Technical Memorandum

SunGuide® Software System

Road Weather Information System Concept of Operations

Version 1.0

April 28, 2014

Prepared for:

Florida Department of Transportation
Intelligent Transportation Systems Program
605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
(850) 410-5600

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List of Acronyms and Abbreviations

ConOps .... Concept of Operations
CSV .... Comma-Separated Value
DPA .... Data Processing Application
ESS .... Environmental Sensor Stations
FDOT .... Florida Department of Transportation
FL511 .... Florida's Advanced Traveler Information System
GUI .... Graphical User Interface
HAR .... Highway Advisory Radio
IDS .... Incident Detection Subsystem
ITS .... Intelligent Transportation Systems
NTCIP .... National Transportation Communications for ITS Protocol
RPU .... Remote Processing Unit
RWIS .... Road Weather Information System
TERL .... Traffic Engineering Research Laboratory
TMC .... Transportation Management Center
TxDOT .... Texas Department of Transportation
WPF .... Windows Presentation Framework

1 Introduction

The first section of this Road Weather Information System (RWIS) Concept of Operations (ConOps) provides four elements: system identification, an overview of the ConOps document, a high-level overview of the proposed system, and a brief description of the scope of effort required. These elements are described in the following sections.

1.1 Document Identification

This document provides a conops for how SunGuide® software will support the RWIS operation from a user's persepctive.

1.2 Document Purpose

The purpose of this ConOps document is to:

- Communicate user needs and proposed system expectations;
- Communicate the system developer's understanding of the user needs and how the system will meet those needs; and
- Serve other purposes, such as building consensus among several user groups or developers, or using to summarized for a press release or information brochure.

1.3 System Overview

The Florida Department of Transportation (FDOT) SunGuide® Support, Maintenance, and Development Contract, contract number BDQ69, addresses the necessity of supporting, maintaining, and performing enhancement development to the SunGuide software. SunGuide software was developed by FDOT through a contract from October 2003 through June 2010. The software is a set of intelligent transportation systems (ITS) software that allows control of roadway devices as well as information exchange across a variety of transportation agencies; it is deployed throughout the state of Florida. SunGuide software is based on ITS software available from the state of Texas with significant customization and development of new software modules to meet FDOT's needs. Figure 1-1 provides a graphical view of SunGuide software.

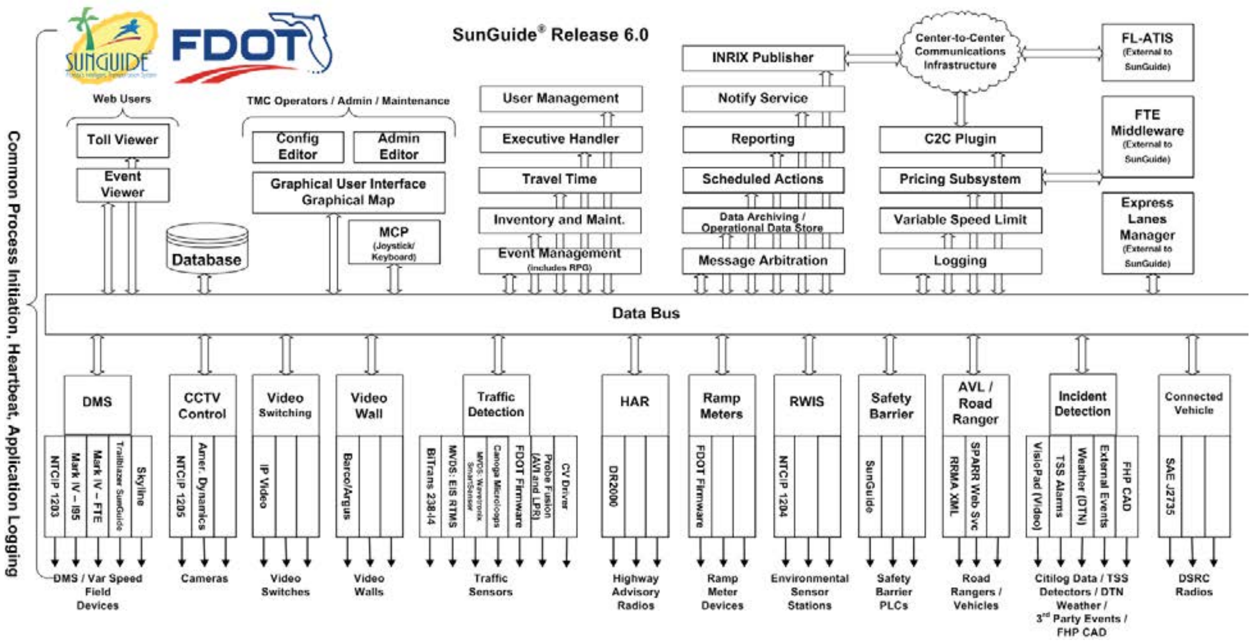

Figure 1-1: High-Level Architectural Concept

The SunGuide software development effort began in October 2003; several major releases have been developed and this document addresses an incremental update of the most recent release. After development, the software will be deployed to a number of regional and local transportation management centers throughout Florida and support activities will be performed.

2 References

This section lists documentation referenced in this ConOps.

2.1 Related Documents

The documents listed below form a part of this document to the extent specified herein.

- *SunGuide Operator Training for Release 5.1*, www.sunguidesoftware.com
- *NTCIP 1204 v02.23 – NTCIP Object Definitions for Environmental Sensor Stations (ESS) Interface Protocol,* www.ntcip.org, filename: 1204v02-23.pdf, July 2005
- *NTCIP 1204 v03 – NTCIP Object Definitions for Environmental Sensor Stations (ESS) Interface Protocol,* www.ntcip.org, filename: 1204v0308r2.pdf, October 2009

These documents can be obtained by request to:

Florida Department of Transportation
Traffic Engineering and Operations Office

605 Suwannee Street, M.S. 90
Tallahassee, Florida 32399-0450
(850) 410-5600

2.2 Contacts

The following is a list of contacts for the SunGuide software project:

- Elizabeth Birriel, ITS Section, Traffic Engineering and Operations Office, elizabeth.birriel@dot.state.fl.us, 850-410-5606

- Clay Packard, Atkins Project Manager, clay.packard@dot.state.fl.us, 850-410-5623

- Robert Heller, SwRI Project Manager, rheller@swri.org, 210-522-3824

- Tucker Brown, SwRI Software Project Manager, tbrown@swri.com, 210-522-3035

3 Current System Situation

The following sections describe the system or situation as it currently exists and any problems to be solved.

3.1 Background

FDOT introduced a subsystem, driver, and graphical user interface (GUI) for RWIS into SunGuide Software Release 2 in October 2005. This supported the National Transportation Communications for ITS Protocol (NTCIP) 1204 v02.18 (April 2004). At the time the SunGuide software RWIS driver was being developed, only two RWIS manufacturers indicated to FDOT that they were developing products that complied with FDOT specifications and also supported the NTCIP 1204 standard. As a result, limited SunGuide software testing concerning the RWIS subsystem was performed using devices provided by Vaisala and Quixote to FDOT's Traffic Engineering Research Laboratory (TERL).

At that time, Quixote had an agreement in place with Surface Systems, Inc. for the resale and private labelling of RWIS products. The Quixote division responsible for RWIS products was later acquired by Vaisala. As of this writing, the products used for prior limited testing at TERL are likely obsolete and not appropriate for future system characterization.

The principle equipment used for limited RWIS SunGuide software testing at TERL was a Vaisala Remote Processing Unit (RPU), including a model DMC586 processing unit, DRI521 sensor interface, power supply, chassis, and DRT511/521 input simulators.

Figure 3-1: Vaisala RPU Used for Limited SunGuide Software Functional Testing

Since the initial RWIS integration into SunGuide software, NTCIP for RWIS was updated to version 3. The RWIS subsystem in SunGuide software must support NTCIP 1204 v03 to allow use of products that implement the current version of the standard.

At this time, FDOT has deployed and approved field equipment on a limited number of projects. The equipment was approved and permitted on a project-by-project basis by authorized local agencies. The equipment was not required to be evaluated and approved by TERL. Some field devices that are now deployed by FDOT claim to support NTCIP 1204, but this has not been validated by TERL, so it is unclear whether or not these products support v03. The devices that are either deployed or are being considered for use on future weather-related projects include the following:

- RWIS Weather Station Devices:

  - High Sierra Electronics Model 5400 RWIS RPU;
  - Optical Scientific Inc. OWI-650 LP-AWS Low Power Automated Weather Station;
  - Microcom Design, Inc. Xpress WS Compact Wind Monitoring Station;
  - Vaisala PWD Present Weather and Visibility Sensors;
  - Vaisala WMT700 Ultrasonic Wind Sensor;
  - Lufft WS600 Ultrasonic Weather Station;
  - Climatronics Corporation All-in-One Weather Sensor; and
  - Quixote (aka Surface Systems, Inc.) legacy weather stations, including RPUs, a variety of sensors, and SCAN Web weather station software.

- Beacon Management Devices
  - Xytronix Research and Design, Inc. WebRelay Dual-III web-enabled, programmable relay device.

Project deployments that are underway or planned in the near future include:

- District 2 – a deployment project on I-75 and SR 441 in the vicinity of Paynes Prairie includes a fog detection and warning system. This system plans to use the following RWIS devices:
  - High Sierra Electronics Model 5400 RWIS RPU
  - Optical Scientific Inc. OWI-650 LP-AWS Low Power Automated Weather Station
- District 1 – a deployment project on I-4 includes a fog detection and warning system. The system devices will be determined by the design build contractor.
- District 5 - saw a pattern that the visibility concerns were not reoccurring in one location; they were sporadically distributed throughout the District. Further, the initial incident did not lead to crashes, but was generally caused by a fire that had occurred and was tamped down during the day, but then expanded at night. Therefore, District 5 looked at a solution that could provide a proof of concept using portable units that can be placed by field maintenance office staff as needed during the first occurrence. Subsequent growth in the fire triggers an alarm. District 5 is currently testing a portable fog/visibility detection system.
  - Sentry™ Visibility Sensor model SVS1 Analog Output Version

3.2 Objectives and Scope

The current system objective prior to this proposed change was to integrate RWIS devices that support the NTCIP 1204 v02 protocol into the system with a GUI display that provides users with the ability to see current weather conditions.

3.3 Operational Constraints

The following are operational constraints for the current system:

- Only supports NTCIP 1204 v02.18; does not support v03;
- Does not have operational integration other than the ability to display current data values received from field sites in the SunGuide software GUI; and
- Does not support the needs of upcoming deployment projects listed in section 3.1 above.

3.4 Description of the Current System or Situation

SunGuide software already supports NTCIP 1204 v02.18 (April 2004) to receive information from environment sensor devices. The device is displayed as an icon on the operator map with the status information available in a pop-up dialog when the icon is clicked.

3.5 User Profiles

This section describes users and how they interact with the current system and with each other when using the system.

3.5.1 ITS Engineers

ITS engineers make decisions on which systems to deploy and obtain status of the systems currently deployed. Supporting the most number of devices and providing the most flexible reporting of the deployed device status will support the ITS engineers. They can use this information to plan deployments and verify successful usage of operations and maintenance funds.

3.5.2 SunGuide Software Administrators

SunGuide software administrators configure newly deployed RWIS devices into the system. They test that the system recognizes and is working properly with the device using a combination of the SunGuide software and the vendor master software. They then monitor and generate reports on devices from the SunGuide software GUI. They will also configure how the devices operate with the alerting component of the SunGuide software, setting thresholds, response plan templates if necessary, etc.

3.5.3 Transportation Management Center Operators

Transportation management center (TMC) operators use SunGuide software to monitor RWIS stations, if necessary; notice when the system reports errors on the device and notify the administrator; and handle alerts when they are produced by RWIS. From alerts, they create events, generate response plans, and coordinate with other agencies per their standard operating procedures.

3.5.4 SunGuide Software Support Engineers

SunGuide software support engineers support the deployment, integration and configuration, and respond to issues with the SunGuide software system.

3.6 Support Environment

The RWIS subsystem will be supported as other SunGuide software subsystems are supported.

4 Justification and Nature of the Changes

The general reasons for changes and the nature of the changes are described in the following sections.

4.1 Justification for Changes

This update to the SunGuide software is necessary in order to effectively utilize RWIS for roadway operations. SunGuide software must remain current with new NTCIP version 3 ESS protocol to help ensure that FDOT is able to deploy new equipment as manufacturers move to the new version of the standard.

SunGuide software user's have also expressed a desire for the software to be able to accept data from a variety of cost-effective, commercially available "all-in-one" weather stations using a non-proprietary protocol that is adaptable to weather stations from multiple manufacturers.

Modifying this subsystem and related components also presents an opportunity to improve the user interface consistent with the new Microsoft© Windows Presentation Framework GUI platform used for other subsystem GUIs. Furthermore, with the updated RWIS data available to SunGuide software, this is an opportune time to add operational value into the system by integrating the RWIS data into the alerting and response plan operations already existing in SunGuide software.

To maintain consistency with existing event management operations, detected incidents should utilize the existing incident detection subsystem and event management subsystems by producing alerts and facilitating event creation.

However, due to how fast fog conditions can develop, the operator reponse from going through the alert and event management process is not fast enough to get warning messages on the DMS to motorists.

In order to avoid sending false positives to motorists, the automatic activation component needs to be optional via configuration after the devices have demonstrated an acceptable level of accuracy.

4.2 Description of Desired Changes

There are numerous changes needed to the system and several ways in which these enhancements can be implemented. The following sections describe the changes needed by SunGuide software.

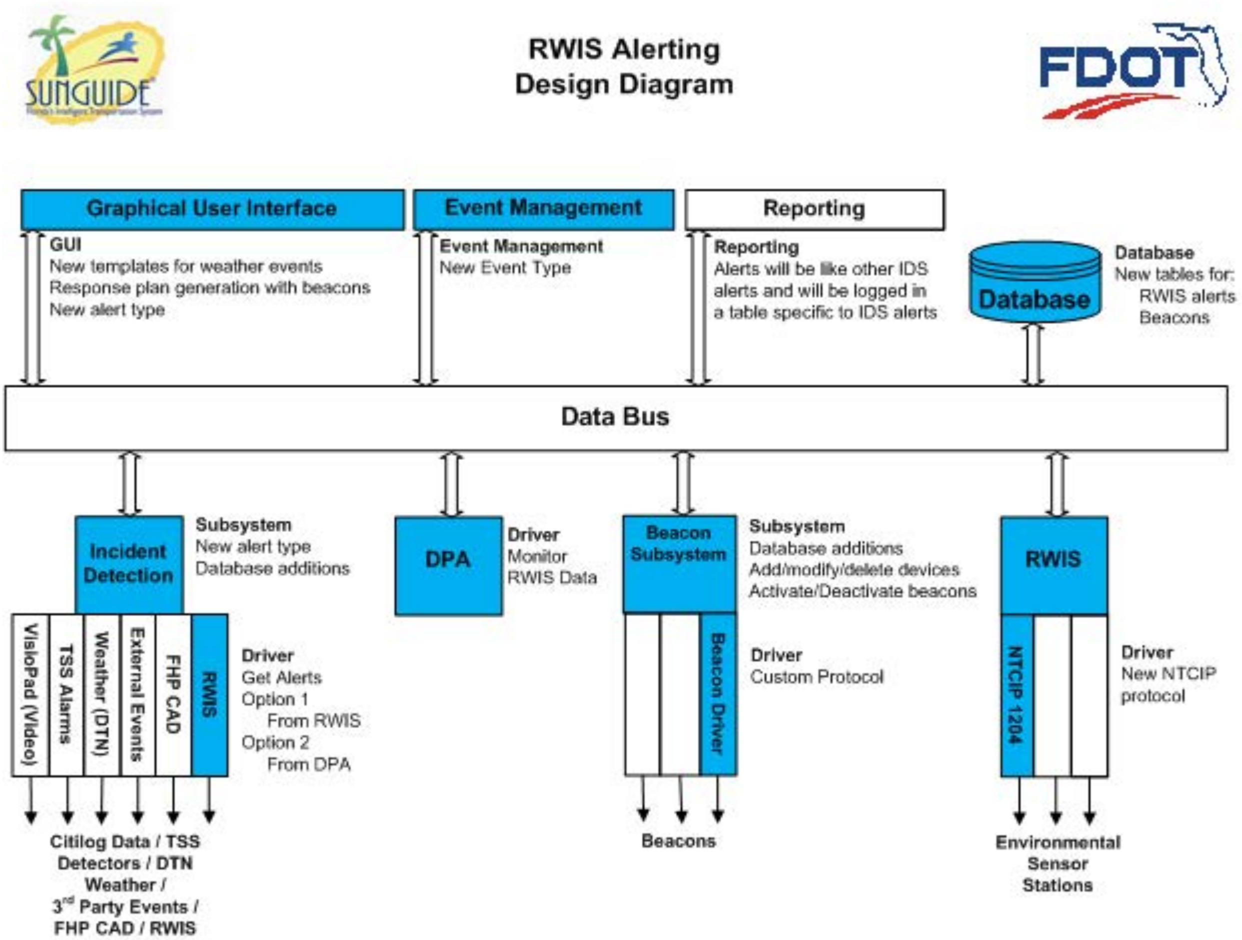

Figure 4-1: RWIS Alerting Design Diagram

4.2.1 RWIS Driver

The basic functionality of this change is to support the NTCIP version 3 protocol for the ESS data. Since the current RWIS driver already supports a version of the NTCIP, the driver will be modified to accept the NTCIP version 3. The RWIS driver must also support data acquisition from non-NTCIP devices in a non-proprietary manner.

Preliminary investigation of commercially available RWIS devices seems to indicate that they commonly use ASCII data transmitted via serial or Ethernet interfaces for communications with other systems. The labelling and ordering of their data within an ASCII comma-separated value (CSV) is often variable, but can be decoded with relatively minor effort.

Additional protocols would also be covered by the same driver, using different logic based on which prototcol the device is configured to use. Alternative additional, separate RWIS drivers could be built and the device would be configured to use the other driver. If the protocol is implemented as a separate driver, this would appear in the architecture in Firgure 4-1 as an additional RWIS procol driver under the RWIS subsystem.

4.2.2 Beacon Subsystem and Driver

To support the use of beacons in this update, a beacon subsystem and driver will need to be developed. The beacons for this enhancement are independent of any device and, therefore, are their own device with their own protocol. Beacons would need to be configured into SunGuide software as independent devices. The means for activation and deactivation of beacons will utilize the Web Relay device and its protocol mentioned at the end of section 3.1.

When the RWIS device generates an alert in SunGuide software, the software will automatically select the appropriate beacons based on a configurable distance radius search from the device in tenths of miles. SunGuide software can be configured to either automatically activate the selected beacons immediately upon selection, to place them in a response plan for the operator to activate as a part of an event, or to take no action.

There may be some deployments where beacons will be controlled solely by the RWIS field device. This will not require SunGuide software integration.

Each beacon in SunGuide software will be configurable to be assigned a static message text and an operational purpose. The operational purpose of the beacon will be used by the system to determine if the beacon matches the type of event and should be included in a response plan suggestion.

Each beacon will be treated like a message device and behave as though it has a queue of activation requests. The beacon will be activated if one or more sources request activation. The sources can be any combination of operators and event and schedules. The beacon will be deactivated when the queue is empty. The operator can remove any activation request or clear the queue altogether in one action. Events and schedules can remove their own activation request. This handles the case where a beacon is manually activated by an operator, also activated by an event response plan and a schedule, and needs to remain activated after the response plan is terminated and even after the scheduled activation has elapsed. The beacon should remain active because the operator's manual activation request remains in the queue.

4.2.3 Operator Map Display

The RWIS devices will have icons on the operator map at their geographical location. These icons will have an indicator when they are in an alarm state. Similarly, the beacons will also have an icon on the operator map with an indicator when they are flashing. For RWIS devices with a beacon attached, a combined icon showing the flashing state of the beacon and the alarm state of the RWIS will be present.

From these icons, the detailed status will be available by clicking on the icon. A Windows Presentation Framework (WPF) window containing a list of RWIS devices will be launched. The RWIS list will have sub-items of attached beacons as there could be multiple beacons attached.

4.2.4 RWIS and Beacon Device Status and Configuration Screen

RWIS and beacon devices will be available on the operator map and in a WPF window list similar to connected vehicle roadside equipment devices. RWIS and beacon devices will each have a separate window. From these lists you can see the status and enter into a configuration mode to change the location or other configuration parameters of the devices. RWIS device configuration may be left in the Admin Editor until a more suitable time to migrate to WPF since little will be modified for configuration of these devices.

The WPF window list will contain devices as items with some configuration and status information in sortable, filterable colums. Each item can be selected, which will reveal a portion of the window showing details for the device. This will be tabbed so that one tab shows the RWIS device status and information, while other tabs could show the attached beacons of the RWIS device and the status of beacons attached to the RWIS device, the alarm and recovery thresholds of the RWIS devices, etc.

Device configuration should include support for the configurability needed for each device as it relates to the automatic response plan activation. Each RWIS event type from each RWIS device can be configured as to which response plan would be automatically activated from either an automatically suggested response plan or a predefined response plan.

4.2.5 Operator Alerting Operations Options

RWIS devices will have alarm and recovery thresholds for each data type. When the alarm threshold is exceeded, the device will be in an alarm state and will alert the operator and automatically activate a response plan, if configured. The alarm will be automatically recovered if the data causing the alert goes past the recovery threshold.

The following options are available for integration of the RWIS data into the rest of the SunGuide software in order to produce alerts to the operators. Option 1 would be to use the existing SunGuide software IDS, while Option 2 would be to use TxDOT's Lonestar Software's DPA to produce operator alerts. These are described in the subsections below.

4.2.5.1 Option 1: Incident Detection Subsystem Integration

Traditionally, alerting in SunGuide software has been done in the incident detection subsystem (IDS). RWIS alerts for data such as wind speed will be configurable for each RWIS device. Alert thresholds and recovery thresholds will be defined for all RWIS data types. The system will have configurable default alarm and recovery threshold values. Each device will initially be set to use these default values, but could also be individually configured to use a specific value. This will allow for different thresholds for different locations and types of facilities, such as roads and bridges.

When the thresholds are breached, the RWIS subsystem will send an alert to the RWIS IDS driver; the alert would be logged to the database and sent to the operator workstations. The operator may respond to that alert in the same manner as other IDS alerts and the response would be recorded in the database. It is expected that alerts in the database will have a similar structure to existing IDS alerts and reports will need to be modified to report on the new data type.

4.2.5.2 Option 2: Data Processing Application (DPA) Integration

In the Texas Department of Transportation's (TxDOT) Lonestar system, the data processing application (DPA) provides similar functionality to SunGuide software's IDS. The TxDOT system monitors data from multiple sources and allows the user to set rules to trigger alerts or emails. As mentioned above, traditional SunGuide software functionality would set a hard threshold for generating an alert. DPA allows users to create more advanced rules including basic logical operators. In the case of weather alerts, more complex alerts could be generated. For instance, SunGuide software could be configured such that data from a specific RWIS would generate an alert if the temperature were below 40 degrees and the wind speed greater than 35 miles per hour. For another RWIS, the DPA could be set up to alert under different conditions to other particular thresholds.

For this update, it would be possible to integrate TxDOT's DPA into SunGuide software and use the rules to generate alerts to the operator map. The integration would also require integration with SunGuide software permissions as TxDOT currently uses a different permissions mechanism. For this option to be consistent with other IDS alerts, an IDS driver will need to be created to handle the alerts through IDS. While this option seems excessive, its intent is to transition to the "DPA style" of alerting and, eventually, all alerts would be generated through DPA.

4.2.6 Event Management and Response Plans

Once alerts have been created, the operator and system will need to take actions based on the alert. When an alert is generated, there will be several options for responding to the alert, including creating a new event or dismissing the alert for a variety of reasons. If an event were created, a response plan would also most likely be created.

Each response plan item type should be configurable to be included in an automaticly activated response plan. This would be a system-wide setting to ensure that only the desired response plan items are included in any response plan that would be automatically activated.

To take full advantage of DMSs, a new template would be created for the visibility event type. The new visibility template will allow users to create messages such as "LOW VISIBILITY AHEAD." Messages could also be changed by the operator after viewing the device information with the specific distance to the sensor creating the alert. These messages might read, "FOG 10 MILES AHEAD" or "FOG NEXT 10 MILES." When selecting DMSs for fog events, highway mile traversal algorithms may be used; however, it might be beneficial to use a radius search. In addition to DMSs, beacons will also be included in to the device linking file or a distance radius search, which will allow these devices to be included in an automatically generated response plan suggestion. As with standard DMS messages, the messages posted are logged in the event chronology. Beacon use will also be logged in the event chronology. If an event is created from the alert, the automatically lighted beacons associated with the RWIS alert will be included in the event as the current response plan that can be terminated or re-suggested.

4.2.7 Automatically Activated Response Plans

In order to provide warning messages to motorists in a timely manner, it is desired to have a response invoked by the system automatically as soon as the data goes into an alarm state. The response should be somewhat generic, but provide enough information to give motorists an immediate "heads up" so they can be alerted that additional caution is needed for a specific roadway condition. DMSs and beacons are the only devices that need an automatic response plan that would be appropriate for RWIS alarms.

This automatic response plan activation needs to be optional and highly configurable. Urban areas may need a different response than rural areas, so each device will need to be configurable independently of other devices. For each RWIS device, each event subtype will be able to be configured for using a suggested, predefined, or no response plan for automatic activation.

If an alert does not produce a response plan, normal operator alert operations will follow.

4.2.8 Automatic Alert Dismissal

The recovery threshold is intended to reduce the number of redundant alerts presented to the operator. However, in the event that an alarm condition recovers, then the same alarm condition reaches the alarm threshold again, and there is an active event already associated to the previous alarm, the alert will be automatically dismissed as associated to the already open event.

4.3 Change Priorities

Table 4.1 lists the priorities of the desired changes.

Table 4.1 – RWIS Change Priorities

Change Location	Change Description	Priority
4.2.1	RWIS Driver - NTCIP 1204 v3	H
3.1	RWIS Driver – Sentry Visibility Sensor model SVS1	L, future
3.1	RWIS Driver – GOES Wind Speed Monitoring system	L, future
4.2.2	Beacon Subsystem and Driver	H
4.2.2 (last paragraph)	Activation Requests as a queue, not a single activation state	L
3.1	Support for Web Relay device	H
3.1	Support for other devices in section 3.1	L, future
4.2.3	Operator Map Display – RWIS and Beacons	H
4.2.3	Windows Presentation Framework	M
4.2.4	Configurability for automatic response plan activation for each RWIS device and data type	H
4.2.5	Alarm and Recovery Threshold	H
4.2.5 via 4.2.3 or 4.2.4	Operator Alert via IDS or DPA Integration	H
4.2.6	Configurability for each event type (Low visibility verses high winds)	L
4.2.6	Event Management Integration	M
4.2.6	Response Plan Integration	M
4.2.6	Simple Radius Search Algorithm	H
4.2.6	Device Linking/Sequencing instead of radius	L
4.2.7	Automatically Activated Response Plan	M
4.2.8	Automatic Alert Dismissal	M

- H = Needed for RWIS operations to be successful moving forward
- M = Adds significant value to operations and is not cost prohibitive
- L = Adds value, but is not critical to operations

4.4 Assumptions and Constraints

The following sections outline the operational and technical constraints of the proposed changes.

4.4.1 Operator Responsabilities for Automatically Activated Response Plans

Operators have an important role in the automatically activated response plans. The automatically activated response plans are only designed for a generic, immediate, "heads up" message when the RWIS alarm is first detected by the system. The operator immediately takes over management of the event created on behalf of the alarm. The following actions are taken by the operator in managing the RWIS alert:

4.4.1.1 Operator handles alert

The operator will first be notified by the system through the Alert Box. The operator optionally clicks find-on-map to locate the device and the device's location on the map so that additional information from the software can be obtained and understood by the operator, or a near-by camera can be easily found. To proceed with handling the alert, the operator clicks on the alert to launch the alert handling window.

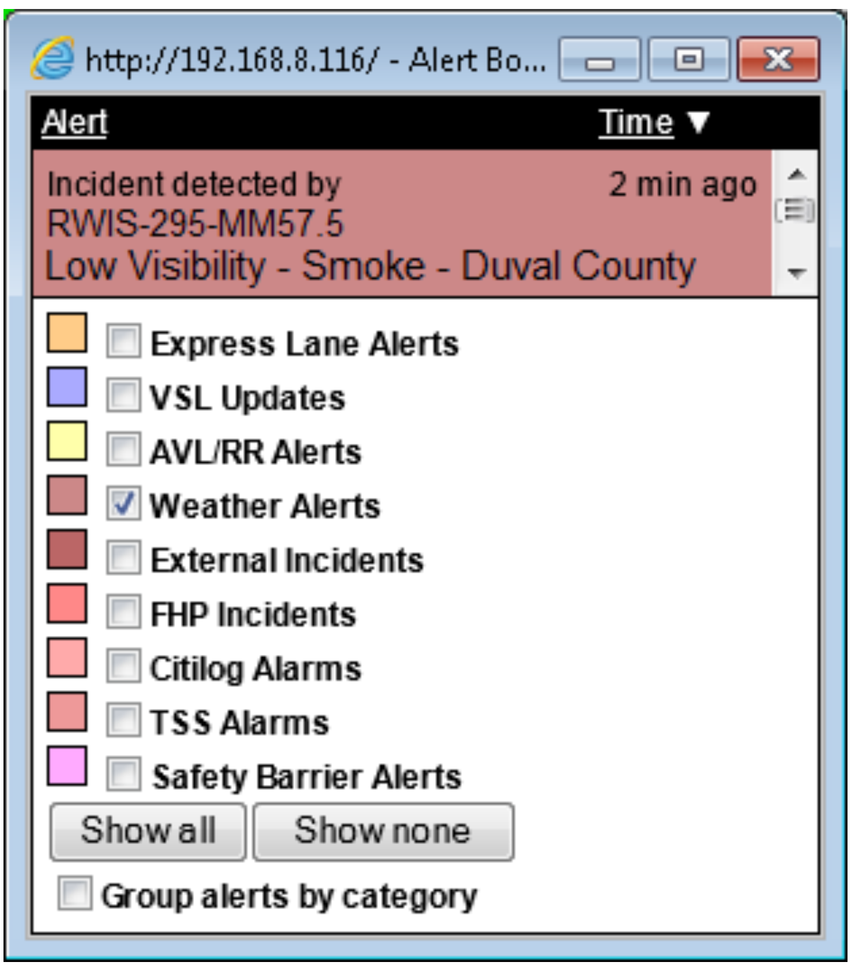

Figure 4.2 Alert Box

4.4.1.2 Operator takes ownership of the event

After clicking on the alert, the operator is presented with the alert handling window. The operator will review the information in the alert handling window and take ownership of the event in order to proceed with managing the response to the RWIS alarm.

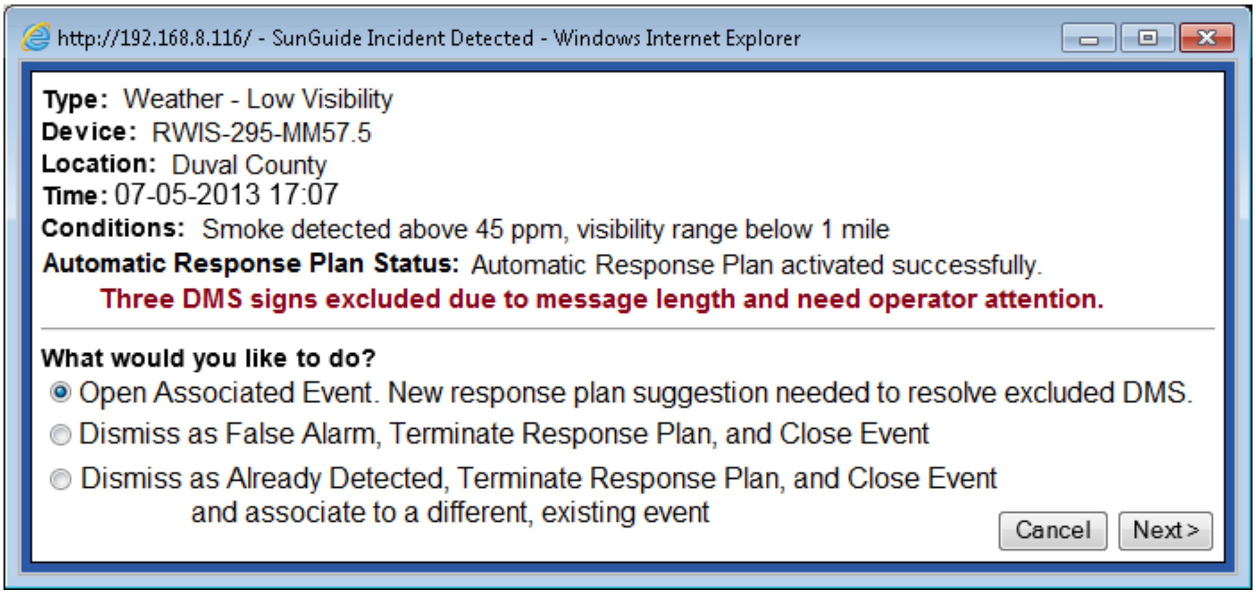

Figure 4.3 – Alert Handling Window for Automatically Activated Response Plans

4.4.1.3 Review and fine-tune response plan items

After handling the alert, the operator becomes the owner of the event and should review the response plan currently active and fine-tune it as needed with additional information and human understanding of the overall situation. If the alert handling window included the warning message that signs were omitted due to message length being exceeded, the operator would then re-request a response plan and the suggestion would include those omitted items. The operator could then manually shorten the message with abbreviations if desired and repost the response plan. The operator would then reactivate the response plan after making changes for additional items to be posted in the field.

4.4.1.4 Fine-tuning plan with additional information

The operator would then manage the event similar to other events. Updated information would be gathered from the RWIS device available from the operator map as well as other sources. Additional, updated, or changing information may warrant a need to update the response plan with more specific or updated information. Additoinal response plan outputs may be desired such as highway advisory radio (HAR), email, Florida's advanced traveler information system

(FL511), additional DMSs, or beacons. After the operator fine-tunes the response plan, the operator would then re-activate the response plan, as there is no other automatic activity once the operator takes ownership of the event.

4.4.1.5 Terminating the response plan

Once RWIS indicates that conditions have cleared, the operator will terminate the response plan, which will remove messages from signs and close the event.

4.4.2 Operational Constraints

1. TMC operators, with brief operator training, should be able to understand and operate the SunGuide software RWIS and beacon GUI, and all other operations related to utilizing the RWIS data produced.

2. Support tasks, including integration, configuration, and diagnosing and resolving issues, should minimize labor effort, disruption to system operations, and additional tools necessary.

3. TMC administrators and ITS engineers should be able to use the SunGuide software to help them manage their deployment, report on the status, and obtain data produced by devices from the SunGuide software GUI.

4. RWIS data and beacon devices should be utilized to add value to operations by utilizing existing operational capabilities of the SunGuide software.

5. RWIS and beacon subsystems and related components should be able to be operated, supported, and maintained by existing SunGuide software operations and support.

4.4.3 Technical Constraints

Technical constraints are inherited from the overall SunGuide software as RWIS and beacon subsystems should be properly integrated into the existing software architecture. Additional detailed constraints include:

1. The existing RWIS driver should be modified, if necessary, to support the existing NTCIP version with the concepts in this update.

2. The existing RWIS driver should be modified to support new communications protocols for each RWIS field weather station, including the legacy NTCIP, the new NTCIP version, and the non-proprietary ASCII-based protocol. If a new RWIS driver is created, the driver should be named (or renamed) to designate its operational differences, for instance *RWIS NTCIP version 2 (or version 3), ASCII serial,* or similar.

3. A representative device should be tested for each driver and for each protocol variation prior to acceptance of the software.

4. The data produced by the RWIS subsystem should be utilized in ways that add value to TMC operations in a manner consistent with existing SunGuide software operations. This includes producing alerts based on per-device alarm and recovery thresholds for RWIS data elements, and producing automatically suggested response plans containing an email with relevant information (location, threshold exceeded, data value exceeding threshold, etc.).

5. The RWIS subsystem and other applications consuming data produced by the RWIS protocol driver(s) should use the existing SunGuide software subsystems and take advantage of existing SunGuide software features. This includes using the RWIS subsystem and generating IDS alerts that create events in the event management subsystem, which allows automatically suggested response plans containing DMS messages, HAR messages, FL511 event publishing, and an email with RWIS information and what caused the RWIS alert. No new subsystems should be built.

6. The GUI specific to RWIS should be upgraded to use the Microsoft Windows Presentation Foundation. Some additional labor effort should be planned for responding to FDOT’s comments and change requests for nuances of the details of the user interface design of the modified user interface. The user interface should contain features comparable to the most recent GUI enhancements to other subsystem GUIs, specifically, the color DMS, scheduling GUIs, and the configuration element of connected vehicles.

7. Each component modified should handle all errors by, at a minimum, logging to the status logger with appropriate log levels. All communications into and out of a process should be logged in the most verbose or detailed log level when the process is configured in that detailed level. No exceptions should be unhandled – at a minimum, they should be caught at the highest level, logged as errors, and the process should attempt to continue to operate. Errors should be raised to the operator as a system message not requiring status logger access so that operators can notify administrators of the potential issue.

8. Device status, weather conditions reported, and alert generation and handling should all be archived and available for reporting through the existing reporting subsystem. Reports should have filters for date range and device. These reports should be consistent with other reports (for example, including reason for device being offline should be available in the data for the device status report).

5 Concepts for the Proposed System

This section describes the proposed system that results from the desired changes specified in the Section 4 of this ConOps.

5.1 Objectives and Scope

FDOT desires to update SunGuide software so that it is able to communicate with devices that support the NTCIP 1204 v03 communications protocol.

SunGuide software could also be updated so that it is able to accept data from weather stations that communicate using non-proprietary protocols. Commercial weather stations commonly use simple protocols to transmit weather information. These are often transmitted as ASCII data via a serial or Ethernet communications interface. Multiple, cost-effective weather stations with accuracy, reliability, and ruggedness appropriate for roadside weather monitoring should be researched, identified, and recommended. SunGuide software could then be updated so that it is able to accept and interpret data provided by these weather stations. This may be done in a future enhancement.

SunGuide software should be updated to implement the changes described in section 4.

5.2 Operational Policies and Constraints

The system will have the same operational constraints inherited from the overall SunGuide software system, the TMC operations, and Section 4.5 of this ConOps.

5.3 Description of the Proposed System

The proposed system description is covered in Section 4.2 of this ConOps.

5.4 Modes of Operation

The following sections describe the proposed system's various modes of operation. Examples of modes of operation include: standard, after hours, maintenance, emergency, training, or back-up.

5.4.1 Configuration

The configuration mode of the system must provide a GUI for adding, deleting, and modifying RWIS devices and their associated configuration. Configuration of a specific device must not impact or degrade the normal operation of other devices not under configuration.

5.4.2 Normal Operations

Normal operations is the primary mode of the system where RWIS and beacon devices are connected to SunGuide software, sending data to the software, and operators are able to interact with the data.

5.4.3 Simulation

For the purposes of reproducing issues in the field, training, and demonstrations, the system must be able to operate in a simulation mode. An RWIS simulator can be launched from a computer on the network and the SunGuide software can be configured to have an RWIS device with the Internet protocol address and port to match the simulation software. The simulation software must be able to be controlled to produce simulation data and interact with the SunGuide software in a manner similar to that of a true RWIS.

5.5 User Involvement and Interaction

Users interaction with the system as described in Section 3.4 of this ConOps.

5.6 Support Environment

The support environment is the same as the existing, overall SunGuide software support environment.

6 Operational Scenarios

The following scenarios are a step-by-step description of how the proposed system should operate and interact with its users and its external interfaces under a given set of circumstances. Each scenario describes a specific operational sequence that illustrates the role of the system, and its interactions with users and other systems.

6.1 Device Integration and Configuration

A new RWIS device is deployed and the configuration information for the device provided to the SunGuide software administrator. The SunGuide software administrator uses the RWIS GUI to add and configure the device in SunGuide software. The traffic engineer has determined appropriate thresholds for several of the RWIS data elements that, when exceeded, require operators to take action. The SunGuide software administrator completes the configuration, including setting alarm thresholds as directed by the engineer, and sets recovery thresholds to 20 percent of the alarm thresholds arbitrarily since that information wasn't provided and is more relevant to the software operation than the field conditions.

6.2 RWIS Device Monitoring

A new RWIS has been installed and configured and the ITS engineer asks the operator how it is working. The operator pans the map to the approximate location and sees that the icon is a dominantly green color. The operator hovers over the icon to instantly reveal the status and some of the current data values instantly as a tooltip. The operator clicks on the device and the status dialog appears, where the operator can see the full status as well as the status of other RWIS devices in a list that can be sorted, filtered, and searched. The operator then goes into the reports and runs several reports, including RWIS data for the last week for that device, and a detailed chronology of the operational status of the device.

6.3 Low Visibility Event

The operator sees a flashing red circle around the RWIS icon on the map, and also sees a low visibility alert in the alert box from the RWIS category of alerts. The operator then clicks on the alert to create a weather event. The operator can manage the event and create response plans. The response plans can include DMS, HAR, email, 511, and beacons. Beacons within a configurable default radius will be automatically included in the response plan. Other beacons or devices can be easily added to the response plan. The operator could request a new response plan suggesting a different distance radii for DMS, HAR, and beacons, if desired.

There will be a new DMS message template for weather events that can produce various messages in a pre-approved format, for example: LOW VISIBILITY <next line> NEXT 5 MILES <next line> SLOW DOWN.

7 Summary of Impacts

This section describes and summarizes the operational impacts of the proposed system from the user's perspective. This information is provided to allow all affected departments to prepare for the changes that will be brought about by the new system.

7.1 Admin and Operator Training

The system will have a need for administrator and operator training for this new module. This will be a small effort and can be included in the existing admin and operator training program provided by Central Office.

7.2 Deployment

Future RWIS devices will have deployment characteristics similar to existing RWIS devices. The most significant difference will be the option to selectively configure each weather station to report data using either the legacy NTCIP or one of the new protocols developed as part of this project. Beacons, however, will be a completely new device type with similarly new configuration screens and operational GUIs.

7.3 Integration and Configuration

The system will require a small additional effort to integrate RWIS devices and configure the system with data element alarm and recovery thresholds. Response plan templates must also be created. During the initial learning period, this may require the SunGuide software administrator to receive consultation from a traffic engineer and weather expert as well as administrator training. The administrator will configure the system, monitor it, and perform fine tuning of thresholds and response plans after some analysis of data and system operation.

7.4 Information Dissemination and Coordination

The system will increase the amount and scope of the information being disseminated. Currently, weather and environmental events are rarely, if ever, displayed on 511, DMSs, and HARs. This will also increase the coordination responsibility of operators as they will be sending out information and will be potentially required to respond to questions about the information being disseminated.

The system will be able to automatically post DMS messages in response to an incident detection system. These messages should be designed to not be overly specific or prescriptive to the motorists. The purpose is to get simple, generic, “heads up” information to the motorists immediately, not to “self-manage” the event. The operator should immediately take over the event and manage the future responses of the system, fine-tuning the messages and responses after checking more detailed information or additional information sources.

8 Analysis of the Proposed System

While SunGuide software is not a weather management system, having awareness is important to mitigating traffic risk. Warning motorists of fog, low visibility, and being able to coordinate road and bridge closings adds tremendous value that SunGuide software can provide to the public. While separate systems could possibly be used to provide the functionalities described in this document, integration with SunGuide software allows operators already attentive to the environment to have a more comprehensive set of input so they can coordinate the best possible response for the safest possible transportation system.

9 Notes

There are no notes at this time.