

Seismic Data Acquisition for Portable Deployments – A New and Transformative Approach

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Overview

An important consideration in selecting instrumentation to support the undertaking of portable seismic campaigns has been the costs associated with physical attributes, namely Size, Weight, and Power. A more holistic approach would be to examine the overall campaign lifecycle and the phases which have the greatest impact on science outcomes. In this regard, some of the key success factors are the decisions made during the deployment planning phase that includes network size, station geolocation, instrumentation and sensor choices. Often overlooked is the data management problem associated with ensuring that the most up-to-date information associated with the plan is communicated to everyone who needs it. Further, another often overlooked aspect is the accurate tracking and reporting of what actually is deployed in the field relative to the plan, since such deviations inevitably occur.

The Pegasus Data Acquisition System is an ecosystem of hardware and software components for portable seismic monitoring that fundamentally transforms how seismic campaigns are conducted. This integrated ecosystem-based approach to seismic data acquisition ensures that campaigns are easy to plan, execute and achieve superb outcome certainty and cost-efficiency. A range of Pegasus models have been designed specifically to support Portable, Polar and OBS campaigns. Seamlessly integrated workflows address all aspects of the campaign lifecycle from pre-planning to pre-configured deployments, harvesting ready-to-use complete data sets, configuration distribution to the field team and automatically generated metadata.

Portable Campaign Workflow



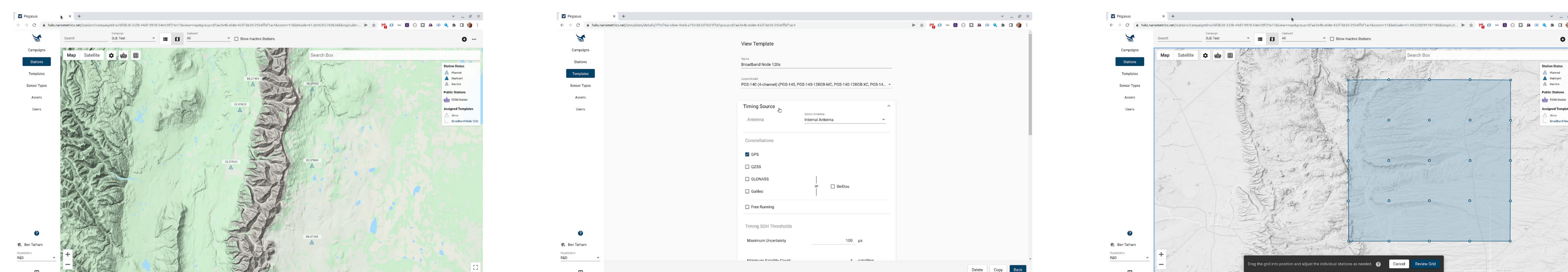
A successful portable campaign starts well in advance of field work with a thorough **plan** that identifies all of the stations, their locations, and their configurations. The information in the plan must be accurately and efficiently communicated to everyone who will be in the field **deploying** the stations. Depending on the duration of the campaign and whether any station health telemetry is available, one or more interim **service** visits may be necessary during which data from stations in the campaign recorded to date is **harvested**. Harvested data and associated metadata is brought back from the field, ready to use for archiving and then **processing**.

The Pegasus Portable Data Acquisition System introduces a transformational approach to the workflow for portable deployments by introducing well integrated software components that work together to eliminate, through delegation to its cloud-based and mobile software components, the burden of managing and distributing the data associated with planning deployments, accurately configuring instrumentation, and accurately capturing the results from the field. It does this in conjunction with powerful, fast, and efficient planning, deployment, and servicing, and data harvesting capabilities offered through Pegasus Campaign Manager, Pegasus Mobile Application, and the Pegasus Data Harvesting Application.

1. Plan

Campaign Manager, the cloud-based component of the Pegasus Data Acquisition System is dedicated to capturing all station data, including the original plan for station deployment as well as reconciling the actual results from the field deployment. Using Campaign Manager for up-front planning offers several key benefits:

- **Consistency:** One or more station configuration templates can be defined for the campaign to establish a configuration baseline used across all planned stations. These templates reflect the specific types of data loggers and sensors to be used in the campaign and also include target geolocation, power, timing, sensor, channel naming, and digitization parameters. Each station planned to be deployed must use one of the predefined configuration templates. This eliminates the possibility of unintentional deviations in configuration when deploying the stations in the field, and ensures consistency among all stations intended to be configured in the same way. Of course you can ad hoc too but following the plan is the best.
- **Convenience:** A map view has layers that include topology and satellite views with zooming capabilities to help ensure that planned station placement reflects any physical or civil constraints imposed by the area. Individual stations can be easily targeted for or relocated from a specific planned location via mouse click or an array planning tool can be activated to quickly add a large number of stations over an area with default spacing specified that can easily be adjusted to deal with exceptions on a per-station basis.
- **Scalability:** Although the Pegasus Mobile Application allows one to create campaigns and configuration templates, doing this in the cloud allows one to easily scale up to large N campaign sizes with dozens or hundreds of stations



2. Deploy

When the focus shifts from the planning of stations in the campaign to actual field deployment, the Pegasus Portable Data Acquisition solution makes the data management workflow seamless and in particular relaxes the burden of campaign information management via delegation to the set of highly integrated components comprising the system:

- **Automatic configuration data distribution:** All of the planned station data captured in Campaign Manager is automatically distributed to all authorized users who will act as the field team for the deployment and are running the Pegasus Mobile Application on their mobile devices. This synchronization of data occurs immediately upon running the application and authenticating with the cloud. This approach eliminates the typical problems that occur when manually sharing information among team members, for example using different versions of documents or spreadsheets shared back and forth via email.
- **Scalable deployment:** With automatic data distribution and the ubiquity of the Internet, it is easy to securely share campaign data with any number of people who will help with the deployment of any number of stations.
- **Easy configuration:** All field team members deploying the stations are armed with all of the planned station definitions and intended associated station configuration templates. This includes the digitizer configuration as well as the kind of sensor to attach. Commissioning of the stations proceeds. For each station in the campaign the plan may specify a particular Pegasus by serial number to use, or the association between station and instrument may be created dynamically in the field. The target configuration is applied to the Pegasus along with any necessary, but unplanned configuration changes that arise (including the creation of entirely new stations) and all configuration changes, planned or otherwise, are recorded by the Pegasus Mobile Application.
- **Complete station configuration dataset:** When the Pegasus Mobile Application eventually detects Internet connectivity, it will automatically perform an upward synchronization to the cloud of all configuration activities performed with it during field deployment. With this data available to Campaign Manager, it is possible to understand any discrepancies between the intended (the original plan) and the actual. Everyone involved with the campaign sees a consistent, up to date view of exactly what was deployed in the field.



3. Service

The Pegasus Mobile Application makes it easy to see at a glance how the station is performing with an easy to use interface that allows one to quickly spot problems. As earlier in the initial deployment phase, any configuration changes conceived post deployment are automatically synchronized to the mobile device prior to the service visit for easy application in the field. Likewise, any impromptu but necessary changes arising in the field are automatically reflected in Campaign Manager once Internet connectivity is established again post visit.

4. Harvest

Harvesting the data produced by each station is extremely fast and easy, offering the following benefits:

- **Efficiency:** Very high speed USB 3.0-based connectivity and highly optimized software provides very fast data harvesting speed. For example, an entire month of 3-channel sensor data recorded at 100 sps can be harvested in < 10 seconds.
- **Complete and ready-to-use dataset:** The data harvested from each Pegasus automatically includes sensor data, SOH, and StationXML-based metadata that accurately reflects the entirety of the Pegasus and sensor configuration

PEGASUS DIGITAL RECORDER



Low SWaP

- < 200mW, 3 channels
- 85 mm (L) x 97 mm (W) x 165 mm (H)
- 0.65 kg

High Resolution

- Resolution: 28-bit
- Dynamic Range: 135dB @ 100 sps, 142dB @ 20 sps

Flexible Configuration and Interfaces

- 3 or 4 channels, with sample rates up to 1,000 sps
- RS-232 serial interface for telemetry
- Internal GNSS antenna and a connector for an optional external antenna
- Bluetooth Low Energy Wireless Interface for configuration, SOH and live waveform monitoring
- Optional Polar rating
- OBS version available for offshore work with the same ecosystem support