

# Enhancing the Agility of Seismic Operational and Long Term Asset Cycles

Turki Al-Ghamdi, Omar Akbar, Jay Fares, Saudi Aramco  
Jeffrey W. Pferd, Abhijeet Narvekar, Petris Technology

## Summary

Although energy markets are experiencing a current slump in demand for fossil fuel, yet the past few years have seen considerable growth in demand for energy. These past favorable market conditions lead to accelerated efforts, worldwide, to find new hydrocarbon resources. This in turn resulted in considerable increase in drilling and seismic activities by oil companies. Additionally, this period exhibited major changes in technology and considerable contraction in the availability of skilled human resources. This placed additional pressures on energy companies to improve efficiency and provide agility in accommodating change. Saudi ARAMCO realizing the need to operate in such an agile environment put in place systems, such as Data Services, for managing, optimizing and streamlining their operational and long term asset cycles.

Data Services is a data management system conceived by Saudi Aramco and developed by Petris Technology Inc. to provide high bandwidth seismic data management in a continuously changing environment. It is based on generic set of services which are orchestrated to provide a collaborative working environment for field, processing and interpretation seismic groups. This system has proven its value by enabling Saudi Aramco to integrate seismic data and workflows for joint venture partners in weeks instead of months, as usually expected by such complex integration. This system is also proving its value in enhancing the long term asset management cycle for future hydrocarbon studies.

## Introduction

Within the Oil and Gas Exploration environment, each geoscience group usually works within their specialized domain cycle focusing on their daily activities, the result of which eventually contribute to the ultimate corporate objectives of maintaining and enhancing reserves. In this paper, we refer to this cycle as the Operational Cycle (OC), see figure 1. In conjunction with these short-period operational cycles there is another cycle with longer period bounding these operational cycles and which is often referred to as Long Term Asset Cycle (LTAC). LTAC provides Oil Companies the ability to maintain and evergreen their data and to gain better understanding of their current and potential assets.

For example, a geo-scientist who is tasked with the processing of seismic data operates within a well understood operational cycle focusing mainly on his daily activities of seismic data processing. At the same time he is also connected to other parties operating within other operational cycles such as seismic acquisition or seismic interpretation. Communications with groups who belong to

other operational cycles are of critical importance to the results of his operational cycle. Although these inter-cycle communications, activities and data flows enrich his operational cycle results, they shouldn't overburden him with extra responsibilities outside his core activities.

Often, data management solutions take the geo-scientist outside his normal operational cycle to the Long Term Asset Cycle (LTAC) which is outside his comfort zone. The LTAC is classically considered as data management

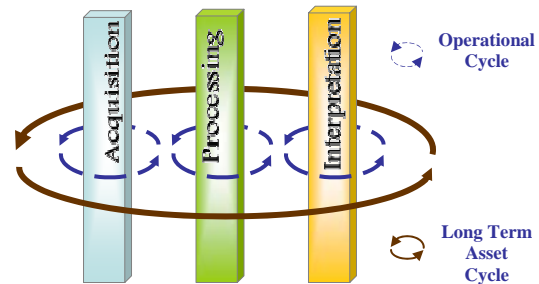


Figure 1

cycle with little value to the domain specific operational cycle. This often leads geoscientists not to support the LTAC as they perceive it to be an overburden process.

Agility means being able to accommodate change in a timely manner. Advances in technology result in the utilization of new equipment and new data which has to be absorbed and utilized. Typically, we react to change by providing some ad-hock solution to remedy the operational cycle and keep the process rolling. This allows geoscientists to continue their daily activities and efficiently meet their direct objectives. Such a solution does remedy the operational cycle; it however, often negatively impacts the LTAC. When data needs to be reprocessed, re-interpreted or reevaluated, the LTAC will not have the adequate information richness to support such activities.

Another way to react to the change is to perform a comprehensive study and provide a custom-built solution. This is not the preferred approach as it is the lengthy route and would hinder the OC process.

In order to provide enhanced operational and strategic agility, Saudi Aramco realized that both the OC and the LTAC cycles need to be better aligned in an environment accommodating change with minimal impact on staff daily activities within their operational cycles. This was facilitated through the utilization of a common system that is integrated within the workflow and facilitates the inter-cycle communication as well as the ever greening of the long term data assets. This system provides a collaborative

## Enhancing the Agility of Seismic Operational and Long Term Asset Cycles

environment that is flexible and can accommodate changes without touching the various underlying infrastructures already in place. The system honors the respective territories the geo-scientists are working in (OC) and does not burden them with mixed inter-cycle responsibilities.

### Case Study

Saudi Aramco commissioned Petris Technology Inc. to build a framework that offers agility for both OC and LTAC cycles. The framework allows Operational and Long Term cycles to readily adapt to changes in technologies, workflows, application systems and data.

Data Services (DSS) is the name selected for this framework. The name reflects the fact that business data needs drive the behavior of the data management software rather than the other way around. Many data management frameworks offered by vendors are rather limited in capabilities and don't fully address business data needs. Additionally, available data management solutions often encapsulate the behavior of the OC and the LTAC cycles within the software code itself making it very costly to accommodate change. Any changes to these cycles necessitated by changes in the business conditions require modifications and enhancement to software code integral to the data management software which requires some investment in time and money.

Figure 2 illustrates the historical situation of Operational and Long Term Asset Cycles in Saudi Aramco. The figure shows no linkage between the two cycles. Each cycle is isolated and collaboration depends on the preferences of the individual performing the work. To interact with the LTAC cycle, geo-scientists have to stretch outside their domain and perform tasks that require effort beyond their normal operational activities.

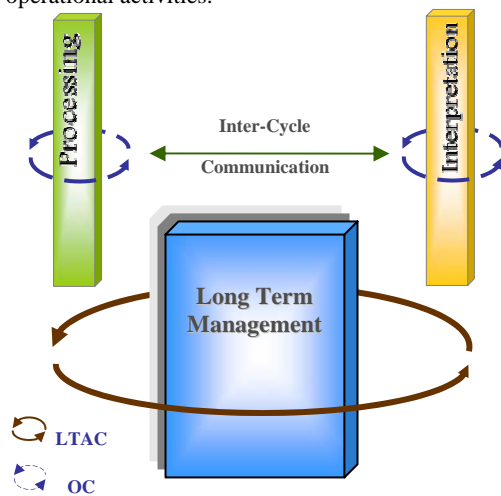


Figure 2

DSS solution provides Saudi Aramco with a controlled environment for collaboration amongst work groups which does not burden the Operational Cycle (OC) and works seamlessly to enrich and evergreen the Long Term Asset Cycle, see Figure 3.

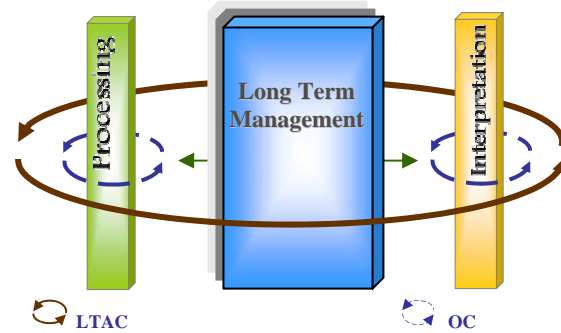


Figure 3

Data Services (DSS) was developed around the concept of Smart Business Objects (SBO). The system intelligence is coupled with data, in the form of meta-data, and referenced through the SBO. These objects are served by generic software components (services) that understand the data through the associated meta-data. Each SBO thus maintains its own behavior and provides a different set of services to its interested users. This allows DSS to accept changes through customization of meta-data primitives, without the need to modify the underlying code encapsulated in the services layer.

DSS was first used in Saudi Aramco environment to replace a legacy system built to manage seismic data from the field to interpretation through the processing cycle.

The architecture of DSS enhanced the agility of Saudi Aramco OC and LTAC cycles. Recently, DSS was challenged with huge amount of unrelated and nonstandard data that belongs to scattered workflows from Saudi Aramco joint partners. The data needed to be managed by the LTAC and be utilized by different Operational Cycles. DSS was able to accommodate this data and absorb it into the standard workflows within a couple of weeks. This provided a breakthrough in workflow and data management process integration where readiness to absorb change was enhanced by at least 80%.

In addition to the enhancement in agility, DSS strengthened the LTAC cycle and give it more control over the Operational Cycles. The DSS gave the LTAC stronger presence within the Exploration workflow, but did not hinder the geo-scientists in their normal operational cycle. This is because the DSS hides the complexities of

## Enhancing the Agility of Seismic Operational and Long Term Asset Cycles

managing data for the LATC for the geo-scientist and makes this process essentially transparent for him.

### Data Services Inventory

Data Services application built with a generic set of services that can manage any type of seismic or non-seismic data. These services are:

- **Registry:** Provides “administrative” user access to the Data Services Registry for system configuration and management. The functions include definitions of: Business Objects, Collections, Patterns, Seeds, Domains, Users and User Groups, States, Quality, Function, Bulk Data Handler, Storage Location, Rules, etc.
- **Security:** Provides single point for all security access, such as User login and authentication, User roles, User groups and domain, Company specific corporate security, State security and Bulk Data/operating system file access security.
- **Load:** The Load Service is utilized by the UI and other services to Utilizes “scripts” to identify, scan, extract data from incoming “seeds”, creates an instance of a business object, creates or adds the business object to an existing collection, applies the in-workflow for each business object, saves the data to the DSS database, and the business model db (i.e. EPPR), and uses the Bulk data handler service to save the bulk data. Also, updating Business Object attributes and associated bulk data.
- **Search:** The search service provides the functionality to search DSS database by business object, collection, free text “Google like” and Map Search. This service, also, extracts the business object attributes and bulk data for a transfer from DSS to external systems. Map Search uses ArcGIS technology from ESRI and is integrated with the text search. It accesses data from both SDE binary special repository and the Oracle Spatial database.
- **Communicator:** This service communicates with external integration engines, such as PWE, OpenSpirit, in-house tools, etc. to exchange data between DSS and other vendor applications as serialized XML stream plus bulk data in the appropriate format.
- **Update:** The update service is used to update one or multiple Business Objects and collections. It

also update attribute data such as state change, quality, locking, etc... And it helps users build relationships between unrelated Business Objects.

- **Bulk Data Handler:** Bulk Data Handler provides a single point entry for all bulk data access. It insulates other services from any knowledge of how and where bulk data is stored. It supports access for multiple storage formats for the same datatype, e.g. SEGY – 2007 file, SEGY -2008 Oracle etc. It can be used by the Load, Update and Communicator services to insert and extract bulk data, and It utilizes the Script Execution Service to execute specific bulk data handler scripts
- **Subscription / Notification:** This service provides functionality for subscribing to change events, e.g. State change, status, locking, updates etc. The service sends notifications to users for events subscribed and also notifications generated by administrators or other users. Also, provides ability to subscribe to data within a geographic area, and be notified when data is added or changed within this subscribed area. Notification may be accomplished via email, or when the user logs in to the DSS system.
- **History / Data Mining:** This service provides reporting functionality and perform audit trails for, user access, state changes, data transfers, data deletions. Also, provides data mining reports for collections, business object, actions.
- **Script Execution Service:** This service executes scripts/functions that determine Business Object behaviors. The service supports multiple platforms such as Linux and Windows. All scripts will have common interface to the SES, for sending parameters to the scripts, and obtaining results from the scripts. Script Management will be performed by the Registry service
- **DB Consistency Check:** This service checks the health of the DSS database. It checks for constraints, database integrity, bulk data integrity, operating system file linkage integrity, and reports system database inconsistencies.

## Enhancing the Agility of Seismic Operational and Long Term Asset Cycles

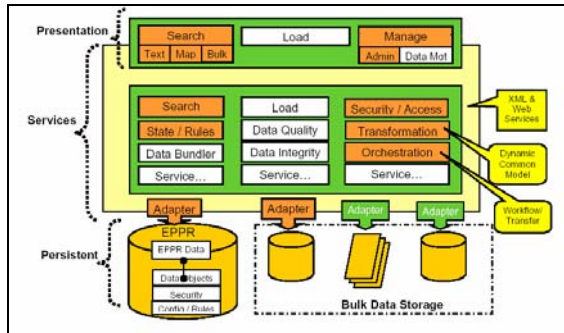


Figure 4: Data Services Components

### Simplification of Seismic workflow

The generic architecture of DSS simplify the process of seismic workflow because it allows the energy company (Saudi Aramco) to become independent of the vendor (Petris) in terms of defining and changing business rules, defining workflows and adding new quality assurance (QA) or analytical processing capabilities. Changing business rules is implemented as a configuration change by the energy company and not as a programming change by the vendor. These aspects yield significant benefits in reducing time to introduce new data or workflows in response to new business needs. And in addition, the company will see a reduction in the cost of services required to implement and migrate the system.

Also, making the DSS a part of the Geoscientist's daily activities, helps data managers to control, monitor and track operations within workflows. Currently, Data and knowledge communicated between producers and consumers is captured by DSS based on some predefined business rules.

### Conclusion

In order to provide enhanced operational and strategic agility, Saudi Aramco developed the Data Services (DSS) system to align the OC and the LTAC cycles in a seamless manner to accommodate any changes in business requirements in timely fashion with minimal impact on the geo-scientists daily activities. DSS has enhanced Saudi Aramco's readiness to accommodate change in some cases by over 80%.

DSS has become an integral part of geo-scientist's daily activities as a tool for gaining better understanding of managed corporate assets. The measures put in place to insure data quality and tracking at every stage in the workflow, has increased the confidence in the output results from every operational cycle. The collaborative

environment ensures a high level of technical excellence is maintained and increases the confidence in project results. Data from DSS tracking and analysis tools have provided insight for process owners to remedy data flow bottlenecks for data managers improve data quality. As a result, Operational Cycles (OCs) were optimized and improved. DSS thus enabled data producers and consumers to easily interact with corporate assets and procedures in a seamless manner in an optimized operational environment, without hindrances to either party.