dangerous" areas semi-transparent color areas (green/yellow/red) over a pre-loaded map (ex: road map)
  - to create areas for graphical SIGMET.

#### Automatic Chart and animation production

- The proposed software shall allow for automated image production according to user-defined schedule ("Image Maker" function). This process shall not require user intervention, except for the initial set-up. Images/charts shall be created automatically daily or several times a day, during months/years, from the meteorological data received in real time.
- The GUI (Graphic User Interface) of this function shall be exclusively driven with mouse and menus. Users shall not have to enter scripts (like "cron" table...).
- Summary of the pending tasks with indication for each task of: status (color), time of next activation, location of the last produced file shall be available.

#### Display of satellite and radar images

- The Forecaster Workstation shall be able to display satellite images and radar images received, for example, from the local radar processing system.
- The proposed software shall allow 3D display of temperature calibrated satellite images
- The imagery facilities shall include easy selection of area, the date / channel / hour of image to display, transparent mode using customizable opacity, the next/previous image instantly.
- For Himawari satellite, it shall be possible to display processed images such as Cloud Top Height, Cloud Top Temperature, Cloud Top Pressure, Cloud Type, Sea Surface Temperature, Land Surface Temperature and Cloud Mask.

#### Display of Alphanumeric Bulletins

- The Forecaster Workstation shall be able to display alphanumeric meteorological bulletins and reports (SYNOG, TEMP, PILOT, SIGMET, SHIP); aeronautical weather messages (METAR, TAF, SPECI).
- The facilities for bulletin display function shall include bulletins and reports retrieval by header, by type and area, by scrolling through a list.

## General features

- The local MET database implemented by the proposed software, shall be non-proprietary
- It shall be possible to have user defined context / Macros allowing the forecaster to obtain all data he uses on a routine daily basis.
- The series of products saved in the workspace shall be updated with fresh data with possibility to prompt forecaster for conformation.
- It shall be possible to display/hide overlays with 1 mouse click
- Forecaster shall have the possibility to accommodate several windows on screen, re-arrange in one click all windows in a mosaic and use multi-screen video adapter.
- The Forecaster Workstation shall allow the user to set-up himself his environment.
  - All set-up is made with user friendly dialog boxes and menus (no edition of system files)
  - All set-up changes are immediately taken into account
  - Easy back-up of set-up on removable media
- Forecaster shall have possibility to define areas that shall be called by their names in all menus (ex: Asia) or by entering its co-ordinates, by mouse-selecting it from the map.

## 5. Other Equipment

The system shall include the following additional equipment:

- a. An uninterruptible power supply (UPS) sufficient to power all system components until the system is safely shut down in case of an electronic outage.

## 6. Other Specifications and conditions

- a. Factory Acceptance Test (FAT) - The Factory Acceptance Test shall be witnessed and accepted by four (4) PAGASA personnel and shall be conducted within a total of seven (7) calendar days including travel time. All related expenses, such as roundtrip air fare, transportation, lodging/accommodation and daily allowances in accordance with the prevailing UNDP rates for each participant shall be shouldered by the winning bidder.
- b. Site Acceptance Test - Following each installation at the location, the successful bidder will demonstrate the operation of the system in accordance with the system specifications, to be witnessed by designated representatives of PAGASA end-users.
- c. Documentation - The successful bidder shall supply two complete sets of printed hardcopy documentation on system operation, maintenance, and troubleshooting . Backup copies on CD or DVD are required. All documentation shall be in the English language and be written in simple English. Sufficient written information should be provided to carry out adequate training of PAGASA staff members in operation and maintenance of the equipment.
- d. Training - After completing each installation and test of the system, the successful bidder shall provide training at the installation site for PAGASA staff members for a period of at least five days, to ensure that PAGASA staff members are well trained in the operation and maintenance of all hardware and software components of the system. Designate at least two dedicated persons for the operation and maintenance of the system and the training shall demonstrate that these personnel can perform system monitoring, system configuration, reinstallation of configuration from a system and first level of maintenance. Training materials, lunch, morning and afternoon snacks and other related training expenses shall be shouldered by the supplier.



- e. Warranties - Three (3) years equipment (parts and labor) warranty starts from the date of acceptance. Warranty includes version upgrades and updates, troubleshooting and support.

Technical support should be 24x7, thru email/phone from the supplier, 24-hour response time starting from time of report and immediate supply of service unit just in case device is unrecoverable.

After the expiration of the warranty, support/assistance should be at standard commercial rates, including the availability of replacement parts for ten years after.

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