Integrated Terminal Weather System (ITWS) Simulator

JVN Communications, Inc.

User's Manual

1st Ed. Rev 4
April 4, 2001

Prepared by:

JVN Communications, Inc.
2617 Berwyn Ct.
Voorhees, NJ 08043

Table of Contents

0.0 INTRODUCTION

Integrated Terminal Weather System Simulator was developed for a purpose of generating ITWS products (described in section 1.0.2).

1.0 OVERVIEW

1.1 Supported ITWS Products

The simulator is capable of playing all of ITWS messages from pre-recorded file and generating only the certain products artificially, which are defined in table 1.0. The messages present in pre-recorded file and artificially generated messages can be mixed in any combination and sent to external user. The time stamp of the messages in the external file is substituted with time of the simulator but timed with original delays and proper order.

1.2 Artificially Generated ITWS Products

Table 1.0

No.	Product Name	ITWS Message Name	Message ID
1	Six Level Precipitation	4 – Precipitation Products 5NM, TRACON, 100NM and 200NM	9849 - 9852
2	Microburst	Microburst TRACON Map Product	9832
3	Wind Shear	Microburst TRACON Map Product	9832
4	Gust Fronts and Wind Shifts	Gust Front TRACON Map Product	9833
5	Storm Cell Motion	4 – Storm Motion – Storm Extrapolated Position Products 5NM, TRACON, 100NM and 200NM	9853 - 9856
6	Storm Extrapolated Position	4 – Storm Motion – Storm Extrapolated Position Products 5NM, TRACON, 100NM and 200NM	9853 - 9856
7	Tornado Vortex Signature	Tornado Detections Product	9838
8	Microburst Alert Panel & ATIS Countdown Timer	Microburst ATIS Panel Message Product	9893
9	Wind Shear Alert Panel & ATIS Countdown Timer	Wind Shear ATIS Panel Message Product	9894
10	Lighting Alert Panel	Airport Lightning Warning	9845
11	Anomalous Propagation (AP) Alert Panel	Anomalous Propagation (AP) Status	9847
12	Gust Front Alert Panel	Gust Front TRACON Map Product	9833
13	Terminal Winds Table	Wind Profile Product	9837
14	Wind shear Ribbon Display	Configured Alerts Product	9840
15	Storm Cell Information	Hazard Text Products 5NM, TRACON, 100NM and 200NM	9857 – 9860
16	Terminal Weather Text	Terminal Weather Normal Text Product and Terminal Weather Special Text Product	9844, 9895

2.0 PRODUCTS

2.1 Anomalous Propagation (AP) Alert Panel Product

Product definitions needed:
`propagation` section 4.3.9

Radar definitions needed:
`Asr9` or `asr9` section 4.2.2

Messages generated:
Anomalous Propagation (AP) Status Product Message
ITWS Msg ID 9847
Product type 20
Latency 26

Description:
The AP Status Product is constructed by definition of `propagation`. Each instance of `propagation` defines a radar reporting anomalous propagation. If an anomalous propagation needs to be reported by multiple radars it needs to be separately defined for each of those specific radars.

2.2 Gust Front Alert Panel Product

Product definitions needed:
`gustfront` section 4.3.3

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Gust Front TRACON Map Product Message
ITWS Msg ID 9833
Product type 2
Latency 3

Description:
The Gust Front Alert Panel Product is constructed by definition of `gustfront`. Each instance of `gustfront` defines a new gust front with independent velocity and heading. If gust fronts are defined in multiple radars the effect is that each of the radars will additionally report gust fronts related to other radars. If a gust front needs to be reported by multiple radars it needs to be separately defined for each of those specific radars.

2.3 Gust Front and Wind Shift Product

Product definitions needed:
`gustfront` section 4.3.3

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Gust Front TRACON Map Product Message
ITWS Msg ID 9833
Product type 2
Latency 3

Description:
The Gust Front and Wind Shift Product is constructed by definition of `gustfront`. Each instance of `gustfront` defines a new gust front with independent velocity and heading. If gust fronts are defined in multiple radars the effect is that each of the radars will additionally report gust fronts related to other radars. If a gust front needs to be reported by multiple radars it needs to be separately defined for each of those specific radars.

2.4 Lightning Alert Panel Product

Product definitions needed:
`lightning` section 4.3.5

Radar definitions needed:
`Adas` or `adas` section 4.2.1

Messages generated:
Airport Lightning Warning Message
ITWS Msg ID 9845
Product type 23
Latency 30

Description:
The Airport Lightning Warning Product is constructed by definition of `lightning`. Each instance of `lightning` defines a sensor location, which is stationary, not a actual lightning strike. The product reports lightning alerts related to multiple radar sites, which don't have to be defined separately by radar definitions.

2.5 Microburst Alert Panel & ATIS Countdown Timer Product

Product definitions needed:
`mbatis` section 4.3.6

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Microburst ATIS Panel Product Message
ITWS Msg ID 9893
Product type 4
Latency 11

Description:
The Microburst ATIS Panel Product is constructed by definition of `mbatis`. Each definition of mbatis resets the data of the message to given parameters at the specified time of the simulation.

2.6 Microburst Product

Product definitions needed:
`microburst` section 4.3.7

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Microburst Product Message
ITWS Msg ID 9832
Product type 1
Latency 2

Description:

The Microburst Product is constructed by definition of `microburst`. Each instance of `microburst` defines a new microburst with independent radius and radial loss. If microbursts are defined in multiple radars the effect is that each of the radars will additionally report microbursts related to other radars. If a microburst needs to be reported by multiple radars it needs to be separately defined for each of those specific radars. Look into section 4.3.7, the definition of `microburst` to find out what's the difference between microburst and wind shear and how to define them.

2.7 Six Level Precipitation Product

Product definitions needed:

`precip`	section 4.3.8
`stormmotion`	section 4.3.10

Radar definitions needed:

`Asr9 or asr9`	section 4.2.2
`Nexrad or nexrad`	section 4.2.3
`Tdwr or tdwr`	section 4.2.4

Messages generated:

AP Indicated Precipitation Product Message

ITWS Msg ID	9848
Product type	19
Latency	26

Precipitation 5NM Product Message

ITWS Msg ID	9849
Product type	7
Latency	14

Precipitation TRACON Product Message

ITWS Msg ID	9850
Product type	8
Latency	15

Precipitation 100NM Product Message

ITWS Msg ID	9851
Product type	9
Latency	16

Precipitation 200NM Product Message

ITWS Msg ID	9852
Product type	10
Latency	17

Description:

The Precipitation Product is constructed by definition of `precip`. Each instance of `precip` defines an area of specified precipitation level. Every radar reports a precipitation area only if it is within its range. Therefore there might be situations when the same area if precipitation is reported by more than one radar at the same time and in other cases none of the radars might report certain precipitation areas. The `stormmotion` definition is needed for the precipitation areas to shift in certain directions. If no `stormmotion` is defined the precipitation will appear stationary. There are three types of radars that are capable of reporting a precipitation: ASR9, NEXRAD, and TDWR. Every radar reports the precipitation with different precision and on different range. ASR9 has range of 64 nautical miles with precision of 1000 meters. NEXRAD has ranges of 100 and 200 nautical miles with precisions of 1000 and 4000 meters respectively. TDWR has range of 5 nautical miles with precision of 250 meters.

2.8 Storm Cell Information Product

Product definitions needed:

`hazard`	section 4.3.4

Radar definitions needed:

`Asr9` or `asr9`	section 4.2.2
`Nexrad` or `nexrad`	section 4.2.3
`Tdwr` or `tdwr`	section 4.2.4

Messages generated:

Hazard Text 5NM Product Message

ITWS Msg ID	9857
Product type	15
Latency	22

Hazard Text TRACON Product Message

ITWS Msg ID	9858
Product type	16
Latency	23

Hazard Text 100NM Product Message

ITWS Msg ID	9859
Product type	17
Latency	24

Hazard Text 200NM Product Message

ITWS Msg ID	9860
Product type	18
Latency	25

Description:

The Hazard Text Products are constructed by definition of `hazard`. Each instance of `hazard` defines information for a new cell. A definition of cell information is radar specific. If a cell is in a position that should appear on more than one radar, it needs to be defined separately for each of those specific radars. There are three types of radars that are capable of reporting a hazard text: ASR9, NEXRAD, and TDWR. Every radar reports the hazard text with range specific message. Therefore in order for multiple radars to report the same message, a separate `hazard` definition must be defined for each of those radars with specific resolution.

2.9 Storm Cell Motion Product

Product definitions needed:

`stormmotion`	section 4.3.10

Radar definitions needed:

`Asr9` or `asr9`	section 4.2.2
`Nexrad` or `nexrad`	section 4.2.3
`Tdwr` or `tdwr`	section 4.2.4

Messages generated:

Storm Motion – Strom Extrapolated Position 5NM Product Message

ITWS Msg ID	9853
Product type	11
Latency	18

Storm Motion – Strom Extrapolated Position TRACON Product Message
ITWS Msg ID 9854
Product type 12
Latency 19

Storm Motion – Strom Extrapolated Position 100NM Product Message
ITWS Msg ID 9855
Product type 13
Latency 20

Storm Motion – Strom Extrapolated Position 200NM Product Message
ITWS Msg ID 9856
Product type 14
Latency 21

Description:
The Storm Motion Products is constructed by definition of `stormmotion`. Each instance of `stormmotion` resets to specific values of the global storm velocity and heading at specified time of the simulation. A definition of storm motion is not radar specific. The active storm motion shifts the entire global map of the precipitation according to the velocity and heading of the motion. There are three types of radars that are capable of reporting a storm motion: ASR9, NEXRAD, and TDWR. Every radar reports the storm motion with different precision and on different range. ASR9 has range of 64 nautical miles with precision of 1000 meters. NEXRAD has ranges of 100 and 200 nautical miles with precisions of 1000 and 4000 meters respectively. TDWR has range of 5 nautical miles with precision of 250 meters

2.10 Storm Extrapolated Position

Product definitions needed:
`stormmotion` section 4.3.10
`stormextrap` section 4.3.11

Radar definitions needed:
`Asr9 or asr9` section 4.2.2
`Nexrad or nexrad` section 4.2.3
`Tdwr or tdwr` section 4.2.4

Messages generated:
Storm Motion – Strom Extrapolated Position 5NM Product Message
ITWS Msg ID 9853
Product type 11
Latency 18

Storm Motion – Strom Extrapolated Position TRACON Product Message
ITWS Msg ID 9854
Product type 12
Latency 19

Storm Motion – Strom Extrapolated Position 100NM Product Message
ITWS Msg ID 9855
Product type 13
Latency 20

Storm Motion – Strom Extrapolated Position 200NM Product Message
ITWS Msg ID 9856
Product type 14
Latency 21

Description:

The Storm Extrapolated Position Product is constructed by definition of `stormextrap`. Each instance of `stormextrap` defines a boundary of storm motion front, which will be reported with specific velocity and heading. The defined boundary should correspond to a specific area that should be defined by `precip` definition, usually of level 3 and up. Similarly as precipitation, a definition of storm extrapolated position is not radar specific. The active storm motion shifts the entire global map of the storm extrapolated position according to the velocity and heading of the motion so that the precipitation and corresponding storm extrapolated position is mapped in the same geographic location. If no `stormmotion` is defined the storm extrapolated position will appear stationary. There are three types of radars that are capable of reporting a storm extrapolated position: ASR9, NEXRAD, and TDWR. Every radar reports the storm extrapolated position on a different range. ASR9 has range of 64 nautical miles, NEXRAD has ranges of 100 and 200 nautical miles, and TDWR has range of 5 nautical miles. Only the storm extrapolated positions that are visible in those radar ranges are reported by the corresponding radars.

2.11 Terminal Weather Text Product

Product definitions needed:

`termtext`	section 4.3.12
`stormmotion`	section 4.3.10

Radar definitions needed:

`Pdata` or `pdata`	section 4.2.5

Messages generated:

Terminal Weather Normal Text Product Message

ITWS Msg ID	9844
Product type	28
Latency	35

Terminal Weather Special Text Product Message

ITWS Msg ID	9895
Product type	29
Latency	35

Description:

The Terminal Weather Text Product is constructed by definition of `termtext`. Each instance of `termtext` resets the data of the message to given parameters at the specified time of the simulation. The definition of the `stormmotion` is only needed to report current storm velocity and heading. If no storm motion is defined by the default the storm motion will be reported as unavailable.

2.12 Terminal Winds Table Product

Product definitions needed:

`wind`	section 4.3.14

Radar definitions needed:

`Pdata` or `pdata`	section 4.2.5

Messages generated:

Wind Profile Product Message

ITWS Msg ID	9837
Product type	26
Latency	33

Description:
The Terminal Winds Table Product is constructed by definition of `wind`. Each instance of `wind` defines a wind properties at certain altitude. The definitions of `wind` with different altitudes at the same location (up to 10 altitudes) are grouped to form a location profile (up to 16 profiles).

2.13 Tornado Vortex Signature Product

Product definitions needed:
`tornado` section 4.3.13

Radar definitions needed:
`Nexrad` or `nexrad` section 4.2.3

Messages generated:
Tornado Vortex Signature Product Message
ITWS Msg ID 9838
Product type 21
Latency 28

Description:
The Tornado Vortex Signature Product is constructed by definition of `tornado`. Each instance of `tornado` defines a new tornado with specific location, velocity and direction. If a tornado is not within a range of any NEXRAD radar it is not reported. The specific NEXRAD radar reports only the tornadoes that are within the range of that NEXRAD.

2.14 Wind Shear Alert Panel & ATIS Countdown Timer Product

Product definitions needed:
`wsatis` section 4.3.15

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Wind Shear ATIS Panel Product Message
ITWS Msg ID 9894
Product type 5
Latency 12

Description:
The Wind Shear ATIS Panel Product is constructed by definition of `wsatis`. Each instance of wsatis resets the data of the message to given parameters at the specified time of the simulation.

2.15 Wind Shear Product

Product definitions needed:
`microburst` section 4.3.7

Radar definitions needed:
`Tdwr` or `tdwr` section 4.2.4

Messages generated:
Microburst Product Message
ITWS Msg ID 9832
Product type 1
Latency 2

Description:
The Wind Shear Product is constructed by definition of `microburst`. Each instance of `microburst` defines a new wind shear with independent radius and radial loss. If wind shears are defined in multiple radars the effect is that each of the radars will additionally report wind shears related to other radars. If a wind shear needs to be reported by multiple radars it needs to be separately defined for each of those specific radars. Look into section 4.3.7, the definition of `microburst` to find out what's the difference between microburst and wind shear and for more detailed parameter definition.

2.16 Wind Shear Ribbon Display Product

Product definitions needed:

`alert`	section 4.3.1
`alertconf`	section 4.3.2

Radar definitions needed:

`Tdwr or tdwr`	section 4.2.4

Messages generated:
Configured Alerts Product Message

ITWS Msg ID	9840
Product type	3
Latency	5, 6, 7, 8, 9, 10, or 31 – depends on product definition (`source` parameter)

Description:
The Wind Shear Ribbon Display Product is constructed through definition of `alertconf` and `alert`. The `alertconf` defines a message and `alert` defines alerts to be included in the given message. The `source` parameter of both `alertconf` and `alert` is the bonding link between those definitions, which basically provides the information to `alertconf` about the alerts that correspond to its definition.

3.0 SCRIPT

3.1 Input Script

The simulator is driven by various definitions, which generally are defined in the input script. Those definitions tell the simulator things like: to what user the output should be sent, whether to use an input file, geographic locations of sites, what radars and what products have to be sent to external users and what parameters they should have. The input script is not required but provides much easier way of defining scenarios and ability to reuse them. Although definitions can be typed in on the terminal while the simulator is running, they cannot be saved for later use.

Table 2.0 – Parts of the script

Item	Description
Input file	Pre-recorded file with ITWS messages
Output file/device	Destination file, where messages are to be written or the device, where messages are to be sent.
ITWS Site name	Name of the ITWS site
Geographical points	Latitude and longitude definitions of projection and radars.
Global attributes	Definition of projection and start time
Radar definitions	Define radars and their attributes
Product enabling/blocking	Define product enabling and blocking
Product definitions	Define products and their attributes

4.0 SCRIPT COMMANDS

Standards:

- `name` of radars and airports must be a maximum of 4 alphanumeric characters.
- parameters that get time, use standard time format `hh:mm:ss`
- `lat&lon` – latitude followed by longitude, separated by comma with no space. The coordinates must be followed by a character letter l (ASCII 108).
- `pos` parameter supports both the Cartesian plane coordinates or `lat&lon` coordinates.

There are four types of radars that this simulator supports: Adas, Asr9, Nexrad and Tdwr. There is also a non-radar object Product Data, which also controls some products. For simplicity its internal name is Pdata.

There are two ways of defining each radar including the non-radar Pdata. By defining the radar with upper case letter, a window is displayed for the given radar and at runtime controls are accessible via GUI (Graphical User Interface). By defining the radar with lower case letter, no window is displayed and at runtime all controls need to be typed in on the terminal.

4.1 Script Commands Overview

4.1.1

Reserved variables:

```
input
ItwsSite
output
```

4.1.2

Reserved keywords:

Adas	Asr9	microburst	propagation	Tdwr
Adas	gustfront	nexrad	run	termtext
Alert	hazard	Nexrad	stormextrap	tornado
alertconf	lightning	precip	stormmotion	wind
asr9	mbatis	projection	tdwr	wsatis

4.1.3

Object specific keywords:

There are also radar specific reserved keywords for each defined radar. Every definition of the radar creates its own radar commands. In order to distinguish a command of specific radar there must be a unique keyword for each defined radar. The radar specific command must be preceded with `radartype_radarname` keyword followed by the sub-keyword (a radar specific command).

4.1.4

Sub-keywords common for all radars:

```
block
disable
enable
unblock
```

4.1.5

Radar specific sub-keywords:

4.1.5.1

ADAS specific:

```
update_adas
update_lightning
```

4.1.5.2

ASR9 specific:

```
update_asr9
```

```
update_ap_status
update_precip_ap
update_precip_tracon
update_stormmotion_tracon
update_hazard_tracon
```

4.1.5.3

NEXRAD specific:

```
update_nexrad
update_tornado
update_precip_100nm
update_precip_200nm
update_stormmotion_100nm
update_stormmotion_200nm
update_hazard_100nm
update_hazard_200nm
```

4.1.5.4

TDWR specific:

```
update_tdwr
update_microburst
update_gustfront
update_conf_alets
update_precip_5nm
update_stormmotion_5nm
update_hazard_5nm
update_mbatis
update_wsatis
```

4.1.5.5

Product Data specific:

```
update_pdata
update_windprofile
update_term_wx_text
```

4.2 Radar keyword definitions

4.2.1

Adas definition:

Adas name **[-airport** name**]**

Parameter definition:

Parameter	Description	Default Value
name	– name of the radar, must be unique across all radars of the same type.	required
[-airport name]	– name of the airport where this radar is located. (maximum of 4 alphanumeric characters)	0000

Radar commands:

Creation of radar keywords is defined in Appendix A.

adas_name block MsgID

If an input file is specified, all the messages of type MsgID from radar ADAS with name name, will be ignored in the input file. (Default)

adas_name disable MsgID
The messages of type MsgID from radar ADAS with name name, will NOT be generated and NOT sent to the output.

adas_name enable MsgID
The messages of type MsgID from radar ADAS with name name, will be artificially generated based on its definition in the script and sent to the output. (Default)

adas_name unblock MsgID
If an input file is specified, all the messages of type MsgID from radar ADAS with name name, will be sent to the output from the input file.

adas_name update_adas
All messages from radar ADAS with name name, are forced to be sent to the output with no regard to their next update time. The messages are sent only when they are enabled. (Runtime command)

adas_name update_lightning
The Airport Lightning Warning message (type 9845) from radar ADAS with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

4.2.2

Asr9 definition:
Asr9 name **[-airport** name**] [-pos** lat&lon**] [-rot** rotation**]**

Parameter definition:

Parameter	Description	Default Value
name	– name of the radar, must be unique across all radars of the same type.	required
[-airport name]	– name of the airport where this radar is located. (maximum of 4 alphanumeric characters)	0000
[-pos lat&lon]	– the geographic position of the radar.	projection tangent
[-rot rotation]	– the degree of rotation off the true north.	0

Radar commands:
Creation of radar keywords is defined in Appendix A.

asr9_name block MsgID
If an input file is specified, all the messages of type MsgID from radar ASR9 with name name, will be ignored in the input file. (Default)

asr9_name disable MsgID
The messages of type MsgID from radar ASR9 with name name, will NOT be generated and NOT sent to the output.

asr9_name enable MsgID
The messages of type MsgID from radar ASR9 with name name, will be artificially generated based on its definition in the script and sent to the output. (Default)

asr9_name unblock MsgID
If an input file is specified, all the messages of type MsgID from radar ASR9 with name name, will be sent to the output form the input file.

asr9_name update_asr9
All messages from radar ASR9 with name name, are forced to be sent to the output with no regard to their next update time. The messages are sent only when they are enabled. (Runtime command)

asr9_name update_precip_ap
The AP Indicated Precipitation message (type 9848) from radar ASR9 with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

asr9_name update_precip_tracon
The Precipitation TRACON message (type 9850) from radar ASR9 with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

asr9_name update_propagation
The Anomalous Propagation Status message (type 9847) from radar ASR9 with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

asr9_name update_stormmotion_tracon
The Storm Motion TRACON message (type 9854) from radar ASR9 with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

asr9_name update_hazrad_tracon
The Hazard Text TRACON message (type 9858) from radar ASR9 with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

4.2.3

Nexrad definition:

```
Nexrad name [-airport name] [-pos lat&lon] [-rot rotation]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the radar, must be unique across all radars of the same type.	required
[-airport name]	– name of the airport where this radar is located. (maximum of 4 alphanumeric characters)	0000
[-pos lat&lon]	– the geographic position of the radar.	projection tangent
[-rot rotation]	– the degree of rotation off the true north.	0

Radar commands:
Creation of radar keywords is defined in Appendix A.

nexrad_name block MsgID
If an input file is specified, all the messages of type MsgID from radar NEXRAD with name name, will be ignored in the input file. (Default)

nexrad_name disable MsgID
The messages of type MsgID from radar NEXRAD with name name, will NOT be generated and NOT sent to the output.

nexrad_name enable MsgID
The messages of type MsgID from radar NEXRAD with name name, will be artificially generated based on its definition in the script and sent to the output. (Default)

nexrad_name unblock MsgID
If an input file is specified, all the messages of type MsgID from radar NEXRAD with name name, will be sent to the output form the input file.

nexrad_name update_nexrad
All messages from radar NEXRAD with name name, are forced to be sent to the output with no regard to their next update time. The messages are sent only when they are enabled (Runtime command)

nexrad_name update_tornado
The Tornado Detection message (type 9838) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_precip_100nm
The Precipitation 100NM message (type 9851) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_precip_200nm
The Precipitation 200NM message (type 9852) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_stormmotion_100nm
The Storm Motion 100NM message (type 9855) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_stormmotion_200nm
The Storm Motion 200NM message (type 9856) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_hazard_100nm
The Hazard Text 100NM message (type 9859) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

nexrad_name update_hazard_200nm
The Hazard Text 200NM message (type 9860) from radar NEXRAD with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

4.2.4

Tdwr definition:

```
Tdwr name [-airport name] [-pos lat&lon] [-rot rotation]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the radar, must be unique across all radars of the same type.	required
[-airport name]	– name of the airport where this radar is located. (maximum of 4 alphanumeric characters)	0000
[-pos lat&lon]	– the geographic position of the radar.	projection tangent
[-rot rotation]	– the degree of rotation off the true north.	0

Radar commands:
Creation of radar keywords is defined in Appendix A.

`tdwr_name block` `MsgID`
If an input file is specified, all the messages of type `MsgID` from radar TDWR with name `name`, will be ignored in the input file. (Default)

`tdwr_name disable` `MsgID`
The messages of type `MsgID` from radar TDWR with name `name`, will NOT be generated and NOT sent to the output.

`tdwr_name enable` `MsgID`
The messages of type `MsgID` from radar TDWR with name `name`, will be artificially generated based on its definition in the script and sent to the output. (Default)

`tdwr_name unblock` `MsgID`
If an input file is specified, all the messages of type `MsgID` from radar TDWR with name `name`, will be sent to the output form the input file.

`tdwr_name update_tdwr`
All messages from radar TDWR with name `name`, are forced to be sent to the output with no regard to their next update time. The messages are sent only when they are enabled (Runtime command)

`tdwr_name update_microburst`
The Microburst TRACON Map message (type 9832) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_gustfront`
The Gust Front TRACON Map message (type 9833) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_conf_alerts`
The Configured Alerts message (type 9840) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_precip_5nm`
The Precipitation 5NM message (type 9849) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_stormmotion_5nm`
The Storm Motion 5NM message (type 9853) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_hazard_5nm`
The Hazard Text 5NM message (type 9857) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_mbatis`
The Microburst ATIS message (type 9893) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

`tdwr_name update_wsatis`
The Wind Shear ATIS message (type 9894) from radar TDWR with name `name`, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

4.2.5

Pdata definition:

```
Pdata name [-airport name] [-user name] -site_range length
           -radar_range length
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the radar, must be unique across all radars of the same type.	required
[-airport name]	– name of the airport where this radar is located. (maximum of 4 alphanumeric characters)	0000
[-user name]	– the name of the user. (maximum of 4 alphanumeric characters)	0000
-site_range length	– the range of the airport in nautical miles.	required
-radar_range length	– the range of the radar in nautical miles.	required

Radar commands:

Creation of radar keywords is defined in section 3.1.3.

pdata_name block MsgID

If an input file is specified, all the messages of type MsgID from Product Data with name name, will be ignored in the input file. (Default)

pdata_name disable MsgID

The messages of type MsgID from Product Data with name name, will NOT be generated and NOT sent to the output.

pdata_name enable MsgID

The messages of type MsgID from Product Data with name name, will be artificially generated based on its definition in the script and sent to the output. (Default)

pdata_name unblock MsgID

If an input file is specified, all the messages of type MsgID from Product Data with name name, will be sent to the output form the input file.

pdata_name update_pdata

All messages from radar TDWR with name name, are forced to be sent to the output with no regard to their next update time. The messages are sent only when they are enabled (Runtime command)

pdata_name update_windprofile

The Wind Profile message (type 9837) from Product Data with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

pdata_name update_terminal_normal_text

The Terminal Weather Normal Text message (type 9844) from Product Data with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

pdata_name update_terminal_special_text

The Terminal Weather Special Text message (type 9895) from Product Data with name name, is forced to be sent to the output with no regard to its next update time. The message is sent only when it's enabled. (Runtime command)

4.3 Product keyword definitions

4.3.1

alert definition:

```
alert name [-t starttime] [-dt deltatime] -source name [-region name]
           [-type name] [-value knots] [-first name] [-last name]
           [-hdg degrees] [-vel knots] [-sd name] [-rbds name]
           [-line number]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this product becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-source name	– source of the alert. (Possible sources: 5 – LLWAS III Alert, 6 – MB Alert Detection, 7 – MB Alert Prediction, 8 – GF Alert Detection, 9 – GF Alert Update, 10 – Alert Runway Configuration, 31 – Airport Wind) This parameter is the link between the alertconf command.	required
[-region name]	– the region ID name (maximum of 7 alphanumeric characters)	null
[-type name]	– the type of the alert (maximum of 4 alphanumeric characters)	null
[-value name]	– a loss or gain value in knots.	0
[-first name]	– first alert location name (maximum of 4 alphanumeric characters)	null
[-last name]	– last alert location name (maximum of 4 alphanumeric characters)	null
[-hdg degrees]	– the direction of LLWAS threshold wind (based on 360°)	999
[-vel knots]	– the speed of LLWAS threshold wind in knots.	99
[-sd name]	– the ID of SD where Ribbon Display is located (maximum of 3 alphanumeric characters)	null
[-rbdt name]	– the ID of RBDT (maximum of 7 alphanumeric characters)	null
[-line number]	– the number of the line where this alert should be displayed.	0

Products affected:

Wind Shear Ribbon Display Product – (see section 2.16)

NOTE:

The alert command requires previous definition of alertconf command. Defining an alert with source has no effect on messages unless alertconf is defined with the same source.

4.3.2

alertconf definition:

```
alertconf name [-t starttime] [-dt deltatime] -source name -runway name
               [-wind_hdg degrees] [-wind_vel knots] [-gust_vel knots]
               [-radar_imp flag] [-llwas_imp flag]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required

Parameter	Description	Default Value
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-source name	– source of the alert. (Possible sources: 5 – LLWAS 3 Alert, 6 – MB Alert Detection, 7 – MB Alert Prediction, 8 – GF Alert Detection, 9 – GF Alert Update, 10 – Alert Runway Configuration, 31 – Airport Wind)	required
-runway name	– the runway configuration name (maximum of 31 alphanumeric characters)	required
[-wind_hdg degrees]	– the direction of wind (based on 360°)	999
[-wind_vel knots]	– the speed of the wind in knots.	99
[-gust_vel knots]	– the speed of the gusts in knots.	99
[-radar_imp flag]	– state of the radar (1 – impaired, 0 – not impaired)	0
[-llwas_imp flag]	– state of the LLWAS (1 – impaired, 0 – not impaired)	0

Products affected:
Wind Shear Ribbon Display Product – (see section 2.16)

4.3.3

gustfront definition:

```
gustfront name [-t starttime] [-dt deltatime] -radar name -id number
               [-hazard knots] [-pos point_list] [-vel knots] [-hdg degrees]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-radar name	– name of the radar that is reporting.	required
-id number	– the gust front ID number. (Any positive number)	required
[-hazard knots]	– the wind shear hazard or change in velocity.	0
[-pos point_list]	– the list of points in quadratic plane and projection as reference point representing the gust front shape. (Exp: -pos "{1,2}{2,3}{2.3,4}")	null
[-vel knots]	– the speed of the gust front in knots.	0
[-hdg degrees]	– the direction in which the gust front is moving (based on 360°)	0

Products affected:
Gust Front Alert Panel – (see section 2.2)
Gust Fronts and Wind Shifts Product – (see section 2.3)

4.3.4

hazard definition:

```
hazard name [-t starttime] [-dt deltatime] -res type [-pos lat&lon]
            [-hail flag] [-lightning flag] [-storm flag] [-echo value]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-res type	– type of resolution of radar. (5NM, TRACON, 100NM, or 200NM)	required
[-pos lat&lon]	– the geographic position of the hazard cell.	projection tangent
[-hail flag]	– indication of presence of hail. (YES – present or NO – unavailable)	null
[-lightning flag]	– indication of presence of lightning. (YES – present or NO – unavailable)	null
[-storm flag]	– indication of presence of sever storm circulation. (YES – present or NO – unavailable)	null
[-echo value]	– the value of echotop. Altitude is denoted in thousands of feet. (NO – not present, altitude, or altitude+).	null

Products affected:

Storm Cell Information Product – (see section 2.8)

4.3.5

lightning definition:

```
lightning name [-t starttime] [-dt deltatime] [-airport name]
               [-pos lat&lon] [-radius length] [-state state]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active. [Default:	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
[-airport name]	– name of the airport where this radar is located. (maximum of 3 alphanumeric characters)	null
[-pos lat&lon]	– the geographic position of the radar.	projection tangent
[-radius length]	– the length of radius in nautical miles of the warning area.	5
[-state state]	– the warning state of the region (1 – ON, 0 – OFF)	1

Products affected:

Lightning Alert Panel Product – (see section 2.4)

4.3.6

mbatis definition:

```
mbatis name [-t starttime] [-id name] -radar name [-source source]
            [-status state] [-timer minutes]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-id name]	– id name of the microburst ATIS alert.	null
-radar name	– name of the radar that is reporting. A TDWR radar with same radar name must be defined, otherwise a message with the alert off is generated.	required
[-source source]	– source of input that triggered the state. (0 – Alert, 1 – PIREP Entry, 2 – PIREP Withdrawal, 3 – Timer)	0
[-status state]	– state of the panel. (0 – OFF, 1 – Countdown, 2 – Active)	0
[-timer minutes]	– number of minutes to countdown. (valid ONLY when status is Countdown)	20

Products affected:

Microburst Alert Panel & ATIS Countdown Timer Product – (see section 2.5)

4.3.7

microburst definition:

```
microburst name [-t starttime] [-dt deltatime] -radar name [-pos1 lat&lon]
                [-pos2 lat&lon] [-radius length] [-loss knots]
                [-det det_flag]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-radar name	– name of the radar that is reporting.	required
[-pos1 lat&lon]	– the geographic position of the microburst or wind shear.	projection tangent
[-pos2 lat&lon]	– the geographic position of the microburst or wind shear. Not used when det_flag is set to 0.	projection tangent
[-radius length]	– the length of radius in nautical miles of the microburst or wind shear.	0
[-loss knots]	– the maximum velocity loss across the microburst or wind shear. If loss is less than 30 a wind shear is produced, if loss is greater or equal to 30 a microburst is produced.	0
[-det det_flag]	– the detection mode flag (1 – detection mode, 0 – prediction mode).	1

Products affected:

Microburst Product – (see section 2.6)
Wind Shear Product – (see section 2.15)

4.3.8

precip definition:

```
precip name [-level level] [-pos point_list]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-level level]	– level of precipitation value 0 – 6, 7 – attenuated, 8 – AP detected, 9 – bad value, 15 – no coverage.	0
[-pos point_list]	– the list of points in quadratic plane with projection as reference point representing the area covered by the precipitation of level specified. (Exp: -pos "{1,2}{2,3}{2.3,4}")	null

Products affected:

Six Level Precipitation Product – (see section 2.7)

4.3.9

propagation definition:

```
propagation name [-t starttime] [-dt deltatime] -radar name [-state flag]
                 [-tas1 tas1_value] [-tas2 tas2_value] [-tas3 tas3_value]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information. (information expires at starttime + deltatime)	simulator end time
-radar name	– name of the radar that is reporting.	required
[-state flag]	– indicates whether an editing radar exists for this ASR9. (0 – no editing, 1 – editing)	0
[-tas1 tas1_value]	– threshold, area and search values. (exp. –tas1 "{3,13,0}")	null
[-tas2 tas2_value]	– threshold, area and search values.	null
[-tas3 tas3_value]	– threshold, area and search values.	null

Products affected:

Anomalous Propagation (AP) Alert Panel Product – (see section 2.1)

4.3.10

stormmotion definition:

```
stormmotion name [-t starttime] [-vel knots] [-hdg degrees]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information. (information expires at starttime + deltatime)	simulator end time
[-vel knots]	– the speed of the storm in knots.	0

Parameter	Description	Default Value
[-hdg degrees]	– the direction in which the storm is moving (based on 360°)	0

Products affected:
Storm Cell Motion Product – (see section 2.9)
Terminal Weather Text Product – (see section 2.11)

4.3.11

stormextrap definition:

```
stormextrap name -id ID_num [-pos point_list]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
-id ID_num	– identifier identifying the storm	required
[-pos point_list]	– the list of points in quadratic plane with projection as reference point representing the front of the storm. (exp: -pos "{1,2}{2,3}{2.3,4}")	null

Products affected:
Storm Extrapolated Position Product – (see section 2.10)

4.3.12

termtext definition:

```
termtext name [-t starttime] [-dt deltatime] [-alert name] [-value value]
              [-storms storm_list] [-next_alert name] [-next_start time]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
[-alert name]	– 3 character alert code (MBA – microburst, WSA – wind shear, HVY – heavy precipitation, HVF – expected heavy precipitation).	null
[-value value]	– the value of the alert, (microburst – loss in knots, wind shear – loss in knots if negative and gain in knots if positive, precipitation – level of precipitation 0 – 6)	0
[storms storm_list]		null
[-next_alert name]	– 3 character alert code, pretends only to precipitation (HVY – heavy precipitation, MOD – moderate precipitation).	null
[-next_start time]	– the time of the simulation when the next alert is expected.	0

Products affected:
Terminal Weather Text Product – (see section 2.11)

4.3.13

tornado definition:

```
tornado name [-t starttime] [-dt deltatime] [-vel knots] [-hdg degrees]
             [-pos lat&lon] [-vel_valid flag] [-hdg_valid flag]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
[-vel knots]	– the speed of the tornado in knots.	0
[-hdg degrees]	– the direction in which the tornado is moving (based on 360°)	0
[-pos lat&lon]	– the geographic position of the tornado.	projection tangent
[-vel_valid flag]	– validity of tornado velocity (1 – valid, 0 – invalid)	1
[-hdg_valid flag]	– validity of tornado heading. (1 – valid, 0 – invalid)	1

Products affected:

Tornado Vortex Signature Product – (see section 2.13)

4.3.14

wind definition:

```
wind name [-t starttime] [-dt deltatime] -location name -row num -col num
          [-alt feet] [-hdg degrees] [-vel knots] [-qual quality]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-dt deltatime]	– the duration time of this information (information expires at starttime + deltatime)	simulator end time
-location name	– profile location name.	required
-row num	– profile row number.	required
-col num	– profile column number.	required
[-alt feet]	– altitude above mean sea level measured in feet.	0
[-vel knots]	– the speed of wind in knots.	0
[-hdg degrees]	– the direction of wind (based on 360°)	0
[-qual flag]	– wind estimate quality flag (0 – good, 1 – valid, 2 – invalid)	0

Products affected:

Terminal Winds Table Product – (see section 2.12)

4.3.15

wsatis definition:

```
wsatis name [-t starttime] [-id name] -radar name [-source source]
            [-status state] [-timer minutes]
```

Parameter definition:

Parameter	Description	Default Value
name	– name of the definition must be unique.	required
[-t starttime]	– the time of the simulation when this information becomes active.	simulator start time
[-id name]	– id name of the wind shear ATIS alert.	null
-radar name	– name of the radar that is reporting. A TDWR radar with same radar name must be defined, otherwise a message with the alert off is generated.	required
[-source source]	– source of input that triggered the state. (0 – Alert, 1 – PIREP Entry, 2 – PIREP Withdrawal, 3 – Timer)	0
[-status state]	– state of the panel. (0 – OFF, 1 – Countdown, 2 – Active)	0
[-timer minutes]	– number of minutes to countdown. (valid ONLY when status is Countdown)	20

Products affected:

Wind Shear Alert Panel & ATIS Countdown Timer Product – (see section 2.14)

4.4 Other keyword definitions

4.4.1

input definition:

```
set input filepath
```

Parameter definition:

Parameter	Description	Default Value
filepath	– a valid path and file name of an input file	required

4.4.2

ItwsSite definition:

```
set ItwsSite sitename
```

Parameter definition:

Parameter	Description	Default Value
sitename	– name of site, must be limited to 3 alphanumeric characters.	required

4.4.3

`output` definition:

```
set output filepath | udp:IPaddress/UDPport | udp:host/UDPport
```

Parameter definition:

Parameter	Description	Default Value
`filepath`	– a valid path and file name of an output file, or IP address followed by UDP port, or host name followed by UDP port. If case of specifying a UDP port the IP address or host name must be preceded with `udp:` token.	required

4.4.4

`projection` definition:

```
set projection type -tangent lat&lon
```

Parameter definition:

Parameter	Description	Default Value
`type`	– type of projection.	required
`-tangent lat&lon`	– latitude/longitude position of the origin of the projection.	required

4.4.5

`run` definition:

```
run [deltatime]
```

Parameter definition:

Parameter	Description	Default Value
`[deltatime]`	– the time for which the simulator should run. Omitting the this parameter causes the simulator to start automatically.	required

Note:

By specifying the parameter `deltatime` the simulator will generate the defined products as fast as possible with proper time stamp but without delays between messages. This functionality is helpful in creating the source files for later playback. Make sure that the output device is not an UDP port; otherwise port will be flooded with messages.

5.0 THE SIMULATOR

5.1 Starting the program

There are several ways of running the simulator, depending on the features that are needed. The most common is to start the simulator with a predefined script. It is always a good idea to define all product definitions in the script. The script provides great reusability and convenience. On the terminal execute:

```
wss script_path&filename
```

This will bring the main simulator window and a window for each radar object, if any, defined in the script. If the command `run` (section 4.4.5) was used in the script the simulation will start automatically, in other case press START button on the toolbar to start simulation.

Another way of launching the simulator program is to use graphical TCL/TK interpreter. Start the interpreter using `itkwish` command. Then on its terminal a main window needs to be included by executing:

```
source /usr/local/bin/wss
```

If an input script is available it needs to be included also by executing:

```
source script_path&filename
```

If an input script is not wanted all definitions need to be typed in on the terminal, as they would be defined in the script. This approach requires more knowledge about simulator's command syntax. It is also much more difficult to create a scenario without mistakes because once a product or radar is defined there is no way of deleting it without restarting the simulator. To start the simulation press the start button or execute the `run` command on the terminal.

5.2 Ending the program

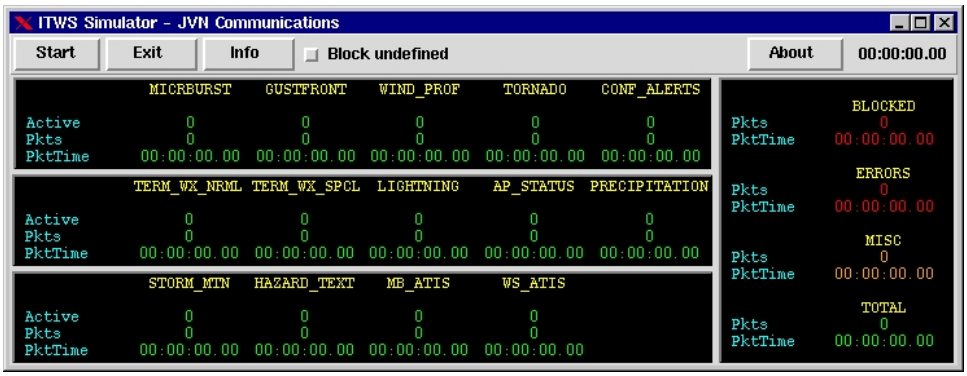
To stop the simulation simply exit the program by pressing EXIT button on the toolbar or by executing `exit` command on the terminal. There is no stop function, which would enable to stop simulation without exiting the program unless a `run` command with specified duration time of simulation is used. But keep in mind that this cases the simulator to work as fast as possible to generate all the messages with timing them with proper delays.

5.3 GUI Features

5.3.1 Main Window

Main window provides statistics about all the messages being outputted by the simulator. The statistics counts are combined totals of artificial messages and messages played from the input file. There are also information about miscellaneous messages and error encountered in the input file.

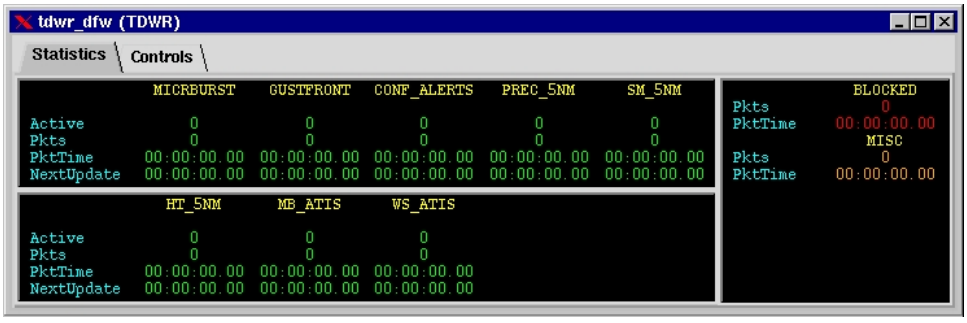
Image 5.1 – Main Window



5.3.2 Radar Object Windows

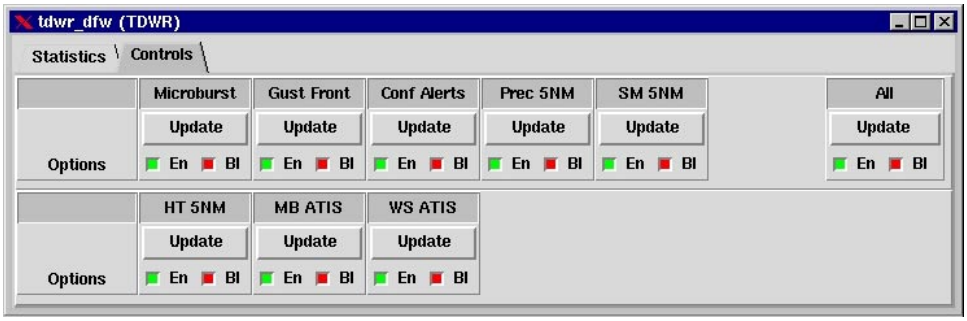
There are 5 different radar objects that the simulator supports. For each defined object a separate window is displayed containing controls for its specific messages. Similarly like main window, the object windows provide statistics about the messages being generated but only related to its specific object.

Image 5.2 – Object Window



Object Window Controls enable easily to update the desired message at any time, restrict the generation of artificial messages by enabling/disabling desired messages, and force the blocking of messages from the input file, which are already defined artificially. To block undefined messages that are played from the file check the `Block undefined` option on the Main Window.

Image 5.3 – Object Window Controls

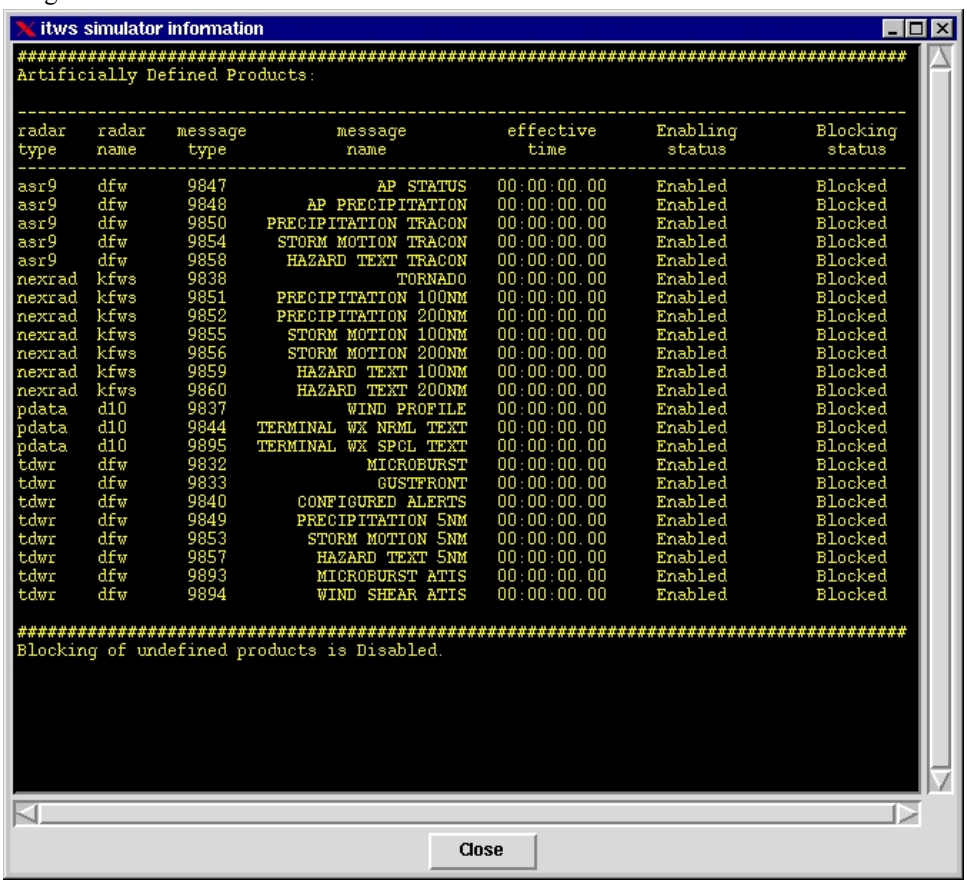


5.3.3

Simulator Information Window

The Simulator Information Window provides information about defined radar objects and products. It shows which products are enables/disabled, blocked/unblocked, its effective time and associated radars. To view the current information about products and radar object defined press INFO button on the toolbar.

Image 5.4 – Information Window



6.0 APPENDIX A

6.1

Examples of constructing object specific keywords
Given that a radar was defined:

`asr9 dal` or `Asr9 dal`
then its radar specific keyword is:
`asr9_dal`
and an examples of a keyword with sub-keyword is

```
asr9_dal block 9850
asr9_dal disable 9854
```

6.2

Example of setting `input`

```
set input /daw/dal2.itws
```

where `dal2.itws` is a file containing prerecorded ITWS messages.

6.3

Examples of setting `output`

```
set output /daw/temp.itws
set output udp:172.26.111.247/4100
set output udp:localhost/9
```

6.4

Example of setting `projection`

```
projection stereographic –tangent 32.847110,-96.851770l
```

NOTE: the last character is a letter l