Contrail® Base Station

OneRain
The Rainfall Company

Total Control of Your Hydrometeorological Network Data and Information Distribution

Contrail Base Station is the visualization tool of choice when managing and controlling access to your hydrologic data is critical. Contrail supports the real-time data collection, processing, archiving and dissemination of your hydrometeorological and water resources data in one place.

Contrail gives users instant access to what they need, when they need it, on any Web-enabled device.

HIGHLIGHTS

- On-premises enterprise edition of Contrail collects, validates and makes data available inside your organization
- Supports an unlimited number of users via a single or multiple web sites
- You control user access; expose your data as needed
- Makes available historical and real-time data
- View real-time and historical gauge-adjusted radar rainfall
- Access outside information such as USGS, HADS and METAR, as well as neighboring systems

OPTIONAL

- 24/7 system health monitoring
- Automated problem notification
- Data backup and recovery
- Redundant, replicated databases
- Remote troubleshooting and technical support
- On-line software upgrades

Contrail collects, validates, processes for alarming and notification, displays on maps, graphs and tables, archives, exports and disseminates hydrometeorological data and information, including gauge-adjusted radar rainfall and inundation maps. Encompassed are tools and reports for sensor management, rainfall and stream-related reporting, maintenance, and custom alarm and notification features. OneRain's solutions enable management of and quick access to water-related emergency action plan content, links to any outside resources, webcam video feeds from difficult sites, and many other web-hosted tools.

Makes Decision-Critical Support Data Highly Available

Contrail is used for operational decision support and emergency operations, post-event analysis, model calibration and planning in flood early warning, dam safety and operations, stormwater and wastewater management.

The Contrail application is configurable to suit specific user needs, for multiple user groups and different types of users simultaneously. The user interface is a common web browser—all recent browsers are supported. Real-time data exchange with other applications is also web/http-based, making firewall issues less problematic when exchanging data among agencies. Contrail's smart interface is adaptive and responsive with optimized performance for Web-enabled mobile devices.

Scalable and Reliable Software Architecture

Running on Linux™ and using a MySQL® database engine, a base station can receive data from any number of sources, sensors and sensor types, and serve any number of different uses. Most licensed server implementations operate at least two servers that are geographically separated, with automated real-time replication of the databases between the two providing redundancy. The database is not limited in size and can grow across multiple servers and disks.

OneRain's mission is to provide industry leading solutions that empower our clients to perform their critical missions

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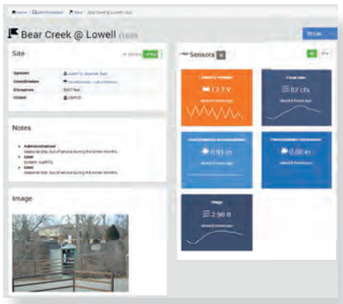
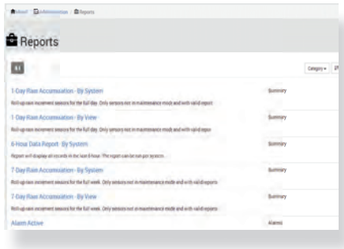
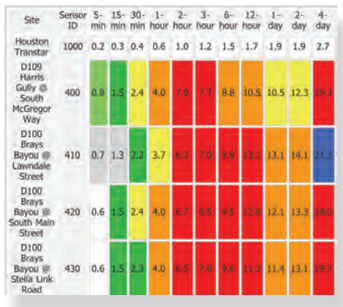






Site	Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
Houston Transtar	1000	0.2	0.3	0.4	0.6	1.0	1.2	1.5	1.7	1.9	1.9	2.7
D109 Harris Gully @ South McGregor Way	400	0.8	1.5	2.4	4.0	7.0	7.7	8.8	10.5	10.5	12.3	19.3
D100 Brays Bayou @ Lawndale Street	410	0.7	1.3	2.2	3.7	6.3	7.0	8.9	13.1	13.1	14.1	21.3
D100 Brays Bayou @ South Main Street	420	0.6	1.5	2.4	4.0	6.7	8.5	9.5	12.0	12.1	13.3	18.0
D100 Brays Bayou @ Stella Link Road	430	0.6	1.5	2.3	4.0	6.5	7.0	9.6	11.3	11.4	13.1	19.7

Multiple Data Exchange Options

Multiple formats are available for automated exchange of data with other systems. Contrail's application programming interface (API) can enable many output data formats for use by other systems such as XML, Standard Hydrologic Exchange Format (SHEF), Delft-FEWS, Hydstra, AQUARIUS, , ASCII text, Excel. There's also a standard data exchange interface that can be accessed by authorized processes using scripts (e.g., Python, Perl, Java, VB.NET, etc.) on other platforms that wish to retrieve data from or offer data to Contrail.

Contrail includes Data Collectors and Data Agents. Data Collectors receive real-time ALERT, ALERT2™, satellite, cellular and TCP/IP data. Data Agents actively retrieve, automatically and periodically, web-resident data sources such as USGS, NWIS, METAR, HADS, TIDES, RWIS and other sites of interest.

You Control Who Sees Your Data

The database architecture is multi-tenant, which means it can be configured for privacy of data within secured user domains. Each user domain is completely under the control of its own administrator(s), who in turn control user access (username/password secured, public "guest") and user privileges. Different privileges can be assigned as appropriate to individual users (viewing data only, alarms viewing, alarms creation, maintenance of sensor and site data, web-site content editing, style and colors, fonts, display icons used, etc.).

Easily Configurable for Diverse Users

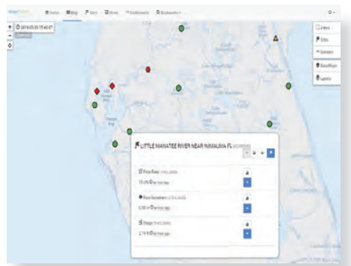
An agency operating a base station can configure one Contrail to meet the needs of many and different users. Multiple web sites are easily created and supported, each with its own branding, logos, content, user accounts, maps, alarms and views of data. Any data view can be for authorized users only, presented to the public, or instantiated as one of each. Within each web site, different user privileges control who sees what. For example, perhaps one web site is for tracking wastewater pump station activities and flow meters along with rainfall from multiple sources including gauge-adjusted radar rainfall; another serves dam operators with dam-related information including inflow, lake levels, gate positions, power production and generator operations, and/or dam safety parameters such as seismic and internal water pressure information; yet another one serves staff who have water quality responsibilities with rainfall, water temperature, dissolved O2, pH, turbidity and other data points.

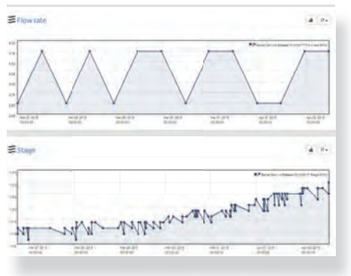
Powerful Data Analysis and Reporting Tools

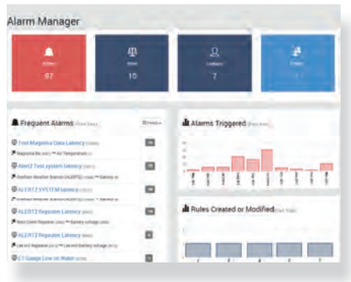
There are numerous reports and reporting tools available of interest to (1) people interested in rainfall and hydrology events (**Contrail Analytics** reports), and (2) people tasked with maintaining and operating real-time monitoring networks (Contrail Analytics and also **Contrail Inventory *Plus)***. Custom reports can be created either by OneRain or by qualified agency staff. These reports can be run as needed.

Contrail Analytics - Suite of Integrated Data-Analysis Tools

Contrail Analytics provides a comprehensive toolset that helps you quickly analyze complex Contrail data sets, identity and highlight trends and changes, and gain true insight into the performance of your hydromet sensor network. It reduces mountains of data into simple visual displays and presents complex information in easy to analyze visual charts and graphics. It provides bulk event and time-series exporting.







Both static and pan-and-zoom maps are supported for data display. Flood warning implementations may include inundation maps that are user controlled layers on the map display. High-resolution, custom maps clearly define sensors and their status. Point and click drill-down to sensor data. At the site or sensor level, Webcam and web video data can be linked into Contrail by authorized administrative users with bookmarks and tailored supporting content.

Real-Time Displays and Post-Event Reports

Contrail real-time displays and post-event reports characterize rainfall and its consequences for its users. For example, the Rainfall Summary table shows rain gauge totals in real time for gauges that can be grouped by area/basin. The Water Level Summary table shows water levels in real time with respect to channel bottom, flood alert level, flood level and historic record levels. Rainfall Intensity reports using Contrail Analytics can summarize, grouped by basin or region and individually as gauges, the recurrence probability of a rainfall event over different durations (e.g., 5-year 1-hour rainfall, 5-year 24-hour rainfall, etc.).

Multigraphs and Hyetographs

Multigraphs showing stream flow or levels together with hyetographs from nearby rain gauges can be user-created and bookmarked for repeated use. Any graph in use (can be multiple ones in new windows) will update with new data according to the base station's configured refresh rate (e.g., once a minute). Graphical displays can also show various alarm and historical thresholds.

Build Custom Definable Alarms and Delivery Notifications

Create user definable rules for alarms to notify via text messages and e-mail. Contrail provides a powerful Boolean equation tool set for identifying conditions of interest. Writing equations in the Alarm rule functions are at your finger-tips. Administrators can create customized rules to trigger an alarm for any sensor or group of sensors within your program. You can have different messages delivered to different people all from the same triggered event—send a short mobile-text message to your on-call staff, send a longer descriptive email to managers, including action plans, send a message to a different department, or send no messages at all; the icons still change color and the Alarm Manager still maintains your event history.

Contrail Inventory *plus* - Centralized Web-based Asset Tracking & Maintenance

Knowing the equipment model and all the relevant information associated with a gauge sensor—its geographical map location, configuration, firmware, cables, spare parts, repair and maintenance records, etc., can be invaluable to your field maintenance operations. Contrail Inventory supports mobile data collection for your field service technicians and engineers to track and manage inventory in the field, create Work Orders for maintenance management, and updates back to the centralized database.

Contact Us

For more information about OneRain's Contrail software, visit onerain.com or call +1 303-774-2033. We're happy to arrange a demonstration and show real life examples of Contrail in action.

Contrail® Base Station Features

- Enterprise software application deployed on your organization's network for Intranet / Internet browser-based access for both Users and Administrators
- Responsive and Adaptive design for optimal use across a wide range of devices such as desktops, laptops, tablets, mobile phones
- Unlimited number of Users with role-based privileges and security settings
- Onsite Mission Critical Base Station
- Local / On-Site Data
- Web Content Management
- Web Styling and Branding - customizable theme colors and logo
- Public website(s)
- Highly scalable, Linux®-based server running a MySQL enterprise database
- Read Only Server Option
- Redundant Server Replication
- Multi-Client (first 5 client Web sites)
- Administrator Managed Database Backups
- Custom Configured Data Services
- Custom Defined Cache and Refresh Controls
- Reload Metadata - Sync Configuration
- Data Collectors / Control: Serial or TCP/IP Connection options, Two-way ALERT (Flasher and Repeater Control), ALERT2™, StormLink™ Cellular, StormLink IP (logging / queuing), , StormLink Satellite, RWIS / NTCIP, Modbus®, Custom Collector Programming
- Data Agents / Data Exchange: USGS, METAR, HADS, CDEC, LRGS /GOES, NOAA Tides, RAWS, Rugid (EVENTS), Wonderware, Campbell Scientific, ORBCOMM, GoData, Custom Data Agent, SHEF .A, SHEF .E, Tabular, XML, Hydstra, Delft-FEWS...
- Unlimited Sensors
- Unlimited Online Data File and Image Management
- Advanced Alarm Management: Boolean / Expert Equation toolset
- Flexible Alarm Delivery Notifications: Contacts and Groups management for user definable alarms notify via pager, cell phone, and e-mail
- Value to text translations - define translation tables to map numeric values to text strings for Contrail data display. Useful for intrusion sensors on doors, float switches, road way sensors
- Online Reports: standard built-in reports and custom online reports
- Map View: Static and Pan-and-Zoom
- Rain Gauge Display
- Graphing: real time graphs that keep data on the graphs current with new data. Graphs auto refresh automatically at timed intervals. Easy to use Date Range buttons. Style thresholds with different lines, colors, and markers.
- Bookmarks: save links to your favorite graphs or any other Contrail web pages for easy access in the future
- File Export / Sensor Data Export (MS Excel / CSV)
- Data Editing (with audit trail)
- Data Revalidation (with audit trail)
- Services: scheduled reports via email, database backups, Data Exchange API
- **Contrail Inventory *plus***: Field maintenance operations and inventory management
- **Contrail Analytics**: Network Performance, Rainfall Intensity Analysis, Mass Balance Rainfall Analysis, Sensor Network Monitoring, Time Series Export, Event Data Bulk Export
- **Contrail TDMA Manager**: ALERT/ALERT2™ network design and provisioning
- **Contrail Camera:** Image collection and hosting (*optional feature - additional fees apply*)

System Requirements

- **CPU:** Dual Core 2.0 GHz
- **RAM:** 2 Gb DDR-2
- **Optical Drive:** 1 24x IDE CD-ROM
- **Data Storage:** 80 Gb
- **Operating System:** CentOS 6, or Red Hat® Enterprise Linux® (RHEL) 6
- **Incoming Network Ports:** Some open network ports are required as follows:

80	Web Access to Contrail Web on the server
8080	Contrail Data Exchange interface
8181	Contrail Inventory application
3306	MySQL access
22	Default ssh port (sometimes moved to an off port for security)
60001 - 60010	Reserved for Stormlink IP (logging queuing ALERT data collection)
60011 - 60020	Reserved for ALERT2 (feed from decoder to base station, usually via a serial to IP conversion)
60021 - 60030	Reserved for ALERT data collection (usually via a serial to IP converter)
60031 - 60040	Reserved
60041 - 60050	Reserved for StormLink cellular data collection
60051 - 60060	Reserved for StormLink Satellite (IDP) collection
60061 - 60070	Reserved for ALERT two-way service

- **Outgoing Network Ports:** Outgoing ports to support data feeds and software updates:

25	SMTP (Simple Mail Transfer Protocol). Required for Contrail to send emails and text messages from alarms. Also used to send reports and notifications of system events.
80 and 8080	Allows data agents to bring in data like USGS, METAR, or FFG
IP Outgoing Access / 443:	Required for software updates: Redhat (or CentOS), and OneRain (handled by allowing IP outgoing access to specific IP or ranges of IP addresses)

- **Supported Web Browsers:** Microsoft Internet Explorer, Mozilla Firefox, Apple Safari, or Google Chrome (latest versions).
- ***Note:*** *OneRain does not test or certify Contrail Base Station to run on specific virtualization solutions.*

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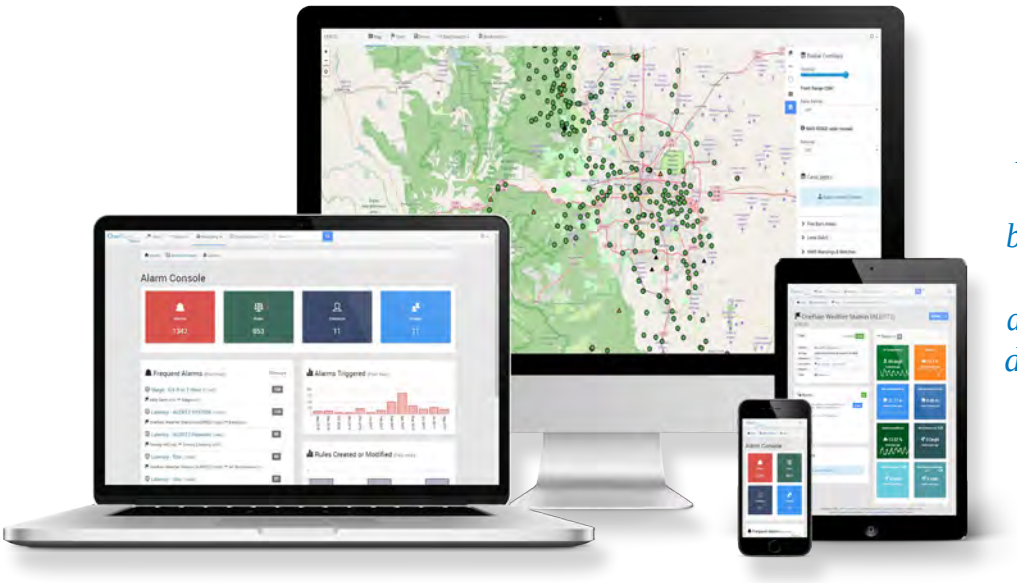

No matter which solution you choose, only a standard web browser is needed on the user's end to access the Contrail application across all devices—desktop and mobile—no special mobile "apps" required.

Contrail®

Flexible Deployment Options to Manage All of Your Hydrometeorologic Data in One Place

More and more organizations are realizing the benefits of combining on-site and hosted Contrail software deployment options. With Contrail, you have three flexible options. Whether to host your own solution on-site, we host it for you (or combination of both), or choosing our software-as-a-service option, OneRain's team of experts will help you assess which deployment solution achieves the highest availability and resiliency for your mission-critical operations. It's good to have options.

Highly Scalable Enterprise Software

Contrail supports the data collection, processing, archiving and dissemination of water resources data collected from your own local ALERT/ALERT2™ gauge sensor network together with federal and state agency data sources such as USGS, METAR, Tides, HADS, RAWS, RWIS, satellite and many other platforms. No matter which solution you choose, **only a standard web browser is needed** on the user's end to have secure access to real-time and historical data via their desktop or mobile device.

OneRain's Contrail software is designed to be a highly scalable enterprise level software solution. At its core are the advanced alarm equations and delivery notification capabilities. Contrail provides simultaneous functionality, management, administration, and services to a large number of users no matter where they are.

DEPLOYMENT OPTIONS

- **Contrail Base Station**—licensed Contrail enterprise software that runs on-premise on your own server(s).
- **Contrail Server**—a OneRain-hosted client-dedicated cloud computing server resource for Contrail.
- **Contrail Web**—the software as a service (SaaS) shared resource edition of Contrail.

SEE OVER ▶▶▶

Understanding Contrail® Deployment Options

1

Contrail Base Station—you license our Contrail enterprise software and run the application on your own server(s). Includes Contrail Analytics and Contrail Inventory *Plus*, and enables you to collect as many data sources and create as many web site views as you require to meet all your users' needs.

2

Contrail Server—a OneRain-hosted and managed cloud-computing server resource running the full version of Contrail Base Station software for you in our secure industrial data center. Contrail Server delivers the full feature set of licensed Contrail Base Station (includes Contrail Analytics and Contrail Inventory *Plus*). A fixed annual subscription cost allows you to extend and load it with as many data sources, web views, custom reports, etc., as you require.

3

Contrail Web—the software as a service (SaaS) edition of Contrail in which we offer you a slot in our multi-tenant enterprise and you administer it for your users. Unlike Contrail Base Station and Contrail Server, Contrail Web operates in a shared resource environment. This is a annual "pay as you go" subscription model to add more web views and sensor data sources.

Features	Contrail Base Station	Contrail Server	Contrail Web
Web Accessible Software	√	√	√
Mobile Access (smartphone, tablet…)	√	√	√
Web Styling and Custom Branding	√	√	√
Web Content Management	√	√	√
File and Image Management	√	√	√
Bookmarks	√	√	√
On-site Mission Critical Database	√		
Hosted Service		√	√
Processing and Performance Configuration	√	√	
Reload Metadata – Immediate Updates	√	√	
Unlimited Sensors	√	√	+
Role Based User Privileges	√		√
Multi-Year Data Queries	√	√	
Multi-Time Zone Support	√	√	√
Multi-Sensor Alarms	√	√	√
Notifications (one alarm, multiple deliveries)	√	√	√
Map View with Layers	√	√	√
Unlimited Custom Maps	√	√	+
Rain Gauge Display	√	√	√
Optional Rainfall Overlay	√	√	
OneRainware™ Radar Rainfall Displays	√	√	√
Graphing (date selection and real-time mode)	√	√	√
Sensor Data Export (MS Excel / CSV)	√	√	√
Data Editing (with audit trail)	√	√	√
Data Revalidation (with audit trail)	√	√	√
Real-Time Data Validation	√	√	√
Incoming Raw Data Viewer	√	√	√
Automated and Manual Data Entry	√	√	√
Equation Support	√	√	√
Ratings Tables (with bulk upload)	√	√	√
Bulk Site and Sensor Configuration	√	√	
Synthetic Sensors	√	√	√
Online Reports	√	√	√
Custom Online Reports	√	√	
Public Web Site Option	√	√	+
Read Only Server Option	√	√	
Server Replication	+	√	√
Multi-Client (first 5 client web sites)	√	√	
Additional Client Licenses	+	√	+
Data Collectors / Control			
Serial to TCP / IP Connection Options	√	√	√
ALERT	√	√	√
ALERT2™	√	√	√

Features	Contrail Base Station	Contrail Server	Contrail Web
StormLink™ IP (logging / queuing)	√	√	√
StormLink Satellite	√	√	√
StormLink Cellular	√	√	√
RWIS / NTCIP	√	√	√
Two-way ALERT (Flasher and Repeater Control)	√	√	
Custom Collector Programming	Call	Call	Call
Data Agents / Data Exchange			
DataSight	√	√	√
USGS	√	√	+
METAR	√	√	+
HADS	√	√	+
CDEC	√	√	+
LRGS / GOES	√	√	+
NOAA Tides	√	√	+
RAWS	√	√	+
Rugid (EVENTS)	√	√	+
Wonderware	√	√	+
Campbell Scientific	√	√	+
ORBCOMM	√	√	+
GoData	√	√	+
Custom Data Agent	+	√	+
SHEF .A	√	√	+
SHEF .E	√	√	+
Tabular	√	√	+
XML	√	√	+
Hydstra	√	√	+
Contrail Inventory *Plus*			
Web Based Inventory Management	√	√	
Mobile Inventory Management	√	√	
Configuration	Call	Call	
Contrail Analytics			
Network Performance Analysis	√	√	
Rainfall Intensity Analysis	√	√	
Time Series Export	√	√	
Event Data Export	√	√	
Mass Balance Rainfall Analysis	√	√	
Contrail TDMA Manager			
ALERT2 network design & provisioning	√	√	
Services			
Scheduled Reports via Email	√	√	√
Database Backups	√	√	√
Data Exchange	√	√	+
Support			
Business Hours Email & Phone Support	√	√	√
Software Upgrade and OS Support	+	√	√
24/7 Full Software Support	+	+	√

+ Available as an additional option / price.

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Contrail®

Implementations that ensure system resiliency, high availability and real-time monitoring to support your critical mission

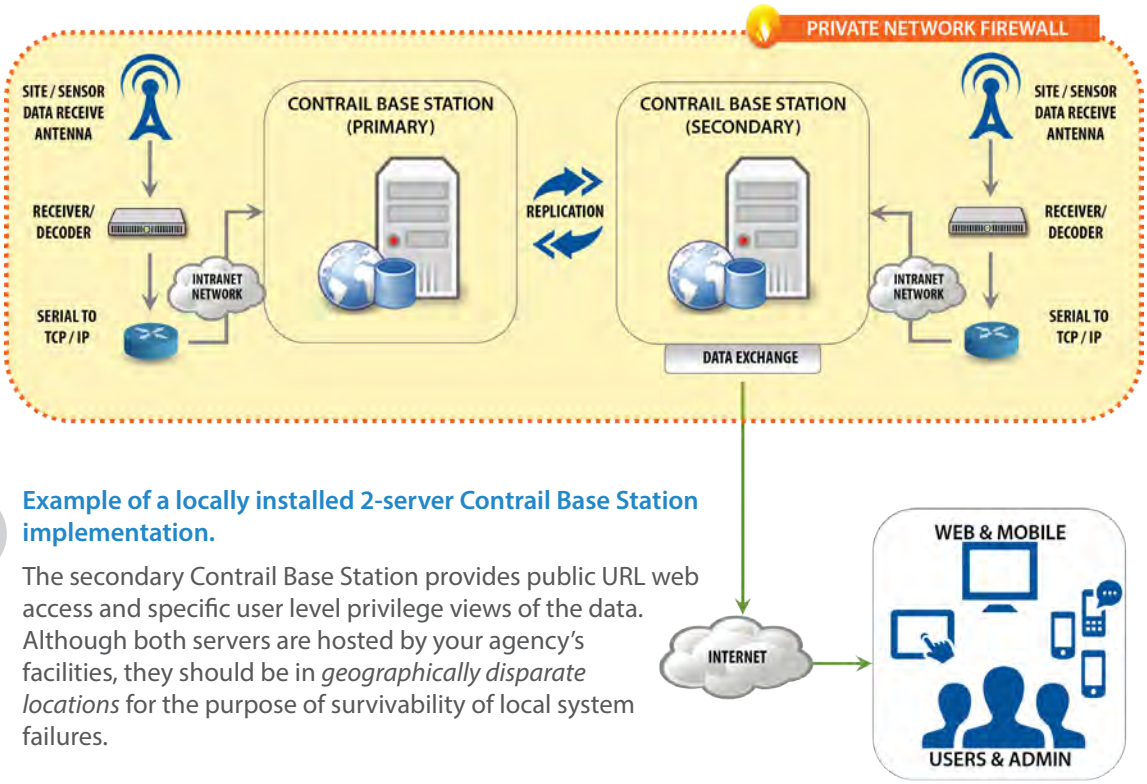
OneRain's Contrail is an enterprise level software solution designed to support your mission-critical responsibilities in early flood warning, emergency management, dam safety, reservoir and hydropower operations and stormwater management.

Are you ready for those challenging situations?

When faced with challenging situations such as major rainstorm or flood events, Contrail must be able to maintain its availablity and provide real-time information to the right people when and where it is needed. To ensure the highest level of availability and optimized performance, OneRain's Contrail application can be deployed with redundant configurations and a core network architecture that maintains at least two continuously replicated databases.

Flexible configurations to achieve required reliability

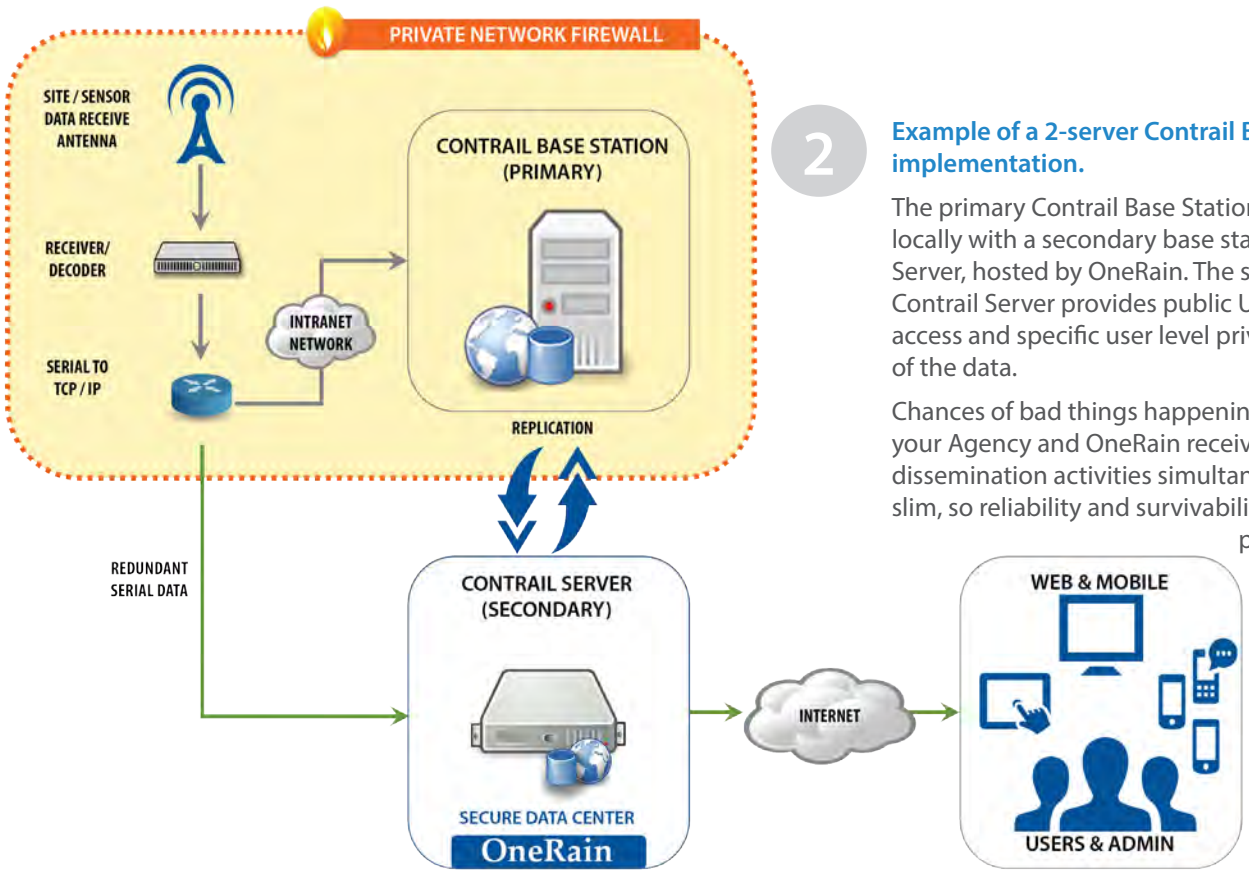
A resilient system provides geographic redundancy, eliminates a potential single point of failure, and will continue to provide service even if there is a system failure at one end—the data feeds and essential agency operations can continue uninterrupted. OneRain understands that different agencies have different demands. Our products and solutions are designed to meet the day-to-day operations as well being a critical resource when the situation demands.



1

Example of a locally installed 2-server Contrail Base Station implementation.

The secondary Contrail Base Station provides public URL web access and specific user level privilege views of the data. Although both servers are hosted by your agency's facilities, they should be in *geographically disparate locations* for the purpose of survivability of local system failures.



2

Example of a 2-server Contrail Base Station implementation.

The primary Contrail Base Station is installed locally with a secondary base station, Contrail Server, hosted by OneRain. The secondary Contrail Server provides public URL web access and specific user level privilege views of the data.

Chances of bad things happening to your Agency and OneRain receive and dissemination activities simultaneously are slim, so reliability and survivability of local problems are very good.

Solutions for small to large scale...

Several configuration architectures are possible. Talk to us today to find out what best meets the needs of your organization.

OneRain's professional services can help you achieve your goals by building solutions that effectively strengthen your monitoring and analysis capabilities and align technology with process to support data sharing, forecasting, early warning, disaster mitigation, and emergency response.

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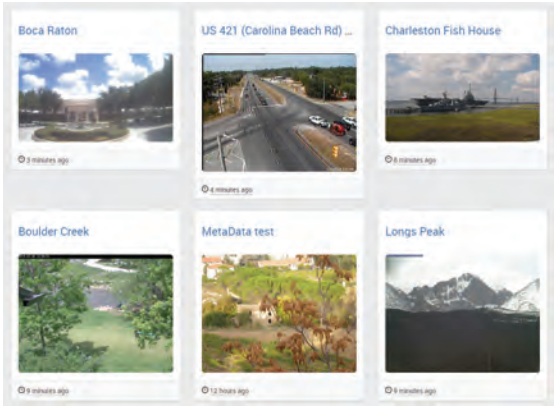
Contrail® Camera

Gain Greater Visual Insights and Situational Awareness with Remote Monitoring



SOFTWARE FEATURES

- 24/7 access and management via any web-enabled device.
- Many viewing options. Tile, list, mosaic, full screen, slideshow and album views for multiple cameras.
- Daily time-lapse. Automatically creates 24-hour time-lapse.
- Historic Snapshot. Creates and stores an image-a-day at a time specified by you.
- Multiple image sources. FTP-enabled cameras, and web accessible images.
- Retains images for 60 Days.
- Image download. Select multiple images and dates with calendar picker.
- Integrated with Contrail software suite.

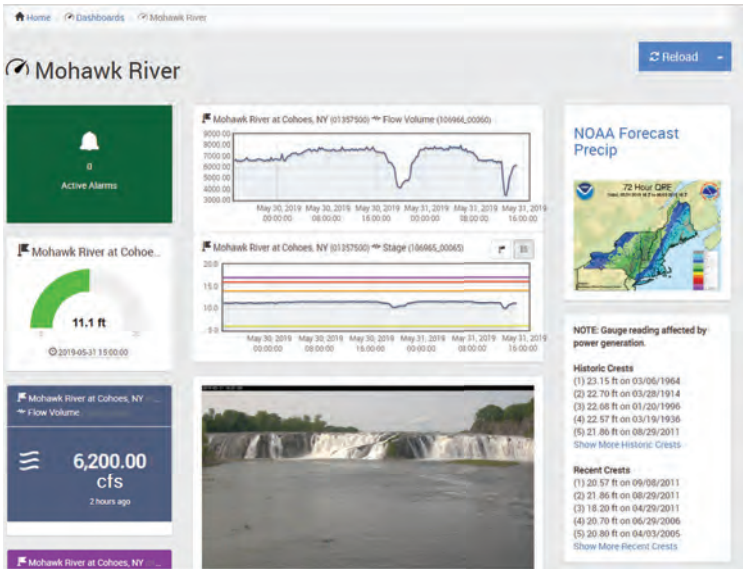
Get the Full Picture

Create a more complete view of conditions with **Contrail Camera** image collection, hosting, and viewing platform. Whether you have existing cameras, or are planning to add them, Contrail Camera provides you with enhanced information and valuable insights for situational awareness.

Agencies rely on **Contrail** software for assessing conditions, risks, and alerting about potential hazards in real-time applications such as flood warning, dam safety, reservoir operations, flooded roadways, and road weather. The effective delivery of critical information for decision makers requires the collecting, processing, analysis, and visualization of real-time data. Visually represented sensor data in maps, charts, graphs, widgets and dashboards has become one of the most effective ways for users to assimilate large volumes of data in Contrail. Combining this data with access to live cameras provides a very quick understanding of an event as it is occurring and helps users improve their situation awareness.

Contrail® Camera - Seamless Integration with Contrail Software Suite

Contrail Camera is OneRain's centralized web-based image storage and management tool that provides secure, password-protected access to view and manage images. It's designed to easily integrate with our Contrail software suite where you can incorporate images into Contrail dashboards and map layers to show sensor data and images side-by-side.



Ask us about camera hardware solutions for your application.

APPLICATIONS

- Flood Early Warning
- Reservoir and Hydropower operations
- High risk/remote Dams Safety Monitoring programs
- Road Weather
- Flooded Roadways
- Post-wildfire burn areas for flood early warning
- Other environmental monitoring

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Experts measuring rainfall and its consequences™

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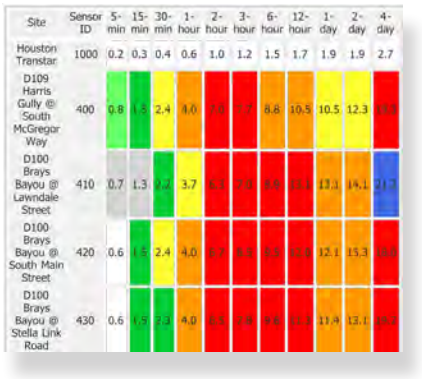
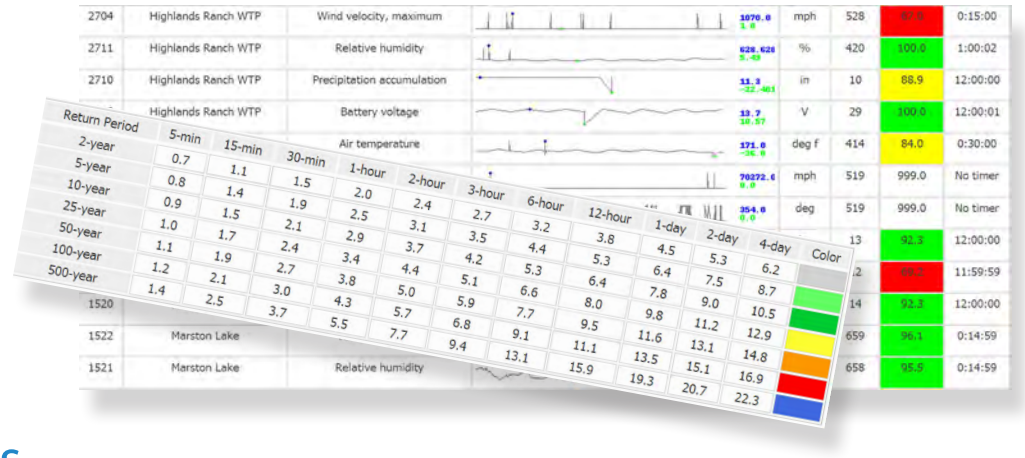


Site	Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
Houston Transtar	1000	0.2	0.3	0.4	0.6	1.0	1.2	1.5	1.7	1.9	1.9	2.7
D109 Harris Gully @ South McGregor Way	400	0.8	1.5	2.4	4.0							
D100 Brays Bayou @ Lawndale Street	410	0.7	1.3		3.7							
D100 Brays Bayou @ South Main Street	420	0.6		2.4	4.0							
D100 Brays Bayou @ Stella Link Road	430	0.6			4.0							



2704	Highlands Ranch WTP	Wind velocity, maximum	1070.0	mph	528		0:15:00
2711	Highlands Ranch WTP	Relative humidity	628.626	%	420	100.0	1:00:02
2710	Highlands Ranch WTP	Precipitation accumulation	11.3	in	10	88.9	12:00:00
	Highlands Ranch WTP	Battery voltage	13.7	V	29	100.0	12:00:01
		Air temperature	171.0	deg f	414	84.0	0:30:00
			70272.6	mph	519	999.0	No timer
			354.0	deg	519	999.0	No timer
					13	92.3	12:00:00
					2	88.2	11:59:59
1520					14	92.3	12:00:00
1522	Marston Lake				659	96.1	0:14:59
1521	Marston Lake	Relative humidity			658	95.9	0:14:59

Return Period	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day	Color
2-year	0.7	1.1	1.5	2.0	2.4	2.7	3.2	3.8	4.5	5.3	6.2	
5-year	0.8	1.4	1.9	2.5	3.1	3.5	4.4	5.3	6.4	7.5	8.7	
10-year	0.9	1.5	2.1	2.9	3.7	4.2	5.3	6.4	7.8	9.0	10.5	
25-year	1.0	1.7	2.4	3.4	4.4	5.1	6.6	7.8	9.8	11.2	12.9	
50-year	1.1	1.9	2.7	3.8	5.0	5.9	7.7	9.5	11.6	13.1	14.8	
100-year	1.2	2.1	3.0	4.3	5.7	6.8	9.1	11.1	13.5	15.1	16.9	
500-year	1.4	2.5	3.7	5.5	7.7	9.4	13.1	15.9	19.3	20.7	22.3	

Contrail® Analytics

Suite of flexible integrated data-analysis tools that extends the power of Contrail

Contrail Analytics provides a comprehensive toolset that helps you quickly analyze Contrail data sets, identify and highlight trends and changes, and gain true insight into the performance of your hydromet sensor network.

HIGHLIGHTS

- Reduces mountains of data into a simple, visual display
- Discover trends in precipitation events with rainfall frequency and distribution information
- Provides the analyses you need to make better decisions and improve the management of your hydromet network
- Presents complex information in easy to analyze visual charts and graphics
- Insightful views reveal the essential information you need to manage your sensor network
- Bulk event data exporting
- Time-Series Export

Included only with Contrail Base Station and Contrail Server (not available with Contrail Web)

Powerful Data Analysis and Reporting Tools

Contrail Analytics delivers powerful web-based data analysis and reporting tools including hydro-meteorological trends, telemetry system activity and maintenance performance:

- **Rainfall Intensities:** rainfall event analysis reports classify the amounts of accumulated rainfall by recurrance intervals over time
- **Mass Balance Rainfall Analysis:** plots and compares multiple rain gauges
- **Sensor Network Monitoring:** sensor activity and performance over time
- **Bulk Exporting:** event data
- **Time Series Data Export:** rainfall and other sensors

Identify Patterns, Trends and Extreme Storm Events

It's easy to generate sensor-level snapshots of hydro-meteorologic activity over periods of interest to quickly answer questions such as:

- How much did it rain this spring?
- What were the high and low temperatures at this site last year?
- Which stream showed the greatest change in stage last July?

OneRain's mission is to provide industry leading solutions that empower our clients to perform their critical missions

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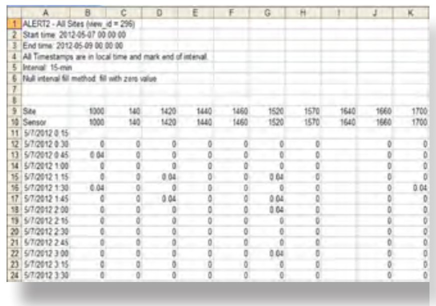


Rainfall Intensity Reports

The frequency analysis of rainfall data are of great importance to engineers and others involved in flood plain management, the design and operation of structures such as storm sewers, dams, reservoirs and hydropower operations that can be affected by heavy rainfall events.

- **Duration** - The length of time over which precipitation occurs (hours).
- **Depth** - The amount of precipitation occurring throughout the storm duration (inches).
- **Frequency** - The recurrence interval of events having the same duration and volume.
- **Intensity** - The depth divided by the duration (inches per hour).

Contrail Analytics derives the maximum rainfall intensities for a set of user-specified storm durations (e.g., 5-min, 15-min, 30-min, 1-hour, 2-hour, 3-hour, 6-hour, 12-hour, 1-day, 2-day, 4-day…), and presents the results in an easy-to-read graphic output that color highlights the recurrance interval for those peak intensity events (e.g., 5-year, 10-year, 25 year...).

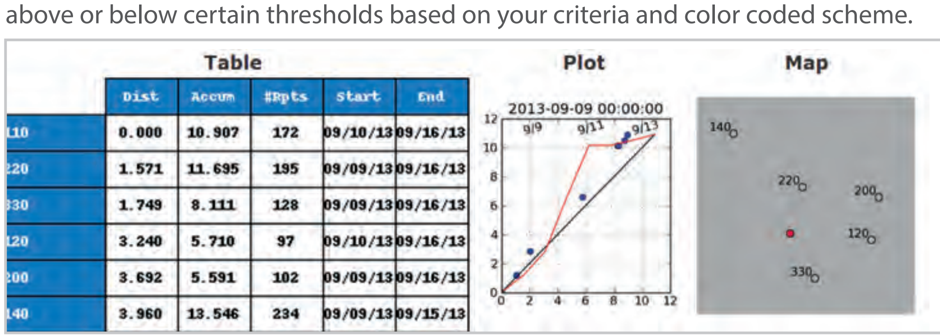
Rainfall Intensities

Inches of rainfall

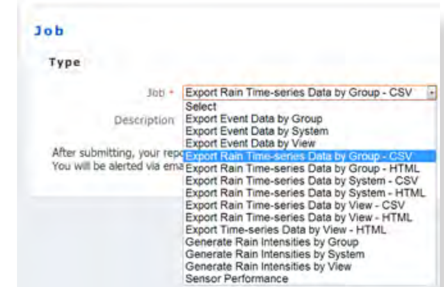
Site	Sensor ID	5-min	15-min	30-min	1-hour	2-hour	3-hour	6-hour	12-hour	1-day	2-day	4-day
P100 Greens Bayou @ Mount Houston Parkway	1600	0.7	1.5	2.7	5.0	9.3	13.5	21.2	23.5	28.5	28.7	38.5
P100 Greens Bayou @ Normandy Street	1610	0.6	1.1	2.2	4.0	7.5	9.2	9.8	11.1	11.7	12.8	18.4
P100 Greens Bayou @ Ley Road	1620	0.9	2.1	3.7	6.5	9.8	11.6	15.8	26.4	26.7	26.8	34.5
P130 Garners Bayou @ Beltway 8	1630	0.5	1.4	2.5	4.3	8.0	10.2	14.6	17.8	17.9	18.0	24.6
P100 Greens Bayou @ US 59	1640	0.4	0.8	1.5	2.4	3.8	5.4	8.6	11.0	11.0	11.0	14.9
P100 Greens Bayou @ Beltway 8	1645	0.6	1.4	2.3	3.6	5.5	7.0	11.3	14.9	15.0	15.2	23.6
P130 Garners Bayou @ Rankin Road	1650	0.5	1.2	2.2	3.4	5.5	7.4	10.6	12.4	12.4	12.4	16.9
P100 Greens Bayou @ Knobcrest Drive	1660	0.5	0.9	1.5	2.1	3.7	4.9	7.8	10.1	10.1	10.3	15.1
P100 Greens Bayou @ Bammel N Houston Road	1665	0.6	1.4	2.5	4.3	6.1	8.0	11.5	13.7	15.8	16.0	19.9
P100 Greens Bayou @ Cutten Road	1670	0.4	0.9	1.7	3.0	4.8	6.6	9.7	14.3	14.4	14.6	17.5
P118 Halls Bayou @ Tidwell Road	1675	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P118 Halls Bayou @ Jensen Drive	1680	0.5	1.3	2.0	2.7	4.2	5.4	8.6	11.4	11.4	11.5	17.4
P100 Greens Bayou @ Tidwell Road	1685	0.9	2.2	4.2	6.3	9.4	11.5	16.1	23.8	26.4	26.5	33.9
P118 Halls Bayou @ Airline Drive	1690	0.5	0.9	1.7	3.2	5.7	7.5	10.7	14.9	14.9	15.0	19.5
P138 @ Aldine Westfield Road	1695	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Set cumulative rainfall intensity duration thresholds and color codes to highlight significant events

The color coding feature enhances viewing and helps you easily identify extreme storm events by automatically marking results in the tabular report for data that fall above or below certain thresholds based on your criteria and color coded scheme.



Double Mass Analysis compares each rain gauge to the five closest neighboring gauges



Contrail Analytics
comprises deep data mining reporting engines that analyze, extract and organize large amounts of data in a form that is informational—compiling intensive query-based searches into specialized reports, charts and exportable data files. This suite of data analysis tools provides a framework to support a variety of "number-crunching" processes on Contrail data.

Sensor Network Performance Monitoring

Knowing how your network and sensors are performing now and over time is critical to operating any automated data collection network. Most base station software gives you a view of what is up or down right now. Wouldn't it be desirable to have real insight and see at a glance which sensors are having problems, which have gaps in reporting, and which are over-reporting?

Contrail Analytics provides a sensor-level snapshot of hydrometeorologic activity over the period of interest. Insightful views provide the essential information you need to understand the behavior of each component of your network.

ID	Site	Sensor	Sparkline	Units	# Reports	Availability %	Timer Interval
1629	S Platte @ Dart	Stage	1.62 1.39	ft	203	999.0	No timer
1629	S Platte @ Dart	Flow Volume	57.533 16.0	cfs	200	999.0	No timer
1635	S Platte @ Dart	Battery voltage	12.623 12.56	V	12	83.3	11:57:57
1640	SPR at Union Ave.	Precipitation accumulation	3.072 2.954	in	15	92.3	11:58:00
1645	SPR at Union Ave.	Battery voltage	12.819 12.67	V	14	100.0	11:57:53
1370	Fire Station 13	Precipitation accumulation	10.119 9.922	in	19	100.0	11:58:00
1375	Fire Station 13	Battery voltage	13.007 12.969	V	14	100.0	11:57:57
2704	Highlands Ranch WTP	Wind velocity, maximum	69.0 0.0	mph	398	51.0	0:15:00
2711	Highlands Ranch WTP	Relative humidity	100.0 7.943	%	368	73.0	0:29:58
2710	Highlands Ranch WTP	Precipitation accumulation	11.064 10.906	in	18	100.0	12:00:00

Contrail Analytics provides a thumbnail view of how your sensors are working by digesting large amounts of information into easily understood monitoring system performance measures. Contrail Analytics serves four primary functions:

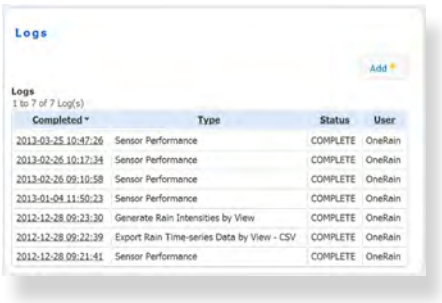
- **Analyze:** Quickly sift through archived data
- **Explore:** Identify issues with sites and sensors
- **Predict:** Enable you to extrapolate trends easily
- **Summarize:** Provide reports on data quality and system performance

Save, Export and Share your Data

Contrail Analytics provides a convenient way to perform time series exports and bulk event data exports to standard data exchange format CSV files.

Contact Us

For more information about OneRain's Contrail products, visit onerain.com or call 1-800-758-RAIN (7246) or 303-774-2033.



Plan Predictive Maintenance

Contrail Analytics uses data analysis to track system performance and plan predictive maintenance. By monitoring gauge and telemetry performance, maintenance planners are able to analyze trends in performance and provide awareness of irregularities before they affect operations.

Preventive maintenance is a common activity for remote measurement stations. Frequency based maintenance helps us to know that things are working as designed. Unfortunately, preventive maintenance doesn't catch all problems and breakdown maintenance becomes a necessity. Breakdown maintenance can be time consuming, costly and causes increased risk while the site is down.

Effective predictive maintenance uses many techniques, some which are field activities and some based solely on telemetered data. Contrail Base Station keeps a history of sensor data available to conduct performance analyses that support predictive maintenance activities.

Contrail Analytics uses three different approaches to analyze environmental monitoring data, including hydro-meteorological trends, telemetry system activity and maintenance performance. These analyses generate graphs and reports on data source availability and data trends that enable you either to have confidence in your system and maintenance provider, or to know that neither the system nor provider are performing as they should.

Contrail Analytics helps to detect both common and rare failure modes before problems occur. By distilling the data into manageable reports and presenting the critical metrics of a system's health, Contrail Analytics improves performance, increases system confidence and reduces costs.

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Contrail® Inventory *plus*

Centralized Web-based Asset Tracking and Maintenance Management Tool for Real-time Monitoring Networks

Contrail Inventory *plus* helps you manage, maintain, and keep track of your gauge sensor network equipment via your desktop or mobile device from anywhere you have an Internet connection.

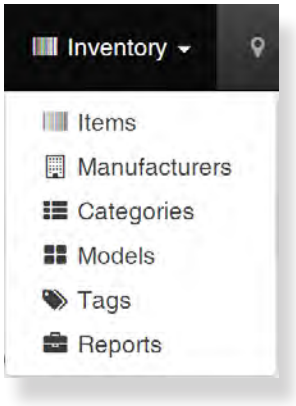
HIGHLIGHTS

- Manage inventory and maintenance in one place
- Multi-user, password protected access
- Centralized updates - everyone works off the same data
- Detailed visibility of inventory adjustments and life cycle history
- Store site and hardware images for easy identification
- Add support documentation so it's available when you need it
- Powerful search options to help you find things easily
- Useful built-in reports and audit tracking
- Export data options

Included only with Contrail Base Station and Contrail Server (not available with Contrail Web)

Supports All Field Maintenance Operations in One Place

Contrail Inventory *plus* is ideal for people tasked with maintaining and operating real-time monitoring networks. It functions as either a web-based desktop application, or can be accessed via your smartphone without any special client software to install.



Equipment Tracking

Knowing all the relevant information associated with a gauge sensor—its location (geo-mapping), configuration, firmware, cables, spare parts, repair and maintenance records, etc.—can be invaluable to your field maintenance operations. Contrail Inventory *plus* supports mobile information collection for your field service technicians and engineers to track and manage inventory in the field, and updates back to the centralized database.

OneRain's mission is to provide industry leading solutions that empower our clients to perform their critical missions

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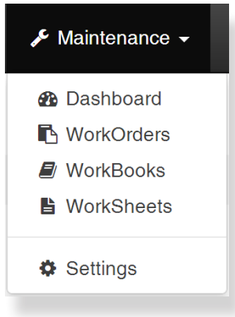
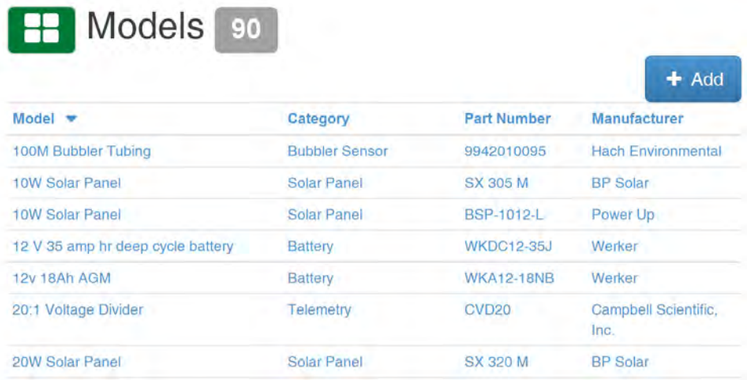
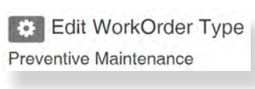




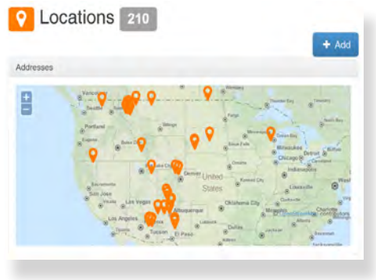
Equipment Maintenance Management

Contrail Inventory plus links your inventory management and maintenance together.

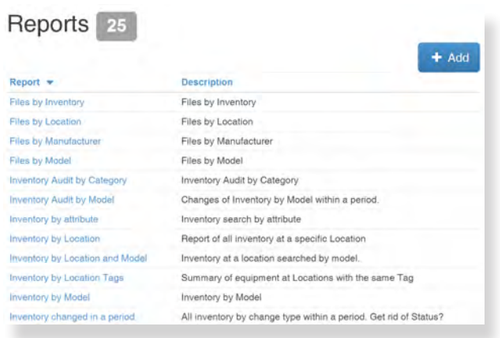
The Maintenance Management module with Contrail Inventory *plus* handles the creation of Work Orders, Tasks, and scheduling of routine, preventative and emergency maintenance activities of any inventory item in the system, giving you the ability to manage all of your maintenance operations in one place.



- **Web access via Desktop or Mobile:** Easy to use interface provides flexible office or remote access with secure login/password protection.
- **Add, manage and track** all inventory located at each field site, including manufacturer, part numbers, serial numbers, and software/firmware versions loaded, cable lengths, etc.
- **Supports field maintenance efforts** to know exact field configurations prior to visiting sites.
- **File/Document Uploads (.doc, .xls, and .pdf):** Add Data Sheets, User Manuals models, Permits and Maintenance Records, RMA and Calibration Reports.
- **Image/Photo Upload:** Images can be added to manufacturers, models, site locations, and inventory assets.



- **Site Location:** Integrated postal addressing and geo-location mapping information to a location.
- **Add Custom Notes:** Notes can be added to manufacturers, models, locations, and inventory assets. The notes field stores free-form text and HTML and automatically generates active links for URL text.
- **QR Barcodes:** A unique Quick Response (QR) code is automatically generated by the Inventory Manager when a new Location or Inventory item is added. QR codes are matrix barcodes that can be easily scanned with a mobile device (phone, tablet, etc.) camera using a third party application. Field service technicians equipped with mobile devices can scan QR code labels applied to gauge sites and equipment to quickly retrieve and display the item's Inventory record.
- **Click and Print Label Creation:** Print QR code for the Inventory item, Location, or all Inventory items at a Location on standard label templates.
- **Powerful Search tool** enables easy lookup of serial numbers, locations, or any other database attribute.
- **Built-in Reports:** Choose from a comprehensive selection of standard report templates.
- **Data Export:** Compatibility with Microsoft Excel Formats.
- **Lifecycle History with Inventory Audits:** Inventory audits provide a way to access the history of a specific piece of equipment from purchase, through all maintenance, until final disposition.



Contact Us

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"Everything you need to manage inventory and maintenance is at your fingertips."

Contrail® Inventory *plus* User Experience

Contrail Inventory's web-based adaptive and responsive design is compatible with the widest range of devices, desktop PCs, laptops, tablets and smartphones.

We've tried to walk in your shoes as we redesigned Contrail Inventory's accessibility to create the best experience possible to match up to your needs. Now, whether you're in the field, or at your desktop, you'll be able to accomplish virtually all your Contrail Inventory management tasks (review, edit, add, upload photos, etc.) anywhere at any time.

Users can get to the information that's important to them fast with easy to understand content priority, workflow and viewpoints:

- Easy to navigate whether on smartphone, tablet and desktop devices
- No special mobile app. required
- Adaptive between mobile and desktop for content, features, viewpoints
- Responsive design fluidly changes and responds to fit any screen or device size

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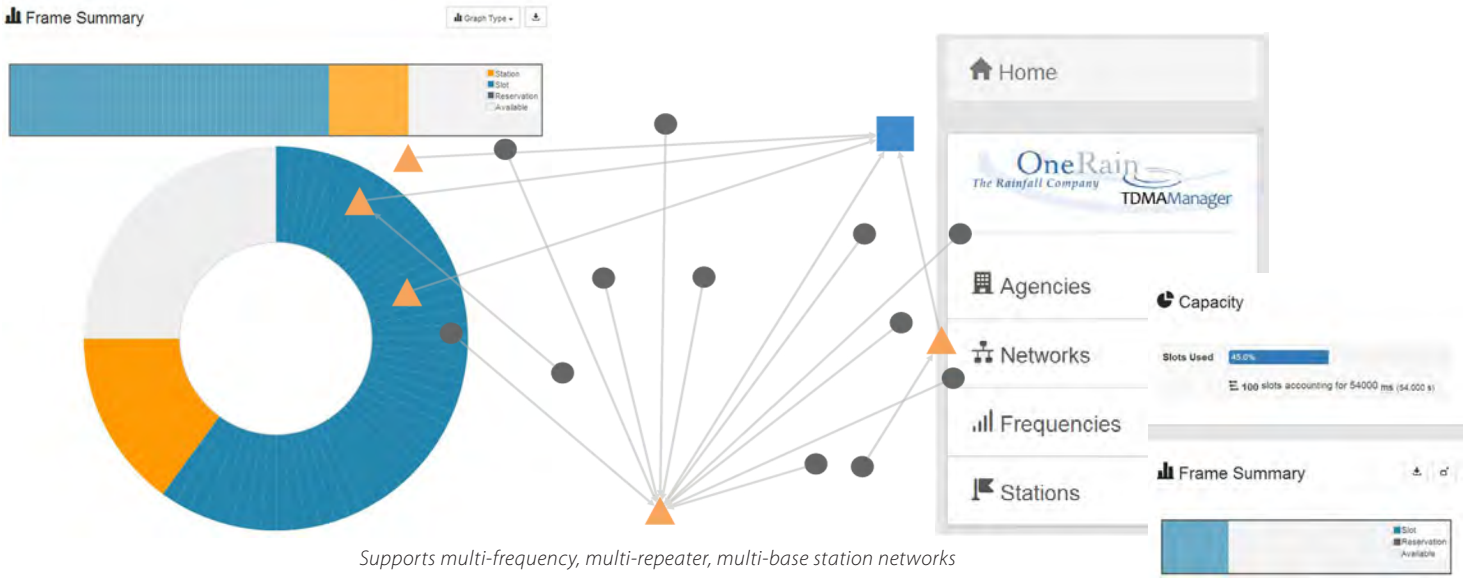


Supports multi-frequency, multi-repeater, multi-base station networks

Contrail® ALERT2™ TDMA Manager™

Visualize and design your network, tracking capacity, available capacity, and data latency

HIGHLIGHTS

- Manage and design one or more networks in a controlled workspace
- Aids in the proactive planning of your network capacity and demands
- QA/QC verification optimizes transmission capacity
- Real-time tracking of live network and ability to create "what if" alternative network designs
- Visibility of other agency's networks
- Reduces potential for conflicts or mistakes
- Import and export network designs

Time Division Multiple Access (TDMA) is a frequency use protocol in which each transmitter is assigned specific times to transmit so that two transmitters on the same frequency do not transmit at the same time, and eliminates data loss due to more than one transmitter on a frequency talking at the same time. ALERT2 supports both the ALOHA and TDMA transmission protocols, but preferably uses the TDMA protocol to reduce or eliminate data loss.

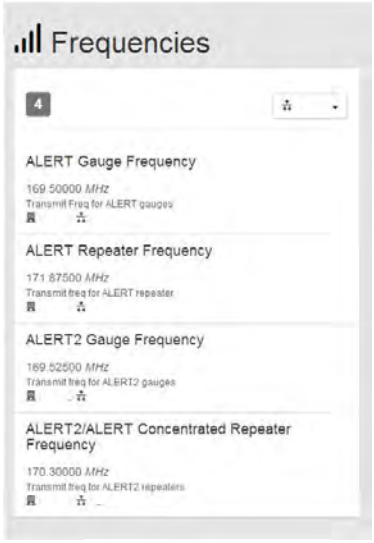
Why use Contrail ALERT2 TDMA Manager?

Contrail ALERT2 TDMA Manager provides multi-user shared access via web interface and enables information sharing that reduces potential for conflicts or mistakes. It gives a complete view of your infrastructure in one place. Multiple agencies can share access.

Contrail ALERT2 TDMA Manager features **Capacity Planning** and **QA/QC Verification** – ensuring the optimization of transmission capacity across all parts of the network. It provides a controlled workspace so that users for an agency can edit/maintain agency TDMA designs, and can see, but cannot edit other agency TDMA designs.

ALERT2™ TDMA Terminology

GENERAL TERMS	DESCRIPTION
ALOHA	ALOHA is a frequency use protocol in which transmitters transmit at any time when they have something to say, and can potentially collide with other transmissions and lose data. The probability of success of ALOHA transmissions can be calculated, assuming that all transmissions are random. ALERT uses the ALOHA transmission protocol. ALERT2 can use the ALOHA transmission protocol, but preferably uses the TDMA protocol to reduce or eliminate data loss.
Frequency	A specific radio frequency (RF) is a resource used by ALERT and ALERT2 for both transmission and receive of signal. Frequency is usually defined in terms of MHz and is divided into 0.0250 MHz ranges.
ALERT Frequency	An ALERT frequency is shared by many transmitters which transmit ALOHA messages, and have potential for collisions and data loss.
ALERT2™ Frequency	An ALERT2 frequency used for TDMA is defined by a frame length, block length, and slot lengths, that is divided into TDMA slots, which are then allocated to transmitters on the frequency.
Network	A network is a combination of frequencies, receivers, transmitters, transceivers used for ALERT and/or ALERT2. A network serves one or more agencies.
Receiver	Base Station, receives on one or more radio frequencies.
Transmitter	Transmits on a single radio frequency.
Transceiver	Is comprised of both a receiver and a transmitter. A transceiver receives on one or more radio frequencies and transmits on a single radio frequency. They typically are repeaters that listen to data content on their receiver, and then retransmit that content on their transmitter.
Frame Length	Frame Length is used to define the transmission repeat for transmitters on a frequency. For example, a transmitter on a 20 second frame would have an assigned TDMA slot with a predefined offset from the top of the frame, and be able to transmit every 20 seconds.
Block Length	The block size is the minimum time interval possible for an ALERT2 transmission. In the ALERT2 specification, it is 250 milliseconds (ms), and is the smallest time that can be used for subdividing a frequency's frame into individual TDMA offsets and slots.
Slot Length	It is the allocated division of time for a transmitter within a TDMA plan for a frequency. This is one or more whole units of block length. The TDMA plans we currently have use 500 milliseconds as the standard slot length, which with ALERT2 allows up to 75 bytes of information to be transmitted.



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Software Maintenance and Technical Support

OneRain's software maintenance and technical support is designed to provide you with latest software enhancements and technical support for your product licenses. We offer two levels of software maintenance and technical support to meet our clients' needs—Standard and Extended 24x7. The first year of Standard support is included with your new product licenses. As an additional option, we offer Extended 24x7 that includes all the benefits of Standard support plus around-the clock critical technical support.

BENEFITS

- Complete support protection
- Access to new features, updates, enhancements and fixes
- Unlimited telephone and email support during normal business hours M-F with standard maintenance
- Access to ongoing scheduled live web-based training sessions
- Most cost-effective way to ensure you're always up-to-date
- Protects your investment: Know that your systems are current
- Predictable budget planning

Standard Software Maintenance

The initial purchase of a OneRain Software License includes the first year of standard technical support. Thereafter, on each annual anniversary, Licensees may purchase standard technical support at an annual price equaling 25% of the current software license fee. It includes both product upgrades and technical support as follows:

- **Subscription and Support:** Under our Standard Software Maintenance agreement, OneRain provides continuing subscription to and support of the most current release of the software during the annual term. Subscription and support include correcting material or substantial defects in the software or deviations from the published software specifications.
- **Telephone Consultation:** Standard Software Maintenance and Technical support also includes reasonable telephone consultation for your organization on the use of the software during OneRain's normal business hours (8 a.m. to 5 p.m. Mountain Time). OneRain strives to respond to normal support calls (or emails received) not later than one business day after receipt of the Licensee contact. Customer outages are treated with the highest priority. OneRain has no obligation to provide on-site support or remote administration of Licensee systems.

Extended 24x7 Software Maintenance

If around-the-clock support is required to meet your critical mission needs, OneRain offers coverage and assistance beyond our normal support hours, as well as Remote Diagnostic Support, Automated Monitoring and Technical Support for your data collection system. Licensees may elect to purchase Extended 24x7 Technical Support (12-month term) at the prevailing list price at any time, provided that your subscription to OneRain's Standard Software Maintenance Agreement is valid. In addition to the **Standard Technical Support** described earlier, OneRain's extended level of service includes the following:

"Extended support provides additional peace of mind for your organization's critical operations with day and night, weekend and holiday round-the-clock technical assistance."

- **24x7 Telephone Consultation.** Our Extended 24x7 Technical Support provides phone support 24 hours a day, seven days a week. OneRain provides an Extended Customer Support HOTLINE telephone number to call requesting service of the covered product. The Extended Customer Support **HOTLINE** operates outside of normal business hours and during statutory holidays.
- **Remote Diagnostic Support*.** OneRain maintains a staff of support personnel with two people on call at any given time. Upon any interruption of processing detected by the monitoring, OneRain sends out alarms to both the client's designated support contact and OneRain's on call staff. OneRain's staff attempt to remotely log into the client's base station(s) and begin the process of diagnosing and trying to fix the problem. We make every effort to get you operational as soon as possible. If the problem cannot be fixed remotely, OneRain works with the customer's designated support contact to solve the problem.
- **Automated Monitoring*.** OneRain sets up automated monitoring of the Licensee base station. For clients that use Contrail® Base Station, OneRain uses the alarm capabilities built into the servers to monitor their health. OneRain will monitor data feeds, check operating system processes and scan Licensee's system network for failures or irregularities, and take remedial action. For clients using DIADvisor™, OneRain monitors the DIADvisor backup feed for receipt of new data within a specified time frame, and an alarm is triggered should that feed stop sending data to OneRain's enterprise. To enable automated monitoring of DIADvisor the Licensee must use OneRain's free backup option.

**Remote Diagnostic Support and Automated Monitoring requires all OneRain on-call staff to have remote access to the client's base station.*

OneRain
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Experts measuring rainfall and its consequences™