



EXTENDING OFFSHORE ASSET LIFE WITH AKSELOS DIGITAL GUARDIAN

Case Study

December 2018

OPERATOR CHALLENGE

Many offshore platforms are working past their originally programmed lives; while in parallel the regulatory standards have become more stringent, which potentially threatens the possibility of continued operation of the asset.



CASE STUDY CHALLENGE

A large production facility in the UK Sector of the North Sea; part of a larger complex of fields that have been operating for over four decades.

The operator is looking to extend the field for a minimum of 20 years and be able to consider a range of asset life extension options.

The OpEx is one of the key considerations in the assessment of life extension. Based on the findings of Akselos, the operator was able to review the best fit inspection strategy and set-down a fit for purpose inspection frequency and type.

Many offshore platforms continue working beyond design life into a mature phase of operation, raising a number of challenges:

Challenge 1 - Extending economic life

- Ensuring that the integrity of their platforms are intact for continued **safe operation, in line with codes, safety and operational standards** as well as best practice and new knowledge. Also, to achieve agreement with the regulator on the terms of reference for the continued operation and to provide input to the Safety Case.

- To provide the **best technical basis** of the Asset Life Extension within the business strategy of the Operating company.
- To operate the platforms in an **economically efficient** way (higher Operational Efficiency), with better levels of optimization; within constraint of leaner budgets and lower OPEX.

A combination of continued reservoir performance, EOR techniques for enhanced recovery, new tie-backs, along with initiatives for Maximizing Economic Recovery (MER) for Hubs, have pushed out the life of the asset **well beyond its original design life**.

Challenge 2 - Increasing scrutiny

Evolution in standards for offshore operation also mean that Operators are increasingly challenged to demonstrate the **viability and compliance of their infrastructure**.

In this case study, of a large platform-complex in the UK sector of the North Sea, the operator was looking to establish a solid **engineering basis** for the analysis of the **platform structural life** that is required to operate for decades after its original design life.

The Operator is expecting to **operate the platform for an additional 20 years**; however, the platform-complex has already passed the original **design-life of over 40 years**.

Challenge 3 - Increasing costs

As the assets age beyond their design life, the **cost of maintaining the infrastructure is increasing** at a faster rate. According to the UK oil and Gas Authority OGA, 84% of older platforms (over 30 years old) **have higher than the average OpEx** in the UK sector of the North Sea. As aging assets require more Inspection Repair and Maintenance (IRM) activities to keep the structures in good shape.

Year on year OpEx costs are increasing, some 5.9 Bn £ for offshore field operation in 2017 for the UK sector alone*; **over 60%* of which is facility management overhead, the majority of which was spent on maintaining fixed platforms**.

OPERATOR SOLUTION

Akselos Integra™ was able to prove the real structural life of the fixed platform by using its high-performance, High speed, high resolution structural modelling.

Akselos was **able to unlock some 15+ years of additional structural life** from the platform.

In the next phase the operator will evaluate if structural life can be extended further using Akselos Digital Guardian.

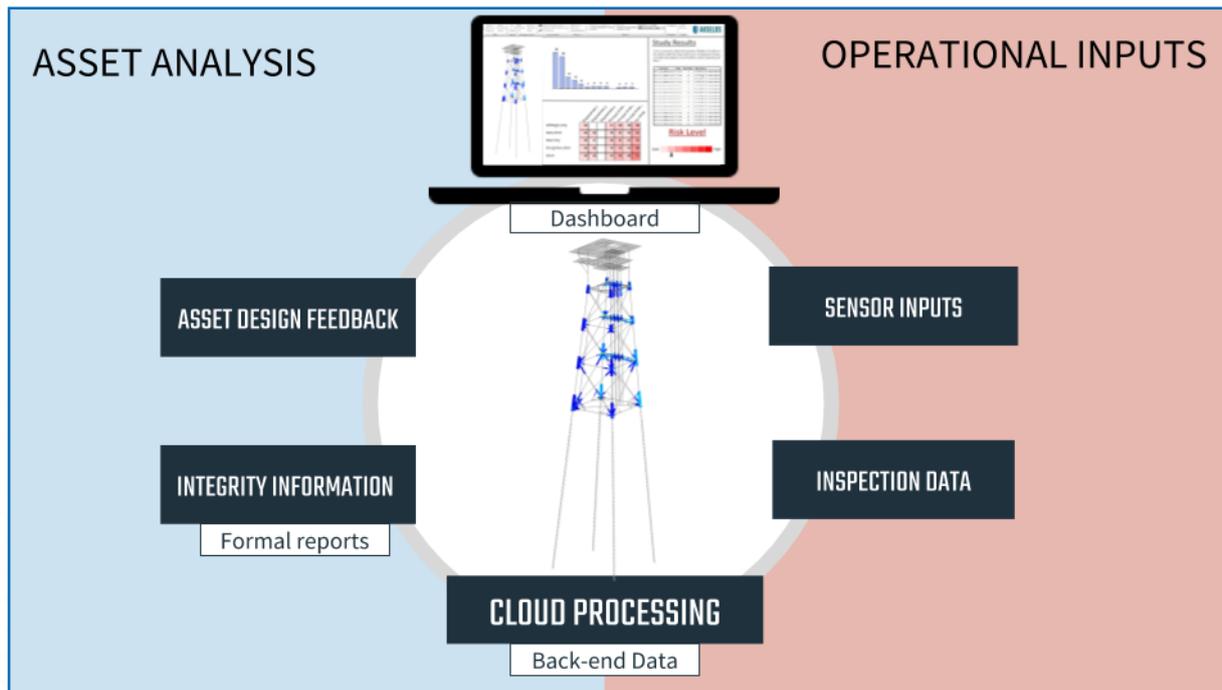
Akselos provides a completely new approach to the evaluation of Asset Life that cannot be achieved using traditional methods.

Akselos Digital twin carries many benefits for the management of large assets based on a **holistic model** on which to assess the platform in near real time allowing the consideration of:

- Engagement with regulators to demonstrate the validity of the Asset Life Extension project (ALE).

Akselos provided the UK operator an unprecedented level of understanding of the real structural life of the fixed platform based on a new level of engineering diagnostics which uses a new physics-based approach to Finite Element Analysis originating at MIT Technology (under exclusive license with Akselos).

This technology was also successfully used, in this case study, as part of the engagement with regulators to motivate Asset Life Extension projects (ALE) and provide the basis of an integrated asset management plan.



- Unlock additional structural life from a platform to extend the operation of asset well beyond the originally conceived viability of the production from the field **generating tens of millions \$ in additional NPV.**
- Provide a step-change in how the Inspection Repair and Maintenance (IRM) program is managed for a field, allowing targeted and potentially lower frequency inspection regime **saving potentially millions from planned OpEx expenditures.**
- Provide a framework for the onward management of structures with a real-time Digital Guardian that provides critical information, **maintain high uptime on the platform including incident response such as collision or rogue wave impacts.**
- Support the full cycle of asset management including a basis for ALE work and the basis of a Decommissioning evaluation/plan; **ultimately saving millions.**

Akselos supports a fully digitized asset giving a more detailed view of the actual structural integrity in a fraction of the time taken using traditional systems.

Traditionally, engineers used conventional analysis tools, such as Finite Element Analysis (FEA), to assess the structural integrity of the asset. Due to computational limitations, FEA is incapable of supporting global system models at a level of sufficient detail.

Akselos gives a near real-time structural integrity tool equipped with a holistic “one-model” approach, that helps automate inspection analysis workflows from inspection data to same day, full structural analysis.

Akselos also supports a fast response to incident resolution using a more automated, data-driven, and physics-based approach that assists the operator in analysing the large amount of inspection data.

OPERATOR SOLUTION

Akselos technology is a powerful evolution over traditional FEA (Finite Element Analysis) with features such as:

- Section losses represented in 3D.
- Deformed members represented in 3D.
- Fast turn-around on handling new situations and re-run of all load cases to re-assess current state of the structure.

Using Akselos Integra, engineers created a condition-based Akselos Digital Twin incorporating all available design specifications and leveraging actual-state datasets. This “base” Digital Twin was built-up using Akselos’s fully parametrized global model with every single joint meshed throughout. This first “Tier 1” model already unlocked part of the Asset structural life, and in this case study, the first analysis (Tier 1) stage released a significant increase in computed fatigue lives (up to x20 increase) based on DNV Fatigue standards.

The Akselos Digital Twin was used to assess areas of potential risk and help identify the true platform life. In addition, the areas of the platform that were potentially at risk were assessed as part of the IRM strategy and as input to the Inspection plan; enabling optimized inspection and significant savings in OPEX.

CASE STUDY BENEFITS

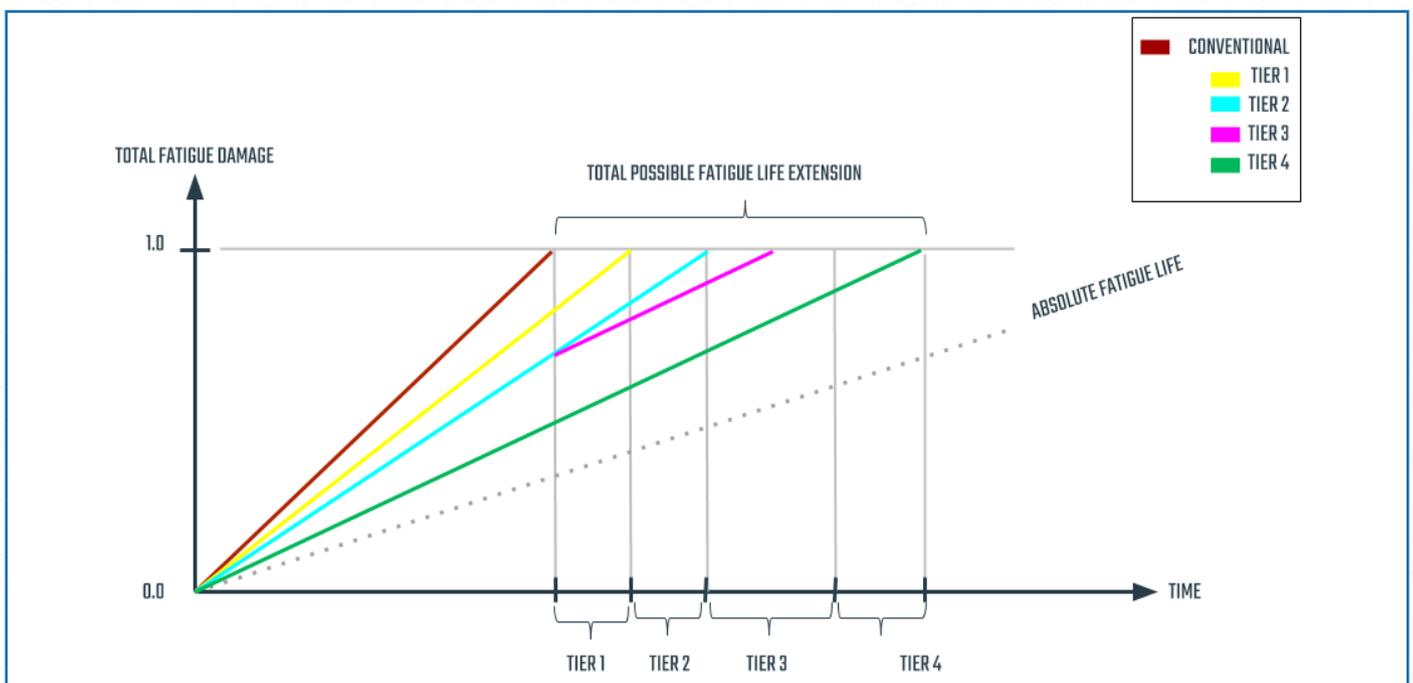
Using the Akselos predictive Digital Twin technology, new insights were obtained on the platform, unlocking additional structural life of some 15+ years.

In addition, the operator was able to take a holistic view of the asset to evaluate alternative engineering concepts for Field Life extension in near real time; and allow a new assessment of the IRM regime and evaluate a more accurate and cost-efficient maintenance platform assets.

EPC PARTNERING

Akselos is partnering with experienced EPC's and Major Oil Companies.

Akselos has successfully delivered projects with Major Oil Companies and EPC's to deliver a fully functioning digital twin that has been strategic for the onward management of assets in the UK sector of the North Sea.



A four-tier system is used to unlock the value frames of extended platform life as each area of uncertainty is systematically removed through full deployment of the digital twin.

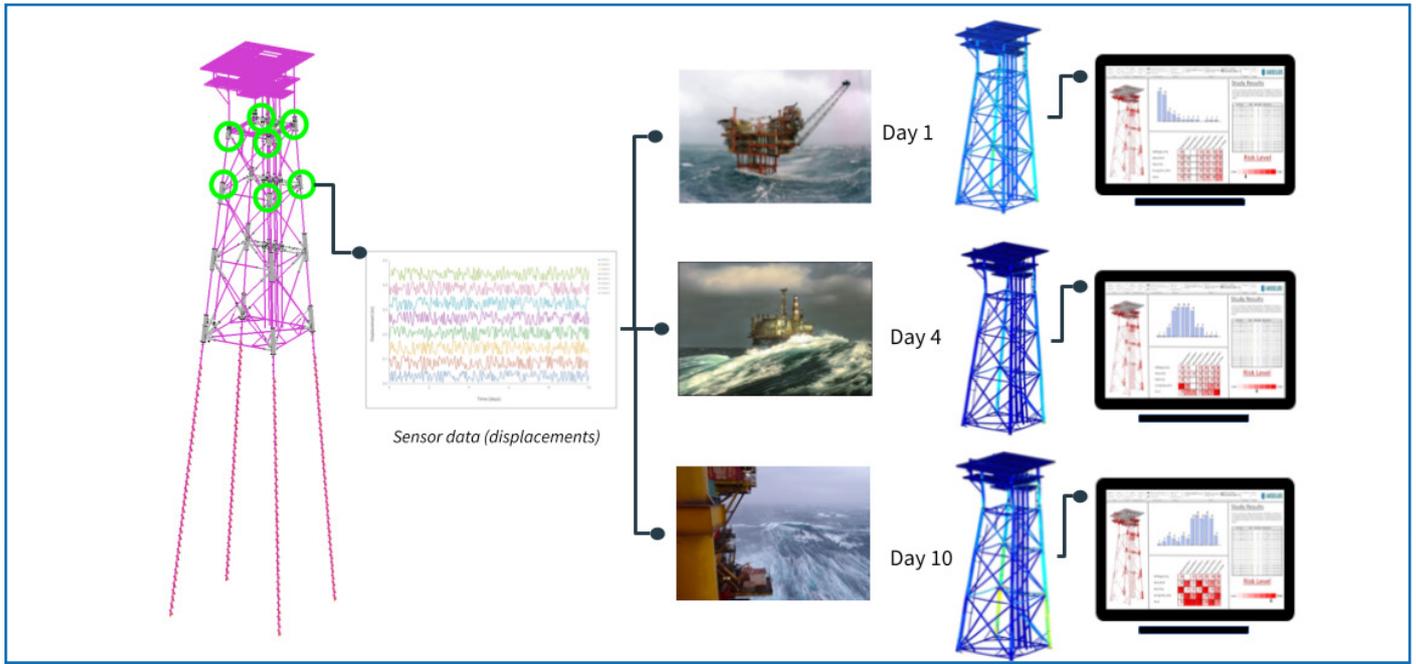
- Tier 1: Global model with mesh modelling of structural joint.
- Tier 2: Model calibration based on sensor system.
- Tier 3: Real-time monitoring of actual fatigue damage.
- Tier 4: Retrospective calculation of true fatigue life.

CONDITION BASED PREDICTIVE DIGITAL TWIN

Akselos **Digital Guardian** can:

- Have one **holistic view** of the asset for all analysis.
- Provide information about **real time asset condition**.

- Can **incorporate asset condition** in the model (cracks, corrosion, damage).
- Can be **calibrated with sensor data**.
- Detailed and accurate, **physics-based**, engineering view.



The calibrated displacements and stresses enable measurement-based analysis of the entire structure (e.g. fatigue and buckling code checks such as ISO 19902, API, AISC, DNVGL, etc., soil/pile monitoring, failure mode analysis, anomaly detection).

HOW CAN YOU WORK WITH AKSELOS?

SERVICE LEVEL AGREEMENT

- OPTION FOR PROJECT INITIATION; DIGITAL TWIN SET-UP WITH A STARTER PACK OF SUPPORT/SERVICES.
- WE CAN HELP YOU GET YOUR DIGITAL TWIN UP AND RUNNING QUICKLY.

TRAINING CENTRE

- TRAINING FOR YOUR ENGINEERS TO HELP AND MANAGE DIGITAL TWINS.
- ONLINE KNOWLEDGE BASE WITH DETAILED INFORMATION.
- FULLY DOCUMENTED SELF TRAINING CENTRE.



FULLY CLOUD-BASED

- ACCESSIBLE FROM ANYWHERE ON THE INTERNET.
- PROMOTING TEAMWORK BETWEEN GEOGRAPHIES AND COMPANIES.

SOFTWARE AS A SERVICE

- AKSELOS' MAIN OFFERING IS A SaaS SOFTWARE (Software as a Service) WITH A LICENSE-BASED SUBSCRIPTION.
- OTHER LICENSING OPTIONS ARE AVAILABLE ON REQUEST.
- PLEASE CONTACT US ON: info@akselos.com.

IMPACT

1. **Successful regulatory engagement (Licence to Operate):**

Extended Operational Life of older or challenged mature assets beyond the original programmed cessation of production (COP) date with natural ageing/fatigue.

2. **Extend the economic field life by unlocking spare structural life beyond the currently understood design limitations**

Akselos with its high-resolution model can provide improved knowledge of the real fatigue life of the asset so that the operator can consider a longer economic life for the asset.

3. **OPEX (Operational Expenditure)** - Operational cost savings

achieved by predictive and targeted maintenance, also inputs to new maintenance and operational models for integrity programs.

4. **FCM - Full Cycle Management** – considering broader asset

management aspects such as support design modifications, incident management, early stage assessment of Decommissioning. Akselos offers the advantage of a fully maintained model ready to evaluate at short notice to respond to any of the situations that an asset is faced with during its normal working life.

5. **Run Time Savings** – Akselos Integra™ allows for detailed

modelling of complex structures using a leaner workflow with fewer steps, thereby reducing errors and also costs.

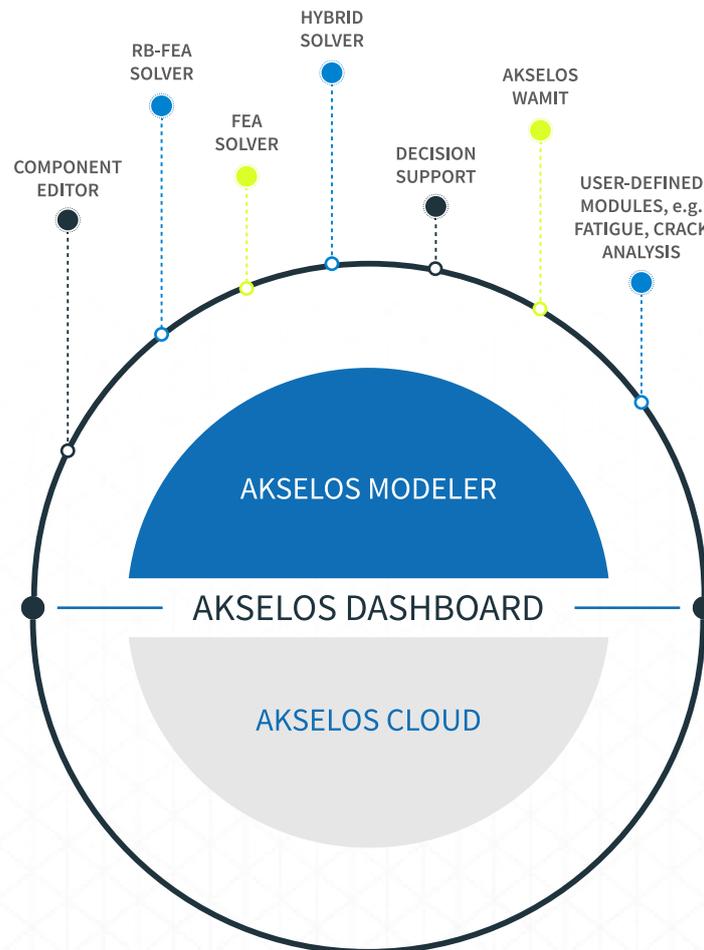
BENEFITS

- Higher confidence of the Operator on the quality of the assumptions for continued operation of the platform.
- Improved engagement with the regulator and stakeholders for maximizing economic recovery.
- Broader basis for establishing asset integrity in the safety case
- Extended life of the Platform-Complex carries an estimated NPV's improvement in the range of 50 to over 100 million \$.
- Cost savings on studies to support the Platform-Complex extension are estimated over 2 million \$ to produce.
- The initial findings of this case study indicate that the operator can continue with a low level of inspection. This represents a significant benefit not only of reduced shut-downs but also of lower OpEx costs.
- Lower inspection frequency potentially representing a 5-20 million \$ saving by asset.
- Number of days gained in the field shut-down window translates into higher Operational Efficiency - impact counted in hours/days.
- Higher analytical capability means also higher Quality IRM with lower risk operation.
- Savings on structural integrity reports and other one-off assessment typically in 50-100 K \$ per range.
- Savings for Decomm planning studies and project management in est. range of 2-6 Million\$, combined with a shorter turn-around time.
- More efficient working, higher quality result and also saving valuable engineers time.
- Estimated savings 50-250 K \$ per asset/per annum.

*Reference to UK OGA report (UKCS Operating Costs in 2017)

About Akselos

Akselos is a digital technology company headquartered in Switzerland, with operations in Europe, the USA and South East Asia. The company has created the world's most advanced engineering modelling, and fastest simulation technology, to protect the world's critical infrastructure today and tomorrow. The technology has the power to revolutionize how we build and manage our critical infrastructure, and pushes the boundaries of what modern engineering and data analytic can achieve. Developed by some of the world's best minds, the MIT-licensed technology builds something far beyond the capability of a conventional digital twin – a digital guardian that allows operators to not only monitor an asset's condition in real time, but helps them to see the future.



Our Akselos Integra platform is a leading engineering simulation platform that revolutionizes asset management and enables you to understand and manage structural safety risk for your entire asset more effectively than anything else on the market.



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